



Optimal Taxation with Imperfect Competition

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Optimal Taxation with Imperfect Competition

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Abstract

This paper explores optimal income taxation in settings where firms have market power in hiring labor. Using a modern model of monopsony from the labor economics literature, I find that the optimal income tax rate is *lower* in a labor market with imperfect competition when compared to a perfectly competitive economy. This effect is driven by a higher elasticity of taxable income and lower inequality of labor income in markets with imperfect competition. To illustrate this result, I calculate the optimal tax rate using the income distribution of the United States and demonstrate that the optimal linear tax rate is 5 percent lower in a perfect monopsony and 3 percent lower in a monopsonistically competitive market when compared with a perfectly competitive market. Finally, I exploit variation in historical tax rates to show that more concentrated labor markets face higher elasticities of taxable income and lower levels of income inequality. These results imply that taking into account market characteristics is critical to the optimal design of fiscal policy, especially when coupled with growing empirical evidence showing that labor markets are rarely perfectly competitive.

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1 Introduction

Recent evidence has challenged the traditional assumption that markets are perfectly competitive. For example, De Loecker, Eckhout, and Unger (2020) suggest that firm market power has been rising since the late 1900s, which is consistent with a tripling of price markups and a decline in the labor share of income, business dynamism, and labor reallocation. Azar et al. (2017) write that horizontal mergers have increased firm concentration in the labor market and decreased wages, which suggests an increase in labor market power. Firms with hiring power in the labor market, also known as *monopsony power*, may limit employees' outside options through non-poaching collusions with other firms or non-compete agreements with workers, which in 2017 affected 24.5 percent of workers (Krueger and Posner 2018). In particular, the markets for nurses, fast-food workers, and high-tech workers have been empirically shown to have high levels of firm hiring power (Sokolova and Sorensen 2018). Monopsonistic labor markets across occupational and geographical lines depress wages, employment, and the labor share of income (Azar et al. 2017, Benmelech et al. 2018, Autor et al. 2020). Addressing imperfect competition through a government-imposed market mechanism may ameliorate these distortions by promoting economic growth and efficiently redistributing income.

This paper studies optimal income taxation in oligopsonistic and monopsonistically competitive markets. While the existing literature on optimal taxation is vast, there has been relatively little work on the relationship between market power and public finance; yet, the tax code is one of the most direct channels through which a government can address market failures such as imperfect competition. In this paper, I solve for the optimal linear tax rate in a model of monopsony similar to Card et al. (2018), which uses heterogeneous worker preferences to generate an upward-sloping labor supply curve. I find a higher elasticity of taxable income and lower inequality

in markets with imperfect competition, which calls for a lower optimal tax rate when compared with markets with perfect competition.

To illustrate this result, I use U.S. income data from the 2020 Current Population Survey to calculate the optimal tax rate in settings with different levels of labor market concentration and using different social welfare functions. I also test two key mechanisms from the model: The effects of firm concentration on the elasticity of taxable income and income inequality. I exploit previous changes in the tax code such as the 2001 and 2003 “Bush tax cuts” to examine the effect of taxes on income in sectors with different levels of labor market concentration, and I show that states with higher labor market concentrations have higher elasticities of taxable income. Using state-level measures of inequality such as the Gini coefficient, I find that states with more concentrated labor markets have lower income inequality.

My paper connects the labor economics literature on monopsony power with the public finance literature on optimal income taxation. A large body of work empirically verifies the presence of monopsonies in labor markets (e.g. Staiger, Spetz, and Phibbs 2010, Webber 2015). Manning (2020) summarizes that monopsony power has been found to decrease the labor share of income and increase wage inequality, and discusses implications for regulatory policy concerning antitrust, immigration, and minimum wage laws. While regulatory responses to monopsony power are frequently concocted, constructing an effective fiscal policy response is more difficult as the effects of price mechanisms are less straightforward to determine. To examine the potential of fiscal policy solutions, I introduce the idea of monopsony into the optimal tax framework summarized in Piketty and Saez (2013) by building on the model of heterogenous worker preferences in Card et al. (2018) that generates an upward-sloping labor supply curve faced by firms. This setup is tractable to analyzing firm wage setting and conducting empirical tests without requiring micro-level data on hiring and quit rates, which are a necessary component of models of search frictions such as in Burdett

and Mortensen (1998).

The literature on optimal income taxation primarily dates to Mirrlees (1971), which illustrates the equity-efficiency tradeoff in a nonlinear tax environment where governments cannot directly observe individuals' productivity. Saez (2001) clarifies the derivations and sufficient statistics that describe optimal income tax rates by formulating taxation in terms of elasticities. Recent work has brought market imperfections into the optimal taxation research, although few papers have yet to incorporate market power in either the product or labor market. For example, Farhi and Werning (2013) consider Mirrleesian taxation through the lens of uncertainty and risk-sharing, and Stantcheva (2014) studies optimal taxation in the presence of adverse selection in the labor market.

More closely related to this paper, Cahuc and Laroque (2014) examine how to approximate a minimum wage in a monopsonistic market and analyze extensive labor supply responses through the monopsony model of Robinson (1933). Da Costa and Maestri (2019) solve for the optimal Mirrleesian tax schedule and allocation implementability in a setting with firm screening contracts and workers with different abilities, and Hummel (2020) analyzes the tradeoff between income and capital taxation. Both Da Costa and Maestri (2017) and Hummel (2020) model market power as a single firm-worker match, where the firm offers a menu of contracts to the worker as an absolute monopsony. Compared to previous work, I focus closely on integrating recent theory on market power from the labor market literature into public finance. This structure provides more freedom for analyzing variations in the degree of monopsonistic power and worker heterogeneity, rather than examining a single firm-worker match. In addition, I contribute empirical tests of taxable income elasticity and inequality on sectors with different concentrations of monopsony power.

2 Model: Optimal linear income tax

This section models the optimal linear income tax rate in competitive, monopsonistically competitive, and oligopsonistic labor markets. Using the organizational framework from Scheuer and Werning (2017), there are two questions that can be asked regarding the effect of labor market power on the optimal tax rate:

Question 1: Given a tax schedule and an observed distribution of earnings, how do the conditions for the efficiency of this tax schedule depend on labor market power?

Question 2: Given a distribution of skills and preferences, how are optimal tax rates affected by labor market power that may affect the distribution of earnings?

I address the more general Question 2 in this section and examine how the tax schedule changes without holding the income distribution fixed. I return to Question 1 in Section 3 by calculating the optimal tax rate using the observed distribution of earnings in the United States.

In this section, I first derive a general formula for the optimal linear tax rate that depends on the sufficient statistics of income inequality and earnings elasticity. Next, I set up a general equilibrium model of a labor market with perfect competition followed by a model of a monopsonistically competitive market to determine the sufficient statistics in each market. I then extend the model of monopsonistic competition to a market with an oligopsony, where the sufficient statistics depend on the number of firms in the market. Finally, I compare the optimal linear tax rates in each of these markets and discuss some intuition behind the result.

2.1 General optimal linear tax rate

To provide a framework for the optimal tax problem, I derive the general linear tax rate following Piketty and Saez (2013). Let the population be continuous of size 1, where individual i has a utility function $u^i(c^i, \ell^i)$ over consumption c^i and leisure

ℓ^i . Individuals pay taxes and receive a lump-sum demogrant from the government's tax revenues, so an individual's consumption is $c^i = (1 - \tau)z^i + \tau Z$ where τ is the tax rate, z^i is the individual's taxable income, $Z \equiv \int_i z^i di$ is the total societal income, and τZ is a per-person universal transfer funded by tax revenues. Before stating the government's problem, I outline the following definitions that will be revisited in more detail in Section 3.

Definition 1 (Welfarism). *Let A denote the set of possible states of the world and U the set of individual utility functions. Let F be an increasing function of individual utilities. Welfarism permits that for $a, b \in A$ and $\vec{u} \in U$, a is preferred to b if and only if $F(u_1(a), \dots, u_n(a)) > F(u_1(b), \dots, u_n(b))$.*

Using a welfarist approach permits comparing states of the world solely through a combination of individual utility functions. Although I focus on welfarist principles in this paper, recent work such as Weinzierl (2017) explores the importance of nonwelfarist approaches to optimal taxation.

One way to formalize the comparison and aggregation of individual utility is through a social welfare function.

Definition 2 (Social welfare function). *A social welfare function is a function $F : U \rightarrow \mathbb{R}$, or a function that maps all potential combinations of individual utilities to a ranking in the real numbers.*

In this paper, I focus on additive social welfare functions, or functions of the form $F(\vec{u}) = \int_i G(u^i) di$ where $G(\cdot)$ is any differentiable function that is interpreted as the social welfare weight on each individual utility. To complete the framing of the optimal tax problem, the government maximizes this social welfare function $SWF = \int_i G(u^i) di$,

$$\operatorname{argmax}_{\tau} \int_i G[u^i((1 - \tau)z^i + \tau Z, \ell^i)] di. \quad (1)$$

This yields the optimal linear tax rate,

$$\tau^* = \frac{1 - \bar{g}}{1 - \bar{g} + \varepsilon} \quad (2)$$

where $\bar{g} = \frac{\int_i g^i z^i di}{Z \int_i g^i di}$, $g^i = G'(u^i)u_c^i$, $\varepsilon = \frac{1 - \tau}{Z} \cdot \frac{dZ}{d(1 - \tau)}$

The optimal linear tax rate τ^* depends on $\bar{g}$, a measure of income dispersion or inequality, and ε , the elasticity of total income with respect to the net-of-tax rate. The inequality measure $\bar{g}$ depends on g^i , or the social marginal welfare weight on individual i derived from the specific form of the chosen social welfare function. I will use a general social welfare function for the majority of this paper, but will specifically consider the utilitarian and Rawlsian cases, which are most commonly examined in the literature, in later analyses.

Observe that if the social welfare function is constructed such that g^i is decreasing in z^i , or if individuals with lower incomes have a higher social marginal welfare weight, then $\bar{g} \in [0, 1)$ and $\bar{g}$ is low (high) when inequality and/or preferences for redistribution are high (low). The optimal tax rate is decreasing in $\bar{g}$; formally,

$$\frac{\partial \tau^*}{\partial \bar{g}} = -\frac{\varepsilon}{(1 - \bar{g} + \varepsilon)^2} \quad (3)$$

This expression is negative as long as $\varepsilon > 0$, which is generally true theoretically and empirically as taxable income is increasing in the net-of-tax rate. In other words, the less that a society values redistribution, the lower the optimal tax rate. In addition, τ^* is decreasing in ε , as a higher elasticity of taxable income implies greater efficiency loss and thus a lower optimal tax rate. The comparative static is

$$\frac{\partial \tau^*}{\partial \varepsilon} = -\frac{1 - \bar{g}}{(1 - \bar{g} + \varepsilon)^2}. \quad (4)$$

Which is negative if $\bar{g} \in [0, 1)$ as previously described. Note that in this setup, ε is a mix of the substitution effect and the income effect as the tax rate is directly linked to the demogrant τZ .

Instead of re-deriving the optimal tax rate for each following market structure, I will use Equation (2) to compare the optimal linear tax rate in competitive and monopsonistic markets. The following proposition, proven in the Appendix, shows that the parametrization of the optimal tax rate is equivalent if the effect of market structure enters through the wage.

Proposition 1. *If income is comprised of wage and labor, $z^i = w^i L^i$, $\ell^i = 1 - L^i$ and wage is a function of labor, then the optimal linear tax rate using any functional form for the utility function can be represented using Equation (2): $\tau^* = \frac{1-\bar{g}}{1-\bar{g}+\varepsilon}$.*

2.2 Perfect competition framework

To more closely examine the parameters of the optimal tax rate, I derive the elasticity of taxable income in a market with perfect competition. The key distinction of this subsection is that firms are wage-takers and face perfectly elastic labor supply curves, which differentiates the perfectly competitive market from the monopsonistically competitive market.

