

# The Choice of the Personal Income Tax Base

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## **Abstract**

Following Mirrlees (1971) and Vickrey (1945), the optimal tax literature has studied the design of a personal income tax where the ideal would be to tax unobserved earnings ability but instead the only available information is actual earnings. In practice, though, taxes depend on a broader range of information about each individual than earnings. In principle, this supplementary information can help in designing a tax that not only has lower efficiency costs but also has more attractive distributional properties, by more closely approximating an ability tax. The objective of this paper is to lay out theoretically and estimate empirically how to best make use of available information about each individual in addition to earnings, solving for the optimal tax base. In contrast to most of the literature on this topic, we show how equity considerations may be quantitatively incorporated in the analysis. In accordance with current practice, we find that the optimal tax base should include capital income, at least to some degree. In contrast to current practice, though, property tax payments and mortgage interest payments should not be deductible, since these deductions are costly on equity and presumably on efficiency grounds as well.

The choice of a personal income tax consists first of the choice of a tax base and then the choice of a tax rate schedule. The past literature on the optimal design of the income tax, as exemplified by Vickrey (1945) and Mirrlees (1971),<sup>1</sup> presumes that the ideal tax base is the earnings ability (wage rate) of each individual, since this is the only characteristic that is assumed to differ across people. In practice, however, earnings ability cannot be monitored for tax purposes. A close observable proxy for earnings ability is labor income (wage rates times hours of work), so that the initial optimal tax literature presumed that labor income is the natural choice of a tax base and then derived the optimal rate schedule given this tax base.

Are there any welfare gains, though, from including in the tax base not just labor income but also other observable information about individuals? Actual tax bases certainly include information beyond labor income, such as interest, dividend, and capital gains income. In addition, by taxing couples as a unit rather than taxing each spouse separately, the labor income of one's spouse affects one's own tax rate. Mortgage and property tax payments are allowed as deductions for those who itemize. The tax base is certainly more complicated than labor income. To what degree can these additional elements in the tax base be explained based on an optimal income tax framework, without adding subsidiary objectives or externalities?

Atkinson and Stiglitz (1976) derive conditions under which the ideal tax base does not make use of information about consumption of other goods, so includes just labor income.<sup>2</sup> One key condition is that consumption goods not differ in the degree to which they are complements to leisure. A second condition is that the amount an individual consumes is not correlated with the individual's marginal utility of income. It is this second condition that we focus on. In doing, so we explicitly allow for heterogeneity in behavior beyond skills.

Are there consumption choices, that reveal information about ability beyond what is revealed by reported earnings? Besley and Coate (1992) argue that providing low-quality in-kind rather than cash transfers help reveal who among low earners has low earnings ability, on the presumption that only those with low earnings ability are in fact willing to consume low quality goods. Similarly, Blomquist and Christiansen (2005) argue that users of excludable public goods should be charged a price different from marginal cost to the degree that demand depends on earnings ability. Kopczuk (2001) argues that tax avoidance should be facilitated if the low skilled can avoid taxes more easily than the high skilled, conditional on labor income. Closer to the choice of income tax base, Gordon (2004) argues that income from savings (dividends or interest income) should be part of the tax base to the degree to which those with high ability save more (or in different forms) than those with low ability, among those with the same labor income.

The first objective of this paper is to explore empirically using PSID data to what degree the observable variables that are commonly part of the income tax base help forecast earnings ability (wage rates) among those with any given level of labor income. Are there observables that help detect high vs. low wage rates among individuals with the same labor income? The variables we focus on are interest and dividend income, the labor income of one's spouse, and expenditures on

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<sup>1</sup>For recent work in this tradition, see Saez (2001) and Gruber and Saez (2002)

<sup>2</sup>For more recent attempts to explicate this result, see Saez (2002), Laroque (2005), and Kaplow (2006).

mortgage interest and property taxes. These choices are partly driven by data availability, but correspond to important pieces of the tax base in practice.

Why might it be plausible that individuals with the same labor income but different underlying abilities choose different consumption patterns? Possible reasons include:

a) Among those with any given level of labor income in a particular year, those with higher earnings ability likely had higher income in prior years, and so higher savings. Higher income from savings then signals higher prior earnings and higher earnings ability.

b) Again because their permanent income is likely to be higher, conditional on current labor income, individuals with higher ability are likely to own a larger house, and so have a larger mortgage.

c) Holding labor income fixed, those with higher wage rates have more leisure, so have higher potential labor income to help in the event of income shocks. This may make it easier to invest in riskier securities, suggesting that higher wage-rate individuals will have more dividend income, holding labor income fixed.

d) Among those with any given level of labor income, those with higher earnings ability are likely to value education for their kids more highly, so will live in communities with higher public school spending and therefore higher property tax payments.

e) The labor supply of secondary earners is very heterogeneous, with some out of the labor force and others working full time. Despite sensitivity of participation decision of secondary earners to their wages, their observed earnings are only weakly linked to wage rates. Due to assortative mating, however, the earnings ability of spouses are highly correlated. The earnings of the primary earner can then provide valuable supplementary information about the earnings ability of the secondary earner, even conditional on that individual's reported earnings.

f) Within a couple, there may be some specialization in market work vs. work within the household, so that the high wage-rate spouse increases labor supply while the low-wage spouse focuses more on non-market activities. As a result, a low-earning spouse may signal high hours for the primary earner, so a lower wage rate than would otherwise have been expected given observed labor income.

Our results show that all of the additional observations we examine help in forecasting wage rates, even after controlling for labor income. Property tax payments are particularly useful. Capital income also helps forecast wage rates, presumably reflecting lifecycle consumption smoothing.

The second main objective of the paper is to solve for how this information should be used in the design of the tax base, trading off any resulting equity gains vs. efficiency costs. Finally, the paper reexamines the data to provide the evidence needed in choosing the tax base suggested by the theory.

The outline of the paper is as follows. We begin in section 1 with a general discussion of an "ability" tax. In particular, to what degree should any of the underlying differences across individuals in addition to differences in earnings ability affect the ideal tax base? The analysis in the rest of this paper follows the past literature in presuming that the ideal tax is an "ability" tax, but this

section at least highlights questions that might be raised about this characterization of the ideal tax.

Section 2 provides some preliminary empirical evidence on the extent to which observable information in addition to own labor income helps forecast an individual's earnings ability, as measured by the wage rate, using data from the PSID.

Section 3 then generalizes the standard optimal tax model to allow for multiple sources of information about the individual, and derives expressions characterizing the optimal tax base. Section 4 makes use of these expressions and the PSID data to estimate the tax base that would be most attractive on equity grounds. Section 5 then examines the resulting equity vs. efficiency trade-off, and draws several conclusions about tax reforms that might be attractive on both equity and efficiency grounds. Our estimates suggest that capital income should be included to some degree in the tax base on equity grounds, complementing findings in studies such as and Conesa et al. (2008) that they should be included on efficiency grounds. In addition, we find that reducing the deductibility of property tax and mortgage payments can be justified on both equity and efficiency grounds. Finally, our results suggest equity gains form a shift to separate rather than joint taxation of couples.

## 1 Is an "ability" tax the ideal tax?

In order to assess the appropriate tax base, the past literature has focused on a utilitarian objection function, where welfare depends on the sum of individual utilities plus some function of tax revenue. Individual utilities are commonly assumed to differ only due to differences in earnings ability. Those with higher ability are presumed to have a lower marginal utility of income.<sup>3</sup>

The optimal tax literature then presumes that "ability" cannot be monitored for tax purposes. It instead focuses on labor income as the tax base: labor income is the key observable variable linked to earnings ability, since it equals wage rates times hours of work. If hours of work depend simply on the wage rate, then the correspondence between earnings ability and labor income is one-to-one. The optimal tax then trades off equity gains with efficiency costs from discouraging labor supply.

Of course, individuals differ in behavior for many reasons beyond differences in earnings ability. Tastes for consumption vs. leisure, tastes for consuming now vs. in the future, tastes for housing and local public services vs. other goods, all can differ among individuals with the same labor income. Given these multiple differences across individuals, how compelling is it to assume that marginal utilities of income differ across individuals only due to differences in earnings ability, the implicit assumption in the past optimal tax literature? Do differences in tastes convey no further information about marginal utility of income?

