Household Taxation, Work Hours Flexibility and Occupational Choice

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Abstract

Goldin (2014) highlights the role of differences in hours flexibility across occupations as a source of gender wage inequality. How does the tax system - in terms of jointness and progressivity - affect occupational choice, work hours and wages across occupations and the gender wage gap? We study these questions in a model of occupational choice and labour supply. The decision to work in the high-wage/high-hours occupation depends on the earnings gain from being in that occupation and the cost of having less leisure time. Taxation affects both the gain and cost of this trade-off and therefore has ambiguous effects. Calibrating the model to US data, we find that the impact of (1) introducing individual taxation and (2) removing tax progressivity via a flat tax on occupational choice is relatively small: the share of women working in the long-hours occupation increases by at most 0.7pp. By contrast, endogenous wages, due to the positive impact long work hours have on wages, play an important role in amplifying the effects of tax reforms. Changes in wages account for between 15-50% of the elasticity of taxable income of the tax reforms.

Keywords: Taxation, Hours Flexibility, Occupational Choice, Gender Inequality

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1 Introduction

While gender differences in labour market outcomes have been shrinking over the last century, important differences remain. For example, Kleven et al. (2019) estimate that women in the United States decrease experience a 31% in earnings even 10 years after the birth of their first child, both due to lower labour market participation and higher rates of part-time work after childbirth. Goldin (2014) argues that differences in hours flexibility across occupations play a key role for these patterns. Some occupations, such as law or business, are very demanding in terms of time and require rigid and uninterrupted work hours. In such occupations, working long hours leads to a disproportionate increase in wages. At the same time, other occupations offer much more flexibility, such as pharmacists. These issues are linked to a variety of societal and technological factors, such as social norms about working culture or how easily workers who reduce their hours can be substituted by others, and suggest that work hours are a crucial determinant of wages and occupational choice.

What are the implications for tax design? The literature suggests that a large part of the labour supply response to taxation comes from married women, with men's labour supply being less elastic (e.g. Guner, Kaygusuz, and Ventura (2011)). Occupational choice and differences in hours flexibility could be important for tax policy analysis for two reasons. First, high marginal tax rates - either through joint taxation, which increases the marginal tax rate of secondary earners, or through high tax progressivity - could discourage people from working in the occupation which offers high salaries but also requires long work hours, as they have to give up a larger share of the earnings gain relative to the alternative occupation. In the long run, as more and more individuals work in the low hours occupations, this would lead to an additional reduction in hours and earnings due to the tax system. Second, when the tax system gives incentives to reduce work hours - again for the example in the context of joint taxation - these reductions lead to a reduction in wages in less flexible occupations in which wages strongly depend on hours. The feedback effect on wages is another indirect effect through which the tax system affects earnings in the long run. For these reasons, abstracting from occupational choice and differences in hours flexibility across occupations could lead to an incomplete assessment of the effects of tax reforms.

In this paper, we study these issues using a quantitative model of household labour supply and occupational choice. The novelty in our setting is that we analyse household taxation in a framework with occupational choice where occupations differ in the convexity of earnings with respect to hours, which captures the key mechanisms highlighted by Goldin (2014). The model is based on Erosa et al. (2022). Men and women are heterogenous in their ability in each occupation and choose their occupation in the spirit of the Roy model. In the context of this model, we first analyse how taxation interacts with the decision to work in the high-pay high-hours occupation. This decision is a trade-off between higher earnings in the high-hours occupation and having to give up leisure because of having to work longer hours. While high marginal tax rates reduce the incentive to go into the high-hours occupation by reducing the amount of additional earnings, the overall effects of the tax system on occupational choice are more complex. The tax system also influences the amount of hours workers choose in each occupation. As a result, the amount of leisure workers have to give up is also endogenous to the tax system. For example, when the tax system leads to a lower hours difference between occupations, this effect would increase the incentive to work in the high-hours occupation. For couples, these effects also depend on family interactions and the jointness of taxation. Therefore, a quantitative model is needed to study these effects more fully.

We calibrate the model to data from the United States and perform two main policy experiments. In the first experiment, we introduce individual taxation. The second experiment is removing tax progressivity by introducing a flat tax. Our policy analysis leads to three main messages. First, we find that the impact of tax policy on occupational switching is relatively small. The largest change in occupations is observed for women in the case of the individual taxation experiment. In that case, the fraction of women working in the high-hours occupation increases by 0.7pp. However, these effects are overall modest in terms of their magnitude, and also in terms of their contribution to aggregate changes in earnings. For example, the increase in women in the high-hours occupation accounts for only 4.6% of the overall increase in women's earnings. We use the calibrated model to shed more light on the economic mechanisms of how taxation effects occupational choice and show that the relatively small effect is partly a result of opposing forces. On the one hand, the two tax reforms we consider increase the additional consumption households get if the woman works in the non-linear occupation. This results both from lower marginal tax rates on the additional earnings, and from a change in relative work hours in the two occupations. On the other hand, the reforms also increase the amount of leisure women have to give up when entering the non-linear occupation. If we only allow for the consumption effect, the fraction of women in the non-linear occupation would increase by 1.9pp rather than 0.7pp due to introducing individual taxation, indicating that changes in the disutility of labour drive down the overall effect. This result highlights that it is important to analyse both how tax reforms affect relative consumption and leisure in the two occupations in order to understand their effect on occupational choice.

The second main result is that endogenous wages play a larger role and amplify the effects of tax reforms on earnings. When a tax reform increases hours, wages go up as well and conversely they decrease when hours go down. We find that these effects, which are not captured by standard models with exogenous wages, are important in the context of the tax reforms we consider. For example, in the case of individual taxation the increase in wages due to higher hours accounts for 32% of the increase in women's earnings due to the reform. Taken together, these two results suggest that occupational choice matters for tax policy analysis mainly through the wage effects which result from differences in hours flexibility. As the tax system changes labour supply incentives and workers adjust their hours, this can have important feedback effects on wages. Through this mechanism, the tax system indirectly influences wage gaps between men and women and different occupations as well as inequality in (gross) wages.

Third, we use our model to study optimal taxation while allowing for endogenous occupational choice and endogenous wages. Using the calibrated model and the tax function from Heathcote, Storesletten, and Violante (2017), we numerically solve for the optimal progressivity parameter in a system of joint and individual taxation while keeping the government budget balanced. We find that high levels of progressivity are optimal under both joint and individual taxation and that the optimal individual tax system welfare-dominates the optimal joint tax system. Joint taxation is only welfare-improving for the highest progressivity values we consider. We also study more general forms of jointness by following Gayle and Shephard (2019) and also using a more flexible specification of the tax schedule, which allows for both positive and negative jointness (meaning that marginal tax rates depend positively or negatively on partner income). We find that the optimal schedule features positive jointness at the bottom of the income distribution and positive jointness at the top. This somewhat contrasts with the results from Gayle and Shephard (2019) and Kleven, Kreiner, and Saez (2009), who find negative jointness being optimal throughout the distribution.

Our model is closely related to Erosa et al. (2022) and Erosa et al. (2024), who study labour market outcomes in models where occupations differ by the extent of non-linearity of wages with respect to hours. Erosa et al. (2022) study to what extent differences in time allocated to domestic activities between men and women can generate differences in occupational choice, work hours and wages. Erosa et al. (2024) study cross-sectional wage and earnings inequality with a particular focus on the role of work hours. Our model extends Erosa et al. (2022) by integrating non-linear income taxation, while their paper does not consider the role of taxation. Bick, Blandin, and Rogerson (2022) also study the cross-sectional relationship between hours and wages with a focus on men and find a non-linear relationship. Our paper complements these studies by studying the implications for tax policy. Since we find that the relationship between hours and and wages matters for the assessing the impact of tax reform, this suggests that more research should be devoted to studying how hours impact wages.

A large literature has studied how different tax policy regimes influence household behaviour. Bick and Fuchs-Schündeln (2017) study cross-country differences in labour supply of married couples and find that taxation can explain a large part of married women's behaviour. Guner, Kaygusuz, and Ventura (2011), Guner, Kaygusuz, and Ventura (2023), Holter, Krueger, and Stepanchuk (2019), Blundell et al. (2016), Heathcote, Storesletten, and Violante (2017), Wu and Krueger (2019) and Conesa and Krueger (2006) study tax and transfer reforms using life-cycle models of labour supply. Guner, Kaygusuz, and Ventura (2012) and Alesina, Ichino, and Karabarbounis (2011) analyse the impact of gender-based taxation. Gayle and Shephard (2019) study optimal taxation for couples, focusing on the role of intra-household bargaining power and the marriage market. Bronson and Mazzocco (2019), Mazzocco, Ruiz, and Yamaguchi (2013) and Low et al. (2021) build life-cycle models with marriage and divorce to study tax and transfer policy. Despite the size of this literature, the analysis of taxation and occupational choice has been limited. Cubas and Silos (2017) focus on the role of differences in income risk and tax progressivity giving an incentive to work in more risky occupations. Sheshinski (2016) analyses how income taxation interacts with occupational choice under frictions. Rothschild and Scheuer (2013) study optimal taxation in the Roy model. The novelty in our paper is analyse the interaction between taxation and occupational choice in a setting where occupations differ in their hours flexibility.