2.2.1 Individual's problem with perfect competition

The individual's problem in the perfectly competitive market derives from the assumptions in Section 2.1, and I impose a functional form on the individual's utility function to obtain closed-form solutions. There are two types of workers with skill levels $S \in \{H, L\}$, where high-skill workers H have a productivity factor β_H and low-skill workers L have a productivity factor β_L such that $\beta_H > \beta_L$. In equilibrium, the differences in productivity will lead individuals to earn different wages. Individual i has the utility function $u^i(c^i, \ell^i)$, and I define the individual's taxable labor income as $z^i = w_S L_S^i$ where w_S is the individual's wage and L_S^i is the number of labor-hours that the individual works, dependent on the individual's skill level. The individual may choose to earn a wage w_S^i or enjoy leisure ℓ with total time endowment normalized to

1. I also assume a log functional form for the individual's utility, where consumption and leisure are additively separable.

$$u^i(c^i, \ell^i) = \log(c^i) + \log(\ell^i) \quad (5)$$

This utility function has a constant relative risk aversion (CRRA) equal to one, and is commonly used in the literature such as in Piketty and Saez (2013). Chetty (2006) confirms empirically that labor supply estimates lead to a CRRA of approximately one, so this functional form is a reasonable approximation of reality. Written in terms of labor-hours, the utility function is

$$u^i(L_S^i) = \log((1 - \tau)w_S L_S^i + \tau Z) + \log(1 - L_S^i). \quad (6)$$

Without loss of generality, I assume that the tax is levied on the worker, who receives $(1 - \tau)w$ from the w in wages paid by the firm. The individual maximizes

$$\operatorname{argmax}_{c^i, \ell^i} u^i(c^i, \ell^i) = \operatorname{argmax}_{L_S^i} \log((1 - \tau)w L_S^i + \tau Z) + \log(1 - L_S^i).$$

The optimal labor-hours worked for an individual of skill level S , L_S^* , in terms of w is

$$L_S^* = \frac{1}{2} \left(1 - \frac{\tau Z}{(1 - \tau)w} \right). \quad (7)$$

I observe that labor is positively correlated with net-of-tax wages ($\frac{\partial L_S^*}{\partial (1 - \tau)w} > 0$) and negatively correlated with economy-wide income through the demogrant ($\frac{\partial L_S^*}{\partial \tau Z} < 0$). This means that the substitution effect dominates, as an increase in wages causes an increase in the labor supply.

2.2.2 Firm's problem with perfect competition

Next, I solve the firm's problem in a competitive market. The production function of each firm j is

$$Q_j = \beta_H f(H_H^j) + \beta_L f(H_L^j) \quad (8)$$

Where H_S^j is the firm's demand for labor of skill level S . This assumes that high-skill workers and low-skill workers are substitutes, although high-skill workers are more productive than low-skill workers because $\beta_H > \beta_L$ as in Section 2.2.1. Firms can observe workers' productivity levels. Each firm j solves the traditional profit-maximization problem

$$\operatorname{argmax}_{H_{j,S}} p(\beta_H f(H_H^j) + \beta_L f(H_L^j)) - (w_H H_H^j + w_L H_L^j), \quad (9)$$

where p is the market price of the output and is equivalent for each firm. Because the labor market is perfectly competitive, all firms offer the market wage w_S to a worker of skill level S . Assume that f is increasing and concave, or $f' > 0$ and $f'' < 0$, and normalize the number of firms in the market to 1. The equilibrium wage for a worker of skill level S from the firm's first-order condition is

$$w_S = p\beta_S f'(H_S^*). \quad (10)$$

In equilibrium, the quantity of labor supplied L_S^* and demanded H_S^* will be equal and the market will clear through the market wage w_S . Although firms offer different wages to workers of different skill levels, I assume that workers cannot observe others' wages, in line with survey evidence that suggests that workers rarely share their salaries and generally do not know what others make (Smith 2015, Dixon 2018). Instead, workers assume that all other workers are of their skill level and receive the same wage, which is an information asymmetry between the worker and the firm. Solving for the equilibrium values of L and w in terms of exogenous parameters gives

$$L_S^* = \frac{1}{\tau + 2} \quad (11)$$

$$\text{and } w_S = p\beta_S f'(L_S^*) = p\beta_S f'\left(\frac{1}{\tau + 2}\right). \quad (12)$$

Because I have not assumed any difference in workers aside from their productivity, Equation (11) implies that workers of both skill levels work for the same number

of hours. Equation (12) gives the usual result that workers are paid their marginal product of labor, which varies by skill level.

2.2.3 Elasticity of taxable income under perfect competition

In this section, I derive the elasticity of total income with respect to the tax rate. The equilibrium conditions given in Equations (11) and (12) give the aggregate income,

$$\begin{aligned} Z &= \int_i z^i di = \sum_S (1 - \tau) w_S L_S^* \\ \Rightarrow Z &= \frac{(1 - \tau)}{(\tau + 2)} p [N_H \beta_H + N_L \beta_L] f' \left(\frac{1}{\tau + 2} \right), \end{aligned} \quad (13)$$

where N_H is the fraction of high-skill workers and N_L is the fraction of low-skill workers. The elasticity of taxable income $\varepsilon = \frac{1-\tau}{Z} \cdot \frac{dZ}{d(1-\tau)}$ is

$$\varepsilon = \underbrace{\frac{(1 - \tau) f''(L_S^*)}{(\tau + 2) f'(L_S^*)}}_{\leq 0} + \underbrace{\frac{3}{\tau + 2}}_{\in [1, 1.5]}, \quad (14)$$

The bounds above hold for $\tau \in [0, 1]$. Although it is not possible to determine an exact value of ε without imposing stricter parameters on the production function, the elasticity using a specific functional form for the production function is examined in Section 3. If $\left| \frac{f''(L_S^*)}{f'(L_S^*)} \right| < 2$, which holds using many common production functions, then the $\varepsilon > 0$ and an increase in the net-of-tax rate increases an individual's wage. For example, using a Cobb-Douglas function with any value of α results in an elasticity between 0.5 and 1.5, depending on τ and α . This is in line with most empirical studies of the elasticity of taxable income place its value somewhere between 0 and 1 (Saez, Slemrod, and Giertz 2012).

2.3 Monopsonistic competition framework

Building on the static differentiated products model of labor market competition in Card et al. (2018), I derive the elasticity of taxable income in a market with monopsonistic competition. In this model, monopsonistic power comes from workers' idiosyncratic preferences over different firms, which give firms some power in setting wages.

2.3.1 Individual's problem with heterogenous preferences

To derive the optimal linear tax rate in the presence of monopsony power, I develop a monopsony model similar to Card et al. (2018) and Manning (2020) to microfound an upward-sloping labor supply curve for each firm. This model uses idiosyncratic worker heterogeneity to create firm market power in the labor market. Each worker i has an idiosyncratic preference $\epsilon^{i,j}$ of working at firm j , where $\{\epsilon^{i,j}\}$ are independent draws from a type I extreme value distribution. The firm cannot observe each individual $\epsilon^{i,j}$, although each worker knows their own ϵ . With this in mind, worker i has a similar utility function as the model with perfect competition,

$$u^{i,j}(c^i, l^i) = \log(c^i) + \log(l^i) + \epsilon^{i,j} \quad (15)$$

where c^i and l^i are the same as defined in Section 2.2. For firm j , worker i maximizes

$$\operatorname{argmax}_{L_S^i} \log((1 - \tau)wL_S^i + \tau Z) + \log(1 - L_S^i) + \epsilon^{i,j}. \quad (16)$$

Solving for first-order conditions gives the optimal labor-hours per worker

$$L_S^* = \frac{1}{2} \left(1 - \frac{\tau Z}{(1 - \tau)w} \right). \quad (17)$$

This expression is identical to the perfect competition case in Equation (7). I then solve for the value function to determine the supply curve facing the firm. Compared to the perfectly competitive case in which each firm takes the market wage w , the

idiosyncratic preferences generate an upward-sloping supply curve, allowing each firm to set a wage w^j . The individual's value function is

$$v^{i,j}(w_j) = \log((1 - \tau)w^j L_S^* + \tau Z(1 - \tau)) + \log(1 - L_S^*) + \epsilon^{i,j}. \quad (18)$$

Define $y^j(w^j) \equiv \log((1 - \tau)w^j L_S^* + \tau Z(1 - \tau)) + \log(1 - L_S^*)$. By the argument and conditions in McFadden (1973), the probability that an individual works at firm j is,

$$q^j = P\left(\operatorname{argmax}_{j \in \{1, \dots, J\}} \{y^j\} = j\right) = \frac{\exp(y^j(w^j))}{\sum_{j=1}^J \exp(y^j(w^j))} \quad (19)$$

where J is the number of firms in the market. I observe that holding all else constant for firm j , q^j is decreasing in J , or the probability of working at firm j decreases as the number of firms increases. The firm-specific supply function is

$$L_S^j = L_S^* \cdot q^j, \quad (20)$$

where L^* is a function of the wage w . As implied by Equation (17), this setup fixes an amount of labor that is then divided across each firm based on their market share q^j .

2.3.2 Firm's problem with monopsonistic competition

Firm j solves a profit-maximization problem similar to the competitive maximization in Equation (9),

$$\operatorname{argmax}_{H_S^j} p(\beta_H f(H_H^j) + \beta_L f(H_L^j)) - (w_H(H_H^j) \cdot H_H^j + w_L(H_L^j) \cdot H_L^j). \quad (21)$$

The main difference in the monopsonistically competitive setup is that w is a function of labor supply H^j because the firm faces an upward-sloping labor supply function. In other words, monopsonistic competition forces wages to be a function of labor hired by the firm. This arises from the fact that I have assumed firms cannot observe each individual's preference $\epsilon^{i,j}$, and therefore cannot perfectly discriminate. The first

order condition is

$$w_S^j \frac{1 + \varepsilon^j}{\varepsilon^j} = p f'(H_S^j). \quad (22)$$

The wage markdown due to the monopsonistic power is $\frac{1+\varepsilon}{\varepsilon}$. The elasticity of labor with respect to the wage is $\varepsilon = \frac{\partial H}{\partial w} \cdot \frac{w}{H}$. I solve for ε using Equation (18) from the worker's problem

$$\varepsilon^j = \frac{\sum_j \sum_S (1 - \tau) w_S^j L_S^*}{\sum_j \sum_S (1 - \tau) w_S^j L_S^* + \tau Z} = \frac{1}{1 + \tau}. \quad (23)$$

By symmetry, because each firm solves the same problem as in expressions (22) and (19), then $w_{j,S} = w_{i,S}$ for all $i, j \leq J$. Thus, w_S is the same for all firms, and the last equality holds because $Z = \sum_j \sum_S (1 - \tau) w_S^j L_S^*$. The wage can be written as

$$w_S = p \beta_S f'(H_S^*) \cdot \frac{1}{\tau + 2}, \quad (24)$$

where the second term $\frac{1}{\tau+2} < 1$ is the markdown compared to the perfectly competitive case. This is an instance of the classic market power result where firms with monopsonistic power pay a lower wage compared to the competitive wage (Robinson 1933).

2.3.3 Elasticity of taxable income under monopsonistic competition

As in Section 2.2.3, I solve for the elasticity of taxable income in the monopsonistically competitive market. The equilibrium condition that labor supplied L_S^* is equal to labor demanded H_S^* gives the aggregate income

$$\begin{aligned} Z &= \int_i z^i = \sum_S (1 - \tau) w L_S^* \\ \implies Z &= \frac{(1 - \tau)}{(\tau + 2)^2} p [N_H \beta_H + N_L \beta_L] f' \left(\frac{1}{\tau + 2} \right). \end{aligned} \quad (25)$$

From Z , the elasticity of taxable income is

$$\varepsilon = \underbrace{\frac{(1-\tau)f''(L_S^*)}{(\tau+2)f'(L_S^*)}}_{\leq 0} - \underbrace{\frac{\tau-4}{\tau+2}}_{\in[-2,-1]}, \quad (26)$$

where the bounds apply for $\tau \in [0, 1]$. As I discuss in later sections, this expression of elasticity is very similar to the elasticity of taxable income in the competitive case, with an additional factor that accounts for the markdown on wage.