Consider, for example, an additively separable utility function:  $U_h(C_h) - V_h(L_h)$ , where  $L_h$  denotes labor supply for individual  $h$ ,  $C_h = w_h L_h$  measures her consumption, while  $w_h$  is her hourly wage rate (her "earnings ability"). In equilibrium, each individual supplies labor until  $w_h U'_h = V'_h$ .

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<sup>3</sup>The shape of this function is key in any quantitative discussion of the optimal tax rate schedule, although qualitative results need not depend on it.

Given  $w_h$ , chosen hours can be higher because the utility cost of time at work,  $V'_h$ , is lower evaluated at any particular  $L_h$ , or because  $U'_h$  is higher at any given value of  $C_h$ . In the first case, the equilibrium marginal utility of income,  $U'_h$ , is lower, whereas in the latter case the equilibrium  $U'_h$  is higher. Both yield the same observable outcomes, so cannot be distinguished based on data for  $C_h$ ,  $L_h$ , and  $w_h$ .

The optimal tax literature usually assumes that  $U'_h$  differs across people simply due to differences in  $w_h$ , so that  $U'_h$  is the same regardless of chosen hours of work. This in effect gives equal weight to these two sources of variation in tastes across people. If, for any given wage rate, hours in fact vary across people primarily because of variation in the utility costs of labor effort,  $V'_H$ , e.g. some people have more stamina than others, then those with higher hours have a lower equilibrium value of  $U'_h$ , justifying a tax on those who work more on equity grounds. Conversely, hours could vary across individuals due to variation in tastes for consumption, e.g. “needs,” so that those working more should be treated more leniently. In either case, there is another dimension to ability, whether “needs” or “stamina,” raising a question of how to combine these two indicators to define the underlying marginal utility of each individual.<sup>4</sup>

Similarly, those who choose to save more could do so because the marginal utility of consuming now is lower, or conversely because the marginal utility of consuming later is higher. In the first case, those who save have lower marginal utility of income, given “earnings ability,” and conversely. By focusing on “earnings ability,” we again view these two alternative scenarios as equally likely, so that observed savings choices reveal no information about an individual’s marginal utility of income.

Similarly, are there equity grounds for taxing an individual differently depending on her marital status, or the “earnings ability” of her spouse, given her own “earnings ability”? Marrying, or marrying a higher wage spouse, could in principle reflect a different dimension of ability: attractiveness as a possible mate. Conversely, marrying (or marrying a more “able” spouse) can just reflect a willingness to put up with a lot in order to have access to the extra income. Even if we presume the same utility level for individuals who make different choices, the individual with a high earning spouse may have a lower marginal utility of income. Whenever an individual has an unusually high-earning spouse, though, the spouse has an unusually low-earning mate. Even if this argument suggests treating the low-earnings spouse as having a lower marginal utility of income, given “earnings ability,” it simultaneously suggests treating the high-earning spouse as more deserving of transfers. On net, assuming that the overall “ability” of the couple is unaffected by the nature of the match is a not unreasonable choice.

Following the past literature, we therefore stick with the assumption that marginal utilities differ across people at the initial allocation due just to differences in earnings ability. Given this ability, some have chosen to marry and some not, some work long hours and others short hours, and some consume now and others consume later. Regardless, all are assigned the same marginal utility of income if they have the same “earnings ability.”

A second key assumption we make is that “earnings ability” can be approximated by an indi-

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<sup>4</sup>One observable reason for having less “stamina” could be poorer health, providing a rationale for treating those with poorer health more favorably under the tax law. Health problems, though, can also directly affect  $U'_h$ .

vidual’s wage rate. There can be many reasons, though, why “ability” differs from observed wage rates. To begin with, some individuals choose more pleasant jobs (being a professor?) rather than higher paying but less pleasant jobs (being an investment banker?). The observed wage rate then does not fully characterize the range of possible jobs the individual could have taken.

Education and on-the-job training also affect wage rates. If we take into account the foregone income and the out-of-pocket costs of education, though, then we should still measure the degree to which some individuals have better options than others.

Observed wage rates also leave out nonwage but still monetary compensation. We have no information, for example, about employer pension contributions or compensation through options or stock. In addition, the labor-contracting literature suggests that wage rates can differ period by period from earnings ability, even if their present values correspond. While there is a long tradition in labor economics of using the market wage rate as a measure of earnings ability, we do recognize the possible omissions.

## 2 Forecasting wage rates based on observables

Building on Atkinson and Stiglitz (1976), Saez (2001) shows that one key assumption needed for excluding consumption choices from the tax base is that these choices do not help forecast the individual’s marginal utility of income, after controlling for labor income. This is testable if wage rates are a reasonable proxy for ability and marginal utility depends on ability only. The objective of this section is then to see to what degree observable information now part of the income tax base helps forecast wage rates even controlling for labor income.

Our data were taken from the Panel Study of Income Dynamics. We included all individuals between ages 18 and 65 observed in any year between 1968 and 2001 who were not self-employed during that year.<sup>5,6,7</sup> We restricted the sample to the Survey Research Center subsample, in order to have a random representative sample.

Let  $Z_{ht}$  denote reported wage and salary income of individual  $h$  at time  $t$ . For  $w_{ht}$ , we normally used  $Z_{ht}$  divided by reported hours of work during the year. When reported labor income was small, however, we worried that this measure could be quite noisy, and of course it is undefined if hours equal zero. For cases with labor income below \$500, we imputed wage rates based on a regression forecasting wage rates as a function of individual fixed effects, year dummies, and age dummies.<sup>8,9</sup>

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<sup>5</sup>We chose 18 as an initial age so as to include the foregone earnings as well as the return to a college education. Time spent in school is viewed as uncompensated “work” rather than leisure, so earns a zero wage rate.

<sup>6</sup>For the self-employed, observed earnings are a noisy and misleading measure of earnings ability, since earnings can show up as dividends, capital gains, or royalty payments as well as wage income.

<sup>7</sup>We use the data from 1968 and 2001 to construct our variables but in the actual empirical specifications we rely on observations between 1994 and 2001 because interest and dividend income cannot be observed separately before 1994.

<sup>8</sup>For those first entering the labor force after age 18, we discounted their initial observed wage rate by 10% per year to construct wage rates back to age 18, on the presumption that the return to education/maturity was roughly 10% per year.

<sup>9</sup>Wage and salary income of course is only one form of compensation. Unfortunately, we have no data on fringe

In the empirical work we focus on a short list of income sources and expenditures for each individual that are in current use in the personal tax base, in addition to own labor income. In particular, we focus on: spouse’s labor income, interest income, dividends, mortgage payments, and property tax payments. Since these are in current use, we face no need to assess whether they can be observed for tax purposes.<sup>10</sup> These variables are all reported directly in the PSID.<sup>11</sup> All monetary variables were converted to real 2001 dollars using the consumer price deflator.

In estimating the relationship between this list of observables and wage rates, we restricted our sample to married couples. The sample of single individuals is particularly heterogeneous, consisting largely of the very young and the very old, along with some divorcees and never-married middle-aged individuals, so can yield results that vary substantially over time as sample composition changes due to changes for example in life expectancy and divorce rates. We defined an individual as “married” if he/she had been married at any point during the year.

Under U.S. tax law, married individuals normally file a joint tax return though, for example, in Canada and the U.K. they each file a separate return. We will ultimately examine whether separate or joint filing provides a better tax base. Let us first presume separate filing, and forecast the wage rate of each married individual as a function of own labor income, the couple’s earnings from financial assets, and their joint expenses for property tax and mortgage interest payments.

In these initial tests, we estimate nonlinear regressions of the form

$$w_{ht} = f(Z_{ht} + X_{ht}\alpha) + \tilde{\epsilon}_{ht} \tag{1}$$

Here,  $w_{ht}$  is the wage rate of individual  $h$  in year  $t$ ,  $Z_{ht}$  is this individual’s labor income that year,  $X_{ht}$  is a vector of other information about this individual, and  $\tilde{\epsilon}_{ht}$  is an iid error term.