2 Model

Our model builds on Erosa et al. (2022) and by integrating non-linear income taxation into a model of family labour supply and occupational choice. The key features of the model are that individuals are heterogenous in their ability for different occupations and their disutility of work and self-select into occupations, which differ in how strongly wages depend on hours, based on these characteristics. The model is static and earnings, wages and work hours are interpreted as average life-time outcomes.

2.1 Occupations, earnings and wages

The model includes two occupations $j = \{1, 2\}$ which differ in the earnings schedule in the occupation. The earnings of individual i working in occupation j are given by:

$$y_{ij} = a_{ij} g_j(h) \tag{1}$$

Earnings depend on labour market ability a_{ij} and a partly non-linear function of hours:

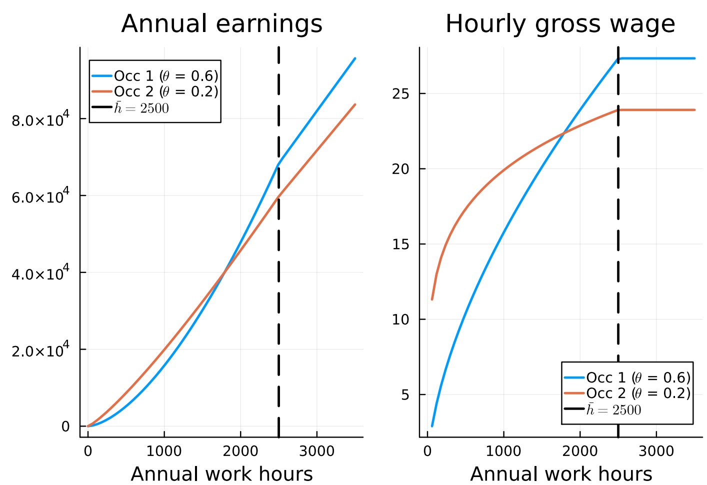
$$g_j(h) = \begin{cases} h^{1+\theta_j}, & h < \bar{h} \\ B_j h, & \text{otherwise} \end{cases} \tag{2}$$

The main difference between occupations is in the parameter θ_j, which describes the convexity of earnings with respect to hours, as long as hours are below the threshold value $\bar{h}$. When hours are above $\bar{h}$, the relationship becomes linear. B_j is chosen such that the function is continuous in work hours, which requires $B_j = \bar{h}^{\theta}_j$. It follows from the earnings equation that wages are also a function of work hours:

$$w_{ij}(h) = \begin{cases} a_{ij} h^{\theta_j}, & h < \bar{h} \\ a_{ij} \bar{h}^{\theta_j}, & \text{otherwise} \end{cases} \tag{3}$$

This means that wages are an increasing function of hours as long as $h < \hbar$ and constant afterwards. The earnings and wage profile are illustrated in Figure 1, which shows the corresponding functions for two particular values of θ_j. The larger θ_j, the more convex earnings are in work hours. We will refer to occupation 1 as the "non-linear" occupation, which features a larger extent of convexity. Occupation 2, which will feature less convexity with $0 < \theta_2 < \theta_1$, will be referred to as the "linear" occupation.

FIGURE 1: Illustration of the earnings and wage functions



Notes: The figure shows the relationship between earnings, hours and wages for the two different occupations.

2.2 Individuals and households

Individuals are characterised by their ability in occupation 1 and 2 (a_{ij}) and their disutility of labour, which is denoted as ϕ_i. Each household consists of a man and woman and is summarised by a six-dimensional vector which includes all characteristics of both partners:

$$\omega_{fm} = (a_{f1}, a_{f2}, \phi_f, a_{m1}, a_{m2}, \phi_m) \tag{4}$$

These characteristics are drawn from a six-dimensional log-normal distribution. The parameters are the means of ability in each occupation and of ϕ ($\mu_{a1}, \mu_{a2}, \mu_\phi$), the variances of these random variables ($\sigma_{a1}, \sigma_{a2}, \sigma_\phi$) and finally the correlation of ability between sectors (ρ_{a12}), of ability between partners (ρ_{afm}) and of disutility between partners ($\rho_{\phi fm}$). Note that the distribution is entirely symmetric between genders. In other words, the model does not impose any exogenous differences in terms of ability or tastes for work vs non-work between men and women.

Individuals derive utility from consumption and leisure:

$$u_g(c, h) = \log(c) + \phi_g \frac{(T_g + h)^{1+\gamma}}{1+\gamma} \tag{5}$$

The parameter ϕ_g captures the weight the individual places on the disutility of labour. T_g is an exogenous parameter reflecting the hours men and women spend on home production. Households maximise the weighted sum of utilities:

$$U = u_f + u_m \tag{6}$$

This means that conditional on occupations j and k, households solve the following optimisation problem:

$$\begin{aligned}\max_{c_f, c_m, h_f, h_m} U_{jk} &= \log(c_f) + \phi_f \frac{(T_f + h_f)}{1+\gamma}^{1+\gamma} + \log(c_m) + \phi_m \frac{(T_m + h_m)}{1+\gamma}^{1+\gamma} \\ & c_f + c_m = y - T(y)\end{aligned}$$

Note that since there is separability between consumption and leisure and households place equal weight on both partners, it immediately follows that consumption of both household members will be identical in the optimum. Household income is given by:

$$y = w_{fj}(h_f)h_f + w_{mk}(h_m)h_m \tag{7}$$

Importantly, the budget constraint reflects that wages are a function of hours, which depends on the occupation each individual works in. $T(y)$ is the tax function, where we follow Heathcote, Storesletten, and Violante (2017) in using the following specification:

$$T(y) = y - \tau_1 y^{\tau_2} \tag{8}$$

The baseline model features joint taxation via income aggregation. Each household chooses the occupation of its members by solving the maximisation problem for each combination of occupations and choosing the best option:

$$\max\{U_{11}, U_{12}, U_{21}, U_{22}\} \tag{9}$$

2.3 How does taxation affect occupational choice?

2.3.1 Building intuition: The case of singles

To better understand the impact of taxation on occupational choice, it is useful to first consider an analogous decision problem but for the case of singles. A single in occupation j would solve the following problem:

$$\max_{c,h} U_j = \log(c) - \phi \frac{(T+h)}{1+\gamma}^{1+\gamma} \tag{10}$$

$$c = w_{ij}h - T(w_{ij}h) \tag{11}$$

This gives rise to the optimal hours choice in occupation j, denoted as h_j^*. The labour supply decision is characterised by the following first-order condition:

$$\frac{(1+\theta)(1-\tau_2)}{\phi} = h\frac{(T+h)^{1+\gamma}}{1+\gamma} \tag{12}$$

Thus, the labour supply decision is not affected by ability, since income and substitution effect from higher ability cancel each other out in the case of log utility. In addition, it can be shown that $h_1^* > h_2^*$. In other words, singles will always work more in occupation 1 than in occupation 2 due to the convexity of earnings with respect to hours.

Singles will choose to work in the non-linear occupation if the indirect utility function is higher in the case of working in that occupation:

$$\log(c_1^*) - \phi\frac{(T+h_1^*)^{1+\gamma}}{1+\gamma} > \log(c_2^*) - \phi\frac{(T+h_2^*)^{1+\gamma}}{1+\gamma} \tag{13}$$

Note that both c_j^* and h_j^* are the optimal choices of the individual which depend on all exogenous parameters. This equation can be rearranged as follows:

$$\underbrace{\log(c_1^*) - \log(c_2^*)}_{\text{Consumption gain from going into occ. 1}} > \underbrace{\phi\frac{(T+h_1^*)^{1+\gamma}}{1+\gamma} - \phi\frac{(T+h_2^*)^{1+\gamma}}{1+\gamma}}_{\text{Leisure cost of occ 1.}} \tag{14}$$

The equation highlights the trade-off that individuals face when considering whether to work in the non-linear occupation. On the one hand, occupation 1 allows them to consume more ($c_1^* > c_2^*$), provided that their ability in the occupation is high enough. On the other hand, working in occupation 1 always leads to working more hours ($h_1^* > h_2^*$), so that individuals incur a higher disutility of work. We label these two components as the "consumption gain" and the "leisure cost" of working in occupation 1. Individuals only choose to work in occupation 1 if, conditional on their ability and disutility of labour parameter, the consumption gain is larger than the leisure cost.

