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Job search under changing labour taxes

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ABSTRACT

Workers' job mobility decisions are related to firms' wage policies but also depend on tax schedules. Using Norwegian population-wide administrative linked employer-employee data for 2010–2019, we study how the job-to-job turnover of employees is affected by marginal taxes and firms' pay policies, thus drawing inferences on job search behaviour. By paying higher wages, job-to-job separation rates drop, but this negative relationship is weakened when income taxes increase, consistent with higher taxes reducing search activity. However, consistent with theory, the tax effect is smaller where workers receive performance bonuses.

1. Introduction

Taxes provide essential revenues to governments contributing to the provision of public services to people and, in some countries, redistributing wealth. In Norway, taxes comprise 43.4 percent of GDP - well above the OECD average - with personal income taxes and social security contributions constituting 36 percent of total taxes (OECD, 2024).[1] Thus, taxation of workers is important for public revenues. However, income taxation also impacts citizens' behaviours, such as educational and occupational choices (Trostel, 1993; Feldstein, 1995; Bruce, 2000; Powell and Shan, 2012; Findeisen and Sachs, 2016).

That tax policies might affect job search behaviour has been recognised since the 1970s when Kesselman (1976) observed that the slope of the labour-supply schedule affects the direction of search incentives. Recently, Berger et al. (2024a) showed that, by affecting search, progressive income taxes can distort hiring and wages when firms have labour market power, i.e., progressive taxes amplify the distortions associated with monopsony. They provide simple quantitative evidence supporting these notions. In their empirical study for the United States, Gentry and Hubbard (2004) found that higher tax rates and increased progressivity decrease the probability that a head of household will move to a better job during the coming year. Thus, in practice, job search activity in the United States appears to diminish as tax levels and progressivity increase. To our knowledge, this is the sole empirical study addressing how worker mobility is affected by taxes.

We contribute to this sparse literature in several ways by examining the way in which firms' wage policies under different tax regimes affect Norwegian workers' job mobility. First, in a simple framework, we show how the interplay of firms' wage policies and labour taxes relate to job search and induce job-to-job mobility. Then, in our empirical analysis, which accounts for worker fixed effects, we show how changing labour taxes induce mismatch and job mobility under different pay regimes. Then we provide contrafactual analysis showing the aggregate effects of the labour tax changes over time on job mobility. Finally, we examine whether the results of Gentry and Hubbard (2004) hold twenty years later in another country.

We show that labour taxes affect the search behaviour of workers. This is likely to influence firms' labour market power in line with the findings from Berger et al. (2024a) with implications for the operation of the labour market and public authorities. Employer labour market power affects wages and hiring, induces wage inequality, yields distorted allocation of labour across firms, and thereby a welfare loss (Berger et al., 2024b).

Our analyses draw inspiration from the rich literature on the

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[1] On average in OECD, taxes constitute 34 percent of GDP. Personal income tax and social security contributions comprise on average 48.4 percent of all taxes (OECD, 2024).

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elasticity of taxable income (ETI) with respect to marginal tax rates (Gruber and Saez, 2002; Saez et al., 2012; Kleven and Schultz, 2014). This literature highlights the negative association between marginal tax rates and income due to reduced effort when the returns to work diminish. It identifies modest labour income elasticities for wage earners on average, but larger impacts whenever tax changes are large, consistent with the notion that smaller changes are attenuated by optimising frictions (for example, adjustment costs and inattention).[2] Recent ETI-literature argues that it is difficult to obtain causal estimates for behavioural responses to marginal income taxes using tax reforms (Jacobsen and Søgaard, 2022), since reforms often affect marginal tax rates differently for individuals at different income levels. In addition, mobility responses have been ignored in many of these studies. However, in a recent paper, Kleven et al. (2024) find support for the notion that earnings responses are delayed and mediated by job switches, and that not only is the probability of job switching positively affected by tax reform, the long-run earnings elasticities are more than twice as large as the short-term responses. Previous studies for Norway also indicate labour income responses following tax reforms, although they ignore mobility issues (Aarbu and Thoresen, 2001). The notion that effort is affected by tax changes could also have implications for firm wage policies and worker turnover.[3] Since performance pay is one strategy to overcome informational deficiencies concerning workers' provision of effort (Lazear, 2000; Lucifora and Origo, 2015), we present some estimates which differentiate between fixed pay and performance-pay.[4]

We utilise Norwegian administrative register data on the population of workers and firms during the period 2014–2019 and, for 2015–2019, we exploit monthly data on jobs including information on work hours, hourly wages and bonuses. Data comprise roughly 3.65 million men and 3.64 million women, and slightly <70 million monthly observations for each gender. To derive measures of firms' wage policies, we apply standard linear fixed effect regressions as they were introduced by Abowd et al. (1999) and which numerous studies have applied (Dale-Olsen, 2006; Barth and Dale-Olsen, 2009) and recently extended (Barth et al., 2021; Engbom et al., 2022; Schmieder, 2023). To avoid complications related to motherhood and family obligations affecting labour supply decisions and job search, we focus our analyses on male private sector employment relationships in firms reporting to the Accounting Register.

During our period of observation, Norwegian earnings tax schedule changes occurred on a yearly basis. Tax rates vary according to the labour income bracket a worker falls into. The labour income brackets defining where higher rates are levied, together with the tax rates themselves, vary over time with government legislation. In our empirical analyses we exploit exogenous variance in the tax rate a worker faces which arise from these government changes to tax rates. Our analyses comprise linear job-to-job separation regressions incorporating fixed worker effects, marginal tax rates and a measure of the predicted probability of receiving a better job offer. To derive a causal interpretation, we utilise instrumental variables (IVs) based on the individual's lagged taxable labour income and the lagged total factor productivity of their employer. As discussed later, we have strong reasons to believe that total factor productivity affects the wage offers firms make.

The remainder of the paper is structured as follows: Section 2 describes the labour tax legislation in Norway during 2014–2019. Section 3 introduces the theoretical background which motivate our empirical analyses. Section 4 presents the data, describes the derivation of main empirical measures, and provides descriptive statistics on these variables. In Section 5, we address our key question by studying how the job-to-job separation rates of Norwegian male workers react to changes in the marginal tax schedule and employers' wage policies. Section 6 briefly concludes.

2. The Norwegian labour income tax schedule

Our empirical analyses pertain to wage earners (not the self-employed and retired workers who face different tax schedules) receiving yearly labour income above a baseline figure in the Norwegian welfare system (so-called 1 G). Workers earning below 1 G face different deductions and rules governing national insurance contributions. The wage earners in our sample face a progressive labour tax schedule comprising three components. Table 1 shows the three components and how they changed between 2015 and 2020. First, all workers pay 8.2 percent of their labour income in *national insurance contributions* (Table 1, row 1) Second, all workers pay a *general labour income tax* which is independent of income level. Those living in northern Norway face a slightly lower general income tax rate as an incentive to live in the more inhospitable climate. Both the basic rate and low rate fell between 2015 and 2020 (Table 1, rows 2 and 3). Third, workers face *a bracket tax* depending on their income level (labelled a 'surtax' prior to 2016) which causes the marginal labour tax rate to be progressive. This bracket tax levies higher tax rates at higher earned income brackets, as seen in the lower half of Table 1 (Panel C).

In 2015 the bracket tax had three levels. For workers with labour income below 550,550 NOK no bracket tax was levied. For workers with labour income between 550,550 and 885,600 NOK, living in central areas, they face a bracket tax of 9 percent. For workers with income above 885,600 NOK, they face a bracket tax of 12 percent. The marginal tax rate is given by the sum of the national insurance contributions, the general labour income tax and the bracket tax. Thus, for 2015, and for workers living in central areas, there were three total marginal tax rates, namely 35.2 percent (for labour income <550,550 NOK), 44.2 percent (for labour income between 550,550 and 885,600 NOK) and 47.2 percent (for labour income above 885,600 NOK).

