Good Pay or Pays Goods: The Impact of Income Taxes on Occupational Choice

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Abstract

The link between taxes and occupational choices is central for understanding the welfare impacts of income and wage taxes. Just as taxes distort the labor-leisure decision, they also distort the wage-amenity decision. When income tax rates increase, workers should favor jobs with lower wages and more non-wage amenities. Few papers have isolated this effect. In this paper, we introduce a two-step estimation strategy to isolate the elasticity of occupation choice with respect to tax rates, testing whether workers select higher (lower) wage jobs when tax rates decrease (increase). We estimate and use each occupation's compensating differential to compare the wages a worker receives in a new occupation relative to the old occupation. In this way, we account for the general equilibrium effects that tax schedule changes may have on wages. We use an instrumental variable strategy which recognizes that workers within an occupation may experience different tax changes due to differences in initial tax-related characteristics other than their own labor income, such as secondary and capital earnings. We estimate a statistically significant overall compensated elasticity of 0.05, implying that a 10% increase in the net-of-tax rate causes workers to change to a job with a 0.5% higher wage.

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1 Introduction

It is well-known that taxes can distort individual labor decisions. Numerous studies have estimated the impact of income taxes on the labor-leisure tradeoff by looking at the effect on number of hours worked. Fewer papers have studied another central component of income tax distortion - the tradeoff between wages and non-taxable amenities. This tradeoff manifests itself through choice of occupation. The link between taxes and occupational choice is critical in our understanding of the welfare impacts of income taxes. Income taxes which distort occupational choices lead to inefficiently-allocated workers with potentially long-term economic consequences.

Income taxes affect occupational choice in a very direct way. By reducing the return to monetary wages, a high tax rate diminishes the benefit to high wage occupations. We can think of workers as getting paid in taxable monetary wages and non-taxable amenities. These amenities are very broadly-defined, including qualities such as difficulty of the job, convenience of the hours, etc. When a worker's tax rate increases, his or her return to working at a high wage, low amenity occupation is reduced. Instead, the worker may optimally demand a job with lower wages, but a more relaxed or safer working environment. The tradeoff, then, is between non-taxable amenities and a taxable compensating differential for the level of amenities provided.

A vast literature has studied the effect of income taxes on the number of hours worked while fewer have looked at this other facet of individual labor supply. The probable reason for this relative interest in "hours worked" is the fact that hours are measurable and knowable. Furthermore, the counterfactual is obvious. An extra hour of work translates into one less hour of leisure. The tradeoff between amenities and wages is much harder to measure for two reasons. First, non-wage amenities vary on many dimensions and there is no perfect and comprehensive index of all the amenities of a job. Second, the counterfactual - the compensating differential - is not immediately known and reported in any data set.

We introduce a new two-step methodology to study the relationship between taxes and occupational choice. In the first step, we estimate the compensating differential for each occupation in each year. These estimates are then used as the dependent variable in the second step. The main specification relates the difference in the compensating differentials of the new occupation and the old occupation to the change in a worker's marginal net-of-tax rate. Basic theory would suggest that when the net-of-tax rate increases, the return to a high wage occupation increases and workers should move to high wage occupations.

Tax changes should have meaningful general equilibrium effects on wages. In our two-step methodology, we compare compensating differentials in the same year so that these general equilibrium effects are implicitly accounted for without imposing any restrictive assumptions on the form of the general equilibrium effects caused by tax changes. Our identification strategy relies on the differential impact that tax schedule changes have on workers in the same occupation but with different initial tax-related characteristics such as capital income and secondary earnings. When the tax schedule changes, a person with high secondary earnings may experience a very different tax change than another worker with the same job who has low secondary earnings.

Our findings suggest that occupational choice is a source of income tax distortion. We find statistically significant, though economically modest, responses on this dimension. Our preferred estimates suggest a compensated elasticity of 0.05, implying that a 10% increase in the net-of-tax rate causes workers, on average, to switch to an occupation paying 0.5% higher wages. In addition, we find suggestive evidence that women are more responsive than men. Interestingly, we find no evidence that younger workers are more responsive than older workers on this dimension.

To our knowledge, this is the first paper that examines the impact of taxes on the individual's choice of compensating differential. A previous literature has studied the effect of tax changes on the provision of specific amenities. For example, Gruber and Lettau (2004) investigated the tax effect on health insurance provision by employers. However, no studies have estimated the elasticity for a measure of all amenities. We see the results of this paper as direct counterparts to the elasticity of hours worked literature. The elasticity of the compensating differential with respect to taxes is a critical component of the individual labor supply response to taxes. This paper asks and studies the question, "When net-of-tax rates increase, do workers move to occupations with higher compensating differentials?"

The rest of this paper proceeds as follows. In section 2, we review existing research on related topics. We then present a theoretical framework on the effect of income taxes on the demand for non-wage amenities in section 3. Section 4 introduces our two-step estimation procedure and explains our identification strategy. In section 5, we discuss the data used in this paper. Section 6 presents the estimation procedure and results, and section 7 concludes.

2 Literature Review

We see our paper as directly complementing the existing labor supply and taxes literature. This vast literature is summarized in Hausman (1985) and Blundell and MaCurdy (1999) and focuses primarily on the impact of taxes on number of hours worked. The consensus of this literature is that women appear to respond to taxes by changing the number of hours that they work, whereas prime-age men are much less responsive. A related set of papers, such as Eissa and Hoynes (2004), examine the effect of taxes on the extensive margin of labor supply, namely, labor force participation. While working hours and labor force participation are important measures of labor supply, there are other margins where taxes could play an important role. Feldstein (1997) highlights the importance of understanding other facets of labor supply:

> [T]he relevant labor supply elasticity is much larger than the traditional estimates imply. The relevant distortion to labor supply is not only the effect of tax rates on participation rates and hours but also their effect on education, occupational choice, effort, location, and all of the other aspects of behavior that affect the short-run and long-run productivity and income of the individual. Unfortunately, we still know very little about how taxes affect labor supply defined in this broad way.

Many workers work 40 hours a week at a full-time job, but the difficulty of their jobs and the pleasantness of the working environment vary significantly from job to job. The literature has largely ignored such labor supply margins.

A related set of studies has studied the effect of taxes on self-employment and entrepreneurship. Gentry and Hubbard (2002) look at the impact of tax progressivity on the decision to become an "entrepreneur." They find evidence suggesting that a progressive tax schedule with imperfect loss offsets discourages entry to entrepreneurship. Bruce (2000, 2002) investigates the link between tax rates and transitions into and out of self-employment. He finds higher marginal tax rates increase the probability of self-employment. He interprets this counter-intuitive finding as evidence of tax evasion.

Very little research has studied the relationship between taxes and occupational choice. Gentry and Hubbard (2004) look at the effects of the tax rate and tax progressivity on changing to a self-reported "better" job. They argue that a more progressive tax system reduces the return to job search and discourages upward job mobility. They find that both higher tax rates and increased tax progressivity decrease the probability that a head of household will move to a better job in the coming year.

Our research is also closely related to the literature on the elasticity of taxable income. Feldstein (1999) argued that the compensated elasticity of taxable income with respect to the tax rate is the central parameter needed to calculate the deadweight loss. Given its importance, many papers have estimated the elasticity of taxable income using various data and empirical strategies.[1] Our specification is similar to the one used in Gruber and Saez (2002) and Auten et al. (2008). The parameter estimated by our paper is, theoretically, a component of the overall tax elasticity. We specify this relationship in section 4.

This paper contributes to the literature on several fronts. First, we study how workers choose occupations of different wage and non-wage compensations in response to tax changes. We use the compensating differential as a measure of non-wage amenities since it acts as a summary statistic of all aspects of a job other than the wage, including better health insurance, lower stress job, safer work environment, higher status, etc. In this way, we look beyond working hours and labor force participation and provide evidence on other aspects of labor supply. Second, the response to tax changes has many components and this paper helps us understand the relative importance of some of these dimensions.

Third, we use identification sources unavailable to the existing tax literature, resulting in a potentially cleaner experiment. Our identification strategy uses tax changes interacted with initial tax-related characteristics other than labor income, essentially shutting down any identification from initial labor income. Since our dependent variable is a labor measure and we assign differential tax rate changes based on non-labor measures, we use a cleaner experiment than the existing literature. Fourth, our strategy directly accounts for general equilibrium effects in a flexible manner. The taxable income elasticity literature must constantly worry about general equilibrium effects and mean reversion biasing their

[1]See Saez et al. (2009) for a survey of the literature.

results. Our results are likely immune to these types of concerns. Lastly, occupation choices may have broader consequences that are not included in a elasticity of taxable income measure. For example, occupation choice may have long-term economic consequences for an individual, implying that distortions on this margin are interesting beyond their relationship to the elasticity of taxable income. In summary, we believe that occupational choice is a potentially significant distortion of income taxes that has been generally ignored by the literature. Our paper focuses on this important margin and provides critical evidence for the understanding of how taxes impact economic welfare.