Breaking the decision of working in the non-linear occupation down into the consumption gain and leisure cost components is useful to understand the impact of taxation on occupational choice. Taking the tax system into account, consumption in occupation j is given by:

$$c_j^* = w_j h_j^* - T(w_j h_j^*) = \tau_1\left(a_j h_j^{*1+\theta_1}\right)^{1-\tau_2} \tag{15}$$

Substituting this into the inequality, we get:

$$\log\left[\tau_1\left(a_1 h_1^{*1+\theta_1}\right)^{1-\tau_2}\right] - \log\left[\tau_1\left(a_2 h_2^{*1+\theta_2}\right)^{1-\tau_2}\right] > \phi\frac{(T+h_1^*)^{1+\gamma}}{1+\gamma} - \phi\frac{(T+h_2^*)^{1+\gamma}}{1+\gamma} \tag{16}$$

First note that the level parameter τ_1 drops out of the inequality for the case of log utility. The decision then only depends on the progressivity parameter τ_2. However, τ_2 affects the trade-off of whether to work in occupation 1 in multiple ways. First of all, there is the direct effect that a rise in τ_2 decreasing the consumption gain because the additional income from going into occupation 1 is taxed at a higher marginal tax rate. At the same time, however, it is important to note that h_1^* and h_2^* are endogenous and also depend on the tax system. Therefore, a tax reform will also influence occupational choice by changing relative work hours. This has two distinct effects. First, a tax reform could for example lower the leisure cost if it reduces the difference in work hours between occupations ($h_1^* - h_2^*$). Second, such a reduction in the difference would also affect the consumption gain, since the additional earnings from going into occupation 1 depend on how much more individuals work in that occupation.

It is also useful to rearrange the equation as follows as a condition for selection into occupation 1:

$$\log\left(\frac{a_1}{a_2}\right) > \frac{1}{1-\tau_2}\left(\phi\frac{(T+h_1^*)^{1+\gamma}}{1+\gamma} - \phi\frac{(T+h_2^*)^{1+\gamma}}{1+\gamma}\right) - \log\left(\frac{h_1^{*1+\theta_1}}{h_2^{*1+\theta_2}}\right) = \delta(\phi) \tag{17}$$

Conditional on ϕ, individuals will choose occupation 1 if the ratio of their ability in occupation 1 and 2 is above a threshold which depends on ϕ and takes work hours in each occupation into account. The progressivity parameter influences this threshold by rescaling the leisure cost.

2.3.2 Couples

Similar mechanisms apply to the case of couples, where the household utility function is:

$$U_{jk} = 2\log(c) - \phi_f\frac{(T_f+h_{fj})^{1+\gamma}}{1+\gamma} - \phi_m\frac{(T_m+h_{mj})^{1+\gamma}}{1+\gamma} \tag{18}$$

Conditional on the man working in an occupation k, the woman will work in occupation 1 if the following condition holds:

$$2\log(c_1^*) - \phi_f\frac{(T_f+h_{f1}^*)^{1+\gamma}}{1+\gamma} - \phi_m\frac{(T_m+h_{m1}^*)^{1+\gamma}}{1+\gamma} > 2\log(c_2^*) - \phi_f\frac{(T_f+h_{f2}^*)^{1+\gamma}}{1+\gamma} - \phi_m\frac{(T_m+h_{m2}^*)^{1+\gamma}}{1+\gamma} \tag{19}$$

This can be rearranged in terms of consumption gain and leisure cost:

$$\underbrace{2\log(c_1^*) - 2\log(c_2^*)}_{\text{Consumption gain}} > \underbrace{\phi_f\frac{(T_f+h_{f1}^*)^{1+\gamma}}{1+\gamma} - \phi_f\frac{(T_f+h_{f2}^*)^{1+\gamma}}{1+\gamma}}_{\text{Leisure cost}} + \underbrace{\phi_m\frac{(T_m+h_{m1}^*)^{1+\gamma}}{1+\gamma} - \phi_m\frac{(T_m+h_{m2}^*)^{1+\gamma}}{1+\gamma}}_{\text{Effect on partner leisure}} \tag{20}$$

There are only two differences to the case of singles. First, the consumption gain is now expressed in terms of household rather than consumption. Second, in addition to the leisure cost of the woman, the household also takes into account how working in occupation 1 will affects the labour supply of the man because of family cross-effects. If the woman enters occupation 1, she will earn more and work longer hours, which reduces the optimal labour supply of the man. Therefore, there is a leisure "gain" through a lower disutility of work, which needs to be taken into account. Note that in the case of couples, it is not possible to derive a cut-off equation similar to equation 17. Now, the consumption gain is given by:

$$(1-\tau_2)\log\left[\frac{a_{f1}(h^*_{f1})^{\theta_1}+a_{mk}(h^*_{m1})^{\theta_k}}{a_{f2}(h^*_{f2})^{\theta_2}+a_{mk}(h^*_{m2})^{\theta_k}}\right] \tag{21}$$

Taken together, the discussion in this section highlights that for both singles and couples, the tax system affects the occupational choice in multiple ways. In addition to the direct effect of changing net income, the tax system also sets different work incentives which may change the optimal work hours choice in each occupation, which then feeds back into occupational choice. Therefore, to study the impact of taxation on occupational choice, a quantitative model is needed which accounts for these different effects.

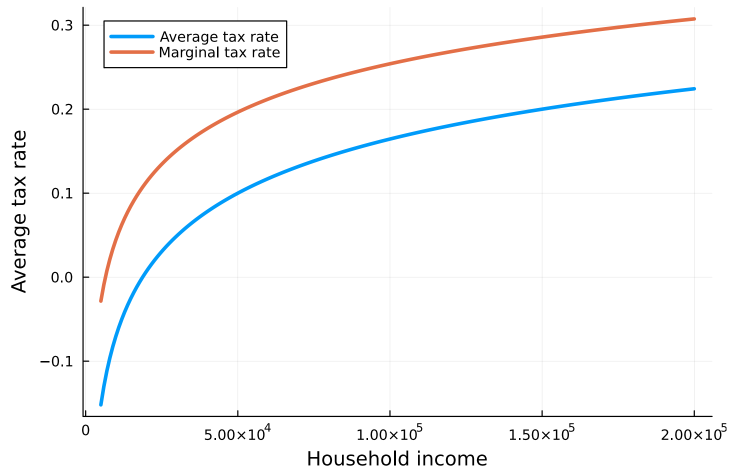
3 Calibration

3.1 Calibrated parameters and model fit

We calibrate the model to match moments from the United States and first set some parameters externally. We follow Erosa et al. (2022) in setting $\hbar = 2500$, which is based on the empirical observation that wages decline in the cross-section when weekly hours are above 50. We restrict hours to be on a grid of 60 points between 0 and 3500. θ_1 and θ_2 are two key parameters which capture the extent of the non-linearity of each occupation. We follow Erosa et al. (2022) by using $\theta_1 = 0.6$ and $\theta_2 = 0.2$. For the tax function, we choose the parameters of τ_1 and τ_2 to match estimated average tax rates from Heathcote, Storesletten, and Violante (2017). We fit the tax function to an average tax rate of 10% at \$50,000 and an average tax rate of 20% at \$150,000. This results in $\tau_1 = 2.87$ and $\tau_2 = 0.107$ and the resulting schedule is shown in Figure 2.

The remaining parameters are chosen to match the same set of moments as Erosa et al. (2022) . We calibrate the mean of ability and of the disutility of labour ($\mu_{a1}, \mu_{a2}, \mu_{\phi}$), the corresponding variances ($\sigma_{a1}, \sigma_{a2}, \sigma_{\phi}$) and the correlation of ability between sectors (ρ_{a12}), of ability between partners (ρ_{afm}) and of disutility between partners ($\rho_{\phi fm}$). Note that rather than normalising one of the means of ability to zero, we calibrate it in order to match the median wage in the economy. This is important to obtain a clear mapping between model units and income, which then enters the tax function. Table 1 compares model and data moments and Table 2 shows the parameters. The fit is very good. The model closely matches the share of men working in occupation 1, the standard deviation of hours, the wage gap between occupation 1 and 2, the correlation of hours within couples, the wage correlation of couples and the median wage. It slightly overpredicts

FIGURE 2: Calibrated tax schedule



Notes: The figure shows average and marginal tax rates given the calibrated tax schedule.

average work hours by 0.11 log points as well as overpredicting the standard deviation of wages in occupation 1.

TABLE 1: Model fit

Moment	**Data**	**Model**
Share of men working in occ. 1	0.6	0.61
Log of mean hours, men	7.67	7.78
Std of wages in occ. 1, men	0.45	0.55
Std of wages in occ. 2, men	0.47	0.43
Std of hours, men	0.26	0.23
Wage gap between occupations, men	0.37	0.36
Hours correlation in couples	0.43	0.45
Wage correlation in couples	0.02	0.04
Median wage	2.83	2.84

Notes: This table shows the model fit by comparing model and data moments. The data moments are taken from Erosa et al. (2022).