The relationship between wage rates and observables can be highly nonlinear. To allow for this, we introduce an unconstrained function  $f(\cdot)$  relating the observable information to the wage rate.<sup>12</sup> The estimation procedure is semi-parametric minimum least squares. In particular, we use a kernel estimator for the function  $f(\cdot)$ , with the bandwidth chosen following the procedure recommended in Härdle et al. (1993). The estimates for the function  $f(\cdot)$  will be of direct interest, since they describe the strength of the local link between the tax base and the wage rate. Under this specification, we expect substantial heteroskedasticity in the error term. To deal with this, we use a type of GLS procedure also suggested by Härdle et al. (1993). In the first stage, we estimate equation (1) as written. We then forecast the square of the resulting residuals as a function of the square of the estimated value of  $f(Z_{ht} + X_{ht}\alpha)$ . Finally, we weight observations by the inverse of the forecasted

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benefits such as employer-financed pension contributions. We considered including unemployment benefits, since at least under full experience rating, these are payments financed out of past labor earnings that are not paid out as wages and salaries. This would lead to the right present value of earnings, even if not the right timing of actual productivity. A similar argument would apply to payroll taxes and/or Social Security benefits as well. PSID data does not allow for constructing comprehensive measures of this kind and hence we chose to ignore this issue.

<sup>10</sup>Other indicators not in current use in the tax code, may also be helpful in forecasting wage rates, given labor income. Examples could be age, gender, race, ethnic background, or region of residence. Since they are not in current use for tax purposes, though, we do not examine their potential role.

<sup>11</sup>No systematic information about realized capital gains is available in the PSID, however.

<sup>12</sup>This function is normalized so that the coefficient on  $Z_{ht}$  by construction equals one.



standard deviation for  $\tilde{\epsilon}_{ht}$  in a second stage regression. Reported results come from this second-stage regression.

The function  $B_{ht} \equiv Z_{ht} + X_{ht}\alpha$  characterizes the tax base that most closely approximates an individual's earnings ability. In column 1 of Table 1, we report estimates for  $\alpha$  when forecasting the wage rate for each married individual as a function of own labor income, the couple's income from interest and dividends, and the couple's joint expenses for property tax and mortgage interest payments. If the assumptions in Atkinson and Stiglitz (1976) are right (including lack of heterogeneity conditional on skills), the coefficients  $\alpha$  should all be insignificantly different from zero. In contrast, we find that all of the coefficients of these supplementary variables are statistically significantly different from zero. The most striking coefficient is that on property tax payments. One interpretation is that controlling for own labor income, those with a higher wage rate demand more local public services, so presumably better schooling for their kids. Alternatively, property tax payments and housing values may serve as a proxy for permanent income (or wage) and thus help in predicting the current wage beyond what can be learned from the income level alone.

Those with higher wage rates (controlling for own labor income) also have more interest and dividend income. This might occur because those with higher wage rates earned more in prior years, for a given value of current labor income, so have higher savings.<sup>13</sup>

Those with higher mortgage payments also seem to have higher wage rates, controlling for the other variables. Perhaps banks are more willing to lend to those with higher skills, even controlling for current earnings. Alternatively, those with higher skills have higher permanent income, even controlling for current earnings, so buy larger houses.

In column 2, we report comparable estimates for the special case in which we constrain the function  $f(\cdot)$  to be linear, so that the specification is equivalent to ordinary least squares. The coefficients are similar to those in column 1. Inspection of the estimated function  $f(\cdot)$  reveals that, for the most part of the earnings distribution, it in fact is quite close to being linear, so that this is not surprising.<sup>14</sup>

In columns 3 and 4 of Table 1, we report equivalent results for two subsamples. In column 3, the sample consists of the higher earning individual within each couple, while in column 4 the sample is the lower earning individual within each couple. Hours of work vary much less among the higher earning spouses, so that own labor income alone does a much better job of forecasting wage rates. Since there is little unexplained variation in the wage rates among the higher earnings spouses, it is not surprising that the other variables have small coefficients. Only interest income still enters strongly, while the sign of the coefficients on mortgage and property tax payments are now negative. Plausibly, the high earner in a couple that wants better housing or better schooling for their kids works longer hours in order to pay the required extra property taxes, implying a lower wage rate than otherwise expected given observed labor income.

In the results for lower earning spouses reported in column 4, however, all of the variables help

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<sup>13</sup>Alternatively, those with higher wage rates may suffer less from hyperbolic discounting, so again save more even controlling for current labor income.

<sup>14</sup>Figure 1 provides a graph of this function for one of the other specifications.

in forecasting wage rates. Property tax payments in particular play a major role. Perhaps the secondary earners most concerned about education are those who choose low or zero hours of work, in order to care for the kids. In order to check on the role played by spouses who were out of the labor force, we reestimated this specification on the subsample of lower-earning spouses who had positive hours of work. In these results (available on request), the coefficients are each roughly half as large, suggesting that an important role for these variables is in forecasting the wage rate for those who are out of the labor force.

Column 5 reports equivalent results presuming joint rather than separate filing. Here the dependent variable is the average wage rate of husband and wife, while labor income equals their average earnings. Again, the key additional indicators of use in forecasting wage rates are interest income and property tax payments.

Column 6 tests whether the labor income of the secondary earner should enter with a different weight when trying to forecast average wage rates of the couple. Given that the lower earning spouse presumably works fewer hours, we should expect a higher coefficient on this spouse's labor income, since the coefficient converting  $wH$  to  $w$  should be proportional to  $1/H$ . In contrast, our estimated coefficient for the labor income of the secondary earner is  $1 - .41 = .59$ , compared to a weight of one on the labor income of the primary earner. A natural explanation for this result is that hours of work are more random among secondary earners, making this indicator for the wage rate much less informative.<sup>15</sup>

The suggested tax base implied by these results corresponds in some ways to current law for married individuals, but not in others. Focusing on the results in column 5, the estimated weight on interest income is 1.7. Interest income enters more strongly in the tax base than under current law, even though the only reason for its presence is to help in forecasting unobserved ability. The estimated weight on dividend income is 0.18, so again corresponding to the inclusion of dividend income, but at a more favorable rate, as under current law.

The suggested treatment of mortgage and property tax payments differs dramatically, however, from current law. Rather than allowing these payments as a deduction, the results instead suggest imposing additional taxes on households based on these expenditures, particularly property tax payments. Note, though, that property tax payments are not currently deductible for households that do not itemize or for those who are subject to the AMT. The President's Advisory Panel on Federal Tax Reform also proposed eliminating the deductibility of property tax payments, and severely restricting the deductibility of mortgage payments, moving the tax code towards the tax base suggested by our initial results.<sup>16</sup>

This leap, though, from regression results to the desired tax base is very casual. The aim of the

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<sup>15</sup>For example, if hours satisfy  $H = \hat{H}(1 + \hat{\eta})$ , then the expected coefficient on  $wH$  is  $1/[H(1 + \sigma^2)]$ . When we constrained the sample to couples where both spouses report positive hours, the estimated weight on the labor income of the secondary earner is .83. While still less than one, suggesting that hours of work are still much more variable for secondary earners than for primary earners, this effect is now much less strong.

<sup>16</sup>We do not of course model alternative rationales for these deductions such as potential externalities from house ownership and local government externalities.

next section is to think through this link more carefully.

The estimates for the function  $f(\cdot)$  can also be revealing. In Figure 1, we graph our estimates for the forecasted average wage rate for a couple as a function of just the couple's average labor income. Here, we find that the forecasted average wage rate is roughly proportional to average labor income for those with average earnings above about \$50,000. Reported earnings are much less informative about wage rates, however, among couples with lower earnings. If income for those earning below \$50,000 is not very informative about earnings ability, then any tax on this income provides limited equity gains while still generating important efficiency costs, suggesting a lower optimal tax rate.

### 3 Theory

#### 3.1 Initial derivation

When there are multiple indicators that are jointly useful in forecasting earnings ability, how should the tax base be designed? To assess this, we begin with an analysis of a single individual. Consider a one-period economy consisting of  $H$  single individuals. Individual  $h$  has wage rate  $w_h$ , labor income  $Z_h$ , a vector of consumption  $C_h$ , and some other observable indicators  $X_h$  that can potentially enter the tax base.