3 Theoretical Framework

In this section, we illustrate the intuition behind our empirical test using a simple model. Assume that a worker chooses from a continuum of job options. Each job offers a combination of wage compensation (w) and non-wage compensation (n). Because both wage and non-wage amenities are costly to employers, higher non-wage amenities imply relatively lower wages ($w'(n) < 0$). The worker values both wage and non-wage amenities. Let y denote the worker's other income, and $T[z]$ the total tax liability given taxable income z. The worker maximizes his utility over consumption (c) and non-wage amenities (n) subject to his budget constraint.

$$\max_{c,n} U(c, n)$$

$$\text{s.t. } c = w(n) + y - T[w(n) + y]$$

The first order condition of this maximization problem can be expressed as

$$\text{FOC: } w'(n)(1 - T') = -\frac{U_n}{U_c} \tag{1}$$

Assuming that $w'(n)$ is fixed for any given individual, equation (1) suggests that when the tax rate increases, the left hand side of the equation increases and $\frac{U_n}{U_c}$ decreases. Under the standard assumption that the utility function is concave, this means that the demand for n must increase relative to the demand for c. Thus, the relative demand for wage compensation decreases when the tax rate increases. It is worth mentioning that $w'(n)$ may change in response to tax changes. As will become clear later in this paper, our empirical strategy holds $w'(n)$ constant by comparing workers who face similar labor market conditions but different tax rate changes.

In Appendix A, we also consider models where the worker chooses both occupation and working hours simultaneously. The tradeoff between wage and non-wage amenities remains the same when the hours decision is included, and these models also predict that workers will demand more non-wage compensation when the tax rate increases.

Variation in amenities in the labor market can originate from two sources. First, there could be sorting among workers such that some occupations become "high amenity occupations" simply because the workers in those occupations tend to demand lots of amenities. Second, some jobs are, by their nature, high amenity jobs. For example, workers prefer safe working environments and firms can likely respond on this dimension, but it is unlikely that construction workers are ever going to have on-the-job fatality rates as low as accountants. Our empirical strategy is agnostic to the reason for or type of amenity heterogeneity.

Like most of the labor supply and tax literatures, we have modeled the individual response in a static framework. This is problematic if workers adjust their current labor supply not only to the current tax rate but also to the tax rates of other brackets which, they believe, they will be subject to in the future. In other words, "future taxes" is an omitted variable. Recall that our experiment is to compare one worker with high secondary earnings to another worker in the same job with low secondary earnings before and after a tax change which differentially affects their tax brackets. These two workers may expect that, in the future, they'll be in different tax brackets than they currently are in and make current occupational choice decisions based on that expectation. As long as these two workers' expectations of their "future brackets" do not change in a systematic manner relative to each other, our estimates will not be biased. Relative to the existing literature which has tended to completely ignore future tax rates, our empirical strategy should be robust to individuals' dynamic responses to tax changes.

4 A Two-Step Estimation Method

4.1 The Setup of the Two-Step Procedure

As described earlier, the difficulty in studying how workers make decisions based on the tradeoff between wages and amenities is the impossibility of observing and measuring all of the amenities of an occupation. In this section, we introduce a two-step estimation method that addresses this difficulty by using compensating differentials as a measure of non-wage amenities.

The key question that we address in this paper is whether workers move to higher wage jobs when net-of-tax rates increase. Suppose individual i worked in occupation k at time $t-1$. At time t, he worked in occupation j. If we could observe individuals' counterfactual wages in occupations they are not working in, our ideal specification would be the following:

$$\begin{aligned} \ln w_{ijt} - \ln w_{ikt} &= \gamma_{kt} + \beta_1[\ln(1-\tau_{ijt}) - \ln(1-\tau_{ik,t-1})] \\ &+\beta_2\Big\{\ln(z_{ik,t-1} - T_t[z_{ik,t-1}]) - \ln(z_{ik,t-1} - T_{t-1}[z_{ik,t-1}])\Big\} + \nu_{ijt} - \nu_{ikt} \end{aligned} \tag{2}$$

where τ is the marginal tax rate and $T_t(z)$ is the tax liability under the tax schedule at time t for total pre-tax income z. If $j = k$, then individual i worked in the same occupation at both time $t-1$ and t.

The left-hand side is the wage that individual i receives in new occupation j at time t relative to the wage he would have received in his old occupation k at time t. It is important to use the time t wage for the old occupation since tax changes potentially have nontrivial general equilibrium effects. To discuss the potential general equilibrium effects of taxes, consider an unpleasant job (low amenity) as tax rates faced by the workers increase. There are two possible firm-level responses now that workers want to leave this job. First, the job can become more pleasant. To some extent, however, this might not be possible due to the nature of the job. Alternatively, wages can increase in response to higher tax rates. There is empirical evidence of both of these effects caused by tax changes. Gruber and Lettau (2004) document amenity provision changes in health insurance. Powell (2009b) estimates a response on the wage dimension for industries with different injury and fatality risks. Because general equilibrium effects may cause wages to adjust from time $t-1$ to t, comparing wages in two different time periods will likely result in estimation being contaminated by the general equilibrium effects. Therefore, it is important for us to compare contemporaneous wages in equation (2). A benefit a this approach is that we do not need to model the labor demand equation since the general equilibrium effects are accounted for without imposing any assumption on the specific labor demand functional forms.

The right-hand side is similar to the Gruber and Saez (2002) specification and separately estimates the substitution and income effects. By separately estimating the income effect, the coefficient on the marginal tax rate variable can be interpreted as a compensated elasticity. This coefficient is the key economic parameter that we estimate in this paper. Notice that our income effect variable is slightly different than the Gruber-Saez variable. A brief discussion of this variable is included in Appendix B.

Equation (2) looks at whether tax rate increases cause workers to move to occupations with lower wages and presumably better non-wage amenities, holding after-tax income constant. In practice, we do not observe w_{ikt}, the wages that individual i would have earned at time t in occupation k had he not moved to occupation j. Furthermore, w_{ijt} includes other individual-level responses to taxes, such as effort, that we want to exclude. To address these problems, we use the compensating differentials of these occupations instead. We model wages in a flexible manner:

$$\ln w_{ijt} = \alpha_{it} + \phi_{it}(n_{ijt})$$

where n_{ijt} is the amenity-level and $\phi_{it}(n_{ijt})$ represents the tradeoff between wages and amenities faced by the individual. This equation allows each worker to have his own menu of wages and amenities. The variation in wages and amenities across potential occupations translates into $\phi_{it}(n_{ijt})$. A worker's wage, then, is the result of the chosen amenity level and a general return to the individual's ability in period t.[2]

Let $\phi_{jt}(\cdot)$ denote the average price function for amenities and n_{jt} the average level of amenities received by individuals working in occupation j at time t. If there are M_{jt} workers in occupation j at time t, then let

$$\phi_{jt}(n_{jt}) = \frac{1}{M_{jt}} \sum_{i \in j} \phi_{it}(n_{ijt})$$

[2]Note that α_{it} is the wage earned by the individual regardless of occupation. It can include other individual behaviors resulting from taxes. For example, if taxes decrease, an individual may decide to work harder and earn a higher hourly wage. If this is true regardless of the occupation, then we want the change in effort separately accounted for. Contrast this example with the possibility that the individual moves to a high-effort occupation with a higher wage when tax decreases. In this case, we want to include the change in effort in the compensating differential.

We can re-write the wage equation as

$$\ln w_{ijt} = \alpha_{it} + \phi_{jt}(n_{jt}) + \underbrace{\phi_{it}(n_{ijt}) - \phi_{jt}(n_{jt})}_{\text{heterogeneity}}$$

where $\phi_{jt}(n_{jt})$ is the compensating differential for occupation j at time t. An individual may receive a compensating differential which varies from the occupation average $\phi_{jt}(n_{jt})$ for two reasons. First, the worker may receive a different level of amenities ($n_{ijt} \neq n_{jt}$). Second, the worker may face a different price function for amenities ($\phi_{it}(\cdot) \neq \phi_{jt}(\cdot)$). Put differently, a worker may get more amenities than the average worker in an occupation and the worker may get paid a higher wage for given a level of amenities. Our wage model allows for individual heterogeneity in the compensating differential term within an occupation.

To simplify notation and because n is not observed, define $\phi_{jt} \equiv \phi_{jt}(n_{jt})$, $\phi_{ijt} \equiv \phi_{it}(n_{ijt})$, and $\mu_{ijt} \equiv \phi_{it}(n_{ijt}) - \phi_{jt}(n_{jt})$. The wage equation now becomes

$$\ln w_{ijt} = \alpha_{it} + \phi_{jt} + \mu_{ijt} \tag{3}$$

Note that equation (3) places no real restrictions on the wage function and is essentially tautological. The purpose is simply to divide each person's wage into separate components.