TABLE 2: Calibrated parameters

Parameter	Label	Value
μ_{a1}	Mean ability occ 1	0.4
μ_{2}	Mean ability occ 2	0.01
μ_{ϕ}	Mean disutility of labour	1.4
σ_{a1}	Var ability occ 1	0.406
σ_{a2}	Var ability occ 2	0.206
σ_{ϕ}	Mean ability occ 2	1.068
ρ_{a12}	Corr. ability in occ 1/2	0.035
ρ_{afm}	Corr. ability partners	0.083
ρ_{ϕ}	Corr. disutility of labour	0.902

Notes: This table shows the calibrated parameters.

3.2 Wage inequality in the calibrated model

Before turning to the tax policy analysis, it is useful to discuss inequality in the calibrated model, as redistribution is one of the key roles of taxation. Table 3 first shows to what extent wage inequality is driven by inequality within/between occupation and gender. The first row first shows that there are significant differences in means: the average wage in the non-linear occupation is 58% higher than in the linear occupation and men earn 10% more than women. The remaining rows show the results from a within-between variance decomposition and quantify to how much these differences in means contribute to overall wage inequality. For occupations, the decomposition shows that between-occupation inequality contributes significantly to overall inequality, although the within-occupation variance is the primary component. For the decomposition by gender, the within-gender variance contributes almost exclusively to the overall variance, as the difference in means between genders is small relative to the variation in wages in the population.

TABLE 3: Within-between decompositions of wage inequality

Label	By Occupation	By Gender
Gap in mean wages	0.5815	0.1015
Variance of wages	0.2925	0.2925
Fraction of variance within	0.8637	0.9923
Fraction of variance between	0.1363	0.0077

Notes: The first row reports the gap in mean wages between occupations (column 1) and men and women (column 2). The other rows show the results from a standard within-between variance decomposition of log wages.

To better understand wage variation within occupation, which is the primary component of inequality, the wage equation can be rewritten as follows:

$$\log\left(w_{ij}(h)\right) = \begin{cases} \log(a_{ij}) + \theta_j \log(h), & h < \bar{h} \\ \log(a_{ij}) + \theta_j \log(\bar{h}), & \text{otherwise} \end{cases}$$

This leads to the following variance decomposition (where $\tilde{h}_i = \min(h_i, \bar{h})$):

$$\underbrace{\text{Var}\left[\log\left(w_{ij}\right)\right]}_{\text{Wage inequality}} = \underbrace{\text{Var}\left[\log(a_{ij})\right]}_{\text{Ability inequality}} + \underbrace{\theta_j^2 \text{Var}\left[\log(\tilde{h}_i)\right]}_{\text{Hours inequality}} + \underbrace{\theta_j \text{Cov}\left[\log(a_{ij}), \log(\tilde{h}_i)\right]}_{\text{Cov. between ability and hours}} \tag{22}$$

This equation highlights the new forces which affect wage inequality in a model of occupational choice. In a standard model, wages would only be determined by ability (the first component). Here, the variation in work hours in the population and how it covaries with ability also need to be taken into account. If there is a lot of variance in work hours, then this will amplify wage inequality, since hours differences translate into wages. In addition, if high ability individuals work longer hours, this effect also amplifies inequality. Note that the equation highlights the key role of the occupation-specific convexity coefficients θ_j in determining the contribution of the hours variance to overall wage inequality. The variance of hours gets scaled by θ_j^2 which means that for values smaller than 1, the contribution gets dampened. Table 4 shows the results by occupation.[1] For the population, the two new components (the hours variance and the covariance between hours and ability) account for between 10.8% and 12.1% of overall wage inequality. These effects are larger for women and smaller for men, reflecting that men's work hours are more likely to be above $\bar{h}$, where wages do not depend on hours anymore.

[1]Note that the decomposition can only be performed within occupation, as ability is scaled differently across occupations which would make the interpretation of the population variance of ability difficult.

TABLE 4: Decomposition of gross wage inequality

Label	Non-linear occupation	Linear occupation
Panel A. Population		
Wage inequality	0.29	0.2
Fraction due to ability (in %)	89.07	87.73
Fraction due to hours (in %)	6.87	2.77
Fraction due to cov. of hours/ability (in %)	4.07	9.49
Panel B. Women		
Wage inequality	0.27	0.2
Fraction due to ability (in %)	84.79	85.18
Fraction due to hours (in %)	10.23	3.29
Fraction due to cov. of hours/ability (in %)	4.99	11.53
Panel C. Men		
Wage inequality	0.3	0.19
Fraction due to ability (in %)	93.0	94.15
Fraction due to hours (in %)	2.7	0.96
Fraction due to cov. of hours/ability (in %)	4.29	4.89

Notes: This table shows the results from the variance decomposition described in equation 22.

4 Policy analysis

4.1 Description of experiments

Our analysis focuses on two policy experiments. First, we replace the current US system of joint taxation by individual taxation. In the current system, the budget constraint of a household is given by:

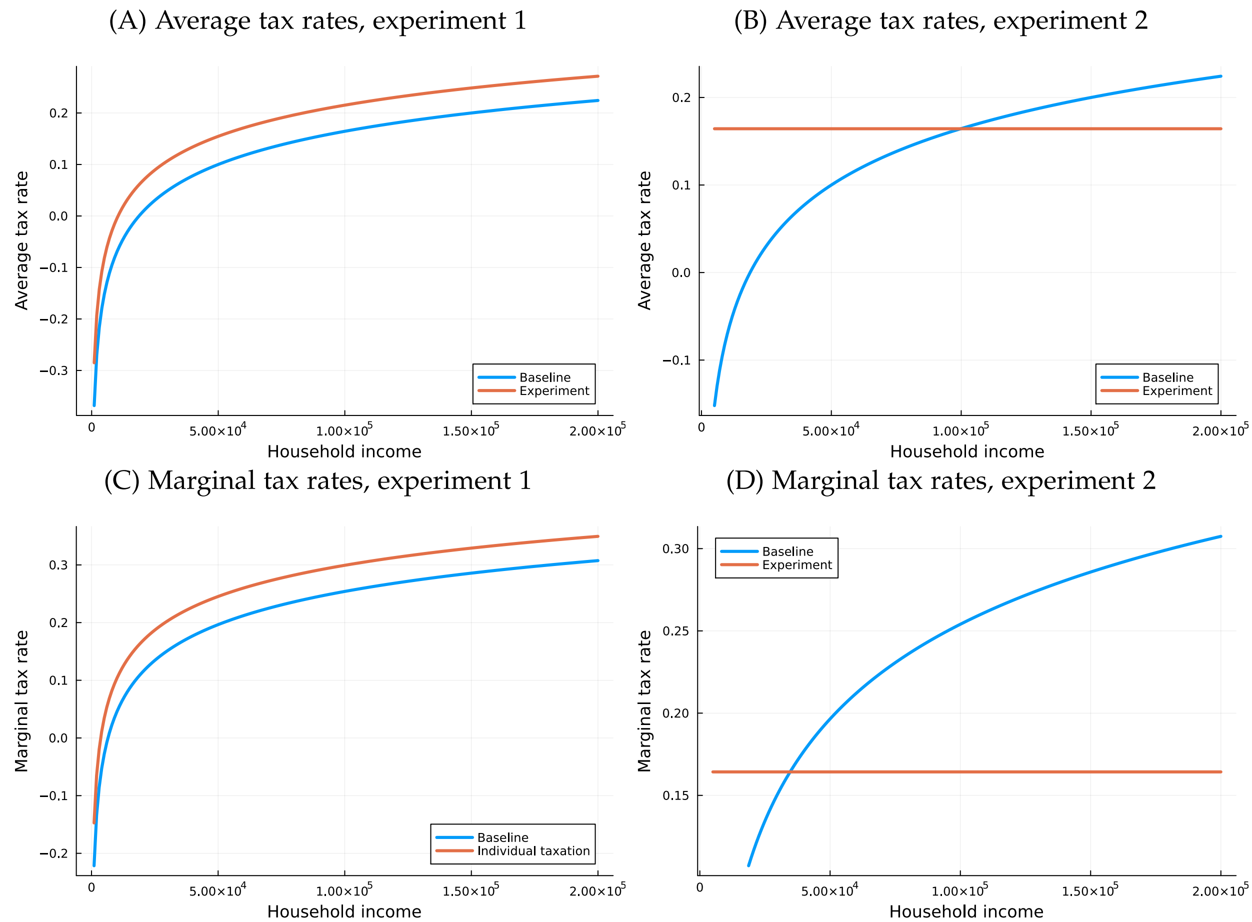
$$c_f + c_m = y_f + y_m - T(y_f + y_m)$$

With individual taxation, this changes to:

$$c_f + c_m = y_f + y_m - \tilde{T}(y_f) - \tilde{T}(y_m)$$

Note that we adjust the level parameter τ_1 so that the reform is budget-balanced. The second experiment involves an increase in progressivity relative to the current system, where the level parameter is similarly adjusted to obtain revenue-neutrality.