Tastes for leisure and consumption vary arbitrarily across individuals. The utility function for individual  $h$  is denoted  $U(C_h, X_h, Z_h; w_h, h)$ , where  $h$  enters the utility function directly to capture any heterogeneity in individual tastes. Here, labor income serves as a proxy for leisure, i.e. leisure equals  $Z_h/w_h$ .

Tax payments are denoted by  $T(B_h)$ , where the tax base  $B_h$  is some function of observables. Assume in particular that  $B_h \equiv Z_h + X_h\alpha$ , to capture the typical structure of the income tax base.

We assume that the marginal utility of income for an individual, denoted by  $U_{hY}$ , simply depends on the individual's wage rate at the observed market equilibrium, regardless of the hours of work and the consumption bundle they choose. We assume that marginal utility is a declining function of the wage rate.

To see more explicitly the assumed normalization of marginal utility, suppose that the utility function  $U(C, X, Z; w, h)$  is some general cardinal representation of preferences for each individual. At the particular date when we entertain the possibility of a reform, marginal utility of income is given by  $g(w, h) \equiv U_Y(C(w, h), X(w, h), Z(w, h); w, h)$ , where  $C$ ,  $X$ , and  $Z$  denote the individual's choices given the environment at that particular date. On equity grounds, we assume that the marginal utility of income at that date depends just on the wage rate, so can be expressed by some function  $U_Y(w)$ . Consequently, the normalized marginal utility of each individual, up to an additive constant, equals  $U_{hY}(C, X, Z; w) \equiv \frac{U_Y(w)}{g(w, h)} U_Y(C, X, Z; w, h)$ .<sup>17</sup>

The government's objective function is assumed to equal:  $\max \sum_h U_h + W(\sum_h T(B_h))$ , where  $W(\cdot)$  is a concave function that reflects the aggregate utility that individuals receive from government

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<sup>17</sup>While unneeded in the following discussion, one may assume as well that the level of utility is also the same for individuals who have the same wage rate, providing a condition determining the value of the additive constant.

expenditures<sup>18</sup> and/or the utility that officials extract through their control over tax revenue. Given this objective function, the government has an incentive to collect revenue more so from individuals with lower marginal utility of income, so higher wage rates. It does not observe wage rates, though, so must rely on observable information. Any distributional gains depend on the average marginal utility of income among those with a higher vs. a lower value of the available tax base. If the tax base were entirely uninformative about wage rates, then these marginal utilities would be equal. The more informative the tax base is about the unobserved wage rates, the larger the difference in the average marginal utilities of income among those with a higher vs. lower value of the tax base, and so the larger the potential distributional gains from basing taxes on this tax base.

The resulting first-order condition for  $\alpha$  (the parameter defining the tax base) is:

$$\sum_h (1 - U_{hY})T'(B_h)X_h = - \sum_h T'(B_h) \left( \frac{\partial Z_h}{\partial \alpha} + \alpha \frac{\partial X_h}{\partial \alpha} \right) \quad (2)$$

Here, the left-hand side measures the welfare gain from transferring a given amount of revenue from individuals to the government, where individual  $h$  pays an additional amount proportional to  $T'(B_h)X_h$ . The resulting net benefit depends on the difference between the marginal value of public funds, by normalization equal to one, and the marginal utility of private funds to individual  $h$ ,  $U_{hY}$ . The right-hand side measures the marginal excess burden created by this increase in tax rates arising from any drop in either element in the tax base.

To shed more light on the left-hand side, we group individuals based on their initial tax base. With some abuse of notation, group  $B$  contains all  $N_B$  individuals with tax base equal to  $B$ . Restating this first-order condition,

$$\sum_B N_B T'(B) E[(1 - U_{hY})X_h | B] = - \sum_h T'(B_h) \left( \frac{\partial Z_h}{\partial \alpha} + \alpha \frac{\partial X_h}{\partial \alpha} \right) \quad (3)$$

Consider next an alternative tax change that alters the tax schedule  $T$ , holding  $\alpha$  fixed, so as to raise just as much extra revenue from those in group  $B$  as occurs with the initial reform.<sup>19</sup> The resulting increase in tax payments for each individual in group  $B$  must then equal  $T'(B)E[X_h | B]$ . The change in welfare resulting from this alternative tax change equals:

$$\sum_B N_B T'(B) (1 - E[U_{hY} | B]) E[X_h | B] = - \sum_h T'(B_h) \left( \frac{\partial Z_h}{\partial n} + \alpha \frac{\partial X_h}{\partial n} \right) = 0, \quad (4)$$

where “ $n$ ” denotes this alternative reform (and the first-order condition is evaluated at  $n = 0$ ). If the initial tax structure is optimal, then any marginal change from the existing optimal rate schedule must have no marginal effect on welfare.

The question is then how expressions (3) and (4) compare. At the optimal tax base, both expressions equal zero, and the difference then equals zero. Consider first the difference between

<sup>18</sup>Without loss of generality, we normalize utilities so that  $W' = 1$  at the existing policy.

<sup>19</sup>A similar approach has been used recently by Laroque (2005) and Kaplow (2006) to show that under separability there is always a Pareto improving reform that eliminates differential taxation of bases other than labor income.

the left-hand sides. This difference (capturing the gains from redistribution) equals:

$$-\sum_B N_B T'(B) E[(X_h - E[X_h|B])U_{hY}|B] = -\sum_B N_B T'(B) \text{cov}(U_{hY}, X_h|B). \quad (5)$$

This is nonzero to the extent that information about  $X_h$  helps forecast  $U_{hY}$  among those with the same  $B$ . Recall that  $U_{hY} = U_Y(w_h)$  depends simply on the individual's wage rate. Therefore, this expression implies an equity gain, supporting including  $X$  in the tax base, to the extent that  $X$  helps in discriminating between low and high wage-rate individuals who have the same  $B$ . If  $X_h$  provides no information about wage rates, given  $B$ , then the covariance will be zero.

For example, assume that  $B$  represents labor income, while  $X_h$  is some form of consumption. If consumption is simply a function of labor income, and does not vary across individuals with different wage rates but the same labor income, then the covariance will be zero. If tastes vary with wage rates, even given labor income, however, then the covariance will be nonzero and there are equity grounds for including  $X_h$  in the tax base.

Consider next the difference between the right-hand sides in expression (4), measuring the excess burden from this compensated change in the tax base. Consider for illustration the special case focused on in Atkinson and Stiglitz (1976), where consumption is weakly separable from leisure for each individual. If a particular good comprises  $\theta\%$  of an individual's consumption, then a tax at rate  $\alpha T'$  on this good has the same marginal effect on individual utility as a tax on labor income at rate  $\alpha\theta T'$ , regardless of that individual's wage rate. When  $\theta$  varies across individuals, the equivalent increase in the labor tax rate varies across individuals. If those with high  $\theta$  on average have the same labor supply elasticity as those with low  $\theta$ , however, then the commodity tax change has the same impact on aggregate labor income,  $\sum_h Z_h$ , as a change in the tax rate on labor income of  $\alpha E(\theta)T'$ .<sup>20</sup>

The efficiency effects of the combined tax changes, arising from changes in  $X_h$  can then be expressed by

$$-\sum_h T'(B_h)\alpha \left( \frac{\partial X_h}{\partial \alpha} - E(X_h|B) \frac{\partial X_h}{\partial I} \right) = -\sum_h T'(B_h)\alpha \frac{\partial X_h}{\partial \alpha} |_c. \quad (6)$$

Here, the expression in parentheses corresponds to the sum of the compensated price effects on  $X_h$ , as claimed by the second expression in this equation, if the income effects  $\partial X_h/\partial I$  are not correlated with  $X_h$ , given  $B$ , again corresponding to Assumption 2 in Saez (2002). Under these assumptions, therefore, the marginal excess burden equals zero starting from  $\alpha = 0$ , increases as  $\alpha$  differs from zero, and more so the more responsive is  $X_h$  to its price. The same argument applies to the efficiency terms involving  $Z_h$ .