When individual i chooses between occupations j and k, the relevant metric is the difference in wages between the two occupations.

$$\ln w_{ijt} - \ln w_{ikt} = \phi_{jt} - \phi_{kt} + \mu_{ijt} - \mu_{ikt} \tag{4}$$

$\phi_{jt} - \phi_{kt}$ is the difference in the compensating differentials between the two occupations at time t and should reflect differences in amenity levels. The main insight of equation (4) is that the individual ability term α_{it} drops out.

To use the compensating differentials in place of counterfactual wages which are unobserved, we plug (4) into (2) and get

$$\phi_{jt} - \phi_{kt} + \mu_{ijt} - \mu_{ikt} = \gamma_{kt} + \beta_1[\ln(1-\tau_{ijt}) - \ln(1-\tau_{ik,t-1})]$$
$$+\beta_2\Big\{\ln(z_{ik,t-1} - T_t[z_{ik,t-1}]) - \ln(z_{ik,t-1} - T_{t-1}[z_{ik,t-1}])\Big\} + \nu_{ijt} - \nu_{ikt}$$

Moving the residual term $\mu_{ijt} - \mu_{ikt}$ to the right hand side, we have

$$\phi_{jt} - \phi_{kt} = \gamma_{kt} + \beta_1[\ln(1-\tau_{ijt}) - \ln(1-\tau_{ik,t-1})]$$
$$+\beta_2\Big\{\ln(z_{ik,t-1} - T_t[z_{ik,t-1}]) - \ln(z_{ik,t-1} - T_{t-1}[z_{ik,t-1}])\Big\} + \epsilon_{ijt} - \epsilon_{ikt} \quad (5)$$

It is worth emphasizing that the dependent variable is not the difference in compensating differentials of two random occupations, but the difference for the new occupation and the old occupation chosen by individual i. However, this is not problematic because the individual is not selecting occupations based on μ, but based on the entire wage. Therefore, sometimes we assign a wage that is "too low" (because the individual is a particularly great match for that occupation), but it is equally likely that we assign a wage that is "too high" (because the individual is a relatively poor match for that occupation, compared to the other workers in the occupation).

The compensating differentials, ϕ_{jt} and ϕ_{kt}, need to be estimated. However, equation (3) cannot be estimated because there is only one observation per person-year and α_{it} is not identified. Instead, we use

$$\alpha_{it} = \alpha_i + X'_{it}\delta$$

where X is a vector of age group fixed effects. Because we focus on $(\ln w_{ijt} - \ln w_{ikt})$ and the α_{it} term cancels out, the form of this term is largely irrelevant. We include the age fixed effects only to minimize the variance of the predicted compensating differential terms.

To summarize, we have presented a two-step estimation method to study the effect of tax rate changes on individuals' decisions to choose among occupations with various wages and amenities. This method allows us to control for the general equilibrium effects and to model wages in a very flexible manner. In step one, we estimate the following equation:

$$\ln w_{ijt} = \alpha_i + \phi_{jt} + X'_{it}\delta + \mu_{ijt}$$

Estimating this equation produces a set of compensating differentials $\hat{\phi}_{jt}$. In step two, we estimate equation (5) using these estimated compensating differentials.

4.2 Discussion of Methodology

Taxes can affect occupational choice by distorting the relative return of wages with respect to non-taxable amenities. This paper defines amenities in a broad and agnostic manner to include unobservable characteristics such as stress, workplace environment, etc. It is very difficult, if not impossible, to arrive at one measure which encapsulates all the amenities for a job. The primary benefit of our methodology is the recognition that we can simply look at wages or, more specifically, the compensating differential to study the same issue. We accomplish this task using a non-restrictive two-step estimation model.

There are numerous benefits to this approach for studying the impact of taxes on occupation choice. At the risk of suggesting a "straw man" alternative specification, we believe there would be a natural tendency to study how taxes affect job turnover using, for example, an indicator variable for "changing jobs." This alternative specification is an instructive baseline to discuss the benefits of our own approach.

First, data on occupations can be very noisy and some "job changes" are potentially the same job categorized differently in various years. Using a dummy variable for "changing jobs" would be econometrically problematic because these coding errors cannot be considered classical measurement errors. Our methodology assigns predicted wages to each occupation and, consequently, turns these coding errors into classical measurement errors in the dependent variable. While our strategy would benefit from more accurate coding systems and we carefully considered the level of our coding system to minimize misclassification errors, inaccuracies should not bias the estimation results in our model.

Second, our methodology flexibly accounts for general equilibrium effects. At no point did we specify any functional form concerning the general equilibrium impact of taxes on wages or amenities. Instead, we simply estimate the compensating differential in each year for each occupation, which internalizes all general equilibrium effects. Similarly, there are substantial wage trends occurring during our time period and our methodology does not require us to model them. By using the compensating differential for both occupations in the same year, we avoid many of the problems caused by wage changes.

Third, we explicitly estimate a parameter of economic interest. This point can best be illustrated by introducing an instructive framework. Denote I as the total income, which is the sum of labor income L and capital income K. Denote s_L and s_K as the share of labor income and capital income respectively. As discussed before, a vast literature has attempted to estimate the elasticity of taxable income with respect to the net-of-tax rate $\epsilon_{I,1-\tau}$. This aggregate elasticity is a weighted average of labor income elasticity and capital income elasticity:

$$\begin{aligned}\epsilon_{I,1-\tau} &= \frac{\partial I}{\partial(1-\tau)}\frac{1-\tau}{I} \\ &= \frac{\partial L}{\partial(1-\tau)}\frac{1-\tau}{L}s_L + \frac{\partial K}{\partial(1-\tau)}\frac{1-\tau}{K}s_K \\ &= \epsilon_{L,1-\tau}s_L + \epsilon_{K,1-\tau}s_K\end{aligned}$$

Labor income can be expressed as $L = wh$ where w is the wage and h is number of hours worked. Following equation (3), the wage w can be modeled as $\ln w_{ijt} = \alpha_{it} + \phi_{ijt}$. Therefore, we rewrite the labor income elasticity $\epsilon_{L,1-\tau}$ as

$$\begin{aligned}\frac{\partial L}{\partial(1-\tau)}\frac{1-\tau}{L} &= \frac{\partial w}{\partial(1-\tau)}\frac{1-\tau}{w} + \frac{\partial h}{\partial(1-\tau)}\frac{1-\tau}{h} \\ &= \frac{\partial \ln w}{\partial \ln(1-\tau)} + \epsilon_{h,1-\tau} \\ &= \frac{\partial(\alpha+\phi)}{\partial \ln(1-\tau)} + \epsilon_{h,1-\tau} \\ &= \epsilon_{w,1-\tau}|_{\phi} + \epsilon_{w,1-\tau}|_{\alpha} + \epsilon_{h,1-\tau}\end{aligned}$$

The above equation indicates that the elasticity of labor income consists of three components each of which can cause labor income to change in response to tax rate changes. The first component is the elasticity of the individual-specific return (α). For example, workers may decide to work harder when the tax rate changes so we can think of this term as an elasticity of "effort." The second component is the choice of non-wage amenities (ϕ). This is the margin that we study in this paper. The third component is the hours worked. The alternative specification does not measure one of these components and does not translate into a meaningful economic parameter. In contrast, our specification quantifies the relative importance of $\epsilon_{w,1-\tau}|_{\alpha}$ in the elasticity of labor income.

One drawback of our methodology is that it may be difficult to understand the driving force behind the results. The empirical strategy may not seem very transparent or intuitive because it does not study any specific non-taxable amenities. Nevertheless, this is not necessarily the fault of the methodology. Because a comprehensive measure of all job amenities does not exist, no methodology which seeks to study the full effect of taxes on job choice can do so transparently. We believe that arriving at an elasticity of the full compensating differential is worth this cost since it includes the complete job choice response of individuals with respect to taxes.

4.3 Instruments

Our main specification in equation (5) cannot be estimated consistently using ordinary least squares (OLS) because the tax variables are endogenous. Tax rates and tax liabilities are functions of wages and, similarly, compensating differentials. Workers that switch to a high wage occupations increased their tax rates and tax liabilities. As a result, we may find increases in taxes correlate with increases in compensating differentials. To solve the endogeneity problem, we need to construct valid instruments for these tax variables.