FIGURE 3: Comparison of Tax Schedules

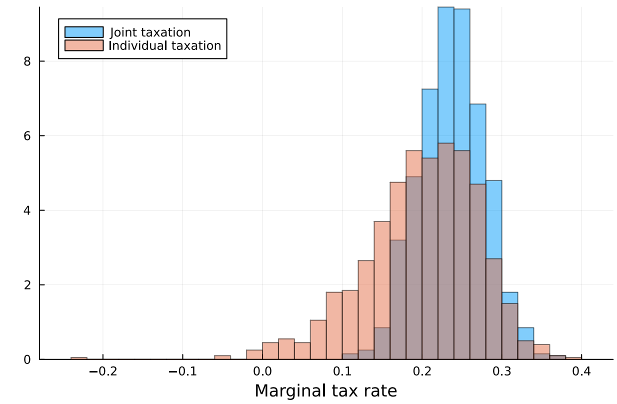


Notes: The figure shows the tax functions in each experiment relative to the baseline tax function. Panels A and B show average tax rates and panels C and D show marginal rates. Note that in each case the level parameter τ_1 is adjusted to keep government revenue constant.

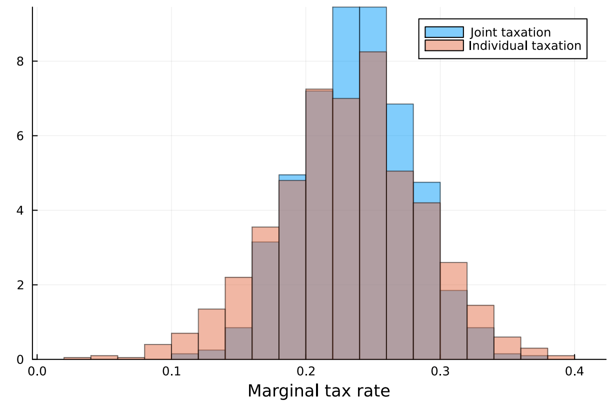
To illustrate the effect of the experiments, particularly about individual vs joint taxation, Figure 4 shows marginal tax rates for all men and women in the calibrated model. Marginal tax rates for joint taxation are computed directly in the calibrated model. For individual taxation, we hold hours choice fixed and recompute marginal tax rates given individual taxation. Panels (A) and (B) first show the univariate distribution of men's and women's marginal tax rates. Individual taxation substantially reduces marginal tax rates for many women, as the left tail of the distribution is much more pronounced in that case. For men, the marginal tax rates change less. Panel (C) also shows the joint distribution of marginal tax rates. With joint taxation, these are identical for both partners given that the tax burden only depends on the sum of earnings. With individual taxation, there is much more dispersion in terms of marginal tax rates given that there are many couples in which the two partners earn different amounts.

FIGURE 4: Joint vs individual taxation: Illustration of marginal tax rates

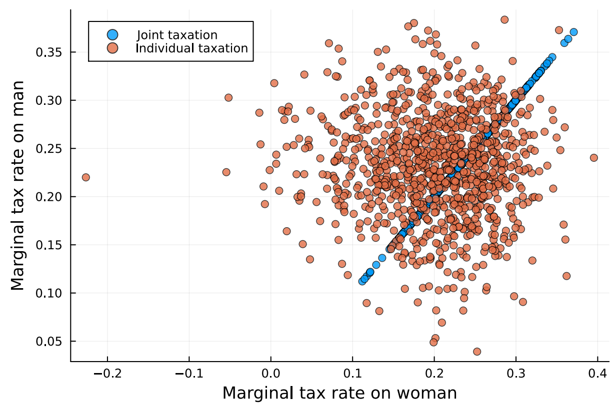
(A) Marginal tax rate, women



(B) Marginal tax rate, men



(C) Marginal tax rates of partners



Notes: The figure compares marginal tax rates between the case of joint and individual taxation. Panel (A) shows the histogram of marginal tax rates for women. Panel (B) shows the corresponding histogram for men. Panel (C) shows a joint plot where the unit of observation is the couple and the x-axis shows the marginal tax rate of the woman and the y-axis shows the marginal tax rate of the man in the couple.

4.2 The impact of taxation on aggregate outcomes

We start the analysis by comparing aggregate outcomes between the baseline economy and the two experiments. Panel (A) of Table 5 first shows the share of individuals (men and women) working in occupation 1, average annual work hours, average wages and (gross) wage inequality (measured as the variance of the log of wages).

TABLE 5: Household taxation and aggregate outcomes

Variable	Baseline	Individual Taxation	Flat Tax
Panel A. Aggregate Economy			
Share in occupation 1 (in %)	59.65	+0.4pp	+0.45pp
Annual hours	2149.83	+0.68%	+2.64%
Hourly wage (in $)	20.48	+0.18%	+0.82%
Wage inequality	0.29	-2.12%	-0.49%
Panel B. By Occupation			
Annual hours, non-linear occ	2286.61	+0.03%	+2.35%
Hourly wage (in $), non-linear occ	24.05	-0.3%	+0.61%
Wage inequality, non-linear occ	0.29	-1.11%	-0.35%
Annual hours, linear occ	1947.63	+1.64%	+2.95%
Hourly wage (in $), linear occ	15.21	+0.74%	+0.66%
Wage inequality, linear occ	0.2	-2.79%	-1.1%

Notes: This table shows aggregate outcomes for the baseline and the two experiments.

Taxation and occupational choice. The table shows that the overall changes in occupational choice are small: when introducing individual taxation, the fraction of individuals working in occupation 1 increasing by 0.4pp. When eliminating progressivity, it also increases by 0.45pp. Table 7 also shows the breakdown by gender. Changes in occupations are stronger for women than for men, although they are still small in overall magnitude. The largest change is observed for women in the case of individual taxation, where the likelihood of working in the non-linear occupation goes up by 0.7pp. These experiments are consistent with the intuition that individual taxation lowers marginal tax rates for women and increases their incentive to work in the non-linear occupation. Introducing a flat tax has a similar effect on marginal tax rates.

To get a better understanding of how taxation affects occupational choice and why the effects are relatively small, we perform a further exercise where we analyse how the tax reforms affects the cost and gain from going into the non-linear occupation. Based on equation 20, we define the following utility components for each household h consisting of members $\{f, m\}$, focusing on the decision of the woman to enter the non-linear occupation while keeping the occupation of the man constant:

$$CG_h = 2\log(c^*_{h1}) - 2\log(c^*_{h2}) \tag{23}$$

$$LC_f = \phi_f \frac{(T_f + h^*_{f1})^{1+\gamma}}{1+\gamma} - \phi_f \frac{(T_f + h^*_{f2})^{1+\gamma}}{1+\gamma} \tag{24}$$

$$LC_m = \phi_m \frac{(T_m + h^*_{m1})^{1+\gamma}}{1+\gamma} - \phi_m \frac{(T_m + h^*_{m2})^{1+\gamma}}{1+\gamma} \tag{25}$$

CG_h is the consumption gain from working in occupation 1, i.e. how much the household increases its consumption when the woman works in the non-linear occupation. LC_f is the leisure cost of the woman due to a higher disutility work. LC_m is the leisure cost of the man due to family cross-effects. When the woman enters the non-linear occupation, she will earn more which will reduce the amount of hours the man works, resulting in a reduction in the disutility from work of the man. The woman will work in occupation 1 whenever the following inequality holds:

$$CG_h \geq LC_f + LC_m \tag{26}$$

Based on this inequality, we perform several thought experiments which aim to assess the relative importance of different channels how the tax reforms affect occupational choice. The motivation for this exercise is that there could be two different reasons why the effects of taxation on occupational choice are relatively small. First, it could be the case that the tax reforms significantly increase the consumption gain from working in occupation 1 due to lower marginal tax rates, but that this effect is offset by an opposing effect on relative leisure in the occupations, which dampens the overall effect through the leisure cost components of inequality 26. Second, an alternative explanation is that the variance of the ability distribution is relatively large and there are few "marginal" individuals for whom the additional benefit of working in occupation 1 from lower marginal tax rates is so big that they would change their preferred occupation. To disentangle these possibilities, we for example replace the consumption gain in inequality 26 by the post-reform consumption gain $\tilde{CG}_h$ and compute how many individuals would work in occupation 1 if only the consumption gain would change due to the tax reform while the leisure cost components stay identical. This means computing the fraction of individuals for whom the following inequality holds:

$$\tilde{CG}_h \geq LC_f + LC_m \tag{27}$$

TABLE 6: Taxation and Occupational Choice: Decomposition of Mechanisms

Label	Individual Taxation	Flat Tax
Panel A. Implied changes in women's occupational choice		
Baseline	58.5	58.5
Change in consumption gain only (in pp)	1.9	1.5
+ Change in leisure cost (in pp)	0.6	0.3
+ Change in partner leisure cost (in pp)	0.7	0.5
Panel B. Further breakdown of change in consumption gain		
Change in cons. gain due to tax only (in pp)	0.7	0.4
Change in cons. gain due to hours (in pp)	1.2	0.8

Notes: This table shows the different mechanisms how tax reforms affect occupational choice. In Panel A, we first report the baseline value of the fraction of women in occupation 1. Then, the table shows the change in this fraction if we only allow for the consumption gain, but not the leisure cost parts, to adjust. Finally, panel A also shows the implied changes if we simultaneously allow for the consumption gain and leisure cost to adjust. Panel B focuses on the change in the consumption gain and shows how the fraction of women in occupation 1 would change if (a) only the tax system changes when computing the consumption gain and (b) only earnings change (due to hours effects). See text for more details.