Our paper does not attempt to estimate these efficiency effects. Instead, we focus on the size of the redistributive effects of tax reforms, as measured by expression (5). When these are nonzero, the optimal value of  $\alpha$  is also nonzero and would be set to balance distributional gains and efficiency losses.

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<sup>20</sup>This assumption corresponds to Assumption 2 in Saez (2002).

Figure 2 provides a possible graph of both the redistributive gains and the efficiency losses generated by changes in  $\alpha$ . Here,  $\hat{\alpha}$  represents the value of  $\alpha$  that maximizes the redistributive gains, so where expression (5) equals zero. Under the separability assumptions in Atkinson and Stiglitz (1976), efficiency is maximized at  $\alpha = 0$ . The optimal value of  $\alpha$  is  $\alpha^*$ , a value between zero and  $\hat{\alpha}$ .<sup>21</sup>

### 3.2 Derivation for Married Couples Filing Jointly

Several further issues arise when considering the tax base for a tax on married couples, assuming joint filing.<sup>22</sup> To begin with, only the couple's joint income from interest, dividends, and their joint mortgage and property tax payments are observable in practice, given the flexibility couples have in changing the name of the owner of any given asset for tax purposes.<sup>23</sup>

An important new question is how any changes in tax liabilities are shared between the two spouses. For simplicity, we assume that any tax change is equally divided between the two spouses.<sup>24</sup> Decreasing the taxes on any married individual by a dollar then increases the utility of the couple by  $.5(U_{pY} + U_{s(p)Y}) \equiv \bar{U}_{pY}$ , where  $s(p)$  denote the spouse of any given primary earner  $p$  and where  $\bar{U}_{pY}$  is defined to equal the average marginal utility of income in the couple.

With joint taxation, the earnings of the secondary earner can potentially be treated differently from that of the primary earner. If so, assume that the tax base for the couple under joint filing equals  $B_p = Z_p + \gamma Z_{s(p)} + \alpha X_p$ . For any  $\gamma \neq 1$ , the marginal tax rate varies between high and low earners within a couple.

The equivalent to expression (5) used to characterize the optimal choice of  $\alpha$ , now summed over couples (primary earners) rather than over individuals becomes:

$$-\sum_B N_B T'(B) E[\bar{U}_{pY}(X_p - E(X_p|B))|B] \quad (7)$$

If earnings of the secondary earner are treated differently, then we have an additional expression for the optimal  $\gamma$ :

$$\sum_B N_B T'(B) E[\bar{U}_{hp}(Z_{s(p)} - E(Z_{s(p)}))|B] \quad (8)$$

Under the tax base that best approximates an ability tax, one or both of these expressions would equal zero, depending on whether secondary earners are taxed differently.

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<sup>21</sup>With multiple dimensions of  $\alpha$ , we instead would solve for the vector of marginal distributional benefits for changes in the vector  $\alpha$ . The marginal excess burden term then takes the form  $-\Omega\alpha$  for some matrix  $\Omega$ . In the special case in which the matrix  $\Omega$  is diagonal, the marginal distributional gain at the optimum must be larger when the marginal excess burden is larger.

<sup>22</sup>In order to decompose this analysis from that on single individuals, we hold fixed the tax base for single individuals when considering possible changes to the tax base for married couples.

<sup>23</sup>In community property states in the U.S., such changes in the nominal owner have no legal implications for divorce settlements, though they can in other states.

<sup>24</sup>See the Appendix for a derivation justifying this assumption when the couple engages in Nash bargaining, where each has a fall-back position equal to the utility he or she would have as a single individual, and where their bargaining power is equal.

### 3.3 Married Couples: Joint vs. Separate Filing

A number of countries tax married individuals separately. The U.S. provides this as an option as well, though relatively few married individuals make use of it. Can a case be made on equity grounds for joint vs. separate filings?

We derived the optimal tax base on equity grounds under joint filing in the previous section. What would the optimal tax base be instead, assuming separate filing? Here we assume the same tax schedule for both primary and secondary earners, so need to assess the welfare effects on both spouses from modifying the tax base.<sup>25</sup> Again we assume that the combined tax change is shared equally among the two spouses.

With separate filing, there is also a policy choice about how to deal with joint assets and liabilities. One approach is to base the law on legal ownership and liability for each asset, giving the couple substantial flexibility to reassign ownership to the spouse facing the lower marginal tax rate, in order to minimize taxes. The approach we presume instead is that the law taxes each spouse based on their joint assets and liabilities, but their individual labor income.

Consider then the effects of a marginal change in  $\alpha$  on a couple, taking into account the effects on the tax liabilities of both spouses. The resulting term equivalent to that on the left-hand side of equation (1) is:

$$\sum_p (1 - \bar{U}_{pY}) [T'(B_p)X_p + T'(B_{s(p)})X_p] = \sum_h (1 - \bar{U}_{hY}) T'(B_h)X_h \quad (9)$$

Here, the first expression is summed over primary earners, so over  $p$ , while the second term is summed over individuals,  $h$ . Note that this second expression is identical to the term on the left-hand side of equation 1, except that marginal utility is for the couple rather than for the individual. With this reinterpretation, we can then follow the previous derivation, implying that the optimal tax base on distributional grounds satisfies

$$- \sum_B N_B T'(B) E [\bar{U}_{hY}(X_h - E[X_h|B])|B] = 0 \quad (10)$$

The question then is how to compare the welfare resulting from use of separate vs. joint filing. Consider the welfare effect of a shift from joint filing to separate filing, with a compensating transfer designed to leave the expected taxes paid by those with any given joint-filing tax base unchanged. The resulting impact on welfare equals

$$\sum \bar{U}_{pY} (T^S(B_p) + T^S(B_{s(p)}) - E(\sum_s T^S|B_p^j)) \quad (11)$$

Here,  $T^S$  denotes the tax schedule for an individual assuming separate filing,  $B_p$  ( $B_{s(p)}$ ) is the optimal tax base estimated above under separate filing for the primary (secondary) earner,  $B_p^j$  is the tax base for the couple under joint filing, while  $\sum_s T^S$  measures the expected tax payments by the couple under separate filing, conditional on  $B_p^j$ .

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<sup>25</sup>We again hold fixed the tax base for single individuals when considering possible changes to the tax base for married couples filing separately.

## 4 Estimation given theory

Our initial empirical work provided suggestive evidence about the possible value of various observations about individuals in addition to their labor income in the design of the tax base. The value of these other indicators in forecasting wage rates can easily vary though across individuals. Based on the theory, we find that any additional ability to forecast wage rates is more important for those individuals with a high marginal utility of income and also for those facing a high marginal tax rate.

Our aim in this section is to estimate the value of  $\alpha$  that is most attractive on equity grounds, given the theory. We will do this for married couples filing jointly and also filing separately. Given these results, we can then compare the equity gains from joint vs. separate filing.

According to the theory, the optimal tax base for a married couple filing jointly should satisfy equation 7.<sup>26</sup> This equation can be reexpressed as follows:

$$\begin{aligned}
 & - \sum_B N_B T'(B) E[\bar{U}_{pY}(X_p - E(X_p|B))|B] = \\
 & - \sum_B N_B T'(B) E(X_p \bar{U}_{pY}|B) + \sum_B N_B T'(B) E(X_p|B) E(\bar{U}_{pY}|B) = \\
 & - \sum_p T'(B_p) X_p \bar{U}_{pY} + \sum_p T'(B_p) X_p E(\bar{U}_{pY}|B)
 \end{aligned} \tag{12}$$

The first term can immediately be calculated, once we have functional forms for  $T(\cdot)$  and  $\bar{U}_Y$ . Evaluating the second term requires evaluating  $E(\bar{U}_{hY}|B)$ .<sup>27</sup> Conditional on this expression, the second term can also immediately be calculated.

Deriving the equivalent expression for the optimal tax base for married couples filing separately, the only change in the expression is the replacement of the tax rates  $T'$  for married couples filing jointly with the tax rates for these individuals filing separately.