Gruber and Saez (2002) instrument actual tax rates with predicted tax rates which are a function of a household's initial income and tax schedule changes. We also use tax schedule changes as a shock to tax rates, but we have to go one step further and shutdown tax change variation based on initial labor income. When the tax schedule changes, the rates of different brackets change by different amounts. We want to use the fact that workers A and B within an occupation may experience different tax rate changes during a tax schedule change because they are in different brackets. However, if worker A is in a higher bracket than worker B because he has a higher wage, then this source of variation is problematic for our empirical strategy. A higher wage may imply a higher-than-average compensating differential (a positive μ_{ikt}), which is a part of the residual term. Instead, our identification relies on differential tax changes resulting from workers being in different tax brackets due to "other tax-related characteristics" in the initial period. Such tax-related characteristics include marital status, number of dependents, secondary earning, capital income, etc.

To implement this strategy, we create "predicted tax changes" (represented by $\hat{\tau}$) and "counterfactual tax changes" (represented by $\tilde{\tau}$) using NBER's TAXSIM program. The predicted tax rate is simply the Gruber-Saez instrument. First, we inflate the worker's $t-1$ income to year t terms so that his real income remains constant. Then, we find his time t tax rate using the inflated $t-1$ income and the time t tax schedule. We call this predicted tax rate $\hat{\tau}_{ikt}$. For the counterfactual tax rate for individual i at time $t-1$, assume there are M people in his occupation at time $t-1$ and index each person by m. First, we find the tax rate individual i would have faced if he had person m's tax-related characteristics but his own labor income at time $t-1$ for each of the M workers. Then we average the M hypothetical tax rates. We call this counterfactual tax rate $\tilde{\tau}_{ik,t-1}$. For the counterfactual tax rate at time t, the steps are similar. We inflate the $t-1$ income to time t so that the income is constant in real terms and repeat the process. We call this counterfactual tax rate $\tilde{\tau}_{ik,t}$.

To summarize, we have obtained the predicted tax rate $\hat{\tau}_{ikt}$, the counterfactual tax rates $\tilde{\tau}_{ik,t-1}$ and $\tilde{\tau}_{ikt}$, as well as the actual tax rate $\tau_{ik,t-1}$:

$$\begin{aligned}
\hat{\tau}_{ik,t-1} &= \tau_{ik,t-1} \\
\hat{\tau}_{ikt} &= E\left[\tau_{ikt} | \text{Labor Income}_{ik,t-1}, \text{Other Income}_{ik,t-1}\right] \\
\tilde{\tau}_{ik,t-1} &= \frac{1}{M}\sum_{m=1}^{M} E\left[\tau_{mk,t-1} | \text{Labor Income}_{ik,t-1}, \text{Other Income}_{mk,t-1}\right] \\
\tilde{\tau}_{ikt} &= \frac{1}{M}\sum_{m=1}^{M} E\left[\tau_{mkt} | \text{Labor Income}_{ik,t-1}, \text{Other Income}_{mk,t-1}\right]
\end{aligned}$$

Our instrument for the tax rate change variable is

$$\Big[\ln(1-\hat{\tau}_{ikt})-\ln(1-\tau_{ik,t-1})\Big]-\Big[\ln(1-\tilde{\tau}_{ikt})-\ln(1-\tilde{\tau}_{ik,t-1})\Big]$$

The first bracketed term refers to individual i's predicted tax rate change. The second term refers to the average tax rate change the worker would have experienced given his initial labor income and the initial "other tax-related characteristics" of the other workers in his occupation. The difference between the two represents the predicted tax rate change experienced by individual i solely due to his initial tax-related characteristics other than labor income. Similarly, our instrument for the tax liability change variable is

$$\Big[\ln\left(z_{ik,t-1}-T_t(z_{ik,t-1})\right)-\ln\Big(z_{ik,t-1}-\widehat{T}_{t-1}(z_{ik,t-1})\Big)\Big]-$$
$$\Big[\ln\Big(\tilde{z}_{ik,t-1}-\widetilde{T}_t(z_{ik,t-1})\Big)-\ln\Big(\tilde{z}_{ik,t-1}-\widetilde{T}_{t-1}(z_{ik,t-1})\Big)\Big]$$

Thus, our tax instruments look at how each person's taxes change relative to how taxes would change if he had the same "other tax-related characteristics" as the other workers in the same occupation. The variation in the tax instruments originates from "other tax-related characteristics" interacting with tax schedule changes. While necessary for our empirical strategy, an important side benefit of shutting down any differential tax change variation based on initial labor income is that it provides a cleaner experiment than the existing tax elasticity literature. The literature has a dependent variable of all taxable income and uses differential tax changes based on initial taxable income as the identifying variation. Our dependent variable is a labor measure and we shut down variation based on initial labor income in constructing our instruments.

5 Data

We use the Panel Study of Income Dynamics (PSID), a longitudinal data set containing household- and individual-level variables on a wide range of topics. Starting with the 1981 data, the PSID provides consistent occupation and industry codes using 1970 3-digit Census coding. After the 1997 survey, the PSID becomes a biannual survey and we can no longer observe individuals' annual income in a continuous manner. Our final data set, therefore, includes the years 1981-1996. We limit our data set to workers between the ages of 25 and 55, excluding the self-employed. In our main specification, we define $t-1$ and t to be three years apart. We also try alternative time intervals as robustness checks. We use sample weights to ensure that our estimates are nationally-representative.

There are three sets of variables in the PSID that we use in our analysis. First, there are a host of income and family composition variables. These variables are important to derive income and wage taxes. NBER's TAXSIM program estimates the tax liabilities and marginal tax rates given this information. Butrica and Burkhauser (1997) show that the tax rates and tax liabilities calculated by NBER's TAXSIM are similar to tax burden values supplied by the PSID staff from 1980 through 1991, the last year the PSID staff provided such information. As show in Table 1, the average household income in our analysis sample is \$57,056 in 1997 dollars. The average tax liability faced by PSID respondents, which is the sum of federal, state, and half of the FICA taxes, is \$14,813 in 1997 dollars. The average marginal tax rate is 35.2% in the sample.

Second, the PSID provides detailed information on labor supply. We have information on the hourly wage rate for each worker in the sample in each year, which is used in the estimation of the compensating differentials. Table 1 shows that the average hourly wage is \$17.35 in 1997 dollars in the analysis sample.

Third, the PSID contains 3-digit occupation and industry codes for the 1970 Census coding system. We use the "main occupation" and "main industry" for each person, referring to the person's main job. A primary concern with the 3-digit coding system is that it may be too detailed and have a great deal of misclassification problem. For example, "Machine operatives, miscellaneous specified," "Machine operatives, not specified," "Miscellaneous operatives," and "Not specified operatives" are four different occupations under the 3-digit coding system. If we use this coding system, many of the observed transitions between occupations are likely to be misclassifications. To minimize these errors while still capturing meaningful transitions between jobs with different non-wage amenities, we categorize workers by the 2-digit occupation codes, which are introduced by Kambourov and Manovskii (2009), interacted with the 1-digit industry codes. We believe that it is potentially important and interesting to distinguish the same occupation by industry. For example, accountants in the finance industry and accountants in the public administration may receive very different amenities. But is also possible that this type of job transition is relatively easy to make and, therefore, a rich source of occupational changes in response to taxes. In the rest of this paper, we refer to occupation-industry combinations simply as "occupations." Some occupation-industry combinations are not possible so in the end, we are left with 115 occupations.

Panel A of Table 2 lists the most frequent occupation changes observed in our data. In general, these transitions look reasonable, suggesting a useful level of accuracy in our occupation coding. Many of the listings occur twice as workers in each occupation appear to freely move across these occupations. Panel B of Table 2 lists the most frequent transitions as a percentage of the original population. Again, it is encouraging to see that these transitions appear reasonable.

On average, we observe 38.2% of the respondents change their occupations within the next three years. Note that we are not the first to find that the PSID has a very large fraction of occupation changes. Kambourov and Manovskii (2009) study the issue extensively. The possibility of misclassification in the PSID is high, which highlights the importance of an approach that does not measure occupation changes using an indicator variable. Again, while misclassification are unfortunate, they should not bias our estimates because they are transformed into classical measurement errors in the dependent variable in our model. Figure 1 shows the occupation change rate across years by age group. It is reassuring that the younger workers appear to have higher occupational change rates than older workers.

In Figure 2, we graph the sample-average marginal tax rate and occupation change rate together. We are not suggesting that any relationship should be evident from this graph since these are aggregated numbers. Figure 2 shows that the overall occupation change rate during the sample period remain relatively stable. The Economic Recovery Tax Act of 1981 and the Tax Reform Act of 1986 are the major tax changes during our sample period. Because they both generated significant differential tax changes by tax bracket, they are the main identifying forces of our estimation strategy.

6 Estimation Results

In section 4, we introduced our two-step estimation method where we first estimate the occupation-year specific compensating differentials, and then use these compensating differentials as the dependent variable to study the impact of tax changes on occupation choice. In this section, we implement this two-step estimation method using the PSID data.