Table 6 shows the results. In Panel A, the table shows that if we only allow the consumption gain to change, the effect of the reforms on occupational choice is indeed larger. For individual taxation, the fraction of women working in occupation 1 would increase by 1.9pp (rather than 0.7pp) with individual taxation, and by 1.5pp (rather than 0.5pp) in the case of the flat tax reform. However, the overall size of the effects is still modest which indicates that the second explanation - that there are few "marginal" individuals - is also relevant for understanding the effect sizes. The table then also shows the effects if we allow the leisure cost to change in addition to the consumption gain. For individual taxation, the implied change in occupational choice goes down from 1.9pp to 0.6pp when we allow the leisure cost of the woman to change, and increases slightly from to 0.7pp when we also allow for the family cross-effect on the leisure of the woman's partner. Thus, the main result here is that the increase in the consumption gain is largely dampened by a simultaneous increase in the leisure cost of the woman, with the effect on partner leisure playing a smaller role. The effects for the flat tax reform are qualitatively similar: again, a large part of the effect of the higher consumption gain is dampened by a higher leisure cost and the effect on partner leisure slightly increases the implied change again.

Finally, note that the increase in the consumption gain due to tax reforms can also be driven by multiple forces. On the one hand, the tax reforms have an effect on women's marginal tax rates, which can increase the consumption gain while keeping earnings fixed. On the other hand, the tax reforms also affect relative work hours in both occupations, which can also increase the consumption gain. For example, if work hours in the non-linear occupation rise more strongly than in the linear one, the consumption gain would be go up. Panel B disentangles these two effects based on equation 21 for the consumption gain of couples. We compute a hypothetical consumption gain when we only replace the tax parameters by the post-reform values while keeping earnings fixed, and one where we only replace earnings by their post-reform values while leaving the tax system unchanged. Panel B of Table 6 shows the results. Both forces contribute to the rise of the consumption gain. For example, when we only allow for the tax effect of individual taxation while keeping earnings fixed, and also keep the leisure cost fixed as in inequality 27, the fraction of women in the non-linear occupation rises by 0.7pp (as opposed to 1.9pp when we consider the full change in the consumption gain). Letting earnings adjust in the consumption gain, but not the tax system, implies an increase of 1.2pp. Thus, interestingly, the hours effect on the consumption gain is larger than the direct change due to tax reform. For the flat tax reform, these results are qualitatively similar.

Taken together, the main lessons from this analysis are the following. First, the two tax reforms increase the consumption gain from working in occupation 1, but this effect is partially offset by an increase in the leisure cost from working in occupation 1, which dampens the overall effect on occupational choice. Second, even when we ignore the effect on the leisure cost, the effect on the fraction of women in the non-linear occupation is modest since the changes in the gain from working in the non-linear occupation are relatively small to the variance of relative ability in the occupations. Third, the increase in the consumption gain is driven both by the direct tax incentives and by changes in relative hours in the occupations.

It is interesting to relate these results to the wider literature on taxation and job choice. The literature has shown that tax progressivity can discourage skill investment and educational attainment through higher marginal tax rates on the additional earnings which result from acquiring skills (e.g. Heathcote, Storesletten, and Violante (2017)). From an occupational perspective, these results imply that tax progressivity makes it more likely that individuals work in for instance low skill and manual occupations. In light of this literature, a natural hypothesis is that a similar mechanism could apply to occupational choice in terms of hours flexibility, as high marginal tax rates should discourage individuals from working in the non-linear occupation. However, we find that the effect of taxation on occupational choice in terms of hours flexibility is relatively small. In theory, this could either be driven by an offsetting effect of taxation on relative work hours in the occupations or by a large variance of the ability distribution. We find that the latter is the case and that the small effect on occupational choice is explained by the presence of few "marginal" individuals.

Taxation, hours and wages. A second key channel how occupations matter for studying the effect of tax reforms is the endogeneity of wages with respect to hours. When tax reforms lead to lower work hours, for example, this reduces wages according to the non-linear earnings schedule in the occupation. We find that introducing individual taxation increases aggregate work hours by 0.68% whereas the flat tax increases them by 2.64%. Individual taxation particularly increases the work incentives for women and leads to an increase in female labour supply by 1.48%, while men react little to the reform. Eliminating tax progressivity also has a stronger effect on women then on men, although both groups increase their labour supply. The table then allows us to quantify the feedback effects which these changes have on hourly wages. With individual taxation, women's *gross* hourly wages increases by 0.44% because women now on average work higher hours, which boosts their wage potential. When removing progressivity, hourly wages decrease by 1.17%.

An interesting aspect is that the tax reforms also affect wage *inequality* in the population through the impact on the hours distribution. We find that the introduction of individual taxation reduces wage inequality by 3.15% and particularly in the linear occupation where it goes down by 3.22%. Table 8 analyses the reasons behind these changes from the perspective of the variance decomposition from equation 22. Recall that wage inequality can be decomposed into components coming from ability differences, hours differences and the covariance between ability and hours. Focusing on the linear occupation, where the larger reduction in wage inequality is observed, the table shows that all three components contribute to the change. The largest contribution (67.5%) comes from the change in the covariance term, meaning that due to individual taxation, the covariance between ability and hours goes down. The hours variance also declines and explains 19% of the reduction in inequality. Finally, there is a small reduction in the ability variance which explains 13% of the change. Note that since ability is not directly influenced by the tax system, a change in the ability variance within an occupation must be driven by selection in and out of the occupation.

TABLE 7: Household taxation and aggregate outcomes, by gender

Variable	Baseline	Individual Taxation	Flat Tax
Panel A. Women			
Share in occupation 1 (in %)	58.5	+0.7pp	+0.5pp
Annual hours	1909.32	+1.48%	+3.25%
Hourly wage (in $)	19.49	+0.44%	+1.17%
Wage inequality	0.29	-3.15%	-0.47%
Panel B. Women, By Occupation			
Annual hours, non-linear occ	2113.58	+0.4%	+2.86%
Hourly wage (in $), non-linear occ	23.25	-0.35%	+0.96%
Wage inequality, non-linear occ	0.27	-2.0%	-0.55%
Annual hours, linear occ	1621.39	+3.01%	+3.59%
Hourly wage (in $), linear occ	14.2	+1.21%	+0.87%
Wage inequality, linear occ	0.2	-3.22%	-0.92%
Panel C. Men			
Share in occupation 1 (in %)	60.8	+0.1pp	+0.4pp
Annual hours	2390.34	+0.03%	+2.15%
Hourly wage (in $)	21.47	-0.05%	+0.51%
Wage inequality	0.29	-0.83%	-0.31%
Panel D. Men, By Occupation			
Annual hours, non-linear occ	2453.09	-0.2%	+1.93%
Hourly wage (in $), non-linear occ	24.82	-0.22%	+0.3%
Wage inequality, non-linear occ	0.3	-0.26%	-0.07%
Annual hours, linear occ	2293.02	+0.41%	+2.44%
Hourly wage (in $), linear occ	16.27	+0.21%	+0.46%
Wage inequality, linear occ	0.19	-1.49%	-1.02%

Notes: This table shows aggregate outcomes separately for men and women.

TABLE 8: Individual Taxation: What's driving the change in wage inequality?

Label	Non-linear occupation	Linear occupation
Change in variance (in %)	-1.11	-2.79
Fraction due to ability variance (in %)	-39.78	13.47
Fraction due to hours variance (in %)	46.55	19.02
Fraction due to covariance (in %)	93.23	67.51

Notes: This table focuses on the experiment where we introduce individual taxation and breaks the change in wage inequality down into the separate components (see equation 22 for details).