2.4 Monopsony and oligopsony

The wage in Equation (24) assumes that the number of firms J is large, meaning that the labor market operates under monopsonistic competition. A similar result holds when J is not large and the market is characterized by a monopsony or oligopsony rather than monopsonistic competition. To analyze this more general case, I assume that firms are homogeneous in their degree of monopsonistic power—that is, $q^j = q^i$ for all $i, j \leq J$. This assumption avoids discussing wage-setting strategies, which may be an interesting avenue of future work. By symmetry, the probability of working at any firm is exactly proportional to the number of firms, or

$$q^j = \frac{1}{J}. \quad (27)$$

Following the log-linearization procedure outlined in Manning (2020), the elasticity of labor with respect to the wage is

$$\varepsilon^j = (1 - q^j) \frac{1}{1 + \tau}. \quad (28)$$

This is a generalized form of the monopsonistic competition elasticity in Equation (23), which is a direct result of Equation (28) when $q_j \rightarrow 0$ for large J . The wage is then

$$w_S = p\beta_S f'(H_S^*) \cdot \frac{J-1}{J(2+\tau)-1}. \quad (29)$$

Observe that Equation (29) approaches Equation (24) as $J \rightarrow \infty$, or as the market moves from a monopsony to monopsonistic competition. Equation (29) yields a total income and elasticity of taxable income,

$$Z = \frac{(1 - \tau)}{(J(\tau + 2) - 1)(\tau + 2)} p[N_H \beta_H + N_L \beta_L] f' \left(\frac{1}{\tau + 2} \right) \quad (30)$$

$$\text{and } \varepsilon = \frac{(1 - \tau) f''(L_S^*)}{(\tau + 2) f'(L_S^*)} - \frac{J(\tau^2 - 2\tau - 8) + 3}{(J(\tau + 2) - 1)(\tau + 2)}. \quad (31)$$

The second term $\frac{J(\tau^2 - 2\tau - 8) + 3}{(J(\tau + 2) - 1)(\tau + 2)}$ approaches $\frac{\tau - 4}{\tau + 2}$ as $J \rightarrow \infty$, which means that the elasticity of taxable income in the J -firm case from Equation (31) approaches the elasticity in the monopsonistic case from Equation (26) as J becomes large.

2.5 Optimal tax comparison

Using the derivations above, I compare the elasticity of taxable income and the inequality of income between the competitive and monopsonistic markets. Because the general linear tax rate expression derived in Equation (2) is fully general with respect to the functional form of the utility function, Proposition 1 shows that the conditions for efficiency of the tax rate are unchanged when adding the above specifications that define perfect competition and monopolistic competition. This means that the elasticity of taxable income and the inequality metric are sufficient statistics that characterize the optimal tax rate, so comparing these elements yields a comparison of the optimal tax.

2.5.1 Elasticity

Let the subscripts C , M , and O represent the cases of perfect competition, monopsonistic competition and oligopsony, respectively. Recall the derivations of elasticity of taxable income ε in Equations (14), (26), and (31):

$$\varepsilon_C = \frac{(1 - \tau) f''(L_S^*)}{(\tau + 2) f'(L_S^*)} + \frac{3}{\tau + 2}$$

$$\begin{aligned}\varepsilon_M &= \frac{(1-\tau)f''(L_S^*)}{(\tau+2)f'(L_S^*)} - \frac{\tau-4}{\tau+2} \\ \varepsilon_O &= \frac{(1-\tau)f''(L_S^*)}{(\tau+2)f'(L_S^*)} - \frac{J(\tau^2-2\tau-8)+3}{(J(\tau+2)-1)(\tau+2)}\end{aligned}$$

It is clear that the first term, $\frac{(1-\tau)f''(L_S^*)}{(\tau+2)f'(L_S^*)}$, is equivalent for ε_C , ε_M , and ε_O . Then, it suffices to observe that

$$\frac{3}{\tau+2} < -\frac{\tau-4}{\tau+2} \leq -\frac{J(\tau^2-2\tau-8)+3}{(J(\tau+2)-1)(\tau+2)},$$

where the last inequality holds with equality as $J \rightarrow \infty$. This implies that

$$\varepsilon_C < \varepsilon_M \leq \varepsilon_O \tag{32}$$

for all values of τ . Intuitively, the preexisting distortionary effect of market power is greater as labor markets become less competitive, so additional impact of a tax change is greater in a market with monopsonistic competition or oligopoly. Recall from Equations (12) and (24) that $w_M = w_C \cdot \frac{1}{\tau+2}$; thus, the monopsonistic wage is more responsive to the tax rate, which yields a great elasticity of taxable income in the monopsonistically competitive market compared to the competitive market. The same argument holds for the oligopolistic case. I elaborate on the intuition behind this result in Section 2.5.3.

2.5.2 Inequality

Recall from the general derivation of the optimal linear tax rate that the inequality metric $\bar{g}$ is defined as

$$\bar{g} = \frac{\int_i g^i z^i}{Z \int_i g^i}, \text{ where } g^i = G'(u^i)u_c^i$$

and $G'(\cdot)$ is the social marginal welfare of individual i . To preserve generality, I do not impose a specific social welfare function, but I do assume that g^i is decreasing in z^i . In the case of two wages, $\bar{g}$ is increasing in the dispersion of wages. Intuitively,

the greater the difference in wages, the greater the inequality in an economy. This notion is formalized in the following proposition, which is proven in the Appendix.

Proposition 2. *In an economy with two types of workers, if social marginal welfare weights $g^i = G'(u^i)u_c^i$ are decreasing in income z^i , then $\bar{g} = \frac{\int_i g^i z^i di}{Z \int_i g^i di}$ is monotonically decreasing in the dispersion of income.*

Essentially, Proposition 2 equates a comparison of wage differences with the metric of inequality in an economy with two types of workers. Recalling the equilibrium values of wage w_S for $S \in \{H, L\}$ from Equations (12) and (24), the wages in each market are:

$$\begin{aligned} w_{C,S} &= p\beta_S f'(L^*) \\ w_{M,S} &= p\beta_S f'(L^*) \cdot \frac{1}{\tau + 2} \\ w_{O,S} &= p\beta_S f'(L^*) \cdot \frac{J - 1}{J(\tau + 2) - 1}. \end{aligned}$$

The dispersion of wages $w_H - w_L$ for each market is:

$$\begin{aligned} w_{C,H} - w_{C,L} &= pf'(L^*) [\beta_H - \beta_L] \\ w_{M,H} - w_{M,L} &= \frac{1}{\tau + 2} \cdot pf'(L^*) [\beta_H - \beta_L] \\ w_{O,H} - w_{O,L} &= \frac{J - 1}{J(\tau + 2) - 1} \cdot pf'(L^*) [\beta_H - \beta_L] \\ \implies w_{O,H} - w_{O,L} &\leq w_{M,H} - w_{M,L} < w_{C,H} - w_{C,L}. \end{aligned} \tag{33}$$

Thus, the difference in wages is *lowest* in the presence of an oligopoly, higher in a monopsonistically competitive market, and highest in the competitive market. Using this result, Proposition 2 implies that:

$$\bar{g}_C < \bar{g}_M \leq \bar{g}_O \tag{34}$$

Intuitively, the markdown on wage in imperfectly competitive markets compresses the income schedule, which leads to less inequality than in a competitive market.

2.5.3 Result

From Equation (2), the optimal tax rate is $\tau^* = \frac{1-\bar{g}}{1-\bar{g}+\varepsilon}$. As noted earlier, observe that τ^* is decreasing in ε and $\bar{g}$. The comparisons from Sections 2.5.1 and 2.5.2 give $\varepsilon_C < \varepsilon_M \leq \varepsilon_O$ and $\bar{g}_C < \bar{g}_M \leq \bar{g}_O$, which directly implies

$$\tau_O^* \leq \tau_M^* < \tau_C^*. \quad (35)$$

Thus, the optimal linear tax rate is *lowest* in a pure monopsony and oligopsony, *higher* in a monopsonistically competitive market, and *highest* in a perfectly competitive market. This answers Question 2 proposed in the introduction to Section 2: Given individual skills and preferences, the optimal tax rate is lower in settings with greater labor market concentration when wages are set in equilibrium. The difference is caused by a higher elasticity of taxable income from the distortionary effect of the monopsony and lower inequality due to compression of the wage schedule.

To build intuition about this result, I first focus on the effect of the elasticity of taxable income. As a brief aside, consider the following conventional expressions for the deadweight loss caused by a tax with and without an existing tax in place. Let ε_S and ε_D be the elasticities of supply and demand for labor, respectively. Let L^* be the quantity of labor and w^* be the wage in equilibrium. Let τ be the original tax rate and $\Delta\tau$ be the change in the tax rate. Then

$$DWL_\tau(\Delta\tau) = \frac{1}{2} \cdot ((\Delta\tau + \tau)^2 - \tau^2) \cdot \frac{\varepsilon_S \cdot \varepsilon_D}{\varepsilon_S - \varepsilon_D} \cdot \frac{L^*}{w^*} \quad (36)$$

Is the deadweight loss of a change $\Delta\tau$ in the tax rate, given the original tax rate τ . Observe that the deadweight loss is increasing in the preexisting tax rate τ . In a perfectly competitive labor market without any preexisting taxes, $\tau = 0$ and the deadweight loss is

$$DWL_0(\Delta\tau) = \frac{1}{2} \cdot (\Delta\tau)^2 \cdot \frac{\varepsilon_S \cdot \varepsilon_D}{\varepsilon_S - \varepsilon_D} \cdot \frac{L^*}{w^*}$$

Because imperfect competition drives a wedge between the supply and demand of labor, this difference can be viewed as equivalent to a preexisting tax. In the canonical model of monopsony such as from Robinson (1933), let S be the supply curve for labor and MRC be the marginal revenue cost of labor faced by the firm, where $MRC(x) \geq S(x) \forall x$ and x is a quantity of labor hired. Let D be the demand curve for labor, and let L_C and L_M be the equilibrium quantities of labor with perfect competition and with a monopsony, respectively. Define $\nu = MRC(L_M) - S(L_M)$. Then, the deadweight loss from a monopsony is

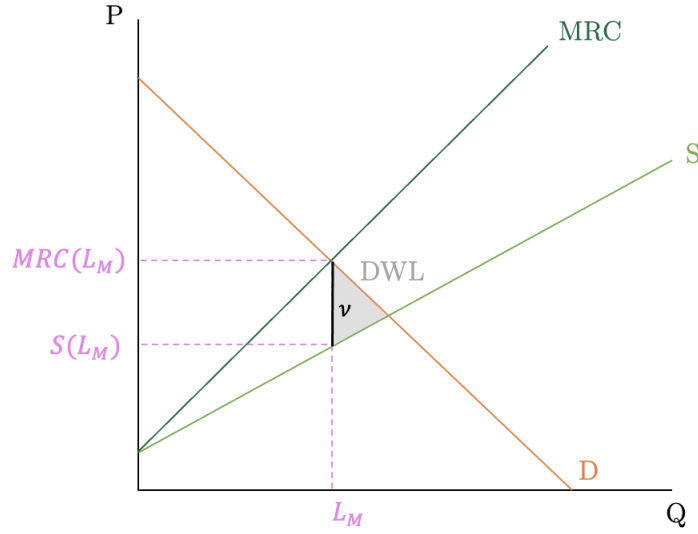
$$\begin{aligned} DWL_{monopsony} &= \frac{1}{2} \cdot (L_C - L_M) \cdot (MRC(L_M) - S(L_M)) \\ &= \frac{1}{2} \cdot \nu^2 \cdot \frac{\varepsilon_S \cdot \varepsilon_D}{\varepsilon_S - \varepsilon_D} \cdot \frac{L_C}{S(L_C)} = DWL_\nu \end{aligned} \quad (37)$$

Thus, the deadweight loss of a monopsony is equivalent to the deadweight loss from a preexisting tax of size ν on the labor market. An important observation is that given this definition of ν , the slope of the marginal cost of labor curve does not matter because this elasticity is already captured in ν . Figure 1 provides an intuitive illustration of this expression using linear supply and demand curves.