6.1 Estimating Compensating Differentials

As introduced in section 4, we estimate the following equation:

$$\ln w_{ijt} = \alpha_i + \phi_{jt} + X_{it}'\delta + \mu_{ijt}$$

where α_i is an individual fixed effect and X_{it} is a vector age-group fixed effects. We require an occupation-year cell to contain at least 5 observations or the occupation-year fixed effect and observations are dropped. We use the PSID sample weights and cluster the standard errors at the individual level when estimating this equation.

Estimating the above equation produces a full set of estimated compensating differentials - $\hat{\phi}_{jt}$. Recall that our measure of compensating differentials is a summary statistic of all non-wage amenities associated with an occupation. Since we cannot create a full list of all amenities, it would be impossible to know the actual compensating differential function. Thus, we are not able to verify whether $\hat{\phi}_{jt}$ is the "right" compensating differential estimate. However, there are ways for us to indirectly check whether these estimates are reasonable.

We previously presented the most frequent occupation transitions in our data in Table 2. Because of the apparent fluidity between some occupations, we would think that these occupations may have very close compensating differentials. We find it comforting that this seems to, in fact, be the case. For example, the two most frequent transitions are between "Operatives (Manufacturing)" and "Craftsmen (Manufacturing)." "Operatives (Manufacturing)" are estimated to have the 47th (out of 115) highest average compensating differential while "Craftsmen (Manufacturing)" have the 45th highest estimated compensating differential. The similarity of these estimates suggests that these jobs are close substitutes. Additionally, the most frequent transitions as a fraction of original people in the occupation is the move from “Accountants (Finance)” to “Managers (Finance).” These two occupations also have very similar compensating differentials as “Accountants (Finance)” are ranked 36th while “Managers (Finance)” are ranked 39th.

We can also check the internal consistency of the compensating differential estimates. It is not necessary that the compensating differentials for occupations remain constant over time. Firm-level responses and worker re-sorting can change the compensating differential for an occupation year-to-year. However, it seems reasonable to assume that there is some correlation over time since occupations have some level of fixed characteristics. Thus, we estimate the following equation for all $s < t$.

$$\hat{\phi}_{jt} = \lambda + \rho\hat{\phi}_{js} + \zeta \tag{6}$$

The results are presented in Table 3. Each cell in Table 3 represents the OLS estimate of ρ from a separate regression where the columns represent t and the rows represent s. Even with the imprecision of the estimates, there does seem to be a strong year-to-year correlation in the predicted compensating differentials.

The OLS estimates of ρ may be biased towards 0 because of measurement error in the explanatory variable. The concern is that year-to-year measurement error is attenuating the estimate. The obvious candidates as available instruments are the lags (or leads) of the predicted compensating differentials. Table 4 presents the IV version of Table 3. We use $\hat{\phi}_{j,s-1}$ as the instrument for $\hat{\phi}_{js}$ when $s > 1984$. When $s = 1984$ and $t > 1985$, we use $\hat{\phi}_{j,s+1}$. When $s = 1984$ and $t = 1985$, we use $\hat{\phi}_{j,s+2}$. Note that the choice of leads or lags does not change the main conclusions of this exercise. The estimates, as expected, are much larger, though noisier. For example, the average 1-year relationship (the coefficients on the diagonal) in the OLS estimates was 0.439. In the IV estimates, the average coefficient is 0.962, suggesting occupations have relatively stable predicted compensating differentials over time. Overall, the correlations shown in Table 3 and Table 4 suggest that the estimated compensating differentials are reasonable.

6.2 Estimating the Effect of Tax Changes

The second step of our two-step estimation procedure is to regress the change in predicted compensating differentials on tax changes. Define $\hat{\phi}^i_{jt}$ as the compensating different for individual i's chosen occupation j at time t, and $\hat{\phi}^i_{kt}$ as the compensating differential at time t for individual i's previous occupation k. Our main specification is

$$\begin{aligned}\hat{\phi}^i_{jt} - \hat{\phi}^i_{kt} &= \gamma_{kt} + X'_{i,t-1}\Pi + \beta_1\left[\ln(1-\tau_{ijt}) - \ln(1-\tau_{ik,t-1})\right] \\ &+ \beta_2\Big\{\ln\left(z_{ik,t-1} - T_t\left[z_{ik,t-1}\right]\right) - \ln\left(z_{ik,t-1} - T_{t-1}\left[z_{ik,t-1}\right]\right)\Big\} + \epsilon_{ijt} - \epsilon_{ikt}\end{aligned}$$

where γ_{kt} represents an occupation-year fixed effect which accounts for the general equilibrium effects experienced by everyone in the original occupation-year. $X_{i,t-1}$ is a vector of control variables, including race, sex, marital status, education, number of dependents, job tenure, (job tenure)^2, and age group fixed effects. When the net-of-tax rate increases, wages become relatively more valuable to workers and workers tend to move to high wage occupations. When the after-tax income increases, the demand for non-wage amenities should increase and workers tend to move to low wage occupations. Therefore, we expect β_1 to be positive and β_2 to be negative.

Note that the occupation-year fixed effect term also accounts for any common or "typical" job changes for people in that occupation-year. If most workers in that occupation-year were, for example, going to move to a higher wage job regardless of the tax change, this term will pick that up. Similarly, say that a significant fraction of workers in an occupation in year $t-1$ move to a specific occupation in year t and the compensating differential for that occupation happens to be mis-estimated in a systematic manner. The occupation-year interaction term should eliminate this bias.

The dependent variable is equal to 0 for any person that does not change occupations. Essentially, our specification simultaneously examines whether people change jobs when taxes changes and what "direction" and "magnitude" that they move in terms of the compensating differential. These non-movers are an important component of the overall elasticity. If people simply do not change occupations in response to taxes, we want to capture that in our estimate.

The dependent variable, the difference in compensating differentials, is estimated rather than observed. In the second step of our estimation, we use the variance-covariance matrix of the predicted compensating differential regressions to adjust the sample weights. More specifically, we weight each observation by the inverse of the square root of the variance of the difference in compensating differentials. This weighting procedure creates a slight problem because workers that do not change occupations have a precisely-estimated compensating differential change of 0. We assign these observations the median standard error for the sample so as not to weight them too highly or too lowly. A robustness check shown later in this paper suggests that these weights are not driving the results. In addition, we also incorporate the PSID weights to ensure that our sample is nationally representative.

Because our sample observations are not independent of each other, we need to adjust the estimated standard errors accordingly. The PSID is a panel data set, so we need to adjust the standard errors for clustering by individual. Furthermore, we estimate compensating differentials for each occupation in each year, and these compensating differentials appear to be serially correlated. Therefore, we also adjust the standard errors for clustering by occupation. We use the multi-way clustering procedure introduced by Cameron et al. (2006) to account for clustering by both occupation and individual.

Before presenting our main estimates, we do a heuristic exercise to illustrate the thought experiment behind our estimation strategy. We divide the sample into workers our instrument predicts will experience a tax rate increase relative to other workers in their occupation-year and workers we predict will experience a relative tax rate decrease. Since most predicted tax rate changes in our data are rather small, we only use the top 25% predicted tax rate increases and top 25% predicted tax rate decreases.[3] We then look at whether these people change to a higher compensating differential job, do not change jobs, or move to a lower compensating differential job. We are interested in the "difference" in the percentage of workers moving to higher wage occupations and lower wage occupations. We also re-scale these differences by the implicit "first stage" to get the correct estimate (since the instrument does not perfectly predict whether an individual does, in fact, experience a tax increase or tax decrease).[4]

Note that there are several caveats to this exercise. Most importantly, the exercise completely ignores the income effect. Workers that experience a tax increase may want to move to a low amenity job simply because their after-tax income has decreased, biasing this exercise against finding an effect. Second, our instrument does not perfectly predict whether the worker does, in fact, experience a tax increase or tax decrease. Third, estimation error in the predicted wages is problematic in this context. Assume that all workers respond to tax rate increases by moving to lower wage occupations and respond to tax rate decreases by moving to higher wage occupations. Unfortunately, we are labeling some wage increases as wage decreases so we see an attenuated effect for the tax rate decrease group. Using the tax rate increase group as a control exacerbates this problem because we are labeling some wage decreases as wage increases. Note that this estimation error is not problematic in our

[3]Note that this sample still includes workers that experience tax rate increases as low as 1% and tax rate decreases as high as -1%.

[4]In general, if our instrument predicts a tax rate increase, the probability that the worker's tax rate actually increased is only 0.35 higher than if the instrument predicts a tax rate decrease. We scale by the appropriate number in each cell.

main specification because it reduces to measurement error in the dependent variable. By using categories here, however, it is very problematic. Fourth, we are shutting down any relationship based on the magnitudes of the tax and wage changes. This relationship is likely the primary source of any effect on this dimension.