The key next steps in estimation are choosing functional forms for  $T'(\cdot)$  and  $\bar{U}_Y$ . Rather than trying to derive the optimal tax rate schedule  $T'(\cdot)$  based on our data, as was done for example in Gruber and Saez (2002), for married individuals filing jointly we simply use the observed tax rate schedule for couples filing jointly in 2000. For married individuals filing separately, we used the tax schedule for single individuals in 2000.<sup>28</sup>

For  $\bar{U}_{pY} = .5(U_{pY} + U_{s(p)Y})$ , our normative assumption is that  $U_{hY} = u(w_h)$ . The key issue is choosing the functional form for  $u(w_h)$ . In our base case, we assume that  $u(w_h) = 1/\max(w_h, \$5)$ , consistent with a utility function equaling  $w_h^{1-\gamma}/(1-\gamma)$  with  $\gamma = 1$ , and assuming that social-safety-net programs assure a minimum standard of living equivalent to what would be faced by someone with a wage rate equal to \$5. As robustness checks, we also report some results for alternative utility functions (other values for  $\gamma$ ) and also for a minimum effective wage rate of \$3.

<sup>26</sup>For now, we ignore the possibility of taxing secondary earnings differently.

<sup>27</sup>Note that this expression does not vary across the first-order conditions for each element in  $\alpha$ , which provides an important computational advantage.

<sup>28</sup>Unfortunately, the NBER Taxsim program did not include a procedure for married couples filing separately, so we approximated their tax schedule with that for single individuals.



Estimation is done on the same sample from the PSID used in section 2, and implemented in R, relying on the *np* package (Hayfield and Racine, 2007) for implementation of semiparametric and nonparametric components.

We construct an empirical estimate of  $E[\bar{U}_{hY}|B]$  by a nonparametric (kernel) regression of  $\bar{U}_{hY}$  on  $Z + \alpha X$ . We select the bandwidth by least-squares cross validation.<sup>29</sup> We then search for the values of the vector  $\alpha$  that simultaneously satisfy the above first-order conditions for each element of  $\alpha$ . The number of moment conditions is the same as the number of elements of  $\alpha$  and hence the optimal value is just identified.

Estimation results for the optimal tax base for married couples filing jointly are reported in column 1 of Table 2. Results are broadly similar to those reported in section 2, so that the reweighting of observations based on differences in marginal utility and in marginal tax rates did not have major effects on our results. While the coefficient on dividend income is even smaller than before, the coefficient on interest income is virtually equal to one, consistent with current law. Mortgage payments now provide little or no added information in forecasting ability, so should not enter into the tax base without some other justification. As before, we find that property tax payments not only should not be allowed as a tax deduction but instead should be taxable, since those who make higher tax payments tend to be more able, for any given labor income.

In column 2, we allow a separate tax rate on the labor income of primary vs. secondary earners. Here, results changed substantially relative to those in Table 1. Literally, the coefficients indicate that the weight on the labor income of the secondary earner should be 2.5 times that on the primary earner. Ignoring any randomness in labor income, given wage rates, this would be consistent with the weighted average hours worked by the secondary earner (with those with a low wage rate being weighted heavily) being 1/2.5 times the average hours worked by the primary earner.<sup>30</sup> Apparently, the noise in hours that had pushed this coefficient down in the estimation in Table 1 is much less of an issue among the low wage workers, while their weighted average hours are smaller.

The other coefficients respond substantially to this change in the weight on the income of the secondary earner. In particular, the weight on interest income is now about half way between the weights on the labor incomes of primary vs. secondary earners, while the weight on property tax payments is somewhat higher than the weight on the income of the secondary earner. This pattern would arise when higher interest income and higher property tax payments are associated with lower hours of work for the secondary earner. Higher mortgage payments are also now weighted more heavily, and again may serve as a signal of low hours for the secondary earner.

Estimation results for the optimal tax base for married couples filing separately are reported in columns 3 and 4 of Table 2. In contrast to the results in Table 1 and those in column 1 of Table 2, we now find much more weight given to these supplementary sources of information. These results

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<sup>29</sup>Because least-squares cross validation is computationally intensive, we implement it by optimizing at a given bandwidth, performing cross validation at the optimum, and iterating until the bandwidth converges. In practice, results are not very sensitive to the choice of bandwidth.

<sup>30</sup>According to the data, the ratio of the average hours worked by secondary earners to those of primary earners is 0.75.

apparently are driven by the extra weight being put on approximating well the tax base for those with high marginal utility of income but low hours of work, who are not as poor as they would appear based on reported labor income.

In column 4, we consider a somewhat counterintuitive tax system with separate filing but the possibility of making taxable income depend on the spouse's income. Interestingly, this specification finds a very significant role for spousal income and eliminates the importance of mortgages and property taxes. In forecasting the head's wage rate, we know from the results in Table 1 that mortgage and property tax payments are of little use. In forecasting the wage rate of the spouse, though, we now find that the head's income (the income of the spouse's spouse) does a better job than mortgage and property tax payments (as can be seen by comparing  $R^2$  in columns 3 and 4).

Table 3 provides some robustness checks. In columns 1-2 of Table 3, we reestimate the results in columns 1-2 of Table 2, but now assuming that the minimum effective wage rate is \$3, rather than \$5. Remarkably little changes. In columns 3-4, we reestimate the results in column 1-2 of Table 2, assuming a less concave utility function ( $\gamma = .5$ ), while in columns 5-6 we assume a more concave utility function ( $\gamma = 2$ ). The reestimates of column 1 of Table 2 results in very small changes, so this specification is very robust. The reestimates of column 2 of Table 2 prove to be much more sensitive. The more weight that is put on individuals with lower wage rates, the higher the estimated weight on spousal income, and on most of the other indicator variables. This pattern is entirely consistent with our prior explanation that lower-wage-rate individuals have lower hours, and less variable hours than do those with higher wage rates, and these lower wage rate individuals receive more weight in the reestimation results in Table 3.

Recall that based on equation 11 we can compute the gain/loss from choosing separate filing over joint filing. The question is whether separate filing does a better job of approximating an ability tax, particularly for those couples with high marginal utility of income. To provide a natural interpretation in monetary terms, we normalize this expression by the sum of marginal utilities. When we compare the joint filing specification characterized by the results in column 1 of Table 2 to the separate filing specification in column 3, there is a loss from separate filing corresponding to \$1196. When we compare the joint filing in specification 2 to the separate filing in specification 4, the loss declines to \$140: the ability to take advantage of spousal information reduces (as would be expected) most of the difference between joint and separate filing.

## 5 Equity vs. Efficiency Gains

In our empirical work, we focused on estimating  $\hat{\alpha}$ , the tax base that would be optimal taking into account solely distributional considerations. The choice of tax base clearly has important effects on economic efficiency as well. We have made no attempt to estimate the marginal excess burden of any change in the tax base.

Even without any quantitative information about the size of efficiency effects, however, we can at least take into account the sign of these efficiency effects. Consider each of the additional sources of information in turn:

**a) Spousal income:** On equity grounds, our results suggest that spousal labor income should be weighted more heavily than is the labor income of the primary earner, presumably reflecting lower average hours of work for secondary earners. Yet on efficiency grounds, the labor income of secondary earners should be taxed more lightly, given the greater sensitivity of labor supply to the net-of-tax wage rate among secondary earners. Having the same weight on the labor income of secondary earners and primary earners can be interpreted as providing a rough balancing between equity and efficiency considerations.

**b) Interest and dividend income:** Here, we find that under the ideal tax base focusing solely on distributional considerations, the tax treatment of income from savings would resemble the current tax structure. There is a large literature assessing the optimal tax treatment of savings, focusing solely on efficiency considerations. The recent literature suggests a positive tax on savings on efficiency grounds.<sup>31</sup> Simulations of the optimal rate often resemble existing tax rates. Existing rates may then seem broadly consistent with the theory on both efficiency and equity grounds.