Since 2016, the bracket tax has yielded five marginal tax levels. In 2016 (still in central areas), for labour income <159,800 NOK, the marginal tax was 33.2 percent. For labour income between 159,800 and 294,900 NOK, it was 33.64 percent. And for labour income between 294,900 and 565,400 it became 34.9 percent. Workers with labour income between 565,400 and 909,500 NOK faced a marginal tax of 43.9 percent, while workers with labour income above 909,500 NOK faced a marginal tax of 46.9 percent.

During our period of observation, Norwegian workers experienced tax rate changes on a yearly basis. First, both the 'basic' general income tax and the 'low' general income tax in the North fell by 5 percentage points during our observation period. Second, the brackets defining the bracket tax changed over time. Third, the tax rates for given brackets changed over time, growing by 4.2 percentage points. Individual income growth induces endogenous tax variation, but changes in tax rates and the definition of tax brackets – which may also be endogenous - may also influence workers' search behaviours.

Fig. 1 reveals changes in the stepped nature of the marginal tax schedule. The bracket tax increases for middle earners compared to top earners imply a reduction in the progressivity of the tax schedule.

[2] Graber et al. (2022) use lottery winnings to obtain variation in unearned income and tax reforms to study how labor earnings respond to changes in Norwegian tax rates.

[3] Given that time limitations can make individuals think short-term and concretely, and a retailer's efforts at communicating about their brand more broadly or specific products more concretely can likewise affect information processing, we explain how different VR experiences might evoke different construal levels (concreteness or abstraction) and how this might influence preferences for information processing (heuristic vs. systematic). We also predict how VR system immersivity might help provide focus to a task and could potentially alter the preference for processing depth. By examining the literature through this theoretical lens, we can better understand how VR retail experiences contribute to consumer decision-making.

[4] Performance pay is often associated with improved firm performance (Lazear, 2000; Lucifora and Origo, 2015) and although some argue that monetary incentives undermine intrinsic motivation and thus performance, this has been refuted in field tests (Esteves-Sorensen and Broce, 2022).

Table 1
Changes in the marginal tax. Income above baseline social services threshold (1 G).

	2015	2016	2017	2018	2019	2020
A) National insurance contributions						
Basic	0.082	0.082	0.082	0.082	0.082	0.082
B) General labour income tax						
Basic	0.270	0.250	0.240	0.230	0.220	0.220
Low	0.235	0.215	0.205	0.195	0.185	0.185
4	Else:0.120	Else:0.137	Else:0.1452	Else:0.154	Else:0.137	Else:0.137
C) Bracket tax						
	2015		**2016**		**2017**	
	Income brackets	Marginal tax rate	Income brackets	Marginal tax rate	Income brackets	Marginal tax rate
0	$0 < I < 550{,}550$	0	$0 < I < 159{,}800$	0	$0 < I < 164{,}100$	0
1			$159{,}800 < I < 224{,}900$	0.0044	$164{,}100 < I < 230{,}950$	0.0093
2			$224{,}900 < I < 565{,}400$	0.017	$230{,}950 < I < 580{,}650$	0.0241
3basic	$550{,}550 < I < 885{,}600$	0.09	$565{,}400 < I < 909{,}500$	0.107	$580{,}650 < I < 934{,}050$	0.1152
3low	$550{,}550 < I < 885{,}600$	0.07	$565{,}400 < I < 909{,}500$	0.087	$580{,}650 < I < 934{,}050$	0.0952
4	$885{,}600 < I$	0.12	$909{,}500 < I$	0.137	$934{,}050 < I$	0.1452
	2018		**2019**		**2020**	
	Income brackets	Marginal tax rate	Income brackets	Marginal tax rate	Income brackets	Marginal tax rate
0	$0 < I < 169{,}000$	0	$0 < I < 174{,}500$	0	$0 < I < 180{,}800$	0
1	$169{,}000 < I < 237{,}900$	0.014	$174{,}500 < I < 245{,}650$	0.019	$180{,}800 < I < 254{,}500$	0.019
2	$237{,}900 < I < 598{,}050$	0.033	$245{,}650 < I < 617{,}500$	0.042	$254{,}500 < I < 639{,}750$	0.042
3basic	$598{,}050 < I < 962{,}050$	0.124	$617{,}500 < I < 964{,}800$	0.132	$639{,}750 < I < 999{,}550$	0.132
3low	$598{,}050 < I < 909{,}500$	0.104	$617{,}500 < I < 909{,}500$	0.112	$639{,}750 < I < 999{,}550$	0.112
4	$962{,}050/909{,}500 < I$	0.154	$964{,}800/909{,}500 < I$	0.137	$999{,}550 < I$	0.137

Note: The total marginal tax rate comprises of national insurance contributions + general income tax + bracket tax. The low-tax areas are levied on workers living in the county of Finnmark and selected municipalities in North-Troms. I denotes labour income.

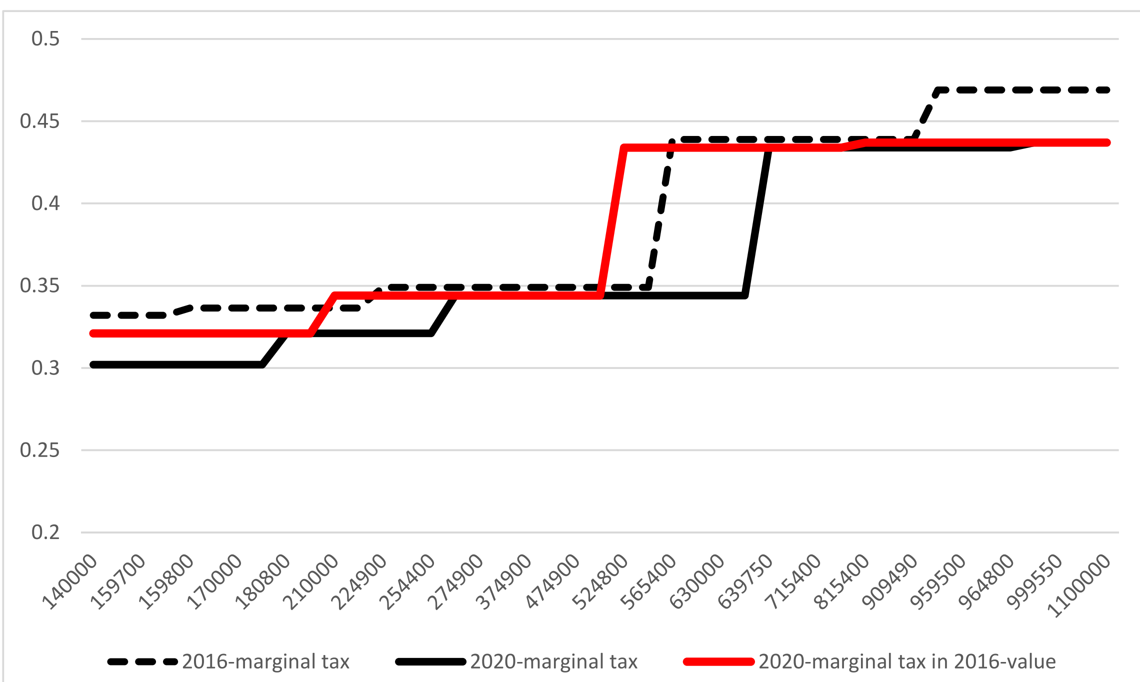

Fig. 1. Changes in the marginal tax rate and the bracket tax over time due to tax schedule changes. 2016 and 2020
Note: See Norwegian Tax Administration (skatteetaten.no) and own calculations. The X-axis expresses nominal labour income, while the Y-axis expresses marginal tax rates (between 0.2 and 0.5).

The general income tax declines also make the marginal tax rate less progressive. In the figure, we have added the 2020 marginal tax rates based on 2016 incomes, accounting for average wage growth over the period. With this perspective, we see that some workers will face higher marginal taxes and others will experience a drop. For some, a minor change to a worker's earnings might induce a strong tax rate change.

3. Theoretical motivation

We base our theoretical motivation mainly on Christensen et al. (2005), which addresses the relationship between wage dispersion, mobility, and optimising search effort under search frictions. This model embeds endogenous search intensity or search effort (depending on the expected gain from a wage offer) into the Burdett and Mortensen-model (Burdett and Mortensen, 1998).[5] We do not explicitly combine these two models, but we are able to derive empirical predictions from them.