Table 5 reports the results of this exercise. We find evidence that workers are moving in response to tax changes. This exercise suggests that a tax change could result in 3-4% of the entire labor force shifting jobs. Given that many people are not changing jobs and many of the job changes we do see are potentially not real or not made for tax reasons (i.e. natural job transitions), this number is rather large relative to the percentage of occupation changes. When considered in terms of tax distortion, however, this table suggests that we should expect the total effect to be rather modest.

Although the above exercise highlights the intuition behind our IV strategy, the IV estimates provide a more rigorous measure of the impact of tax changes on choices over occupations with different amenities. The first column of Panel A in Table 7 presents the OLS estimates of the key coefficients. In our model, we hypothesize that workers will choose higher wage jobs when their net-of-tax rate increases and β_1 should be positive. However, the OLS estimate of β_1 is negative and statistically significant. This finding is consistent with our suspicion that the change in the net-of-tax rate is endogenous. For example, a worker who moves to a higher wage job will probably also face a higher tax rate because of his higher income. We need to use the instruments constructed in section 4 to isolate the causal effect of tax changes on occupation choice.

Table 6 presents the first stage results for our main specification. We report the relevant coefficients and Shea's Partial R^2 statistic which indicates the strength of the first stage. The first stage coefficients are all positive, suggesting that when the instruments predict a higher tax rate or tax liability, the individual actually experience an increase in tax rate or tax liability. Note that our instruments strongly predict the endogenous variables. We should point out that the strength of the prediction of the after-tax variable is a side effect of holding initial pre-tax income constant in the endogenous variable, as discussed in Appendix B.

The second column in Table 7 presents the IV estimates. Compared to the OLS estimate, the IV estimate of β_1 has the expected sign. Its magnitude suggests that a 10% increase in the net-of-tax rate would cause individuals to move to an occupation with a wage that is 0.46% higher. This elasticity is economically very modest, though significantly different from 0. The IV estimate of β_2, the effect of changes in after-tax income on occupation choices, is small and statistically insignificant.

It is well known that male and female labor markets may have different dynamics. Hence, we study the male and female samples separately in addition to studying the full PSID sample. Note that whenever we use a different sub-sample in this paper, we estimate the predicted compensating differentials using only the relevant sub-sample. In other words, we estimate predicted wages by occupation-year separately by gender for these regressions. Also, the tax instruments are formed using only the sub-sample. The gender-specific IV estimates suggest that women are more responsive on this dimension than men, with an elasticity of 0.087 against 0.033. This finding is consistent with conclusions drawn from previous literature that women's labor supply tend to be more elastic than men.

6.3 Robustness Checks and Extensions

We have so far focused specifically on a 3-year interval length. Even though the 3-year interval length is our preferred specification because it allows the worker ample time to respond to taxes by searching and moving to a different occupation, we believe the adjustment time itself is of interest. In Table 8, we present IV results for 1-, 2-, 3- and 4-year intervals. For the full sample, the estimate of β_1 is small and statistically insignificant in the 1-year interval specification. However, it is positive and statistically significant in the 2-, 3-, and 4-year specifications. This pattern suggests that the occupation adjustment is not immediate, but that by the second year, the full adjustment has occurred. The same pattern holds for women except that the magnitude of the estimated coefficient is larger than in the full sample. For men, the largest elasticity is in the first year (though this estimate is not significantly different from the other estimates). The 2-, 3-, and 4-year specifications have small and statistically insignificant estimates. Overall, the results shown here suggest that male and female workers have different labor supply responses to tax changes. Female workers seem to have a higher tax elasticity than male workers when it comes to choosing between wage and non-wage amenities across various occupations.

We might think that the coefficients of interest vary by age. We cut the sample into "young" (25-34) and "old" (35-55) to examine this possibility. Table 9 presents the IV estimation results. For simplicity, we only report the coefficient on the marginal net-of-tax rate, though the estimated specification is the same. Moreover, it is important to remember that the predicted compensating differentials and the instruments use only the sub-sample in question. Overall, the results provide mixed evidence. The elasticity does not seem to vary by age, though there is weak evidence that older workers are responding more. This may be because older workers understand their marginal tax rates better. In addition, we see young men responding more for some interval lengths, but not for others. For women, the standard errors are large, though these is some evidence that older women are more responsive. The main takeaway from this table is that the main results are not being driven by young workers, as some might expect. Even though young workers are more likely to change occupations, as shown in Figure 1, they do not seem to be more responsive to taxes when making these changes.

Finally, we look at the effect of our weights on the estimates. In Table 10, we do not weight the regressions by the standard error of the difference in the compensating differential estimates. We do, however, still use the PSID sample weights. The results are largely unchanged. This robustness check suggests that our weighting procedure is not driving our main results as we would come to the same conclusions without the weighting.

7 Conclusion

We introduce a new methodology to estimate a critical but understudied component of income tax distortion. We find that when the net-of-tax rate increases, workers move to higher wage jobs, implicitly sacrificing non-taxable amenities. We find a statistically significant compensated elasticity of 0.05. In related work, Powell (2009a) focuses on the elasticity of labor income in a quantile framework and reports a mean elasticity of 0.5. Our paper, then, suggests that the wage-amenity tradeoff is 10% of the overall labor tax distortion. We also find suggestive evidence that women are more responsive than men on this dimension and no evidence that younger workers are driving the results.

A Models with Intensive Labor Supply

Adding the intensive labor supply decision (h = hours worked) does not change the FOC for the wage-amenity tradeoff in a meaningful way. We can model amenities in two different ways. First, we can think of each job as having a fixed level of amenities n. The worker maximizes a utility function which now contains hours worked. Previously, we used $w(n)$ to represent labor income. When adding in the intensive margin of labor supply, we think of labor income as equal to the wage $\omega(n)$ times hours worked h:

$$\max_{c,h,n} U(c,h,n)$$

$$\text{s.t. } c = \omega(n)h + y - T[w(n)h + y]$$

The first order conditions of this maximization problem can be expressed as

$$\text{FOC1: } \omega'(n)h(1-T') = -\frac{U_n}{U_c}$$
$$\text{FOC2: } \omega(n)(1-T') = -\frac{U_h}{U_c}$$

Note that the FOC regarding to the choice of non-wage amenities is essentially the same as the model shown in section 3 of the paper.

Alternatively, we can think of amenity consumption as proportional to the number of hours worked. For example, a safe working environment decreases fatality rates per hour. Each hour worked, then, is extra consumption of this safety. We can model amenities as nh instead of n:

$$\max_{c,h,n} U(c,h,nh)$$

$$\text{s.t. } c = \omega(n)h + y - T[w(n)h + y]$$

The first order condition of this maximization problem can be expressed as

$$\text{FOC1: } \omega'(n)(1-T') = -\frac{U_n}{U_c}$$
$$\text{FOC2: } \omega(n)(1-T') = -\frac{U_h + U_n n}{U_c}$$

The relevant FOC is, again, essentially the same. Because n now represents amenities per hour, the worker's choice is based on the wage, $\omega(n)$, instead of total labor income, $\omega(n)h$.

B Gruber-Saez Specification: Income Effects

There is a key difference between the after-tax income variable in our specification and the Gruber-Saez specification. Our specification uses $\ln\left(z_{i,t-1} - T_t\left[z_{i,t-1}\right]\right) - \ln\left(z_{i,t-1} - T_{t-1}\left[z_{i,t-1}\right]\right)$ where we include only the taxable income at time $t-1$. The Gruber-Saez specification uses $\ln\left(z_{it} - T_t\left[z_{it}\right]\right) - \ln\left(z_{i,t-1} - T_{t-1}\left[z_{i,t-1}\right]\right)$ which lets taxable income z change between periods $t-1$ and t. This is not an issue of endogeneity for Gruber and Saez (2002) given their research question and their instruments. In the context of this paper, we believe that because z is a choice variable, it should not be allowed to move over time. Thus, we model the income effect as the response due to the change in the tax schedule, holding z constant at the time $t-1$ level.