Combining Equations (36) and (37) seems to imply that the deadweight loss from taxing a monopsonistic labor market is higher than the deadweight loss from taxing a competitive labor market because the monopsonistic labor market faces the preexisting ‘tax’ caused by the market distortion, but the difference in slope between the MRC and S curves means that it is slightly more complex to draw this conclusion. The derivation above and in Equations (32) and (35) verify that using this framework for monopsony, oligopsony, and monopsonistic competition, the distortionary effect of imperfect competition *does* lead to a greater deadweight loss stemming from a tax. Figure 2 displays the deadweight loss from a tax on a monopsony (lighter grey triangle) and in a perfectly competitive market (darker grey trapezoid).

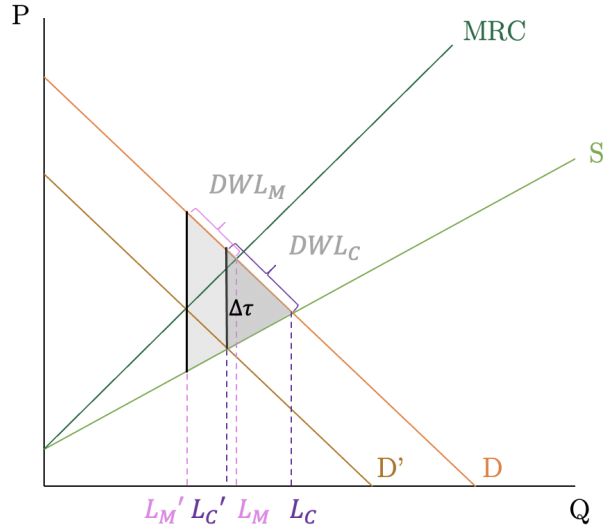
The elasticity comparison captures the additional deadweight loss from a monop-

Figure 1: Deadweight loss from a monopsony and equivalent tax ν



Notes: This figure shows that the deadweight loss from a monopsony is equivalent to the deadweight loss from a tax of size ν , where ν is the difference between the marginal revenue cost and the supply curves at the equilibrium quantity of labor hired.

Figure 2: Deadweight loss of a tax in a competitive and monopsonistic labor market



Notes: This figure shows the change in the equilibrium quantity of labor and the deadweight loss after imposing a tax on a perfect monopsony and in a labor market with perfect competition. The tax wedge is $\Delta\tau$, which is represented by a shift from $D \rightarrow D'$ in the demand curve for labor. The deadweight loss from the monopsony, DWL_M , is larger than the deadweight loss from in the competitive market, DWL_C due to the existing distortion from monopsony power.

sony, which implies a lower optimal tax rate. The second statistic that pins down the tax rate is the inequality metric $\bar{g}$. The intuition behind lower inequality in less competitive markets is more straightforward: Because imperfectly competitive labor markets pay a markdown on the wage that is independent of worker productivity, the entire wage schedule becomes more compressed as the number of firms decreases. Thus, the difference between the utilities of high-skill and low-skill workers is smaller in a less competitive market, which leads to lower inequality and a higher value of $\bar{g}$.

3 Numerical illustration

In this section, I calibrate my model using income data from the 2020 Current Population Survey (CPS) to calculate how the optimal tax rate changes as the number of firms and structure of the labor market moves from a monopoly to a perfectly competitive market. I take as given the income distribution of the United States and derive the optimal tax rate using previously determined expressions of elasticity for different markets. This analysis directly responds to Question 1 outlined in Section 2 by computing the optimal tax rate with an observed distribution of earnings. Because the income distribution is an observable input, these calculations are representative of a realistic policy-making process.

3.1 Utilitarian social welfare function

To conduct these calculations, I assume a Cobb-Douglas production function and perform calibrations using different values of α . The functional form for firm production from Equation (8) is

$$Q_j = \beta_H(H_H^j)^\alpha + \beta_L(H_L^j)^\alpha. \quad (38)$$

This production function implies that high- and low-skilled labor are substitutes, although high-skill labor is more productive than low-skill labor. In these calculations,

I test the values $\alpha = 0.25, 0.5$, and 0.75 , where the $\alpha = 0.75$ value mirrors the estimation of the labor share in the American economy in the canonical work of Cobb and Douglas (1928). To define the social welfare weight on each individual, I first follow a framework of utilitarianism that depends on Definition 1 and Definition 2 of welfarism and social welfare functions. Specifically, I assume a utilitarian social welfare function, which is one of the most common social welfare functions used in the optimal tax literature (Piketty and Saez 2013). Given a vector of utilities $\vec{u} = (u^1, u^2, \dots)$ the utilitarian social welfare function takes the form

$$SWF_{utilitarian} = \int_i u^i di. \quad (39)$$

The social welfare weight on individual i under the utilitarian social welfare function is $G^i(x) = x$. Each individual's social welfare weights are thus

$$g_i = \frac{\log^{-\gamma}(c^i)}{c^i}. \quad (40)$$

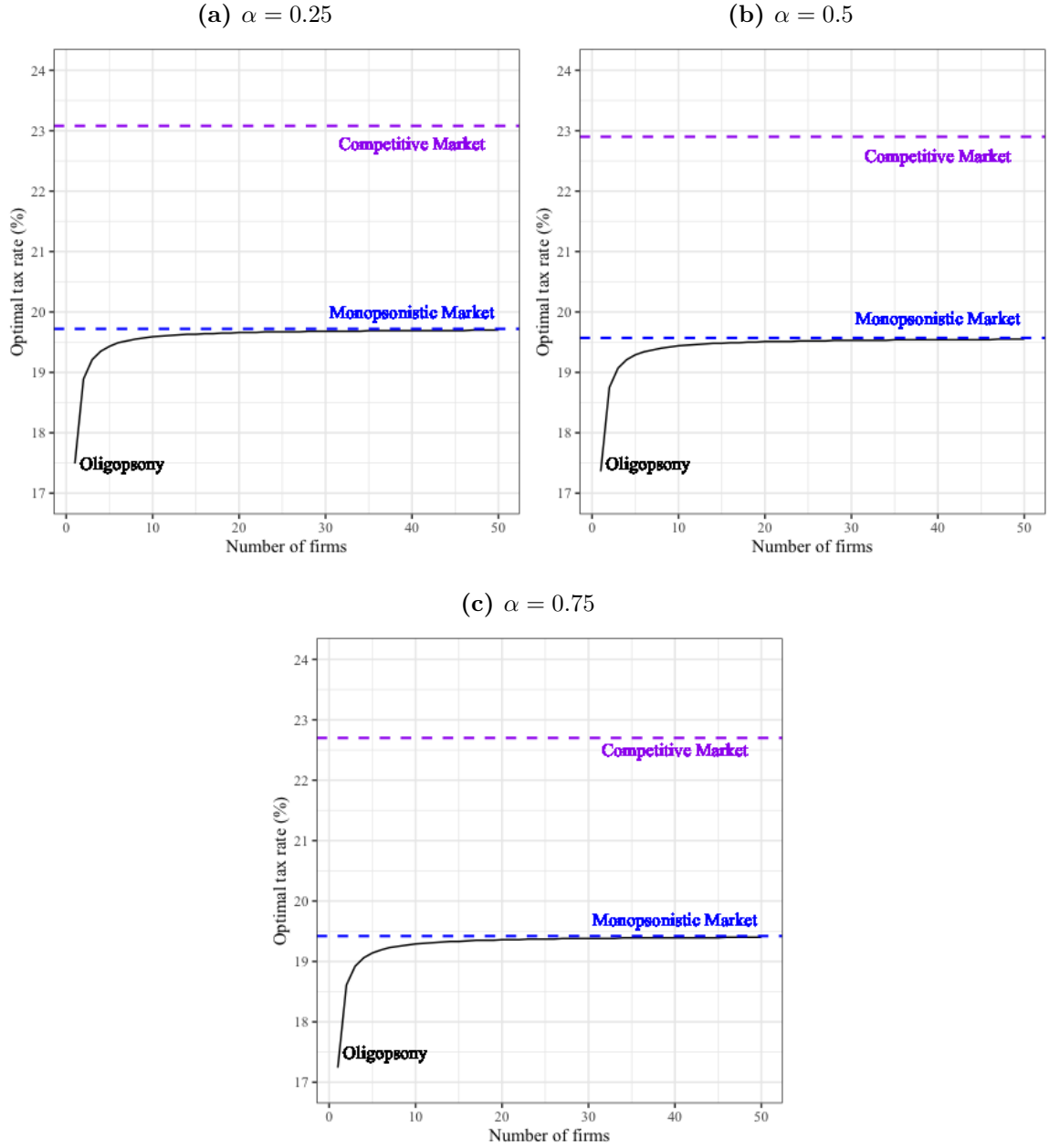
Finally, I use the following utility function which matches the functional form used in Section 2:

$$u^i(c, l) = \log(c^i), \quad u_c^i = \frac{1}{c^i}, \quad c^i = (1 - \tau)z^i + \tau Z \quad (41)$$

Where z_i and Z represent the U.S. income distribution from the 2020 CPS. As in Piketty and Saez (2013), I assume that 90 percent of tax revenues are returned to the worker and 10 percent of tax revenues are used in other forms of government spending.

Results from this calibration are shown in Figure 3. As discussed in Section 3, the optimal tax rate is highest in a perfectly competitive market, followed by a monopsonistically competitive market, and is lowest in a market with an oligopoly. In addition, the optimal tax rate in an oligopoly increases quickly as the number of firms increases, becoming very close to the monopsonistically competitive market—within

Figure 3: Optimal linear tax rate with different market structures



Notes: This figure displays calculations of the optimal linear tax rate using different values of α that determine the concavity of the production function. Panel (c), where $\alpha = 0.75$, most closely approximates empirical estimates of α for the U.S. economy. As in the theoretical model, the optimal tax rate is highest in a competitive market, lower in a market with monopsonistic competition, and lowest in a pure monopoly. In an oligopsony, the optimal tax rate is increasing in the number of firms and quickly approaches the rate in the monopsonistic market.

0.2 percent with all values of α —when the number of firms reaches 50. With an α value of 0.75 from the standard Cobb-Douglas estimation, the optimal linear tax rate

is 22.7 percent in a perfectly competitive market, 19.4 percent in a monopsonistically competitive market, and 17.25 percent in perfect monopsony. This implies that when compared to a perfectly competitive market, the optimal tax rate is about 5 percent lower in a market with a perfect monopsony and 3 percent lower in a monopsonistically competitive market. These optimal tax estimates are slightly below the average U.S. tax rate, which was 24 percent in 2019 (Bradbury, Harding, and Paturot 2020).

The estimates from this model are somewhat lower than other estimates of optimal linear tax rates in the literature, notably Piketty and Saez (2013), which calculates the optimal tax rate using the United States income distribution for elasticities of 0.25, 0.5, and 0.75 and finds optimal tax rates of 61 percent, 48 percent, and 36 percent respectively. Because the elasticities derived in this paper are significantly higher than those used by Piketty and Saez, especially in the monopsonistic and oligopolistic cases, the optimal tax rate is lower. For example, the elasticity at the optimal tax rate using $\alpha = 0.75$ is 1.33 for a perfectly competitive market, 1.72 for a monopsonistically competitive market, and 2.07 for a perfect monopsony. Investigating and correcting this discrepancy may be an important future extension of this work, especially because the model in this paper is based off of a simple labor-leisure tradeoff and is not more deeply microfounded. While the exact values for elasticity derived in this section may not be completely accurate, the *relationship* between the elasticities for competitive and imperfectly competitive markets—for example, the result that the elasticity is lower in a monopsonistically competitive market than a perfectly competitive market—are likely robust to additional specifications.

3.2 Generalized utilitarian social welfare function

The structure of the social welfare weighting function $G(\cdot)$ is crucial to determining the tax rate, but the utilitarian social welfare function may not be the most representative of societal preferences for redistribution. To examine how different social

welfare functions affect the optimal tax rate, I repeat the calculations from Section 3.1 using different functional forms for $G(\cdot)$. As observed in Equation (3), the optimal tax rate is decreasing in $\bar{g}$; in other words, the less a society values redistribution, the lower the tax rate. In this section, I examine a class of *generalized utilitarian social welfare functions*, or social welfare functions that range from utilitarianism to Rawlsianism.