Assume a firm posts a wage offer w, hires any worker accepting this offer, and pays all its workers this wage. The wage offer distribution is denoted by F(w), where F(w) represents the probability that a randomly selected wage is not greater than w. Workers search randomly for wage offers. Each worker receives job offers at a rate λs, where s is a measure of the worker's search effort. Each worker chooses search effort subject to an increasing convex search cost function $c(s)= c_0s^2$, where c_0 is a positive parameter.[6] Finally, employment relationships are destroyed exogenously at a rate δ. As unemployed, the workers receive b and pay no tax. Let t denote the marginal tax rate. When employed, the workers receive instantaneous utility of (1-t)w. We assume that each worker maximises expected wealth, which can be expressed by:

$$rV_e(w)=\underset{s\geq 0}{max}\left((1-t)w-c(s)+\lambda s\left[\int \max(V_e(w),V_e(x))dF(x)-V_e(w)\right]\right.$$
$$\left.+\delta[V_u-V_e(w)]\right), \tag{1}$$

where V_u is the value of unemployed search. Following the derivation of Christensen et al. (2005) while incorporating (1-t)-tax element, shows that Eq. (1)) can be rewritten as

$$V_e(w)=\underset{s\geq 0}{max}\left\{\frac{(1-t)w-c(s)+\delta V_u+\lambda s\left[\int \max(V_e(w),V_e(x))dF(x)\right]}{r+\delta+\lambda s}\right\},$$

where

$$V_e'(w)=\frac{(1-t)}{r+\delta+\lambda s(w)[1-F(w)]}>0.$$

Then, as shown by Christensen et al. (2005), optimal search effort is given by the first order condition:

$$c'(s(w)) \;=\; \lambda\int_w^{\overline{w}}[V_e(x)-V_e(w)]dF(x)=\lambda\int_w^{\overline{w}}V_e'(w)[1-F(x)]dx=(1-t)\lambda\int_w^{\overline{w}}\frac{1-F(x)}{r+\delta+\lambda s(x)[1-F(x)]}dx.$$

Since c(s) is positive convex, s(w) is decreasing in w. Christensen et al. (2005) show that since search effort is not observed, one cannot identify λ and s separately, but one can recover one joint parameter comprising the search cost parameter, c_0, and λ. With a squared search cost function, this yields $\lambda(w)=(1-t)\frac{\lambda^2}{c_0}\int_w^{\overline{w}}\frac{1-F(x)}{r+\delta+\lambda(x)[1-F(x)]}dx$, which is declining in w and t. For completeness, the expected discounted lifetime income for an unemployed worker be given by

$$rV_u=\underset{s\geq 0}{max}(b-c(s)+\lambda s\left[\int \max(V_u,V_e(x))dF(x)-V_u\right]. \tag{2}$$

The worker's reservation wage, R, is given by the condition $V_e(x)= V_u$, implying that search effort if unemployed equals s0=s(R), and that $R=b/(1\text{-t})$.

From Christensen et al. (2005: Eq. (6))), with no taxes, we know that a firm's separation rate can be expressed as:

$$Q(w)=\delta+\lambda s(w)[1-F(w)], \tag{3}$$

where $s'(w)<0$ and $F'(w)>0$ and Q express the separation rate from the firm.[7] $\overline{F}(w)$=1-F(w) then expresses the probability of receiving a better job offer, where $\overline{F}'(w)<0$. The better paid you are, the less likely it is that you will receive a better wage offer.

Given this squared search cost function, we can, as a simplification and approximation acting as motivation for our empirical analyses, express $\lambda(w)$ as $\lambda(w)=(1-t)\frac{\lambda^2}{c_0}\int_w^{\overline{w}}\frac{1-F(x)}{r+\delta+\lambda(x)[1-F(x)]}dx\approx(1-t)\frac{\lambda^2}{c_0}\left[\gamma_0-\frac{\gamma_1}{\overline{F}(w)}\right]$, where $\lambda'(w)<0$. Incorporating taxes in the search intensity function then yields the separation function:

$$\begin{aligned}Q(w)&=\delta+\lambda(w)[\overline{F}(w)]\approx\delta+(1-t)\frac{\lambda^2}{c_0}\left[\gamma_0-\frac{\gamma_1}{\overline{F}(w)}\right]\overline{F}(w)\\&=\delta-\frac{\lambda^2}{c_0}\gamma_1+\frac{\lambda^2}{c_0}\gamma_1t+\frac{\lambda^2}{c_0}\gamma_0\overline{F}(w)-\frac{\lambda^2}{c_0}\gamma_0t\overline{F}(w).\end{aligned} \tag{4}$$

In this separation function, firms differ from one another in their payment policy only by the virtue of frictions and optimising turnover behaviour, and workers optimise on search effort.

Finally, note that in this model the workers have perfect information on the arrival rate of offers, the offer distribution, and job destruction. If imperfect information exists, then beliefs about search costs, returns to search, and outside options will matter, as is seen in the study of Miano (2023).

4. Econometric model

Based on Eq. (4)), we can model the probability that worker i employed at workplace f at year t leaves for a new job at another workplace in year $t+1$ by the simple linear probability model expressed by Eq. (5)):

$$Q_{ift+1}=\alpha_0+\alpha_t\widetilde{t}_{it+1}+\alpha_F\overline{F}_{ft}+\alpha_{FT}\widetilde{t}_{it+1}X\overline{F}_{ft}+\alpha_ZZ_{ift}+\theta_i+\xi_{ift+1}, \tag{5}$$

where ξ_{ift} is a standard error term, θ is a fixed worker effect, and Z_{ift} contains time-varying and fixed exogeneous control variables. We let the job destruction rate, δ, be expressed by $\delta=\alpha_0+\alpha_ZZ_{ift}+\xi_{ift}$. Note in one

[5] In the Burdett and Mortensen (1998) framework one set of labour market frictions leads to the dissolution of a job as expressed by a job destruction rate. Another set of frictions arises from the information flow related to job offers, usually expressed by a job offer arrival rate. Although often taken for granted in analyses, these frictions can be influenced by workers. For instance, expectations of future pecuniary rewards in new employment relationships influence workers in terms of how hard they look for new jobs. Thus, the probability that a worker ends an employment relationship is not only related to wage offers and factors outside the worker's control, but also how intensively they search for new jobs (Christensen et al., 2005).

[6] This squared cost function is a simplification of the cost function of Christensen et al. (2005), however, we are primarily interested in motivating our empirical analyses, and for that purpose, we argue this simplified function is sufficient. More involved search cost functions are also found in Miano (2023).

[7] Following Burdett and Mortensen (1998), the wage offer distribution can be expressed as $F(w)=\frac{\delta+\lambda s}{\lambda s}\left(1-\frac{p-w}{p-b}\right)^{0.5}$.

specification, we even let the Z-vector comprise dummies for tax brackets, so when doing so, we only utilise the tax variation within brackets. Our key variables are the expected marginal tax for the next year ($\widetilde{t}_{it+1}$ which isthe tax schedule for year $t+1$ applied to labour income from year t added expected wage growth), the probability that the worker receives a better job offer ($\overline{F}_{ft}$) and the interaction between these.

When we estimate Eq. (5)), we measure $\overline{F}_{ft}$ and $\widetilde{t}_{it+1}$ as deviations from their global mean. This is done so the readers easily see, evaluated at the global means, the impacts of the probability of better wage offers and marginal taxes directly, without having to take into account the interaction term. On the other hand, this makes it more difficult to the relate the parameters directly to the parameters in Eq. (4)).[8] When we estimate the separate impacts of $\overline{F}_{ft}$ and $\widetilde{t}_{it+1}$ on separations, we expect that a higher probability of a better job offer should always increase the separation probability, while changed marginal tax rates potentially cause separations due to contract misalignment and shirking (agency considerations) and affect job search incentives.