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Figure 1:

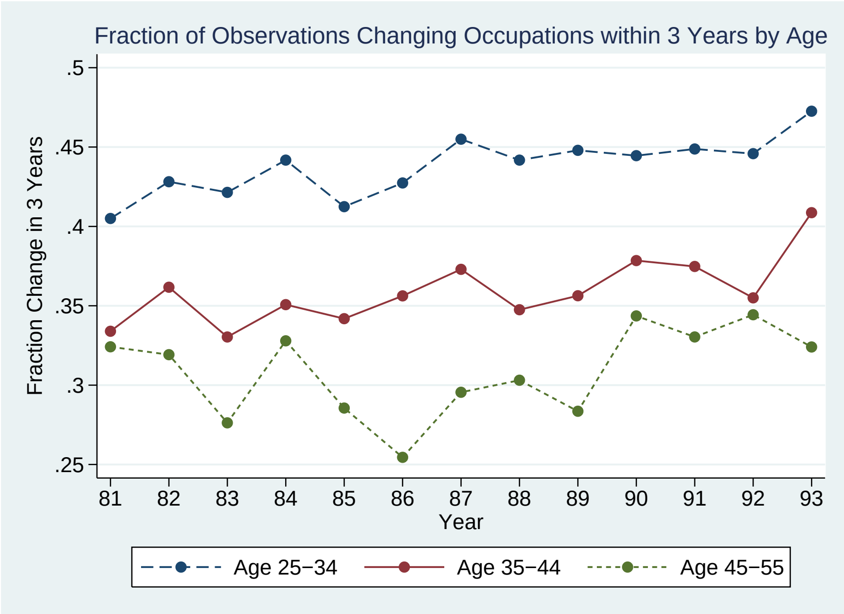

Figure 2:

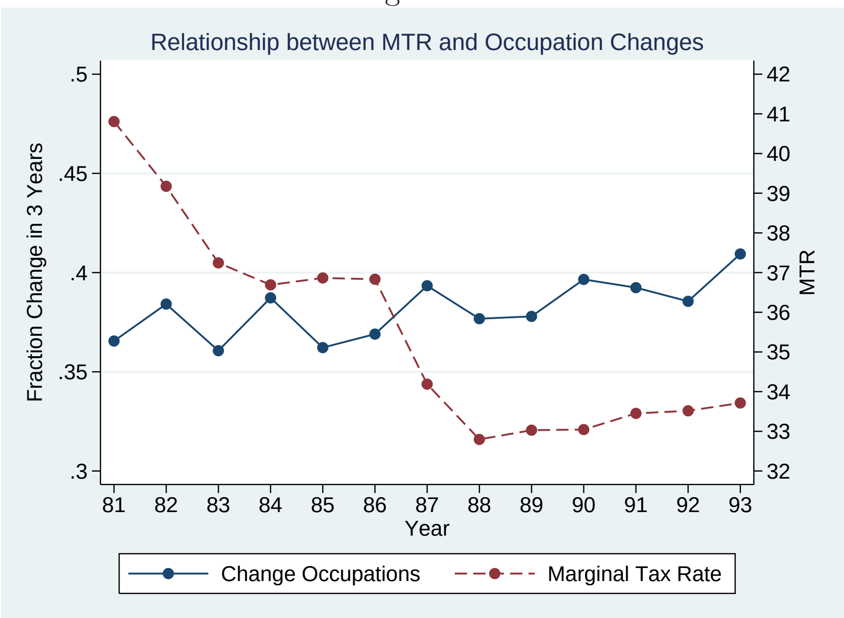

Table 1: Summary Statistics of the PSID Analysis Sample

	Mean	SD
%Change within 3 years	38.2	48.6
Wage	17.35	11.10
Age	37.2	7.5
%Male	50.4	50.0
%Married	70.3	45.7
%Less than High School	10.1	30.2
%High School Graduates	39.5	48.9
%Some College	22.0	41.5
%College Graduates	28.3	45.1
Total Income	57,056	36,490
Marginal Tax Rate	35.2	9.3
Tax Liability	14,813	13,851

Note: Wage, total income, and tax liability are in 1997 dollars.

Table 2: Most Frequent Occupation (Industry) Changes with 3 Years

A. Most Frequent in Numbers

Original	New
Operatives (Manufacturing)	Craftsmen (Manufacturing)
Craftsmen (Manufacturing)	Operatives (Manufacturing)
Sales (Retail)	Managers (Retail)
Managers (Retail)	Sales (Retail)
Operatives (Manufacturing)	Unskilled Laborers (Manufacturing)
Unskilled Laborers (Manufacturing)	Operatives (Manufacturing)
Service Workers (Service)	Clerical (Service)
Clerical (Service)	Managers (Service)
Secretaries (Service)	Clerical (Service)
Service Workers (Service)	Other Medical (Service)

B. Most Frequent in Percentage

Original	New	%
Accountants (Finance)	Managers (Finance)	30.6
Sales (Services)	Managers (Services)	30.2
Unskilled Laborers (Manufacturing)	Operatives (Manufacturing)	29.4
Sales (Manufacturing)	Sales (Retail)	29.3
Foremen (Construction)	Craftsmen (Manufacturing)	27.7

Note: Must have at least 40 in original occupation-industry to be considered in Panel B.

Table 3: Pairwise Comparisons of Predicted Compensating Differentials: OLS Estimates

	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
1984	0.461***	0.484***	0.346***	0.293***	0.320***	-0.007	0.215*	-0.103	-0.035	0.156	-0.245**	-0.063
	(0.093)	(0.090)	(0.100)	(0.106)	(0.083)	(0.108)	(0.126)	(0.090)	(0.100)	(0.099)	(0.107)	(0.113)
1985		0.360***	0.414***	0.457***	0.251***	0.083	-0.095	0.165*	0.065	0.071	-0.09	0.253**
		(0.086)	(0.086)	(0.082)	(0.080)	(0.094)	(0.112)	(0.086)	(0.096)	(0.090)	(0.101)	(0.104)
1986			0.672***	0.429***	0.216**	0.031	-0.104	-0.117	-0.16	0.031	-0.198	0.076
			(0.082)	(0.102)	(0.098)	(0.111)	(0.130)	(0.099)	(0.109)	(0.106)	(0.142)	(0.116)
1987				0.674***	0.216**	0.168	-0.089	-0.041	-0.173	0.068	0.062	0.163
				(0.084)	(0.093)	(0.110)	(0.135)	(0.093)	(0.104)	(0.105)	(0.115)	(0.115)
1988					0.442***	0.405***	-0.144	0.159*	0.027	0.398***	0.283**	0.499***
					(0.094)	(0.095)	(0.131)	(0.094)	(0.107)	(0.094)	(0.136)	(0.110)
1989						0.293**	0.295**	0.182	0.267**	0.417***	0.365***	0.357***
						(0.113)	(0.131)	(0.110)	(0.113)	(0.111)	(0.123)	(0.127)
1990							0.450***	0.14	0.393***	0.493***	0.479***	0.400***
							(0.118)	(0.100)	(0.098)	(0.090)	(0.106)	(0.116)
1991								0.207***	0.380***	0.372***	0.241**	0.522***
								(0.077)	(0.080)	(0.076)	(0.092)	(0.106)
1992									0.256**	0.287***	0.327***	0.562***
									(0.109)	(0.104)	(0.118)	(0.114)
1993										0.450***	0.453***	0.418***
										(0.086)	(0.101)	(0.104)
1994											0.524***	0.577***
											(0.101)	(0.104)
1995												0.479***
												(0.092)

Note: Each cell represents a separate regression. Column headings refer to year of predicted wage variable for dependent variable. Row headings refer to year of explanatory variable in the regression.

Table 4: Pairwise Comparisons of Predicted Compensating Differentials: IV Estimates

	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
1984	0.904***	0.954***	1.012***	1.079***	0.385**	0.167	-0.459	0.113	-0.014	0.083	-0.353	0.17
	(0.208)	(0.219)	(0.255)	(0.283)	(0.166)	(0.232)	(0.307)	(0.191)	(0.210)	(0.210)	(0.227)	(0.213)
1985		1.056***	0.734***	0.622***	0.672***	-0.014	0.458	-0.231	-0.077	0.343	-0.531**	-0.122
		(0.242)	(0.202)	(0.201)	(0.210)	(0.236)	(0.315)	(0.201)	(0.217)	(0.230)	(0.251)	(0.222)
1986			1.138***	1.228***	0.667**	0.228	-0.43	0.242	0.055	0.01	-0.478	0.417
			(0.235)	(0.325)	(0.276)	(0.282)	(0.332)	(0.255)	(0.278)	(0.253)	(0.299)	(0.291)
1987				0.648***	0.281*	0.035	-0.155	-0.229	-0.247	0.033	-0.166	0.122
				(0.128)	(0.144)	(0.164)	(0.194)	(0.144)	(0.158)	(0.159)	(0.178)	(0.176)
1988					0.339**	0.268*	-0.097	-0.011	-0.259	0.118	0.095	0.379**
					(0.147)	(0.151)	(0.202)	(0.132)	(0.164)	(0.149)	(0.169)	(0.159)
1989						0.826***	0.624*	0.373	0.143	1.056***	0.667**	1.184***
						(0.292)	(0.339)	(0.256)	(0.278)	(0.308)	(0.312)	(0.332)
1990							1.334***	0.43	1.159**	1.434***	1.271**	1.222**
							(0.441)	(0.450)	(0.484)	(0.507)	(0.504)	(0.573)
1991								0.291	1.010***	1.123***	0.986***	0.562***
								(0.213)	(0.275)	(0.296)	(0.321)	(0.159)
1992									1.878**	1.759**	1.186**	1.548***
									(0.749)	(0.688)	(0.578)	(0.409)
1993										1.116**	1.310**	1.906**
										(0.470)	(0.560)	(0.731)
1994											1.016***	0.907***
											(0.246)	(0.223)
1995												0.992***
												(0.209)

Note: Each cell represents a separate regression. Column headings refer to year of predicted wage variable for dependent variable. Row headings refer to year of explanatory variable in the regression.