Definition 3 (Generalized utilitarian social welfare functional). *A social welfare functional is considered generalized utilitarian if there exist increasing functions $g^i : \mathbb{R} \rightarrow \mathbb{R}$ such that for all possible outcomes $x, y \in X$ and individuals with utilities $u^i \in \vec{u}$, $x \succsim y \iff \sum_{i=1}^n g^i(u^{x,i}) \leq \sum_{i=1}^n g^i(u^{y,i})$.*

The corresponding social welfare function for a generalized social welfare functional is

$$\int_i G(u^i) di, \quad (42)$$

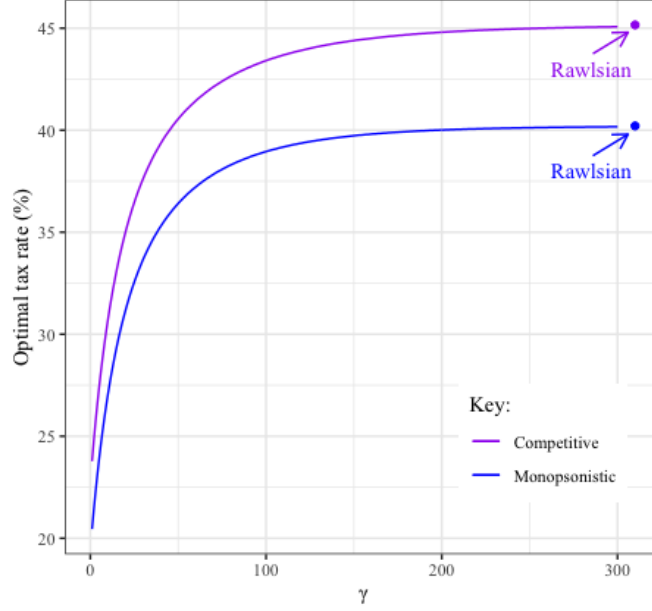
where $G : \mathbb{R} \rightarrow \mathbb{R}$ is increasing. Focusing on a specific type of generalized utilitarian social welfare function, I define the following family of generalized social welfare functions that nest the utilitarian and Rawlsion criterion:

$$SWF_\gamma = \begin{cases} \int_i \frac{(u^i)^{1-\gamma}}{1-\gamma} di & \gamma \geq 0, \gamma \neq 1 \\ \int_i \log(u^i) di & \gamma = 1 \end{cases} \quad (43)$$

To generate these social welfare functions, $G(x) = \frac{x^{1-\gamma}}{1-\gamma}$ for $\gamma \geq 0, \gamma \neq 1$, and $G(x) = \log(x)$ for $\gamma = 1$. Intuitively, this class of social welfare functions takes the sum of individual utility functions weighted by a parameter γ , which lends it more flexibility than a purely utilitarian social welfare function. The utilitarian social welfare function is equivalent to SWF_0 , and the Rawlsian social welfare function is equivalent to $\lim_{\gamma \rightarrow \infty} SWF_\gamma$. The parameter γ can be viewed as a coefficient of risk aversion for the social planner, which is discussed further in the Appendix. The results from

calibrating the model to a social welfare function SWF_γ with varying γ and using $\alpha = 0.75$ are in Figure 4.

Figure 4: Optimal linear tax rate with different social welfare functions



Notes: This figure displays calculations of the optimal linear tax rate using social welfare functions with different concavities, as parametrized by γ . While the optimal tax rate is higher in the competitive case for all values of γ , this difference is increasing in γ . Also, both markets have optimal tax rates that are increasing in γ and approach the optimal tax rate using Rawlsian criterion.

The optimal tax rate is higher in the competitive case for all values of γ , and the difference between the optimal tax rates in the competitive and monopsonistic markets is *increasing* in γ . This is because as γ increases, more weight is placed on the separation of utility between high-skill and low-skill workers. Since wage inequality is greater in the competitive case, the optimal tax rate increases by a greater extent in the competitive market than the monopsonistic market as the social welfare function moves from utilitarianism to Rawlsianism. In addition, the optimal tax rate approaches the rate derived from the Rawlsian criterion for both markets as γ increases, stabilizing at around $\gamma = 200$.

4 Empirical evidence

In this section, I empirically test the two main predictions from my model. Markets with more labor market concentration have: (1) A higher elasticity of taxable income and (2) Lower inequality. To measure labor market power, I use the Herfindahl-Hirschman Index (HHI) for each location-occupation pair documented by Azar et al. (2020), which is negatively correlated with wages and the elasticity of labor supply and thus a good measure of employer power in localized labor markets (Azar et al. 2019, Azar et al. 2020). Consistent with the predictions from the model, markets with higher HHIs also have higher elasticities of taxable income and lower inequality.

4.1 Elasticity of taxable income

4.1.1 Empirical framework

To estimate the elasticity of taxable income in different markets, I use an instrumental variables strategy that exploits changes in the tax code which drive changes in taxable income. I mostly follow the empirical framework of Gruber and Saez (2002). The taxable income z of any individual is a function of the tax rate and non-taxable income I , or $z = z(1 - \tau, I)$. In the framework of Section 2, non-taxable income I is analogous to leisure ℓ that is paid at a unit wage of 1, and an individual has total income $(1 - \tau)z + I$. A change in the taxable income can be broken down into a change in the net-of-tax rate and non-taxable income:

$$\begin{aligned} dz &= -\frac{\partial z}{\partial(1 - \tau)}d\tau + \frac{\partial z}{\partial I}dI \\ \implies dz &= -\frac{z(1 - \tau)}{z(1 - \tau)} \cdot \frac{\partial z}{\partial(1 - \tau)}d\tau + \frac{z(1 - \tau)}{z(1 - \tau)} \cdot \frac{\partial z}{\partial I}dI \end{aligned} \quad (44)$$

Define the uncompensated elasticity with respect to the net-of-tax rate as $\varepsilon = \frac{1-\tau}{z} \cdot \frac{\partial z}{\partial(1-\tau)}$, the compensated elasticity or substitution effect as $\eta = \frac{1-\tau}{z} \cdot \frac{\partial z^h}{\partial(1-\tau)}$, and the income effect as $\sigma = (1 - \tau) \cdot \frac{\partial z}{\partial I}$. Rewriting Equation (44) using these definitions

yields

$$dz = -\varepsilon z \frac{d\tau}{1-\tau} + \sigma \frac{dI}{1-\tau}.$$

By the Slutsky equation, $\varepsilon = \eta + \sigma$. Substituting in the compensated elasticity and income effect for the uncompensated elasticity,

$$\begin{aligned} dz &= -\eta z \frac{d\tau}{1-\tau} - \sigma z \frac{d\tau}{1-\tau} + \sigma \frac{dI}{1-\tau} \\ \implies \frac{dz}{z} &= -\eta \frac{d\tau}{1-\tau} + \sigma \frac{dI - z d\tau}{z(1-\tau)} \end{aligned} \quad (45)$$

I use Equation (45) to estimate the parameters η and σ to determine the effect of market concentration on the income effect, substitution effect, and overall elasticity of taxable income.

To estimate this equation, I use the following approximations. Assume two years $t = 1, 2$. I estimate this equation with a two-year lag to allow time for taxpayer adjustments, so the regressions represented by year 2 will use data from year $t_1 + 2$. Then, I approximate z by z_1 and dz by $z_2 - z_1$. Observe that $d\tau$ is the change in the marginal tax rate and $dI - z d\tau$ is the change in net-of-tax income. Let $T_j(z_j)$ be the total tax liability and $T'_j(z_j)$ be the marginal tax rate in year j . Similarly, I approximate $d\tau$ by $T'_2(z_2) - T'_1(z_1)$ and $dI - z d\tau$ by $(z_2 - T_2(z_2)) - (z_1 - T_1(z_1))$.

Finally, I use a log-log specification as the measured changes in income may be very large. This gives the regression

$$\log(z_2/z_1) = \eta \log \left(\frac{1 - T'_2(z_2)}{1 - T'_1(z_1)} \right) + \sigma \log \left(\frac{z_2 - T_2(z_2)}{z_1 - T_1(z_1)} \right) + \epsilon \quad (46)$$

However, because the tax rate is determined by one's income, there is an endogeneity problem for both parameters of interest. Running an OLS regression on this equation will result in an upwards-biased estimate of η because an increase in income will also lead to an increase in the marginal tax rate without any behavioral effects. Thus, η is correlated with ϵ . In addition, individuals with different incomes may have

different income growth rates that are not due to tax changes, perhaps because of mean reversion or widening inequality. This implies that σ is also correlated with ϵ .

To solve the endogeneity problem, I follow Gruber and Saez (2002) and instrument for both the change in marginal tax and net-of-tax income using the counterfactual tax rate given no behavioral response. Specifically, I will instrument for $\log\left(\frac{1-T_2'(z_2)}{1-T_1'(z_1)}\right)$ using $\log\left(\frac{1-T_2'(z_1)}{1-T_1'(z_1)}\right)$ and similarly instrument for $\log\left(\frac{z_2-T_2(z_2)}{z_1-T_1(z_1)}\right)$ using $\log\left(\frac{z_1-T_2(z_1)}{z_1-T_1(z_1)}\right)$. Intuitively, these instruments use changes in the tax code to identify the true elasticity with respect to tax rates. The marginal tax instrument is the change in the net-of-tax rate if real income does not change from year 1 to year 2; the income shock instrument is the change in tax liability if real income does not change from year 1 to year 2. I also use a multitude of years to prevent collinearity and preserve identification under these conditions.

4.1.2 Data and results

I use data from the Panel Survey of Income Dynamics as well as NBER’s TAXSIM calculator to estimate these parameters. The PSID is a longitudinal household survey that collects data on the individuals and descendants from a nationally representative sample of 18,000 individuals and 5,000 families identified in 1968. The collected information is extensive, with questions addressing topics from employment to education to health. I am using data from the PSID from years 2001 to 2011, which maps to income data from years 2000 to 2010.

In addition, I use data from Azar et al. (2020), which measures market concentration using online job vacancies collected through Burning Glass Technologies, to measure the market concentration that each worker in the PSID faces. Because data from the PSID is at the state level and the HHI indices from Azar et al. (2020) are at the commuting zone level, I aggregate up to the state level by taking the average HHI of each commuting zone to construct individual HHI indices. I also use a crosswalk

provided by the Integrated Public Use Microdata Series (IPUMS) to match 6-digit SOC codes from the Azar et al. (2020) dataset to the 3-digit OCC codes from the PSID. Some descriptive statistics on the data from each individual’s base year are listed in Table 1.

Table 1: Summary Statistics (Base Year)

	Median	Mean	Standard Deviation
Taxable Income (\$)	53,105	74,269	99,311
Married Dummy	–	0.82	–
Personal Exemptions (\$)	14,000	14,998	4,667
Marginal Tax Rate (Federal + State, %)	38.09	40.16	6.77
Tax Liability (Federal + State, \$)	20,403	30,067	43,212
Herfindahl-Hirschman Index	5,972	5,892	3,466

Notes: This table shows some demographic information for the individuals in the PSID dataset during 2001-2011. Units are 2001 dollars. The income distribution is reasonably similar to the U.S. population, which had a median income of \$42,228 in 2001 (Denavas-Walt and Cleveland 2002). The HHI, which proxies the market concentration, is relatively high and skewed high. The mode of the HHIs is 10,000, with 1,873 individuals facing markets with one firm. The minimum HHI is 16.02. Since the U.S. Department of Justice considers an HHI of over 1,500 to be moderately concentrated and an HHI of over 2,500 to be highly concentrated, the median worker in this dataset faces a highly concentrated labor market.

To construct this dataset, I match individuals using their 1968 identification number provided by the PSID. I exclude families whose marital status changed from year 1 to year 2, as these changes may lead to large changes in income that are not related to tax policy. I also omit individuals who have no taxable income in either year, as well as individuals who either moved states or changed occupations from year 1 to year 2. Finally, I deflate each year’s income metrics using the core PCE deflator, obtained from FRED, using a base year of 2001. Because I use data from years 2001 to 2011 collected every other year, I have five pairs of years to compare. I stack these

years to obtain a total number of 200,370 observations.