When deriving the theoretical relationship between separations and marginal taxes, we assume that work effort, in contrast to search effort, is given and can be contracted upon. It is not within the scope of this paper to introduce efficiency wages or performance pay into the model above. However, the classical Burdett and Mortensen (1998) model without endogenous search effort has been extended by Piyapromdee (2018) to allow the output of a match between a worker and a firm to depend on a worker's non-contractable effort level and that the work effort provided is costly for the worker. Firms monitor workers imperfectly, at a cost, and fire shirking workers if found shirking. While this model comprises many of the traits and characteristics of a standard equilibrium search model, it also comprises elements like the classical Shapiro and Stiglitz (1984) efficiency wage model. For example, wages and monitoring are two ways employers seek to manage shirking. From this, reminiscent of the Shapiro and Stiglitz-model, Piyapromdee (2018) derives an equilibrium non-shirking-wage, which will be the lowest wage offered in the economy, where nobody shirks. No employed worker shirks, but the wage is higher than it would have been, given contractable effort. Adding taxes to this model should imply that, since a tax hike reduces the return to work, a tax hike would increase the non-shirking wage, and some of the workers employed before the tax hike would start shirking, and a proportion of these would be caught and lose their job.

In the Piyapromdee (2018) search-model, effort affects worker output and firms optimize wages and monitoring to achieve profit-maximising labour supply. Firms cannot always contract on output. In a standard textbook performance pay model where the relationship between output and effort is not directly observed, the optimal solution is that the risk-neutral principal offers a constant absolute risk-averse (CARA) agent with convex effort costs, a linear contract comprising a fixed salary and a bonus depending on output. By introducing a labour income tax affecting the agent in the standard principal-agent model, one easily sees that the agent's optimum effort is reduced, and thus the optimum contract is changed.[9] The piece-rate on performance does not change, but the salaried part should increase with increasing marginal taxes. Changing labour taxes affects the participation constraint of the agent and thus induces worker separations leading to better aligned contracts between workers and employers. Thus, from this discussion, both efficiency wage and standard agency considerations imply that separations could increase when marginal taxes increase. If this is the case, this would also contribute positively to α_t. However, we might also infer that changing labour taxes (i.e., increasing taxes and changes to the optimal contract for workers and firms) will induce mobility.

In Eq. (5)), the relationship between marginal taxes, the predicted probability of receiving a better wage offer, and their interaction, is given by a simple linear specification. In such a specification, impacts will be symmetric, i.e., equal tax reductions and tax hikes yield the same sized but opposite signed impact. As robustness checks, we explore this in our empirical analyses.

Estimation of Eq. (5)) faces two challenges: both the marginal tax rate and the predicted probability of receiving a better wage offer (as well as their interaction) are likely to be endogenous. In the ETI-literature, tax rates are often related to labour income, making the endogeneity obvious. In our case, the endogeneity bias will arise if the synthetic marginal tax rate (tax schedule from year $t+1$ based on labour income from year t) is related to the error term in the separation regression, which measures seperations in year $t+1$. Furthermore, and as pointed out by Jacobsen and Søgaard (2022), it is difficult to obtain causal estimates for behavioural responses to marginal income taxes using tax reforms. To instrument the marginal tax rate for year $t+1$, we use a synthetic marginal tax rate based on labour income from t-1. Note that this labour income does not induce separations in time t. In addition, all regressions comprise predetermined labour income vigintile dummies and in one specification, we even add dummies for income intervals defining the tax brackets, i.e., we utilise only the tax variation over time for these tax brackets, in addition to the other tax rate changes.

Next, as pointed out in Section 3, firms optimize their wage policy with respect to turnover and monitoring costs, making firms' wage policies endogenous in Eq. (5)). Similarly, individuals' separation decisions next year could be strongly related to the mechanisms that determine this year's labour income and potentially next year's labour income, and since next year's labour income determines marginal taxes next year, we could face an omitted variable bias or bias arising from endogeneity related to workers' optimizing behaviour. Furthermore, there is a tendency in Norway for employers to pay out holiday entitlements, remaining bonuses and firm lay-off compensation when workers leave a job. This creates a positive correlation between the amount of pay received the month a worker leaves the firm and the probability that the worker leaves, which biases the impact on mobility towards zero (given the impact should be negative). Third, as pointed out by Bonhomme et al. (2023), limited mobility bias causes the AKM variance of firm effects to be overstated, which induces a negatively biased covariance between worker and firm effects. This is less of a problem for us, but since limited mobility bias causes bloated firm wage premium variance, it also biases the impact on mobility towards zero. For analyses of separations and pay, these biases can be considered measurement errors. Thus, to avoid these biases we introduce IVs for the marginal tax rate and the estimated probability that the worker receives

[8] Equation 4) indicates that the estimate of α_{FT} is negative, while the estimate of α_F should be positive. Similarly, the estimate of $\alpha_t$is expected to be positive. If we estimate our regressions on untransformed data, i.e., we do not measure $\overline{F}_{ft}$ and $\widetilde{t}_{it+1}$ as deviation from global means, this is confirmed. While we expect $[\alpha_F+\alpha_{FT}\widetilde{t}_{it+1}]$ to always be positive, a higher probability of a better job offer should always increase the separation probability, but since changed marginal tax rates potentially cause separations due to contract misalignment and shirking (agency considerations) and affect the job search incentives, the sign of $[\alpha_t+\alpha_{FT}\overline{F}_{ft}]$ is ambiguous a priori.

[9] If output is given by $y = e+\varepsilon$, where e is effort and ε a zero-mean random normal-distributed shock with variance σ^2, the offered linear contract is $w=(1-t)(s+\beta y)$, the CARA risk-averse agent's effort is convex $x(e)=0.5ce^2$, the agent's optimum effort will be given by $e^*=(1-t)\beta/c$, while the optimal contract offered by the principal will be $\beta^*=1/(1+cr\sigma^2)$ and $s^*=(U^*/(1-t)r)-0.5(1-t)^2\beta^{*2}[(1/c)-r\sigma^2]$. Thus, $\partial\beta^*/\partial t=0$ and $\partial s^*/\partial t>0$.

a better job offer, and the interactions between these. As IVs, we use firm- and year-specific predetermined total factor productivity and a synthetic marginal tax rate (and interaction). These IVs are discussed and described more in detail in Section 5.

5. Data

We utilise Norwegian administrative register data on the population of workers and firms during the period 2014–2019. During these years, we have monthly data on jobs, including information on work hours, hourly wages and bonuses. Data comprise roughly 3.65 million men and 3.64 million women, with nearly 70 million monthly observations for each gender. In total, our data comprise slightly >133 million observations. Our main analyses use yearly data since this is the frequency with which the tax schedule changes. We focus on private sector employment relationships in firms reporting to the Accounting Register. This selection is necessary since we need to measure total factor productivity. In practice, this means we discard very small firms, finance and banking firms and restrict the analyses to public and private limited companies. Next, we select employment relationships active on December 15th each year.[10] This ensures a certain correspondence between mobility decisions and information on the tax schedule, since the tax schedule for year $t+1$ is published by the Ministry of Finance in December year t.[11] Finally, we focus on men, since women are more likely to experience spells outside the labour market due to maternity leave and child-care. Thus, apart from when we derive the workplaces' wage policies using monthly data on all employment relationships (both men and women), we utilise information on 1.15 million male workers and 5 million observations. Limiting the data to private sector employment relationships in firms reporting to the Accounting Register gives us information of 2.5 million observations on 664 thousand workers.

The quality of the data is very good, since these data comprise a linking of the Central Population Register and the Tax Authorities' registers of jobs and earnings collected for tax purposes. The wages derived from these data comprise the value of taxable fringe benefits reported to the Tax Authorities. In addition, we know working hours. This allows us to derive a measure of hourly wages which includes the value of fringe benefits. Furthermore, we know monthly bonuses paid during the year, thus we can differentiate between performance pay (bonus) and fixed salaried pay.[12] Finally, when linking information from the Income Register using workers' identifying numbers, we observe all taxable labour income, thus permitting us to recover marginal taxes. Our data comprise a full panel of firms and their employees, with detailed information on workers and workplaces. Our data do not allow us to differentiate between voluntary quits and forced layoffs, and when we use the term job-to-job mobility, we ignore mobility within firms and ignore whatever tasks these jobs comprise. Thus, one might also define this as employer-to-employer mobility.