Table 5: Predicted Tax Changes and Occupation Changes

	All		
	Change in Compensating Differentials		
	%Decrease	%Same	%Increase
Predicted MTR Decrease	18.88	59.19	21.92
Predicted MTR Increase	20.35	58.80	20.85
Difference	-1.47		1.07
Scaled Difference	-4.05		2.95
	Male		
	Change in Compensating Differentials		
	%Decrease	%Same	%Increase
Predicted MTR Decrease	17.47	61.66	20.87
Predicted MTR Increase	17.64	63.44	18.92
Difference	-0.17		1.95
Scaled Difference	-0.46		5.32
	Female		
	Change in Compensating Differentials		
	%Decrease	%Same	%Increase
Predicted MTR Decrease	20.08	57.12	22.80
Predicted MTR Increase	23.12	54.44	22.44
Difference	-3.04		0.36
Scaled Difference	-8.36		0.99

Note: "Predicted MTR Decrease" refers to the top 25% of MTR decreases predicted by the instrument. "Predicted MTR Increase" refers to the top 25% of MTR increases predicted by the instrument. "Scaled Difference" equals "Difference" divided by the first stage relationship between the instrument and the endogenous explanatory variable.

Table 6: First-Stage Estimation Results for 3-Year Occupation (Industry) Changes

	All		Male		Female	
	$\Delta \ln(1-\tau)$	$\Delta \ln(z-T)$	$\Delta \ln(1-\tau)$	$\Delta \ln(z-T)$	$\Delta \ln(1-\tau)$	$\Delta \ln(z-T)$
$\Delta\left(\ln(1-\hat{\tau}) - \ln(1-\tilde{\tau})\right)$	0.445***	0.009***	0.487***	0.011***	0.392***	0.005**
	(0.020)	(0.002)	(0.021)	(0.002)	(0.033)	(0.002)
$\Delta\left(\ln(z-\hat{T}) - \ln(\tilde{z}-\tilde{T})\right)$	0.421***	0.897***	0.812***	0.879***	0.116	0.989***
	(0.102)	(0.013)	(0.131)	(0.016)	(0.156)	(0.014)
Occupation*Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Shea's R^2	0.0454	0.5773	0.0550	0.4504	0.0357	0.7606
N	42,350	42,350	21,675	21,675	18,953	18,953

Note: Covariates included but not shown in this table are gender, race, education, job tenure, (job tenure)^2, number of dependents, marital status, and age group dummies. Standard errors in parentheses are clustered by occupation and individual using two-way clustering technique. Significance levels: * 10%, ** 5%, *** 1%.

Table 7: OLS and IV Estimation Results for 3-Year Occupation (Industry) Changes

	A. All (N=42,350)	
	OLS	IV
$\Delta \ln(1-\tau)$	-0.023***	0.046**
	(0.004)	(0.019)
$\Delta \ln(z-T)$	0.103***	0.046
	(0.034)	(0.044)
Occupation*Year Fixed Effects	Yes	Yes
	B. Male (N=21,675)	
	OLS	IV
$\Delta \ln(1-\tau)$	-0.021***	0.033
	(0.006)	(0.025)
$\Delta \ln(z-T)$	0.006	-0.072
	(0.043)	(0.069)
Occupation*Year Fixed Effects	Yes	Yes
	C. Female (N=18,953)	
	OLS	IV
$\Delta \ln(1-\tau)$	-0.027***	0.087**
	(0.007)	(0.036)
$\Delta \ln(z-T)$	0.145***	0.055
	(0.055)	(0.068)
Occupation*Year Fixed Effects	Yes	Yes

Note: The dependent variable is the difference in predicted compensating differentials between the old and new occupations at time t. Covariates included but not shown in this table are gender, race, education, job tenure, $(\text{job tenure})^2$, number of dependents, marital status, and age group dummies. Standard errors in parentheses are clustered by occupation and individual using the two-way clustering technique. Significance levels: * 10%, ** 5%, *** 1%.

Table 8: IV Estimation Results of Occupation (Industry) Changes with Different Interval Lengths

	A. All			
	1-Year	2-Year	3-Year	4-Year
$\Delta \ln(1-\tau)$	0.015	0.049**	0.046**	0.041**
	(0.021)	(0.020)	(0.019)	(0.019)
$\Delta \ln(z-T)$	-0.093	-0.078*	0.046	0.003
	(0.068)	(0.046)	(0.044)	(0.040)
Occupation*Year Fixed Effects	Yes	Yes	Yes	Yes
N	58,051	49,244	42,350	36,518
	B. Male			
	1-Year	2-Year	3-Year	4-Year
$\Delta \ln(1-\tau)$	0.059**	0.027	0.033	0.022
	(0.029)	(0.026)	(0.025)	(0.028)
$\Delta \ln(z-T)$	-0.592***	-0.171**	-0.072	-0.083
	(0.161)	(0.075)	(0.069)	(0.071)
Occupation*Year Fixed Effects	Yes	Yes	Yes	Yes
N	29,570	25,200	21,675	18,795
	C. Female			
	1-Year	2-Year	3-Year	4-Year
$\Delta \ln(1-\tau)$	0.027	0.080**	0.087**	0.067*
	(0.036)	(0.038)	(0.036)	(0.035)
$\Delta \ln(z-T)$	-0.233**	-0.081	0.055	0.079
	(0.100)	(0.071)	(0.068)	(0.056)
Occupation*Year Fixed Effects	Yes	Yes	Yes	Yes
N	26,546	22,331	18,953	16,417

Note: The dependent variable is the difference in predicted compensating differentials between the old and new occupations at time t. Covariates included but not shown in this table are gender, race, education, job tenure, $(\text{job tenure})^2$, number of dependents, marital status, and age group dummies. Standard errors in parentheses are clustered by occupation and individual using the two-way clustering technique. Significance levels: * 10%, ** 5%, *** 1%.

Table 9: IV Estimation Results of the Marginal Tax Rate Effect on Occupation (Industry) Changes by Interval Length and Age Group

	All		Male		Female	
	Young	Old	Young	Old	Young	Old
1-Year	0.000	0.005	0.087*	0.039	-0.032	0.069
	(0.040)	(0.041)	(0.050)	(0.060)	(0.090)	(0.051)
N	25,021	30,645	13,168	15,428	11,651	14,994
2-Year	0.030	0.044	-0.004	0.033	0.063	0.070
	(0.030)	(0.036)	(0.041)	(0.056)	(0.066)	(0.067)
N	21,898	25,160	11,615	12,707	10,118	12,263
3-Year	-0.006	0.055*	-0.055	0.060	0.084	0.115**
	(0.031)	(0.031)	(0.036)	(0.057)	(0.100)	(0.054)
N	19,534	20,790	10,437	10,530	8,956	10,088
4-Year	0.048	0.058*	0.090**	0.003	-0.043	0.126**
	(0.030)	(0.034)	(0.037)	(0.053)	(0.069)	(0.061)
N	17,445	17,205	9,323	8,703	7,993	8,346

Note: The dependent variable is the difference in predicted compensating differentials between the old and new occupations at time t. Covariates included but not shown in this table are gender, race, education, job tenure, (job tenure)^2, number of dependents, marital status, and age group dummies. Standard errors in parentheses are clustered by occupation and individual using the two-way clustering technique. Significance levels: * 10%, ** 5%, *** 1%.

Table 10: IV Estimation Results: Effect of Weighting

	All		Male		Female	
$\Delta \ln(1-\tau)$	0.046**	0.041**	0.033	0.033	0.087**	0.063**
	(0.019)	(0.018)	(0.025)	(0.027)	(0.036)	(0.032)
$\Delta \ln(z-T)$	0.046	0.024	-0.072	-0.089	0.055	0.017
	(0.044)	(0.045)	(0.069)	(0.081)	(0.068)	(0.065)
Occupation*Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Weighted by Standard Errors	Yes	No	Yes	No	Yes	No
N	42,350	42,350	21,675	21,675	18,953	18,953

Note: The dependent variable is the difference in predicted compensating differentials between the old and new occupations at time t. Covariates included but not shown in this table are gender, race, education, job tenure, (job tenure)^2, number of dependents, marital status, and age group dummies. Standard errors in parentheses are clustered by occupation and individual using the two-way clustering technique. Significance levels: * 10%, ** 5%, *** 1%.