I use NBER’s TAXSIM calculator, which takes individual income data and returns federal and state tax liabilities, to calculate the relevant tax information for each individual from the PSID. I use the scripts written by Margaret McKeehan and Nick Frazier to convert PSID data into a format usable by TAXSIM. As mentioned above, I estimate the regressions with a two-year lag to allow time for behavioral responses and endogenizing of policy change. To generate the instruments, I run the PSID data for time period 1 through the TAXSIM program for time period 2 (e.g. the PSID data from 2001 would be inputted into the 2003 TAXSIM generator) to obtain the changes in tax rates and liability had taxable income not changed from time period 1 to time period 2.

I have chosen the period 2001–2011 because this timeframe captures multiple changes in the tax code that can be used to examine the elasticity of taxable income. The Economic Growth and Tax Relief Reconciliation Act of 2001 and the Jobs and Growth Tax Relief Reconciliation Act of 2003, often referred to as the “Bush tax cuts,” significantly reduced marginal income tax rates especially for high-income earners. A summary of the income tax rate cuts compiled by Emily Horton at the Center on Budget and Policy Priorities is in Table 2. In addition to the Bush tax cuts, a series of other tax relief and stimulus acts during this period created larger child tax credits, raised the alternative minimum tax exemption, enacted stimulus payments, and more. The total effect of these policies on the net taxes paid by a representative four-person, single-income family with \$40,000 in wage income is in Table 3, based on calculations from the Department of the Treasury and legislation documentation from the Tax Policy Center.

This test relies on a few assumptions. The HHI data from Azar et al. (2020) was calculated in 2016, so I assume that levels of industry concentration have remained relatively constant between 2001 and 2016. With regards to the empirical strategy,

Table 2: Income tax reductions after the 2001 and 2003 tax cuts

Taxable Income	Previous Rate (%)	New Rate (%)
Below \$17,000	15	10
\$17,000 – \$68,000	15	15
\$68,000 – \$137,000	28	25
\$137,000 – \$209,000	31	28
\$209,000 – \$374,000	36	33
Above \$374,000	39.6	35

Notes: This table lists the changes in the marginal income tax for each income bracket after the Economic Growth and Tax Relief Reconciliation Act of 2001 and the Jobs and Growth Tax Relief Reconciliation Act of 2003.

isolating the elasticity of taxable income using tax code changes assumes that the relationship between the error ϵ and income z_1 remains constant over time, or that there are no other factors that affect income which are correlated with changes in the tax code. I use marital status, logged income, age, and age² as controls. Results from running the regression specified in Equation (46) are in Table 4. An additional robustness check using federal taxes only as well as results from the first-stage regression can be found in the Appendix.

Column (1) of Table 4 shows the regression with the income and substitution effects only to check that the directions match theoretical and other empirical predictions. As expected, the substitution effect is negative—a higher tax rate decreases marginal earnings, leading individuals to substitute away from taxable work—and the income effect is positive—a higher tax rate reduces total income, incentivizing individuals to work more. Adding the substitution and income effects through the Slutsky equation leads to a total uncompensated elasticity of 0.923, which is in line with other empirical estimates that fall between 0.3 and 2 (Saez, Slimrod, and Giertz

Table 3: Federal Income Taxes Paid, 2001–2011

Year	Income (\$)	Pre-2001 tax (\$)	Actual tax (\$)	Tax Reduction (\$)
2001	34,200	1,250	450	800
2002	34,700	1,228	428	800
2003	35,500	1,303	503	800
2004	36,400	1,378	-570	1,948
2005	37,700	1,490	-495	1,985
2006	38,900	1,565	-445	2,010
2007	40,000	1,625	-428	2,053
2008	41,100	1,700	-2,283	2,983
2009	41,900	1,715	-1,399	3,114
2010	42,900	1,805	-1,319	3,124
2011	43,900	1,858	-487	2,345

Notes: This table shows the tax burden for a four-person, single-income family with \$40,000 annual wage income (2007 dollars). Notable tax changes include the 2001 and 2003 tax cuts, the Economic Stimulus Act of 2008, the Emergency Economic Stabilization Act of 2008, and the American Recovery and Reinvestment Act of 2009.

2009). Gruber and Saez (2002), which outlines the empirical strategy used in this paper, find an elasticity of taxable income of 0.611.

In Column (2) and Column (3), I create indicator variables for each quartile of the HHI. Column (2) shows the regression including interaction terms with the indicator for the top quartile HHI metric, or $HHI > 10,000$. Both the substitution effect and the income effect are positive and significant at the 1% level. Summing the two terms, the additional effect of working at a firm in the highest quartile of labor market concentration increases the elasticity of taxable income by 0.084. This is consistent

Table 4: Elasticity of taxable income and labor market HHI

	<i>Dependent variable: $\log(\text{TI2})/\log(\text{TI1})$</i>		
	(1)	(2)	(3)
Substitution Effect	-0.040*** (0.013)	-0.045*** (0.008)	-0.103*** (0.013)
Income Effect	0.963*** (0.004)	0.807*** (0.002)	0.802*** (0.003)
Substitution $\times$ HHI >10,000		0.075*** (0.014)	0.134*** (0.017)
Substitution $\times$ $5,972 \leq \text{HHI} < 10,000$			0.092*** (0.019)
Substitution $\times$ $2,709 \leq \text{HHI} < 5,972$			0.091*** (0.018)
Income $\times$ HHI >10,000		0.009** (0.004)	0.014*** (0.005)
Income $\times$ $5,972 \leq \text{HHI} < 10,000$			0.007 (0.005)
Income $\times$ $2,709 \leq \text{HHI} < 5,972$			0.008 (0.005)
Observations	200,370	200,370	200,370
R ²	0.895	0.924	0.924
Adjusted R ²	0.895	0.924	0.924
Residual Std. Error	0.278	0.236	0.236

*p<0.1; **p<0.05; ***p<0.01

Notes: This table displays results from estimating the elasticity of taxable income. Column (1) shows that the substitution effect is negative and the income effect is positive, consistent with theoretical predictions. Column (2) interacts the highest quartile of labor market concentration with elasticity terms and indicates that there is a positive relationship between HHI and income elasticity. Column (3) interacts the upper three quartiles of HHI with elasticity terms and finds that income elasticity is increasing with HHI. This is especially true through the substitution effect, where each quartile of HHI roughly above the ‘highly concentrated’ range of 2,500 has a positive association with the compensated elasticity. Only the top quartile of HHI has a positive association with the income effect.

with the model’s prediction that regions with higher labor market concentration face lower elasticities of taxable income.

Column (3) interacts each quartile of the HHIs with the income and substitution effect, excluding the lowest quartile to prevent perfect multicollinearity. As in the previous regressions, a higher HHI is correlated with a greater substitution and income effect. The coefficient on the interaction between the HHI quartile and the substitution effect is positive and significant for all of the top three quartiles of HHIs and is increasing in each consecutive quartile. The coefficient on the interaction between the HHI quartile and the income effect is positive and significant for the highest quartile of HHIs only. This result further confirms the theoretical prediction that higher HHIs are correlated with a higher elasticity of taxable income, which is driven by both the substitution and income effect—although the substitution effect has a more pronounced impact.

It is important to note that the results in Table 4 are correlative with HHI rather than causal. While this regression uses an instrumental variables strategy, the exogenous shock is to determine the elasticity of taxable income rather than isolate the effect of firm concentration on elasticity. Testing for the causal effect of firm concentration on elasticity requires exogenous variation in the industry concentration. To my knowledge, there has not been conclusive research that is able to empirically test for the relationship between labor market power, elasticity, and inequality. One way to approach this problem may be through the framework of Greenstone, Hornbeck, and Moretti (2010), which uses plant openings as variation through which to examine agglomeration spillovers in total factor productivity. An issue with this approach when applied to market power is that this variation does not only affect market concentration but also the demand for labor, especially as the authors also document that a new plant also attracts more firms in turn due to productivity spillovers. Further research into the causal effect of labor market power on inequality or the elasticity of

taxable income would be an interesting path for future research.

4.2 Inequality

Next, I test the second prediction from my model: Markets with higher labor market concentration have lower inequality. Because only 4,712 occupation-state pairs from the PSID data have more than one observation, I aggregate up to the state level rather than the occupation-state level. In addition, I test this hypothesis both using income data from the PSID and Gini coefficients by state tabulated by the 2010 American Community Survey. This is because many states in the PSID data have fewer than 100 observations, which limits the power and accuracy of testing inequality at the state level. In addition, six states do not have PSID residents, so the Gini coefficient data provide a more comprehensive view of the entire United States. The drawback of using the Gini coefficient is that this calculation only takes into account the dispersion of income, rather than the marginal utility experienced by each individual required to calculate the social welfare functions defined in Section 3. Proposition 2 shows that this is a valid approximation for comparing inequalities between markets.

To test this hypothesis, I regress the state-level metric of inequality—either the Gini coefficient or $\bar{g}$ on the state’s average HHI. Specifically, I run the regression

$$Inequality = \beta_0 + \beta_1 HHI + \epsilon. \quad (47)$$

The results from this regression are in Table 5. In Column (1), the Gini coefficient is negatively correlated with the HHI, and this result is statistically significant at the 1% level. Because lower values of the Gini coefficient indicate lower inequality, this means that lower inequality is correlated with higher HHIs. This concurs with the theoretical prediction that states that have more market concentration have lower inequality. In Column (2), the coefficient on $\bar{g}$ is slightly positive, although this effect

is not statistically significant. Because the utilitarian criterion yields a $\bar{g}$ that is low when inequality is high, this would also indicate that markets with higher HHIs have lower inequality. There are two outlier states in the PSID data used to construct $\bar{g}$, which I omit for Column (3). These states are South Dakota with a $\bar{g}$ of 186 and Utah with a $\bar{g}$ of 103. Even without these outliers, $\bar{g}$ is slightly positive but not statistically significant. A more detailed discussion of these outliers is below.

Table 5: Inequality and state-level HHI

	<i>Dependent variable:</i>		
	(1) Gini coefficient	(2) $\bar{g}$	(3) $\bar{g}$
HHI	−0.00001*** (0.00000)	0.006 (0.006)	0.0004 (0.002)
Constant	0.508*** (0.016)	−22.170 (28.584)	2.798 (11.541)
Observations	50	44	42
R ²	0.093	0.023	0.001
Adjusted R ²	0.074	−0.0001	−0.024
Residual Std. Error	0.020	32.163	9.565

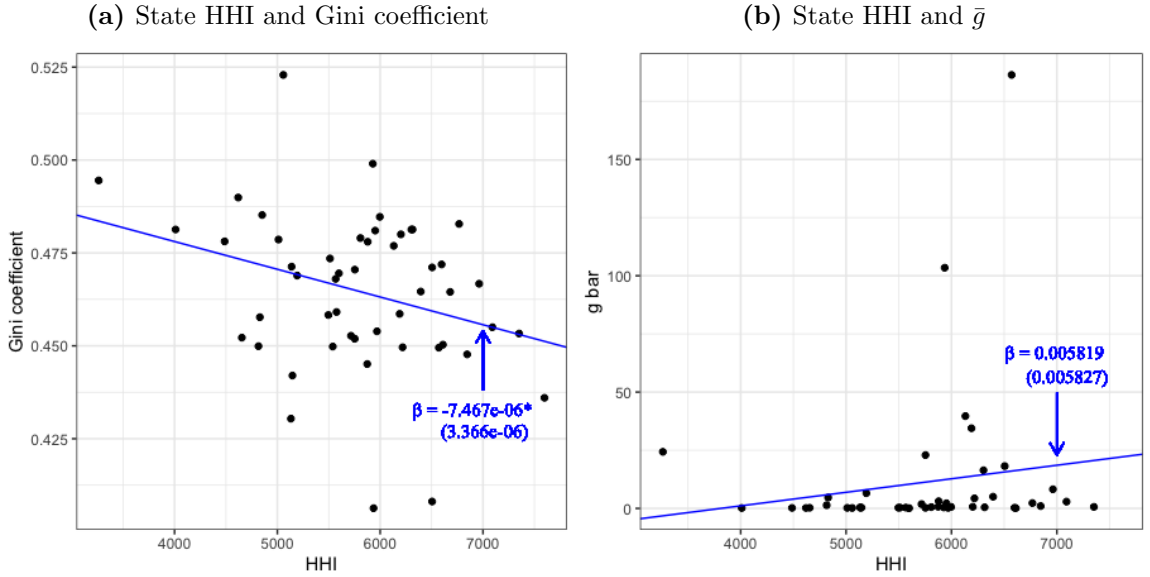
*p<0.1; **p<0.05; ***p<0.01

Notes: This table shows the relationship between different metrics of inequality and state-level HHI. Column (1) illustrates that the Gini coefficient is decreasing in the HHI, or that inequality is decreasing in market concentration. Column (2) does not find any statistically significant results, but shows that $\bar{g}$ is weakly increasing in HHI, which also means that inequality may be decreasing in market concentration. Column (3), which runs the same regression as in Column (2) but without two outlier states, also finds a weakly positive but not significant relationship.