5.1. Key measures and descriptives

Job-to-job separation dummy, Q: Defined as a worker employed at workplace f at the end of year t but moves to another workplace at year $t+1$.

Expected marginal tax rate for year $t+1$, $\tilde{t}_{it+1}$: The marginal tax rate is given by the sum of the national insurance contributions, the general income tax and the bracket tax. The rate depends on labour income and the tax schedule. The expected marginal tax for year $t+1$, $\tilde{t}_{it+1}$, is calculated from the tax schedule of year $t+1$ based on the labour income for worker i in year t multiplied by the industry and occupation-specific wage growth rate from year t-1 to t. When we multiply the labour income by the previous year's growth rate, this is to acknowledge that workers have wage growth expectations.

In Fig. 2, we see the development over time in the marginal tax rate within worker. Due to the reduction in the general income tax, the distributions shift downwards. However, we also see a tendency to wider distributions over time, indicating larger dispersion in marginal taxes which follows from the increase in the bracket tax (by moving brackets and changed tax rates within brackets).

Synthetic marginal tax rate for year $t+1$, $t(\widetilde{I_{it-1}})_{it+1}$: The synthetic marginal tax rate for year $t+1$, $t(\widetilde{I_{it-1}})_{it+1}$, is calculated from the tax schedule of year $t+1$ based on the labour income for worker i from year t-1 multiplied by the industry and occupation-specific wage growth rate from year t-2 to t $(\widetilde{I_{it-1}})$.

Wage policy at workplace f at time t: The wage policy at workplace f at time t is estimated based on the population-wide monthly data following Barth and Dale-Olsen (2024). We apply standard linear fixed effect regressions as they were introduced by Abowd et al. (1999) and recently extended e.g. to incorporate time-varying firm effects (Barth et al., 2021; Engbom et al., 2022; Schmieder, 2023), notwithstanding some methodological weaknesses (Bonhomme et al., 2023). We start by residualizing the log hourly wage, controlling for worker age (age and age squared measured relative to 35 years of age) and education qualifications (7 dummies) as seen in Table A2 in the appendix.[13] Then, having added the intercept to this residualised wage, we estimate the regression given by Eq. (6) for worker i employed by firm f in year y and month m:

$$lnW^{r}_{ifmy} = \alpha_0 + \theta_i + \Delta_{fy} + \beta_{fy}\ln\,(seniority)_{ifmy} + \varepsilon_{ifmy}, \tag{6}$$

where ε_{ifmy} expresses a standard error term, θ_i expresses a worker FE.

This equation identifies a standard wage premium or firm FE, Δ_{fy}, as seen previously in the literature, but adds in firm- and year-specific returns to seniority profile, β_{fy}, i.e., allows for firm heterogeneity also in the seniority wage profile.[14] Measured at the firm yearly average, $\Phi_{fy} = \Delta_{fy} + \beta_{fy}\overline{\ln\,(seniority)_{fy}}$, expresses the standard wage premium. We assume that the distributions of the wage premiums follow a standard logistic distribution, where the mean and scale is defined by the average and standard deviation of the wage premium across firms within a year. Let $F_{fy}\left(\Phi^{k}_{fy}\right)$, k=newly hired, average seniority, and 15 years, express these distributions. The probability that a worker receives a better job

[10] This means that that summer seasonal workers and workers marginally attached to the labour market will be discarded. Due to the fixed effect approach, we need observations of workers in a job for more than one year. By focussing on workers in short spells during the year, possibly having several employment relationship, we also loose the link between yearly labour income, taxes and the job. By conducting what is called stock-sampling, we select longer spells and focus on workers solidly embedded in the labour market, with a clearly defined job. Flow-sampling would have selected shorter spells. We also introduce a lower limit on labour income. Tax issues for marginally attached workers and workers in atypical workers are clearly important but will have to be addressed in another paper due to the added complexity.

[11] For example, let say we had selected active jobs on May 1st. Many of these workers might have quit before information on the new tax schedule would have been available, but in our analyses, we could have attributed such mobility to tax changes.

[12] Our original data is based on monthly observations for each month in the year, thus focussing on December 15th has no impact on the definition of bonus pay jobs versus salaried jobs.

[13] This two-step procedure normalizes the impact of age and education to the average in the labour market. Computer memory (RAM) limitations when estimating the firm fixed effects on over 150 million observations mean we cannot do it in one step. Given appropriate hardware it could easily be conducted in one step.

[14] Although our data consist of slightly over 26072 connected groups, 140219617 observations are in group 1, while the rest of the observations (815772) are in the remaining 26071 groups. So, 99.42 percent of the observations are connected.

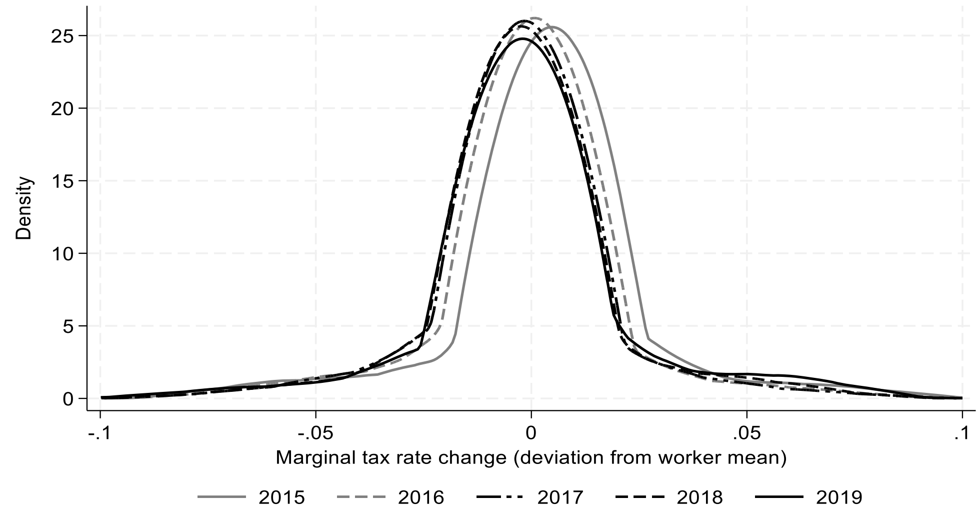

Fig. 2. Changes in the marginal tax rate distribution within worker
Note: Based on male employment relationship active on December 1st each year. Deviation from worker mean.

Table 2
Descriptive statistics. Workers.

	2015	2016	2017	2018	2019
Private sector+accounting registers workers					
Job-to-job separation rate	0.111	0.114	0.124	0.129	0.125
	(0.315)	(0.318)	(0.330)	(0.336)	(0.331)
$\widetilde{t}_{it+1}$	0.391	0.383	0.381	0.381	0.381
	(0.049)	(0.050)	(0.050)	(0.051)	(0.051)
$t(\widetilde{I_{it-1}})_{it+1}$	0.395	0.388	0.384	0.382	0.381
	(0.049)	(0.050)	(0.051)	(0.053)	(0.054)
Δ^s_{ft}	−0.152	−0.237	−0.266	−0.257	−0.226
	(0.685)	(0.655)	(0.669)	(0.684)	(0.796)
β_{ft}	0.065	0.076	0.080	0.079	0.077
	(0.142)	(0.141)	(0.146)	(0.150)	(0.171)
$\overline{F_{ft}(\Delta^s_{ft})}$	0.443	0.404	0.380	0.377	0.398
	(0.070)	(0.118)	(0.147)	(0.148)	(0.120)
TFP_{ft}	0.055	0.080	0.081	0.092	0.103
	(0.361)	(0.381)	(0.383)	(0.398)	(0.407)
Seniority (months)	81.181	82.955	83.489	83.277	83.574
	(90.531)	(90.528)	(90.673)	(90.808)	(91.106)
Log I_{it-1}	12.983	13.017	13.017	13.027	13.059
	(0.712)	(0.665)	(0.682)	(0.695)	(0.686)
Bonus job$_{if}$	0.367	0.380	0.379	0.367	0.339
	(0.482)	(0.485)	(0.485)	(0.482)	(0.474)

Note: Active jobs per December each year for workers earning at least 1 G (Social Services Baseline Figure).

offer is then expressed by $\overline{F_{fy}(\Phi^k_{fy})}$=1-$F_{fy}\left(\Phi^k_{fy}\right)$. When analysing separation behaviour, we let time be denoted by t (instead of y), since these are conducted on yearly observations.