**c) Mortgage interest payments:** Here, on equity grounds, we forecast that these payments should not play any nontrivial role in the tax base. Ignoring any externalities, the treatment that is best solely on efficiency grounds would be to treat investments in owner-occupied housing and negative investments in bonds (mortgages) the same as other forms of savings. If on efficiency grounds, savings should be taxed, as is argued in the recent literature, then the implicit rental income from housing should be taxable and mortgage interest deductible. Alternatively, if the implicit rental income from housing is not taxable, then a compensating response would be to eliminate the deductibility of mortgage interest<sup>32</sup>. On both equity and efficiency grounds, then mortgage interest should not be deductible.

**d) Property tax payments:** Our results indicate that property tax payments provide valuable information in forecasting wage rates, even given labor income. On equity grounds, not only should these expenditures not be deductible, but they should instead add to the tax base. On efficiency grounds, fiscal externalities and spillovers from local public expenditures are often used to defend the current tax deductibility of property tax payments. The offsetting equity costs raise questions, though, about the current tax treatment.

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<sup>31</sup>One strand of this literature, reviewed in Golosov et al. (2006), shows that a positive tax rate on capital income makes it easier to redistribute between high ability and low ability individuals, by making it less attractive for high ability individuals to save to finance consumption during periods with low future earnings. A second strand, exemplified by Conesa et al. (2008), argues that taxation of capital income serves to redistribute resources from periods when individuals are not credit constrained to periods when they are.

<sup>32</sup>Eliminating both together works appropriately if the face value of the mortgage and the house are equal.

## A Behavior of Married Couples

Assume that married couples choose their joint labor supplies and joint consumption levels based on Nash bargaining over the division of their joint resources. Under Nash bargaining, each spouse has as a fall-back position the utility he or she would have as a single individual.

Denote the utility function of the husband by  $U^H(C_H, L_H)$ , where  $C_H$  is consumption and  $L_H$  is leisure. Similarly, let the utility function of the wife be  $U^W(C_W, L_W)$ . If single, consumption and leisure satisfy  $C_{HS} = w_H(1 - L_{HS}) - T_{HS}$ , and similarly for the wife, where  $T_{HS}$  denotes tax payments when single. As a married couple, they face a joint budget constraint equal to

$$C_{HM} + C_{WM} = w_H(1 - L_{HM}) + w_W(1 - L_{WM}) - T_M \quad (13)$$

Under Nash bargaining, they choose their consumption levels and labor supplies to maximize

$$\left( U^H(C_{HM}, L_{HM}) - U^H(C_{HS}, L_{HS}) \right) \left( U^W(C_{WM}, L_{WM}) - U^W(C_{WS}, L_{WS}) \right) \quad (14)$$

where we implicitly assume here that the two spouses have equal bargaining power. To simplify the resulting algebra, we take a first-order approximation to each change in utility, e.g.  $U^{HM} - U^{HS} = U_C^{HM} \Delta C_H + U_L^{HM} \Delta L_H$ .

The resulting first-order conditions can be combined to show that labor supply is allocated efficiently between the two spouses:

$$\frac{U_L^{HM}}{U_C^{HM}} = \frac{U_L^{WM}}{U_C^{WM}} \frac{w_H^n}{w_W^n} \quad (15)$$

Here,  $w^n$  denotes the net-of-tax wage rate on marginal labor supply. Unless, total resources change, there is no impact of marriage then on labor supplies.

Given this result, the first-order conditions for the consumption of each spouse can be expressed by

$$\Delta C_W = \Delta C_H + \left( \Delta L_H \frac{w_H^n}{w_W^n} - \Delta L_W \right) \frac{U_L^{WM}}{U_C^{WM}} \quad (16)$$

If each couple spends the same fraction of any extra resources they receive on consumption vs. leisure, then we infer that  $\Delta C_W = \Delta C_H$ .

## B Data

We rely on PSID data for 1968-1997, 1999 and 2001. We extract the following categories of variables (further details follow): demographic variables (gender, age, marital status, number of children, state of residence), hours, labor income, business and farm income, business and farm assets, unemployment income, mortgage payments, property taxes, dividend, interest income and other categories of capital income when available. We rely on this information to construct the following variables used in the analysis: wages, labor income, dividend, interest and trust income (disaggregated when

possible), mortgage payments, property taxes, marginal tax rates, total federal and state tax liability. Because in some cases questions in PSID change over time, we devoted considerable effort to come up with definitions that are consistent over time. We discuss our procedure for each variable in more detail below.

Generally, we restrict the sample to the Survey Research Center sample which is a random equal probability sample of the U.S. population. We exclude the so called Survey of Economic Opportunities sample that was not consistently covered throughout the whole period (changes occurred in 1997) and that was derived by a somewhat unclear sampling procedure (see Charlie Brown.... for details). We also exclude the Latino sample that was followed for a short period of time only. We use in our analysis data for heads and wives, and do not rely on information about a person when she was a dependent. We do not use PSID sampling weights anywhere. We often weight observations by either the average family labor income or the average own labor income depending on whether family-level or individual observations are used. Unless otherwise indicated, we adjust dollar variables for changes in the price level using the CPI-U index, using 2001 as the baseline.

**Labor income.** We construct full labor income by adding up wages and salaries, bonuses, overtime payments, tips, commission income, professional practice income, miscellaneous labor income and labor part of business/farm income. The last of these variables is imputed in PSID with rules regarding spousal shares and labor/capital division varying somewhat over time, but with not enough information to adjust to any standard definition. This is one reason why we usually exclude individuals owning a business.

**Asset income.** PSID has always included questions about some forms of capital income but due to changes in how the questions were asked and changes in the detail of breakdown of asset income into various categories, we can only construct a consistent definition starting in 1984. For 1984-1992, we construct a single variable “dividend, interest and trust income” for both heads and wives. This variable specifically excludes other categories of asset income that cause definitional problems prior to 1984 such as rental income, alimony, business and farm income, “market gardening” and “roomers and boarders.” It is constructed separately for heads and wives but in practice we use it aggregated to the family level. Starting in 1993, we can actually separate dividend, interest and trust income for both heads and wife and we do so.

**Business Income.** For the most part, we exclude business owners from the analysis. Labor income includes a share of income from business as constructed by PSID. We construct a separate business labor income variable for heads and wives but, in the case of wives, we can do so only starting in 1993. We also construct a family-level variable representing business asset income. Finally, and most credibly due to data and conceptual problems with allocating business income to capital/labor categories, we construct a family level total business income variable. Prior to 1993, this variable does not include (usually small) wife’s labor share of business income.

**Wage rate.** While a wage rate measure is already available in the PSID, our labor income measure does not exactly coincide with the PSID measure and we define it by dividing our definition of labor income by the hours reported in the PSID. We do so for those who work more than 500 hours in a given year. For those who work at most 500 hours, we impute the wage rate by first regressing log wages when working more than 500 hours on the full set of year and age dummies and individual fixed effects, for men and women separately, and then using fitted values from this regression (accounting for the individual fixed effect) in years when a person works 500 hours or less. Although we use data starting with 1984 for most of the analysis, the wage imputations and lifetime wage calculations use wage rates starting from 1968.

**Deductions.** Information about mortgage payments and property tax payments is systematically available in the PSID starting in 1984. In some cases mortgage payments include property taxes. In those cases, we reduce mortgage payments by separately reported property tax if the latter is not greater than mortgage payments.

**Other issues.** State of residence is not available in years 1994-1997. In these cases, we assign state of residence from the nearest year among 1992, 1993, 1999, 2001 for which state of residence is available.

We use the term “secondary income” to denote the spouse with lower income.

**Taxes.** We compute tax liability by relying on the TAXSIM calculator available at <http://www.nber.org/taxsim>. Our calculation accounts for: labor income of both spouses, unemployment insurance, dividends and interest income (separately starting with 1993, jointly and treated as interest income prior to 1993). We account for the number of children for the purpose of computing exemptions/child tax credit. We assign filing status of married filing jointly (to those married), single (to those single without children) or head of households (single with children). Because our analysis is performed for those between ages of 25 and 60, age exemptions are not an issue. We use TAXSIM to compute federal and state tax liability and marginal tax rates, while accounting for the information listed above. We use federal marginal tax rates unless otherwise indicated (although state taxes do affect federal taxes through their effect on itemized deductions).