Figure 5 plots the relationship between the HHI and the metric of inequality. Because the Gini coefficient and $\bar{g}$ are inverses—that is, the Gini coefficient is low when inequality is low, but $\bar{g}$ is low when inequality is high—the opposite slopes of the regression lines for Panel (a) and Panel (b) indicate results in the same direction. The negative relationship between the HHI and the Gini coefficient is in Panel (a), while the positive relationship between the HHI and $\bar{g}$ is in Panel (b). The small

sample size in Panel (b) has likely led to inaccurate estimations of $\bar{g}$ —especially in the cases of South Dakota and Utah, which have $\bar{g}$ values of 186 and 103 and only 5 and 10 individuals sampled in each state, respectively. The lack of sufficient data using the PSID means that the correlation between the state HHI and $\bar{g}$ is not interpretable with any level of statistical confidence, even when removing outliers as in Column (3) of Table 5.

Figure 5: Optimal linear taxes with different market structures



Notes: This figure graphically shows the results from Table 5 and plots individual state values. The Gini coefficient is decreasing in a state's HHI, while $\bar{g}$ is weakly but not statistically significantly increasing in a state's HHI.

As with the elasticity of taxable income, the relationship between a state's HHI and income inequality is correlative rather than causal. Yet, the empirical confirmation of both of the model's predictions may indicate that *given the existence* of different labor market concentrations in the United States, the optimal tax rate should be lower in regions that have higher degrees of labor market concentration measured by HHI. These results corroborate the theoretical answer to Question 2 proposed in Section 2: Given individual skills and preferences, the optimal tax rate should vary negatively with the degree of labor market power in a region due to the positive re-

relationship between income elasticity and market power and the negative relationship between income inequality and market power.

5 Future extension: Nonlinear income taxes

Examining the difference between linear income taxes illustrates the key trade-off between equity and efficiency but is less general than a nonlinear income tax comparison. While I do not formalize a full model regarding nonlinear income taxation in this paper, I will address one perspective from which to approach this problem.

Scheuer and Werning (2017), which explores the optimal tax rate in the presence of ‘superstar’ effects, offers an approach to integrating imperfect competition into the nonlinear tax framework. In their paper, Scheuer and Werning modify the earnings function to be supermodular in an individual’s labor-effort and their firm match quality; that is, earnings are convex in effort. They find that the conditions of efficiency for a tax schedule are unchanged with superstar effects, that superstars push down optimal tax rates due to higher elasticities with a given distribution of income, and that superstars have no effect on the optimal tax schedule without holding the distribution of income fixed as the higher inequality and higher elasticity of earnings are exactly offset.

This work and markets with monopsonistic competition would be analogous if the *level of monopsony power is decreasing in the skill of the worker*, similar to the setup of Hummel (2020) which considers the case where higher-ability workers are better negotiators and suffer less from market power. If the only assumption in the monopsonistic market is that workers face a markdown from the competitive wage that is decreasing in ability, then the result would be identical to that from Scheuer and Werning (2017). This assumption does not capture the difference between monopsonistically competitive and oligopsonistic markets, and likely leads to the unrealistic conclusion that the wage of the highest-skilled worker approaches the competitive

wage.

In a more straightforward extension of the model in this paper into the nonlinear tax framework, recall from Equation (22) that the wage in a monopsonistically competitive market is a markdown from the competitive wage. This markdown is increasing and concave in the elasticity of labor with respect to the wage faced by each firm, which is set by labor market clearing in equilibrium. In addition, section 2.4 demonstrates that the markdown is decreasing in the number of firms in a market. To abstract slightly from the microfounded result in this paper, suppose for illustrative purposes that the elasticity of labor for firm j is some decreasing and convex function of the number of firms in the market, $\varepsilon^j(J)$. The wage in the oligopsonistic market w_o compared to the competitive wage w_c is

$$w_o(J) = w_c \cdot \frac{\varepsilon^j(J)}{1 + \varepsilon^j(J)}. \quad (48)$$

Notably, this equation does not include the dependence of ε on the tax rate in equilibrium, which simplifies the setup compared to the linear tax model. However, Equation (48) is the same result from traditional models of market power such as Robinson (1933) that are not microfounded on the individual worker level.

Because this expression does not include any endogenous variables, it satisfies the same Pareto optimality condition and optimal tax expression as in Proposition 1 from Scheuer and Werning (2017), which in turn is the same optimality condition as the usual Mirrlees formulation derived in Saez (2001). Thus, this characterization of market power, like the superstar effect, is neutral with respect to the conditions for efficiency of a tax schedule. Setting up the same comparison as in Proposition 2 in Scheuer and Werning (2017) would yield a comparison between the optimal tax in a competitive market and a monopsonistically competitive market. If, as in this paper, the compensated elasticity is higher as the number of firms J increases, then (assuming away or assuming equivalent income effects) the optimal tax rate for

a given distribution of earnings is lower in more concentrated markets. Additional investigations may also focus on deriving the optimal nonlinear tax rate given a set of preferences rather than a given distribution of earnings.

While these examples provide some illustrative intuition for nonlinear taxation in the presence of labor market power, they do not fully represent results from modern models of monopsony. Incorporating the microfounded market structure in previous sections into a nonlinear tax framework is a natural and important extension of this paper.

6 Conclusion

Labor market power affects the wages and employment of countless workers and has implications for the optimal design of fiscal policy in localized labor markets. Because monopsonistic power creates preexisting employment distortions and compresses the wage distribution, markets with higher levels of labor market power should bear lower income taxes.

This paper contributes to the optimal taxation literature by extending the optimal linear tax model to settings where firms have hiring power in the labor market. By integrating the model of monopsonistic competition from Card et al. (2018), which depends on workers having idiosyncratic preferences over working at different firms, I show that markets where firms have hiring power experience higher elasticities of taxable income and lower wage inequality when compared to competitive labor markets. Both of these effects are strongest in a market with a perfect monopsony and decrease in intensity as the number of firms in the market increases. This implies that the optimal labor tax is inversely related to the number of hiring firms in a market, which is a proxy for labor market power.

An important implication of this result is that the optimal labor tax may differ by region or occupation, which is a way that the optimal tax rate could depend on

“tagging.” In this case, the “tag” is determined by a firm’s characteristics—its labor market share—rather than the individual’s characteristics, the latter having been more frequently explored in the optimal tax literature such as in Akerlof (1978) and Mankiw, Weinzierl, and Yagan (2009). Because states often have different levels of market concentration, localized taxes such as state income taxes may be important in achieving a closer approximation of the optimal tax rate for each labor market.

Data from the PSID combined with information on local occupation HHIs from Azar et al. (2020) show that the elasticity of taxable income is indeed positively correlated with labor market HHI. Similarly, state-level Gini coefficients indicate that states with a higher average HHI have lower income inequality. These results confirm the model’s predictions that markets with more labor market power, measured by the HHI, have higher elasticities of taxable income and lower inequality. A valuable avenue for future research would be to conduct causal, rather than correlative, tests on the relationship between a market’s HHI, elasticity of taxable income, and inequality.

While this paper examines optimal linear income tax rates, future work on this topic should extend this model to a non-linear Mirrleesian setting. In addition, this model depends on a log-linear utility function, so including a generalized functional form for utility may provide broader results. It is also important to note that while this paper argues that the optimal tax rate is lower in the presence of a monopsonistic labor market rather than a competitive labor market, the true optimal tax rate may differ due to a variety of other individual and market characteristics. As taxing as it may be, including market power in the study of optimal taxation will provide a richer perspective on how fiscal policy interacts with the economy.

A Appendix

A.1 Omitted proofs

A.1.1 Proposition 1

First, I show a detailed derivation of the optimal tax rate in Equation (2). Recall from Equation (1) that the government maximizes

$$\operatorname{argmax}_{\tau} \int_i G[u^i((1 - \tau)z^i + \tau Z, \ell^i)] di \quad (49)$$

With respect to τ . To more specifically connect this expression to the framework of the competitive and monopsonistic markets, let $z^i = w^i \cdot L^i$ where w^i is the wage and L^i is the labor-hours worked. Leisure is then $\ell^i = 1 - L^i$, as the individual has total time endowment of 1. Let w^i be a function of L^i , as the wage is a function of labor-hours for both markets. The individual maximizes u^i with respect to L^i , leading to the first order condition,

$$(1 - \tau)u_c^i \cdot \left(\frac{\partial w^i}{\partial L^i} L^i + w^i \right) = u_\ell^i \quad (50)$$

Which implicitly defines L^{i*} . Observe that Equation (50) is analogous to the usual first order condition capturing the tradeoff between labor and leisure, $(1 - \tau)w^i u_c^i = u_\ell^i$, with the additional term $\frac{\partial w^i}{\partial L^i} L^i$ that captures the effect of wages being set in equilibrium as a function of labor supply. Taking the derivative of Equation (1) with respect to $(1 - \tau)$ yields,

$$\int_i G'(u^i) \cdot \left(u_c^i \cdot \left[(1 - \tau) \frac{\partial L^i}{\partial (1 - \tau)} \left(\frac{\partial w^i}{\partial L^i} L^i + w^i \right) - w^i L^i + Z - \tau \cdot \frac{dZ}{d(1 - \tau)} \right] - u_\ell^i \cdot \frac{\partial L^i}{\partial (1 - \tau)} \right) = 0 \quad (51)$$

From the first order condition in Equation (50),

$$(1 - \tau) \frac{\partial L^i}{\partial (1 - \tau)} u_c^i \cdot \left(\frac{\partial w^i}{\partial L^i} L^i + w^i \right) = \frac{\partial L^i}{\partial (1 - \tau)} u_\ell^i \quad (52)$$

Then, letting $z^i = w^i L^i$ and defining $\varepsilon = \frac{1-\tau}{Z} \cdot \frac{dZ}{d(1-\tau)}$, Equation (51) simplifies to,

$$\begin{aligned} & \int_i G'(u^i) u_c^i \cdot \left[-z^i + Z - \tau \cdot \frac{dZ}{d(1-\tau)} \right] = 0 \\ \implies & \int_i G'(u^i) u_c^i \cdot \left[(Z - z^i) - \frac{\tau}{1-\tau} \varepsilon Z \right] = 0 \end{aligned} \quad (53)$$

Then, defining $\bar{g}$ as in Equation (2), I rearrange Equation (53) to obtain the desired tax rate: $\tau^* = \frac{1-\bar{g}}{1-\bar{g}+\varepsilon}$. $\square$

A.1.2 Proposition 2

I will show that in an economy with two types of workers, if $g^i = G'(u^i) u_c^i$ is decreasing in income, or $\frac{\partial g^i}{\partial z^i} < 0$, then $\bar{g} = \frac{\int_i g^i z^i}{Z \int_i g^i}$ is monotonically decreasing in the dispersion of income. Assume there are two types of workers that earn high and low incomes z_H and z_L where $z_H > z_L$, and without loss of generality let $z_H = z_L + C$ where C is a positive constant. Normalize $z_L = 0$, which means that $z_H = C$ and $z_H - z_L = C$. Let N_H and N_L be the number of workers with high and low incomes. Finally, let $g_H, g_L \geq 0$ be the social marginal welfare weight on any individual with income level H and L , respectively. By assumption, $\frac{\partial g_H^i}{\partial z^i} < 0$ and $\frac{\partial g_L^i}{\partial z^i} < 0$. Using these definitions, $\bar{g}$ can be rewritten as,

$$\bar{g} = \frac{N_L g_L z_L + N_H g_H z_H}{N_L^2 g_L z_L + N_H^2 g_H z_H + N_L N_H g_L z_H + N_L N_H g_H z_L}. \quad (54)$$