Table 2 provides simple descriptive statistics on our key variables for each year. We see that the job-to-job separation rates increase a little over time. Average seniority, however, also increases over time, indicating that employment level adjustments also occur. Marginal tax rates appear to drop, while no clear pattern over time can be found concerning the predicted probability of receiving a better job offer. Total factor productivity clearly grows from 2015 to 2019.

5.2. *On the relationships between the different IVs and the endogenous variables*

As pointed out in Section 4, it is not unreasonable to believe that changes in marginal taxes are endogenous in a job-to-job separation regression. Next year's marginal taxes are calculated based on this year' labour income, and this year' labour income can follow from workers' optimizing behaviour. Thus, to avoid the potential bias affecting the marginal tax rate in the job-to-job separation regression, we introduce a synthetic marginal tax rate as an IV. This synthetic tax rate is calculated using the tax schedule of year $t+1$, but rests on the lagged annual labour income from year t-2. This is less likely to be endogenous with respect to the separation decision in year $t+1$, since the lagged labour income from year t-2 and the tax schedule of year t did not generate a separation in year t. Still, we expect the synthetic marginal tax rate to be positively correlated with the next year's marginal tax rate.

Next, as pointed out in Section 4, for three reasons, the distribution of the predicted probability of receiving a better job offer is endogenous in Eq. (5)). Thus, to avoid all these three sources of bias, we follow Barth and Dale-Olsen (2024) and utilise information from the Accounting Register and estimate firm- and time-specific total factor productivity (TFP) based on the control function approach of Ackerberg et al. (2015) and Gandi et al. (2020). We apply a Cobb-Douglas value added production function, with capital and labour as factors of production, treat labour as a free factor and utilise intermediates in the control function to avoid the standard endogeneity issues relating to capital and labour in the production function estimation literature.

The wage offer distribution of Burdett and Mortensen (1998) is also a function of productivity, thus theoretically wage offers are a function of productivity.[15] To avoid reverse causality problems, we apply predetermined TFP (from year t-1) as an IV for the probability of receiving a better job offer. More productive firms are more likely to pay better and thus predetermined or lagged total factor productivity should be negatively correlated with the probability of receiving a better job offer. By shifting the labour demand at different productivity levels, we map the

[15] The wage offer distribution can be expressed as F(w) $= \frac{\delta+\lambda s}{\lambda s}\left(1-\frac{p-w}{p-b}\right)^{0.5}$, while $\overline{F}(w) = 1 - F(w)$. Total differentiating $\overline{F}(w) = -0.5\frac{\delta+\lambda s}{\lambda s}\left(\frac{w-b}{p-b}\right)^{-0.5} dw + 0.5\frac{\delta+\lambda s}{\lambda s}\left(\frac{w-b}{p-b}\right)^{-0.5}\left(\frac{w-b}{(p-b)^2}\right)dp$, which implies that for a firm at the profit-maximising level of $\overline{F}(w)$, i.e., when $d\overline{F}(w)$=0 , then $\frac{dw}{dp} = \left(\frac{w-b}{p-b}\right) >$ .Thus, firms increase their wages when productivity increases. Across firms, we therefore expect to see a negative relationship between the probability of receiving a better wage offer and total factor productivity.

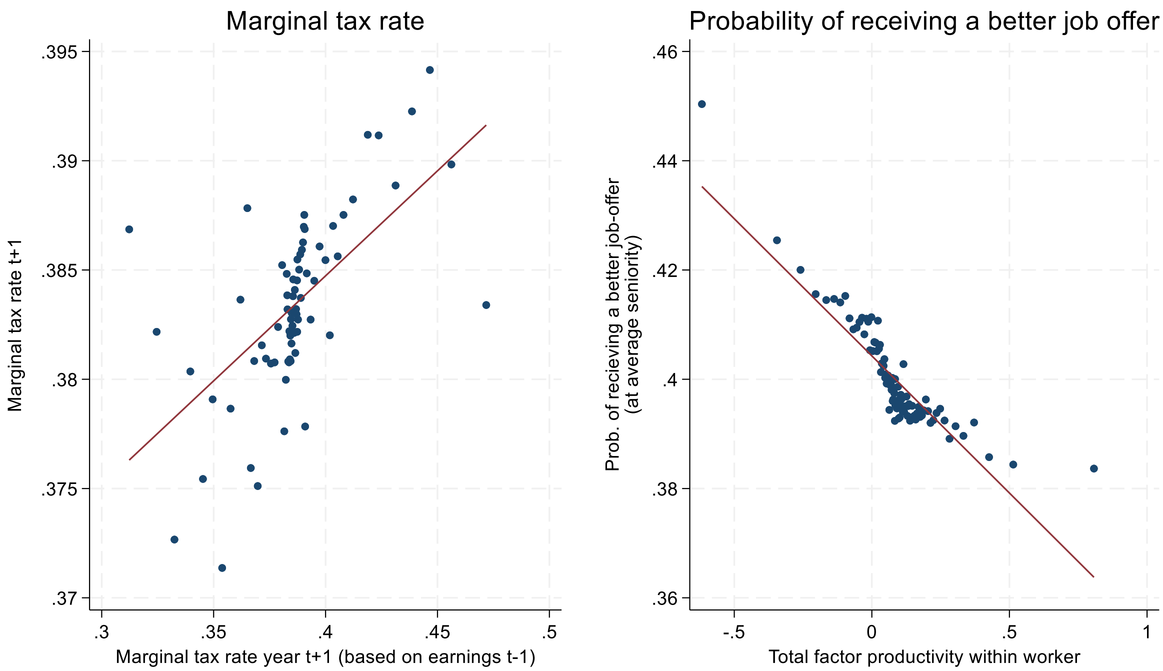

Fig. 3. The relationship between endogenous variables and corresponding IVs
Note: Binscatter of the relationships between the endogenous variables and corresponding IVs.

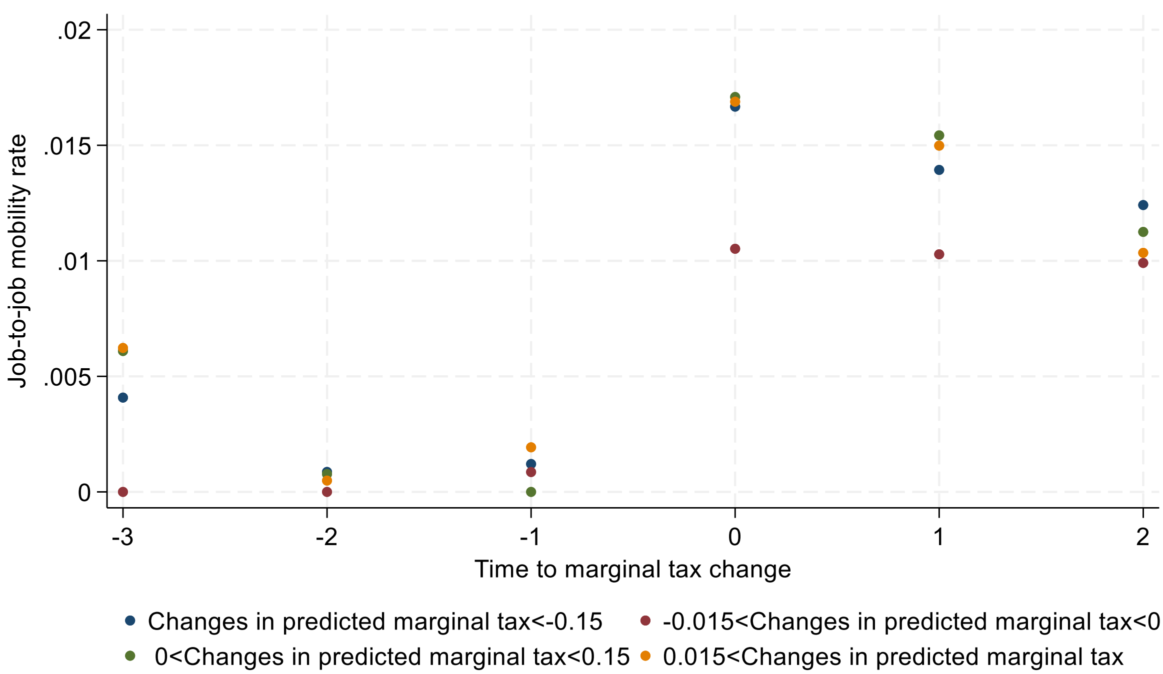

Fig. 4. On the relationship between changes in the predicted marginal tax rates and the impact on job-to-job mobility rates
Note: Binscatter of the relationship between job-to-job quits and the time to a change in the predicted marginal tax rate.

labour supply curve.