The relative importance of hours, wages and occupations. Table 5 shows that tax reforms can affect aggregate income through three channels: through work hours, wages and occupational choice. To quantify the role of occupational switches, we also perform the policy experiments while holding occupational choices fixed at the values from the baseilne simulation. To study the importance of wage changes, we adopt the following procedure. For the baseline simulation, denote the work hours, wage and income of each individual as (w_i^0, h_i^0, y_i^0). Similarly, these outcomes for policy experiment k are (w_i^k, h_i^k, y_i^k). We can then construct a "hypothetical" dataset, where wages are taken from the policy experiment, and hours are taken from the baseline. This is described by the vectors $(w_i^0, h_i^1, \tilde{y}_i)$. In this case, income needs to be recomputed as $\tilde{y}_i = h_i^1 w_i^0$. Then, we can compute aggregate statistics on the hypothetical data to study whether the differences between wages between simulations matter quantitatively.

TABLE 9: Contribution of wage and occupation changes to overall income change

Label	Household Income	Income (Women)	Income (Men)
Panel A. Individual Taxation			
Value in baseline (in $1000)	93.89	40.51	53.38
Change in experiment (in pp)	0.18	0.87	-0.34
Fraction of change due to wage changes (in %)	50.44	32.71	15.71
Fraction of change due to occupation changes (in %)	5.56	4.6	0.0
Panel B. Flat Tax			
Value in baseline (in $1000)	93.89	40.51	53.38
Change in experiment (in pp)	3.18	4.04	2.52
Fraction of change due to wage changes (in %)	21.78	25.54	17.2
Fraction of change due to occupation changes (in %)	0.94	0.99	0.79

Notes: This table quantifies the importance of changes in wages and occupational choice for explaining the average change in gross income due to each policy reform.

Table 9 shows the results from these exercises. Panel A first focuses on the experiment of individual taxation. Average gross household income increases by 0.18pp due to individual taxation. The table isolates the role of changes in wages and occupational choice. Wage changes account for 50% of the increase and occupational choice accounts for 5.5%. Women's average income increases by 0.87pp, with 32.7% due to wage changes and 4.6% due to occupations. Men's income declines slightly. Wage changes account for 15% of that decline and the role of occupational changes is negligible. Overall, these results demonstrate that wage changes are an important amplification mechanism when studying the effects of tax reforms. Occupational changes, by contrast, play a small role, which reflects the small changes in occupational shares which were observed in Figure 5. These patterns are qualitatively similar for the experiment of eliminating progressivity where 17-25% of income changes are due to wage changes and where occupational changes play a very small role.

4.3 Taxation and gender and occupation gaps

In this section, we study how taxation affects gender and occupational inequality by focusing on gender gaps in occupations, hours and wages. The results are shown in Table 10. In terms of gender inequality, introducing individual taxation reduces gender inequality across all dimensions studied. In the baseline model, there is a substantial gender gap in both hours (26%) and hourly wages (9%). Introducing individual taxation lowers both of these gaps by 8%. Importantly, this implies that roughly 8% of the gender gap is caused by the jointness of the tax system and would disappear if individual taxation was introduced. Breaking these results down by occupation, we find that the reduction of gender inequality is stronger in the linear occupation than in the non-linear one.

TABLE 10: Taxation and gender gaps

Variable	**Baseline**	**Individual taxation**	**Flat Tax**
Panel A. Aggregate Economy			
Occupation gap (in %)	2.3	-26.09%	-4.35%
Hours gap (in %)	26.63	-8.52%	-4.96%
Wage gap (in %)	9.78	-8.28%	-6.85%
Panel B. By Occupation			
Hours gap, non-linear occ (in %)	17.3	-5.09%	-6.59%
Wage gap, non-linear occ (in %)	5.15	-0.97%	-13.2%
Hours gap, linear occ (in %)	39.35	-9.61%	-3.28%
Wage gap, linear occ (in %)	14.32	-8.38%	-3.07%

Notes: This table shows the gender gap in hours and wages for the aggregate economy and by occupation. The gender gap is defined as the percentage deviation of men's average wages/hours relative to the corresponding outcome for women.

Table 11 also looks at occupational gaps (that is, the mean difference between the non-linear and linear occupation). Panel A first shows these gaps for the aggregate economy. Individuals in the non-linear occupation work 14% more hours, have 36% higher wages and 45% higher earnings than people in the linear occupation. Thus, note that earnings differences are not only driven by people in the non-linear occupation working more hours, but also by higher wages, which can stem from both selection and the positive effect of long hours on earnings. Both introducing individual taxation and eliminating progressivity somewhat contribute to closing these gaps, although mainly in terms of hours. For example, individual taxation reduces the hours gap by 9% and the flat tax reduces it by 3%. Effects on wages and earnings are smaller than the effect on hours in each case; the flat tax has negligible effects on these gaps, while individual taxation reduces the occupational wage gap by 1.79% and the earnings gap by 2.52%.

TABLE 11: Taxation and occupation gaps

Variable	Baseline	Individual taxation	Flat Tax
Panel A. Aggregate Economy			
Occupational hours gap	14.82	-9.24%	-3.38%
Occupational wage gap	36.77	-1.79%	-0.09%
Occupational earnings gap	45.24	-2.52%	-0.88%
Panel B. Women			
Occupational hours gap	23.29	-8.56%	-2.35%
Occupational wage gap	38.91	-2.46%	0.14%
Occupational earnings gap	51.99	-3.09%	-0.77%
Panel C. Men			
Occupational hours gap	6.53	-8.87%	-7.07%
Occupational wage gap	34.45	-0.82%	-0.29%
Occupational earnings gap	38.9	-1.4%	-1.07%

Notes: This table shows the gender gap in hours and wages for the aggregate economy and by occupation. The gender gap is defined as the percentage deviation of men's average wages/hours relative to the corresponding outcome for women.

5 Optimal Taxation

Finally, we use our calibrated model in order to study optimal taxation in terms of jointness and tax progressivity. We maximise the utilitarian social welfare function:

$$W(\tau_1, \tau_2, J) = \int_{\omega=(a_{f1},a_{f2},\phi_f,a_{m1},a_{m2},\phi_m)} U_f(\tau_1, \tau_2, J) + U_m(\tau_1, \tau_2, J) dP(\omega) \tag{28}$$

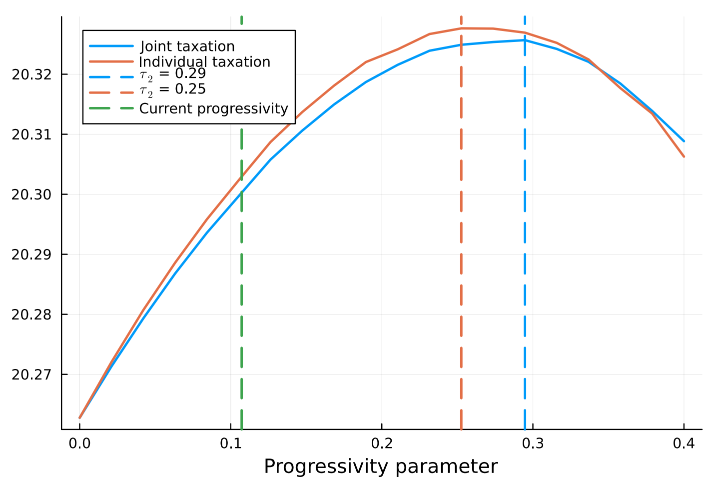
The objective function highlights the underlying 6-dimensional heterogeneity in terms of ability in the two sectors and the disutility of labour of each partner, which is weighted equally in the objective function of the planner. τ_1 and τ_2 are the two parameters of the tax system and $J \in \{0, 1\}$ is a variable which indicates whether taxation is joint or individual. The budget constraint of the planner is the following:

$$G(\tau_1, \tau_2, J) = \int_{\omega=(a_{f1}, a_{f2}, \phi_f, a_{m1}, a_{m2}, \phi_m)} T(y(\omega), \tau_1, \tau_2, J) dP(\omega) = \bar{G} \tag{29}$$

Thus, total tax revenue must be equal to an exogenous revenue requirement which we set equal to the government revenue from the current US tax schedule in the calibration.

To solve the policy problem, we solve the model on a grid for the progressivity parameter and iterate for the budget-balancing level parameter in each case. Figure 5 shows the social welfare function both for the case of individual and joint taxation. We find that $\tau_2 = 0.29$ is optimal with joint taxation and $\tau_2 = 0.25$ is optimal with individual taxation. Our model suggests that switching to individual taxation would be welfare improving for most values of the progressivity parameter. Only for very high values of progressivity, joint taxation would be preferable. Contrasting these results with the current US system, which has a relatively low amount of progressivity and features jointness, we find that the optimal schedule would substantially increase progressivity to $\tau_2 = 0.25$ while also switching to individual taxation.

FIGURE 5: Optimal Taxation: Social Welfare



Notes: The figure shows average and marginal tax rates given the calibrated tax schedule.