Taking the derivative of $\bar{g}$ with respect to C and dropping terms that are 0 yields,

$$\frac{\partial \bar{g}}{\partial z_H - z_L} = \frac{\partial \bar{g}}{\partial C} = \frac{(N_L g_L + N_H^2 g_H) \frac{\partial g_H^i}{\partial z^i} - N_H^2 g_H \frac{\partial g_H^i}{\partial z^i}}{(N_H^2 g_H z_H + N_L N_H g_L z_H)^2} \quad (55)$$

The denominator is trivially positive. Both terms in the numerator, $(N_L g_L + N_H^2 g_H) \frac{\partial g_H^i}{\partial z^i}$ and $N_H^2 g_H \frac{\partial g_H^i}{\partial z^i}$, are negative as $\frac{\partial g_H^i}{\partial z^i} < 0$. Because $N_L g_L \geq 0$, then $(N_L g_L + N_H^2 g_H) \geq N_H^2 g_H$. This means that $(N_L g_L + N_H^2 g_H) \frac{\partial g_H^i}{\partial z^i} - N_H^2 g_H \frac{\partial g_H^i}{\partial z^i} \leq 0$, which implies,

$$\frac{\partial \bar{g}}{\partial z_H - z_L} \leq 0. \quad (56)$$

With equality holding only if N_H or $N_L = 0$. Thus, $\bar{g}$ is monotonically decreasing in the dispersion of $z_H - z_C$. □

A.2 Risk aversion in social welfare functions

A social welfare function can be treated as the expected utility for a benevolent social planner, or equivalently as an agent under Rawls's *veil of ignorance* or in line with the thought experiment in Harsanyi (1953). To formalize this notion, define the agent's utility function as,

$$G_\gamma(x) = \begin{cases} \frac{x^{1-\gamma}}{1-\gamma} & \gamma \geq 0, \gamma \neq 1 \\ \log(x) & \gamma = 1 \end{cases} \quad (57)$$

Where x is in a set of utilities U . Observe that $G_\gamma(x)$ is exactly equivalent to the functions g_i that define the class of generalized utilitarian social welfare functions in Equation (43). Let A be a random variable that takes the values $u_{x,i}$ for all $u_{x,i} \in U$ with probability $P(A = u_i) = \frac{1}{|I|}$. Then, the social welfare function can be written as,

$$\begin{aligned} SWF_\gamma &= \begin{cases} \int_i \frac{(u^i)^{1-\gamma}}{1-\gamma} di & \gamma \geq 0, \gamma \neq 1 \\ \int_i \log(u^i) di & \gamma = 1 \end{cases} \\ &= |I| \cdot E[f(A)]. \end{aligned} \quad (58)$$

Intuitively, the agent has a utility function with respect to the state of the world that they may be born in, and the functional form of their utility defines the structure of the social welfare function. The agent maximizes their expected utility, which is equivalent to a social planner maximizing the social welfare function.

To determine the degree of risk aversion for the agent's utility function, I compute the Arrow-Pratt measure of relative risk aversion $R_{G_\gamma}(A) = -\frac{AG''_\gamma(A)}{G'_\gamma(A)}$ as follows:

$$R_{G_\gamma}(A) = \begin{cases} -\frac{\gamma A \cdot A^{-\gamma-1}}{A^{-\gamma}} = \gamma & \gamma \geq 0, \gamma \neq 1 \\ -\frac{-A \cdot A^{-2}}{A^{-1}} = 1 & \gamma = 1 \end{cases} \quad (59)$$

So the agent is risk-averse with a coefficient of relative risk aversion γ . This means that the agent is risk-averse with respect to the *distribution* of different potential utilities. A higher (lower) γ means that the agent is more (less) risk-averse; in the context of a social planner, a higher (lower) γ means that the social planner values individuals with lower utilities more (less). Thus, a utilitarian social planner is risk neutral, while a Rawlsian social planner is extremely risk averse. It is important to note that while I have assumed here that individuals approach societal outcomes solely from a perspective of risk, work such as Cowell and Schokkaert (2001) and Carlsson et al (2005) show that individuals are also inequality-averse, which may put upwards pressure on the empirical value of γ .

A.3 Robustness checks

Table A.1: Elasticity of taxable income and labor market HHI, federal taxes only

	<i>Dependent variable: $\log(\text{TI2})/\log(\text{TI1})$</i>		
	(1)	(2)	(3)
Substitution Effect	-0.515*** (0.060)	-0.574*** (0.016)	-0.623*** (0.023)
Income Effect	0.969*** (0.008)	0.763*** (0.002)	0.759*** (0.003)
Substitution $\times$ HHI >10,000		0.664*** (0.226)	0.714*** (0.227)
Substitution $\times$ 5,972 $\leq$ HHI < 10,000			0.113*** (0.040)
Substitution $\times$ 2,709 $\leq$ HHI < 5,972			0.070* (0.037)
Income $\times$ HHI >10,000		0.023 (0.034)	0.027 (0.034)
Income $\times$ 5,972 $\leq$ HHI < 10,000			0.004 (0.006)
Income $\times$ 2,709 $\leq$ HHI < 5,972			0.012** (0.006)
Observations	19,304	19,304	19,304
R ²	0.914	0.968	0.968
Adjusted R ²	0.914	0.968	0.968
Residual Std. Error	0.274	0.167	0.166

*p<0.1; **p<0.05; ***p<0.01

Notes: This table offers a robustness check on the main results in Table 4 by estimating the elasticity of taxable income using changes in federal taxes only, rather than the combination of federal and state taxes. Although the overall effect of HHI on income elasticity is slightly lower without changes in state taxes, the general pattern of a greater compensated elasticity in more concentrated markets holds. However, there is little impact of HHI on the income effect. In fact, the only statistically significant interaction is between the second quartile of HHI and the income effect, which is small but positive and only significant at the 5% level. This means that the effect of HHI on income elasticity likely works through the substitution effect.

Table A.2: First-stage regressions

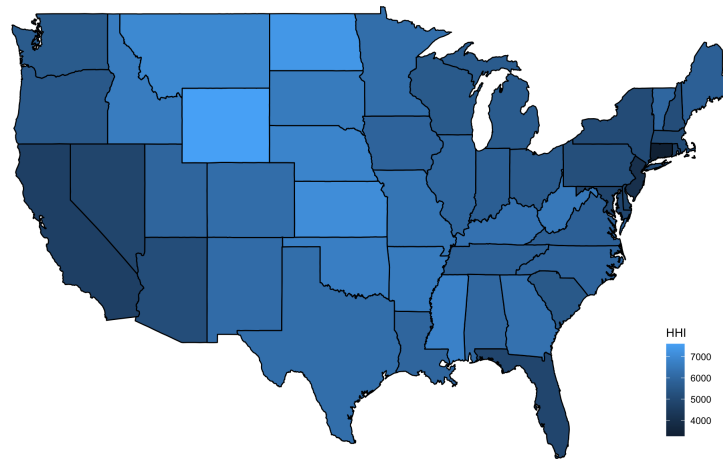
	<i>Dependent variable:</i>			
	Δ marginal tax rate	Δ net-of-tax income	Δ marginal tax rate	Δ net-of-tax income
	(1)	(2)	(3)	(4)
Substitution effect Instrument	0.438*** (0.004)	−0.388*** (0.018)	0.438*** (0.004)	−0.387*** (0.018)
Income effect Instrument	0.001** (0.0004)	−0.247*** (0.004)	0.001** (0.0004)	−0.248*** (0.004)
Log(income)	0.022*** (0.0004)	−0.254*** (0.003)	0.022*** (0.0004)	−0.254*** (0.003)
Married dummy	0.006*** (0.001)	−0.047*** (0.006)	0.006*** (0.001)	−0.047*** (0.006)
Age	0.0001 (0.0002)	−0.017*** (0.002)	0.0001 (0.0002)	−0.017*** (0.002)
Age ²	−0.00001*** (0.00000)	0.0003*** (0.00002)	−0.00001*** (0.00000)	0.0003*** (0.00002)
HHI >10,000			−0.005*** (0.001)	0.011* (0.006)
5,972 ≤ HHI < 10,000			−0.003*** (0.001)	−0.002 (0.006)
5,972 ≤ HHI < 10,000			−0.003*** (0.001)	−0.004 (0.006)
Observations	200,370	200,370	200,370	200,370
R ²	0.253	0.105	0.253	0.105
Adjusted R ²	0.252	0.105	0.253	0.105
Residual Std. Error	0.119	0.943	0.119	0.943
F Statistic	11,281.450***	3,935.962***	7,529.152***	2,624.922***

*p<0.1; **p<0.05; ***p<0.01

Notes: This table shows the results from the first stage regression on the instrumental variables regression illustrated in Table 4. The time-shifting instrument is strong, with large F-statistics and reasonable R² values for all regressors and specifications of interest.

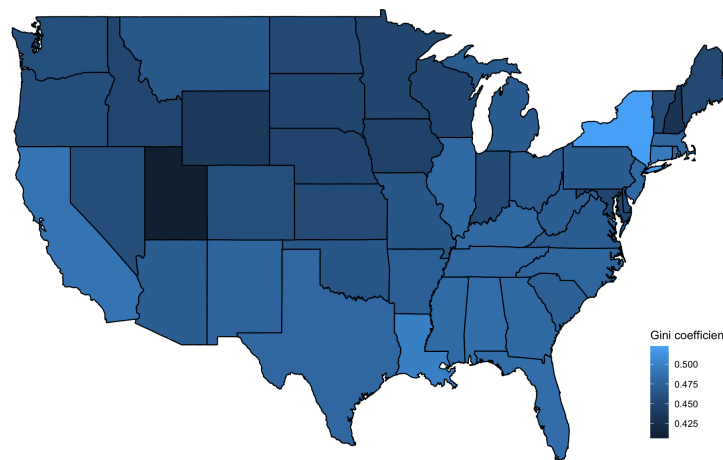
A.4 Maps

Figure A.1: State-level HHIs



Notes: This map shows the distribution of HHI, a proxy for market concentration, on the state level. Markets are generally less concentrated near the coasts and more concentrated in the Midwest.

Figure A.2: State-level Gini coefficients

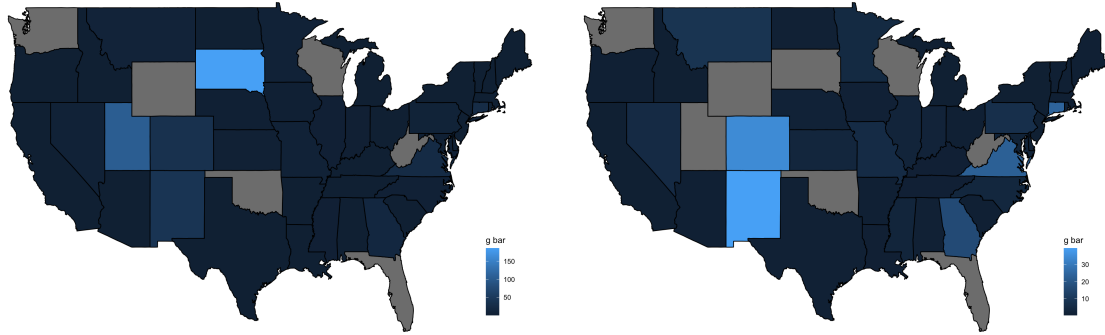


Notes: This map shows the Gini coefficient of each state. Overall, states near the coasts and in the South have higher Gini coefficients and therefore more inequality, while states in the upper Midwest and Northwest have less inequality.

Figure A.3: State-level $\bar{g}$

(a) State-level $\bar{g}$, all states with sufficient data

(b) State-level $\bar{g}$, no outliers



Notes: This figure shows $\bar{g}$ on a state level. Panel (a) displays this data for all states with sufficient data. There are six states with insufficient data (less than two surveyed individuals in the state), and the average number of observations in each state is 29. Given the small sample size, there is significant variance in the measures of $\bar{g}$ by state, which makes it difficult to discern any reasonable pattern. Panel (b) shows that omitting two outliers, South Dakota and Utah, does not significantly improve the readability of this metric.

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