Fig. 3 shows simple bin-scatters of the relationships between the endogenous variables and the instruments measuring these relationships within worker, i.e., they are measured as deviations from worker means. On the left-hand-side of Fig. 3, we see, as expected, that the marginal tax rate is positively correlated with the synthetic tax rate. On the right-hand-side of Fig. 3, we see that total factor productivity is negatively correlated with the predicted probability of getting a better wage offer. This is also as expected, since higher total factor productivity should imply higher wage premiums, while higher wage premiums imply a lower probability of getting a better wage offer.

In Fig. 4, following Kleven and Schultz (2014) we ignore the issue of wage offers and their interactions with marginal taxes but just ask whether the job-to-job mobility rates of individuals facing different changes in predicted marginal tax differ before and after tax increases. We do not provide a full event study regression analysis, but present broad relationships in the form of binscatters.

We follow an event history approach and let event-time 0 indicate the year of the predicted tax increase (for roughly 10 percent of the workers, they face several tax increases, but in these cases, we only measure the first tax change). The predicted marginal tax rate that is estimated is similar to the first stage regression of the marginal tax rate in Eq. (5)), i.e., we assume that the marginal tax rate based on the tax schedule of year $y + 1$ given labour income year y is a linear function of the marginal tax rate based on the tax schedule of year $y + 1$ given labour income year y-1, year fixed effects, and worker fixed effects.[16] We have split the workers experiencing changed predicted taxes into four categories depending on the size of the change: i) large decline, ii) small decline, iii) small growth, and iv) large growth. Fig. 4 shows by simple binscatters that for all these four groups, the job-to-job mobility rates are small before the tax treatment, but when the tax treatment arrives (at time 0), the job-to-job mobility rates increase many times. Fig. 4 indicates that changing tax rates causes misalignment with respect to the return to work, and both growing and diminishing marginal tax rates are associated with quits. On average, the job-to-separation rate in our sample is around 12 percent, thus when the hike induced by the altered marginal taxes is around 1–1.5 percentage points, this constitutes a 10 percent increase in quits.

The relationships in Fig. 4, however, are affected by individual heterogeneity. As an alternative approach, first define and measure a marginal tax change as: $\widetilde{\Delta t}_{it+1} = t(\widetilde{I_{it-2}})_{it+1}$-$t(\widetilde{I_{it-2}})_{it}$, i.e., the tax changes based on the same earnings (for 2 periods ago). Then, we select workers who don't experience tax changes during our period of observation (our pure control group), and those who experience up to two times, but where we let the first indicate treatment time. This latter group of workers will be part of both the control and treatment group over time, and thus standard two-way FE-models will be affected by spurious correlations (de Chaisemartin and D'Haultfœuille, 2020; Borusyak et al., 2024; Sun and Abraham, 2021). We apply the Sun and Abraham (2021) estimator to our model[17] and estimate this model on four different samples:

i) "our" private sector sample, restricted to a balanced panel of workers
ii) Private sector jobs, restricted to a balanced panel of workers
iii) Private+public sector jobs, restricted to a balanced panel of workers
iv) Private+public sector jobs

In the Appendix, Table A3 and Figure A1 show the results. In all samples, we see an increase in the job-to-job quit probability following an increase in the synthetic marginal tax rate.

6. Results

6.1. General impact

Now we analyse how sensitive workers' separation decisions are to marginal taxes and firms' wage policies. We model the probability that worker i employed at workplace f at year t leaves for a new job at another workplace in year $t + 1$ by the simple linear probability model expressed by Eq. (5)), where we add the marginal tax rate, the predicted probability that the worker receives a better job offer, and the interaction between the two. Time dummies and the constant express the contributions to job-to-job transitions not related to job search, taxes and pay. In all our specifications, we also add a vector of lagged (t-1) earnings vigintile effects to absorb potential earnings effects affecting our IV (this control vector has negligible impact), a vector of age vigintile dummies and industry dummies.

The estimated parameter associated with the interaction yields direct evidence on how labour taxes affect job search behaviour. Note that we have subtracted the global mean from both the tax rate and predicted probability before calculating the interaction term, so the parameters capturing the tax rate and predicted probability directly yield the impacts measured at the global mean.

Table 3 presents the results from the regressions of Eq. (5)) based on observations from private sector firms linked to the accounting registers. From the discussion in Sections 4 and 5, we know that marginal taxes and the predicted probability that a worker receives a better job offer are likely endogenous, thus making simple FE regressions biased, likely towards zero. Thus, in models 1–4 we instrument these variables and their interaction using total factor productivity and marginal taxes based on lagged labour income (and their interaction). As the Kleibergen-Paap F-values reveal, these instruments perform nicely and are strong. The first stage estimates are presented in Table A1 in the appendix. This IV-strategy has a strong impact on our estimates (Model 5 presents non-IV estimates).

From model 1, we see that on average across these workers, increasing the marginal tax by 10 percentage points reduces job separations by 7.1 percentage points. Similarly, increasing the predicted probability that a worker receives a better job offer by 1 percentage point increases the separation rate by 0.69 percentage points. And we observe a strongly significant and negative parameter associated with the interaction term which tells us that the search intensity of workers drops as the marginal tax increases. However, due to the interaction term, it is difficult to interpret the total effect of marginal tax changes.

In Model 2, we address concerns in the recent ETI-literature pointing toward tax bracket creep as an endogenous source of tax variation. Thus, in Model 2, we add controls for the different income intervals defining the tax brackets and utilise only the within-bracket marginal tax variation over time. Model 2 shows that controlling for these income intervals defining the tax brackets has negligible impact on our estimates, i.e., most of the variation utilised to identify the tax effects are not related to changes in the tax brackets, but changes to the level of the general labour income tax and tax changes within the income intervals defining the tax brackets. In the rest of the paper, we utilise Model 1 as our preferred specification.

For completeness, we also present the simple FE regressions of Eq. (5)) in Model 5. These estimates tell us that, if we ignore bias from endogeneity, a 10 percentage points higher marginal tax imply a reduction in the job separation rate around 1.5 percentage points. Similarly, increasing the predicted probability that a worker receives a better job offer by 1 percentage point increases the separation rate by 0.38 percentage points. Thus, even in these biased regressions, workers' job search is hit by labour taxes, and firms' pay policies affect worker turnover.[18]

To ease interpretation, Fig. 5 depicts the marginal impacts on the job-to-job separation rate for increased marginal taxes and increased better job offer probabilities based on the estimates of Model 1 in Table 3. In the figure to the left, we measure the impact on the separation rate of a 1 standard deviation increase in the probability of a better job offer across the marginal tax distribution. We see that while the FE-estimates indicate that better job offer probabilities matter only marginally, but positively, on the separation rate, the IV-estimates reveal strongly diminishing impacts across the tax distribution. This means that if a worker is located at the bottom of the tax distribution, firm pay policies have a strong impact on his mobility, but as one moves up the tax

[16] The regression can be expressed as: $\widetilde{t}_{it+1} = \alpha_0 + + \alpha_t \widetilde{t}'_{it+1} + \alpha_Z Z_{ift} + t_t + \theta_i + \xi_{ift+1}$. Then $\Delta\widehat{\widehat{\widetilde{t}}_{it+1}} = \widehat{\widetilde{t}_{it+1}}$-$\widehat{\widetilde{t}}_{it}$ reveal tax changes.