We also consider a more general tax function which allows for different forms of jointness. We follow Gayle and Shephard (2019) in using a tax system which is defined by n grid points for each partner. This leads to a grid $\{y_1, ..., y_n\}$ for income. The parameters of the tax system are the tax liabilities at each combination of grid points ($t_{ij} = T(y_i, y_j)$). Since taxation in most countries does not explicitly depend on gender, we assume that the tax system is symmetric ($t_{ij} = t_{ji}$). Therefore, a tax system with n grid points for each person in total has $N = \frac{n(n+1)}{n}$ parameters. We further impose $t_{00} = 0$ which rules out transfers and reduces the number of parameters by 1. In order to obtain the tax liabilities for incomes which do not lie on the grid, we use bilinear interpolation, which assumes that the tax liability in each quadrant of the grid is described by:

$$T(y_f, y_m) = a_1^{ij} + a_2^{ij} y_f + a_3^{ij} y_m + a_4^{ij} y_f y_m \tag{30}$$

In particular, this implies the following functional form for marginal tax rates:

$$\frac{\partial T(y_f, y_m)}{\partial y_f} = a_2^{ij} + a_4^{ij} y_m \tag{31}$$

Thus, with bilinear interpolation, marginal tax rates are constant within tax brackets, but depend on the level of partner income through the interaction term a_4^{ij}.

This problem is computationally demanding due to a potentially high number of policy variables and we run the optimal policy computations on a HPC cluster using 40 cores. For tractability, we set $n = 4$ and set the nodes of the tax grid to $\{0, 50k, 100k, 1.5m\}$. The last grid points is chosen large enough so that almost all incomes in the economy are covered by the tax schedule.[2] This schedule leads to $N = 9$ policy variables. We numerically search for the optimal tax system using a sequential quadratic programming (SQP) algorithm to maximise welfare with the budget constraint of the government as an equality constraint.[3] To assess the robustness of the solution, we perform the optimisation multiple times with random starting values and find that the solutions are always very close.

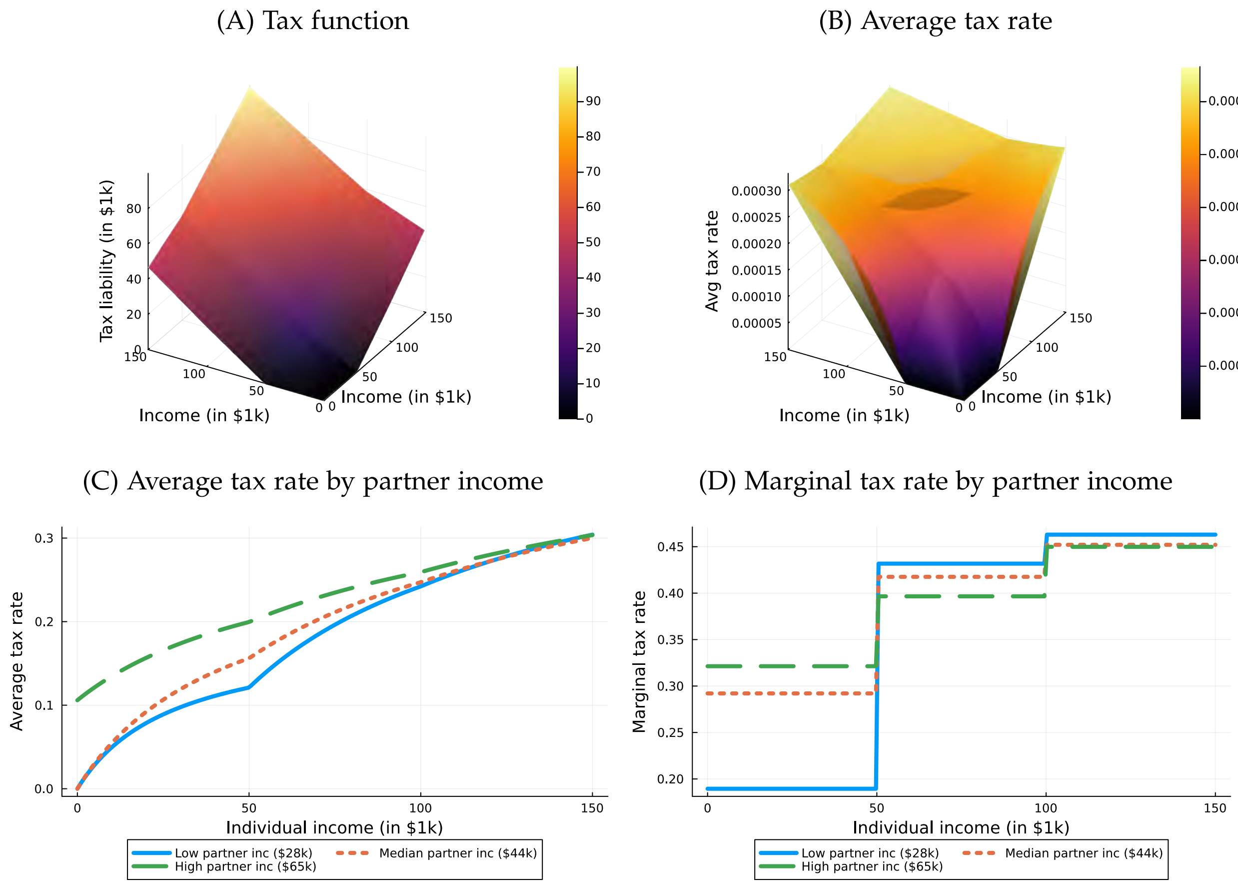
Figure 6 shows the results. Panel (A) and (B) first illustrate the optimal schedule by showing how the total tax liability and the average tax rate vary with the income of both partners. Panel (C) shows the average tax rate (total tax liability as a fraction of household income) and how it varies with the income of one partner for different values of partner income. As partner incomes, we choose the 25th, 50th and 75th percentile of the income distribution of men in the calibrated model. The average tax rate is always highest for individuals with a highest value of partner income. Panel (D) shows marginal tax rates for different values of partner incomes. We find that in the lowest tax bracket, individuals with high partner income have *higher* marginal tax rates, while they have lower marginal tax rates when they are in higher tax brackets. Thus, the optimal tax system features mixed jointness: positive jointness at the bottom of the distribution and negative jointness at the top. This result somewhat differs from the optimal schedule in Gayle and Shephard (2019) and Kleven, Kreiner, and Saez (2009). Kleven, Kreiner, and Saez (2009) consider a very stylised unitary model of household behaviour and find that the optimal tax system features negative jointness due to redistributive concerns, as this schedule benefits "mixed" couples in which only one partner has a high income. Gayle and Shephard (2019) structurally estimate a rich collective model with home production and a marriage market and find that negative jointness is optimal. Since characterising the optimal tax schedule in richer two-earner models is

[2]Since incomes are unbounded in our model (due to ability being drawn from a normal distribution), we linearly extrapolate the tax burden when income is above \$1.5 million. However, this affects very few individuals in the calibrated model.

[3]Derivatives are computed numerically using finite differences. We use the algorithm SLSQP from NLOpt.

analytically challenging, it is unclear to what extent the intuition from Kleven, Kreiner, and Saez (2009) carries over to richer models. In the context of our model, which in particular allows for wages to be a function of hours, which is ruled out in Kleven, Kreiner, and Saez (2009), we find partial support for negative jointness.

FIGURE 6: Optimal taxation with general tax function



Notes: The figure shows the optimal tax system when using a more general tax function which uses interpolation between a specified set of grid points. Panel (A) shows the resulting 3D tax function with the income of both partners on the x and y axis and the tax liability on the z axis. Panel (B) shows the corresponding average tax rates (the tax liability as a fraction of household income). Panel (C) shows how the average tax rate changes with the income of one partner conditional on different values for partner income. Panel (D) shows a similar plot for marginal tax rates.

6 Conclusion

Differences in hours flexibility across occupations have been pointed out to be a key determinant of gender inequality. In this paper, we study the implications for taxation using a model of household labour supply and occcupational choice. We show that taxation affects the incentives to work in the high-pay high-hours occupations through multiple channels. On the one hand, the tax system influences the earnings gain from working in the high-hours occupation through the marginal tax rate on the additional earnings. On the other hand, the tax system also influences the amount of leisure individuals give up by going into the high-hours occupation by changing the optimal amount of work hours in each occupation. Calibrating our model to the United States, we find that both a switch from joint to individual taxation and an increase of progressivity have relatively small effects on the fraction of workers in the high-hours occupation. At the same time, hours flexibility plays an important role in amplifying the impact of tax reforms, since changes in hours translate into different wages conditional on occupation. These results suggest that taking the feedback effects between hours and wages into account is important when studying the potential impact of tax reforms.

The paper points towards several important avenues for future research. On the empirical side, it highlights that the relationship between hours and wages has significant policy implications, which underscores the need for more research on quantifying the dynamic effects of hours on wages. On the theoretical side, the analysis could be extended to capture life-cycle patterns in wage growth and income risk, would would allow for a more realistic quantitative implementation. In addition, the results suggest that it would be important to extend existing models of optimal income taxation for couples for endogenous wages and occupational choice to account for the mechanisms studied in this paper.

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