We construct three variants of the tax rates. The current tax rate is obtained by applying law in effect at the time of the interview. The 1999 tax rates are obtained by first indexing all the dollar variables to 1999 values using Social Security Administration wage index and then applying the 1999 law. The hypothetical tax rates when single apply to those who are married and are obtained as follows. Based on the single population we compute the average number of hours working by age and gender. We then construct hypothetical labor income when single by multiplying own wage rates by the average hours when single given age and gender. We allocate half of children to each parent, with the odd child going to the mother. Own unemployment income, if any, is used. Half of capital income is allocated to each spouse. We multiply property and mortgage interest payments by 2/3 to rudimentarily account for returns to scale in these kinds of payments occurring within

a family. Finally, we assign the marital status of single or head of household, depending on the presence of children, and apply the current law.

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Table 1: Predicting wages

Variables	Married Individuals		Married	Married	Married Couples	
	(1)	Linear (2)	Head (3)	Spouse (4)	(5)	(6)
Spousal income						-0.408 (0.018)
Dividends	0.359 (0.032)	0.378 (0.042)	0.052 (0.011)	0.423 (0.023)	0.176 (0.053)	0.483 (0.059)
Interest	1.173 (0.039)	1.493 (0.080)	0.559 (0.018)	1.893 (0.094)	1.700 (0.070)	1.702 (0.067)
Mortgage	0.418 (0.022)	0.432 (0.026)	-0.034 (0.011)	0.600 (0.045)	0.223 (0.041)	0.019 (0.037)
Property Tax	2.522 (0.058)	3.056 (0.105)	-0.191 (0.045)	5.126 (0.155)	1.381 (0.043)	1.961 (0.137)
Bandwidth	2344.369		721.082	3290.666	2700.804	3455.407
$R^2$	0.650	0.629	0.820	0.341	0.747	0.763
$N$	22736	22736	11351	11379	11396	11390

Table 2: Optimal tax base

Variables	Joint Filing		Separate filing	
	(1)	(2)	(3)	(4)
Spousal Income		1.530 (1.062)		2.565 (0.270)
Dividends	0.054 (0.192)	0.233 (0.578)	0.329 (0.080)	0.288 (0.111)
Interest	1.087 (0.405)	1.879 (1.441)	3.605 (2.120)	1.006 (0.158)
Mortgage	0.191 (0.315)	0.742 (1.313)	2.321 (0.465)	-0.198 (0.065)
Property Tax	1.435 (0.818)	3.532 (2.982)	8.441 (2.323)	-0.042 (0.111)
Bandwidth	3469.209	6469.991	3359.540	741.100
$R^2$	0.589	0.581	0.382	0.447
OLS $R^2$	0.410	0.462	0.276	0.397
$N$	11383	11388	22721	22762

Table 3: Sensitivity of the optimal tax base

Variables	Minimum wage = \$3		$\gamma = 0.5$		$\gamma = 2$	
	(1)	(2)	(3)	(4)	(5)	(6)
Spousal income		2.092 (0.972)		0.892 (0.393)		4.132 (0.951)
Dividends	0.011 (0.469)	0.231 (0.665)	0.111 (0.376)	0.253 (0.357)	-0.045 (0.313)	0.327 (0.234)
Interest	0.823 (0.362)	1.830 (0.719)	0.951 (2.879)	1.370 (0.617)	1.108 (0.299)	3.752 (0.319)
Mortgage	0.101 (0.322)	0.821 (1.384)	0.291 (0.367)	0.545 (0.447)	0.141 (0.359)	2.177 (0.722)
Property Tax	1.200 (1.243)	4.325 (4.429)	1.545 (0.745)	2.808 (3.066)	1.198 (1.669)	7.899 (3.188)
Bandwidth	3982.637	6564.610	3979.703	6237.598	3630.270	7009.498
$R^2$	0.486	0.488	0.659	0.648	0.461	0.459
OLS $R^2$	0.303	0.364	0.498	0.555	0.259	0.331
$N$	11390	11400	11386	11380	11388	11402
Weighted primary hours	2419.828	2420.019	2391.795	2391.824	2447.393	2447.581
Weighted secondary hours	1897.615	1896.689	1862.336	1860.996	1942.649	1942.409

Figure 1: Prediction of the average wage rate of a couple based on joint labor income

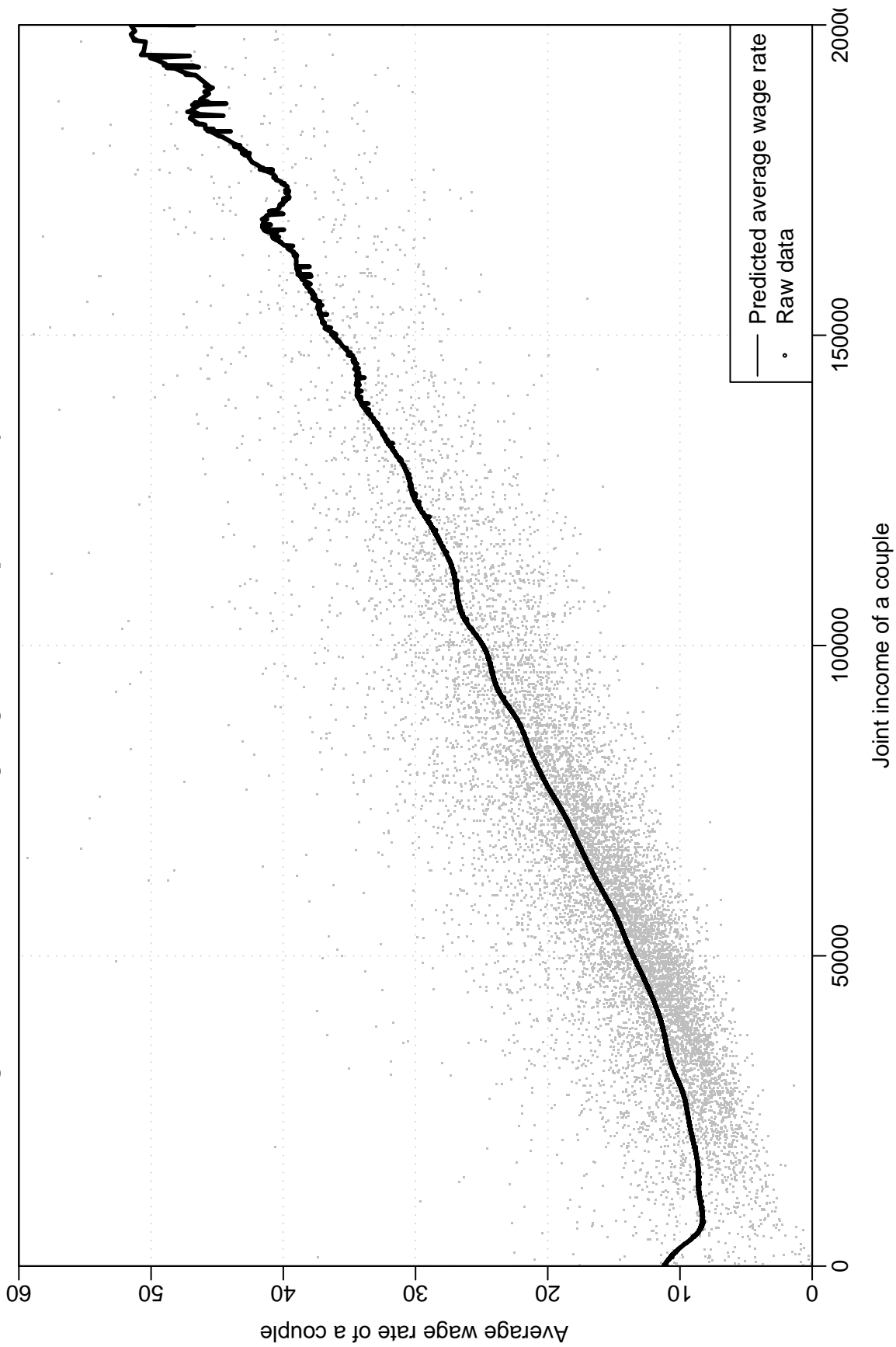


Figure 2: Marginal effects of  $\alpha$ : Distributional gains vs efficiency losses