[17] $Q_{ift+1} = \delta_0 + \sum_{t=y-3}^{t=y-2} \delta_t B_{ift} + \sum_{t=0}^{t=y+2} \delta_t P_{ift} + t_t + \delta_c X_{ift} + \Phi_f + \theta_i + \nu_{ift+1}$, where B and P express the before-treatment and post-treatment periods, Φ_f is a workplace-specific fixed effect, and θ_i expresses a fixed worker effect.

[18] Our motivation for restricting the analyses to private sector firms linked to the Accounting Registers was that this allows us to use total factor productivity as an IV for the predicted probability of receiving a better wage offer. If we conduct these fixed effects regression on private and public sector observations (the whole economy), we get rather similar parameter estimates.

Table 3
The impact of marginal tax and pay policy changes on yearly job-to-job separations. Men.

Dep: dummy for job-to-job separation $t+1$	IV-FE				FE
	Model 1 b/se	Model 2 b/se	Model 3 "Positive tax shocks" b/se	Model 4 -"Negative tax shocks" b/se	Model 5 b/se
$\widetilde{t}_{it+1}$	**−0.716****	**−0.728****	**−0.769****	**−1.656****	**−0.158****
	(0.206)	(0.217)	(0.304)	(0.567)	(0.011)
$\overline{F_{ft}(\Delta_{ft}^{s})}$	**0.692****	**0.707****	**0.930****	**0.658****	**0.380****
	(0.086)	(0.087)	(0.163)	(0.086)	(0.006)
$\widetilde{t}_{it+1}$ X $\overline{F_{ft}\left(\Delta_{ft}^{s}\right)}$	**−7.168****	**−7.186****	**−10.006****	**−10.525****	−0.115
	(1.137)	(1.120)	(1.955)	(2.045)	(0.067)
Strength of instruments					
Kleibergen-Paap F-value	426.33	474.43	163.98	89.74	
Controls					
All models: year FE, Worker FE, age vigintile dummies, predetermined/lagged earnings vigintile dummies, industry FE					
Tax bracket		Yes			
W	647,783	647,783	431,714	384,619	647,783
N	2503,178	2503,178	1117,743	912,618	2503,178

Note: For detail on first stage estimates, see Table A2. $^{**}p < 0.01$, (se clustered on workers).

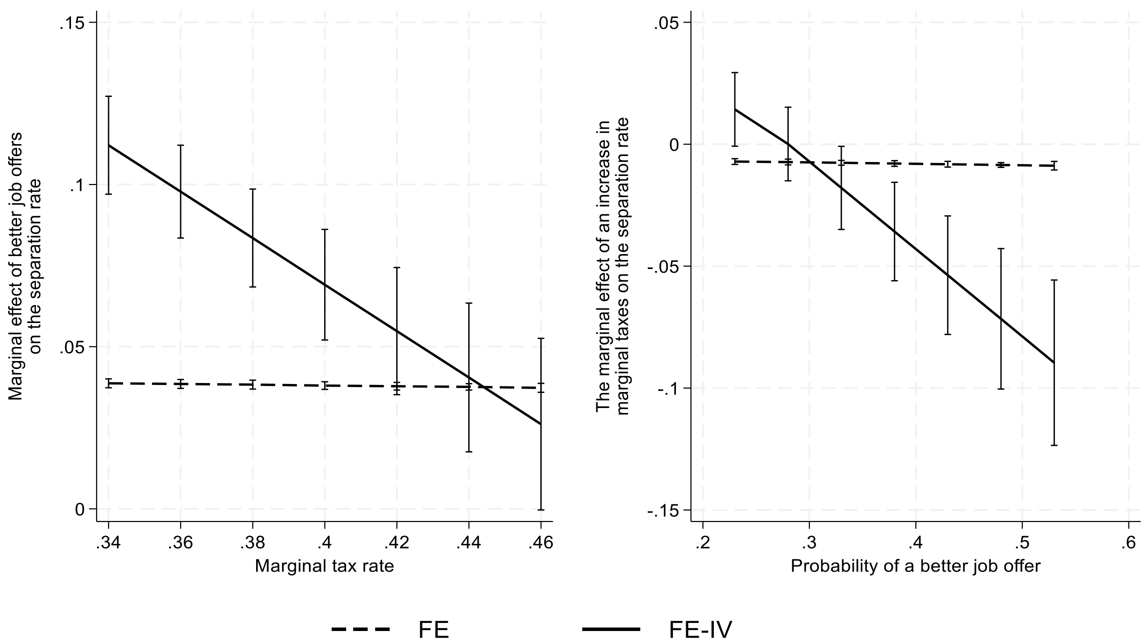

Fig. 5. The marginal impacts of the marginal tax and higher job offer probability on the job-to-job separation rate
Note: The marginal effects are estimated based on the parameter estimates of Model 1 in Table 3.

distribution, the importance of firm pay policies diminishes.

The figure to the right in Fig. 5 measures the impact on the separation rate of a 1 standard deviation increase in the marginal tax rate across the probability of receiving a better job offer distribution. We see that while the FE-estimates indicate that higher marginal taxes matter marginally, but negatively, on the separation rate, the IV-estimates reveal strongly diminishing impacts across the distribution of the probability of receiving a better job offer. Thus, if the worker is employed at a firm paying top wages, the probability of receiving a better job offer is small, and the future gain from mobility is limited already such that the marginal taxes have limited impact on mobility. However, if a worker is working at firm located at the bottom of the wage offer distribution, the probability of receiving a better job offer would be high, and the tax policy has a strong detrimental impact on this worker's search efforts and mobility decisions.

Are separations are affected more strongly by tax increases or tax reductions? To shed light on this issue, first we estimate the residuals from a simple linear regression of the marginal tax based on lagged income on year dummies, age group FE, industry FEs, lagged income vigintile FEs, and worker FE. Then, in Models 3 and 4 of Table 3, we repeat the analyses of Model 1, but nos study the potential differential impacts related to growing or diminishing marginal taxes as expressed by positive or negative residuals. We see those positive shocks to the marginal tax (as expressed by the residuals) yield an impact that is twice as strong as the equivalent negative shock. The positive impact of a better job offer on separations is stronger in the face of a negative tax shock than it is under a positive tax shock. The search effort, however, appears quite similar in intensity.

6.2. Pay schemes

Firms apply different strategies to motivate workers and ensure optimum performance of employed workers. One of these strategies is to pay bonuses whenever a performance target is reached. Bonus pay can be interpreted as a method of compensating workers for effort (which they dislike) thus eliciting better performance by workers.

Table 4
The impact of marginal tax and pay policy changes on yearly job-to-job separations. Men. Different pay regimes.

Dep: dummy for job-to-job separation $t+1$	Private sector+accounting registers			
		Model 1-FE-IV b/se	Model 2-FE-IV b/se	Model 3-FE-IV b/se
Bonus pay job$_{if}$		**−0.080****	**−0.085****	**−0.075****
		(0.003)	(0.003)	(0.003)
$\tilde{t}_{it+1}$		−0.281	**−0.716****	**−0.860****
		(0.197)	(0.206)	(0.209)
$\overline{F_{ft}(\Delta^s_{ft})}$		**1.531****	**0.679****	**0.618****
		(0.062)	(0.087)	(0.095)
t^{s+3}_{it+1} X $\overline{F_{ft}(\Delta^s_{ft})}$		**−8.490****	**−7.080****	**−9.459****
		(1.184)	(1.278)	(1.401)
BonusX$\tilde{t}_{it+1}$				**0.293****
				(0.055)
BonusX $\overline{F_{ft}(\Delta^s_{ft})}$				0.094
				(0.062
BonusXt^{s+3}_{it+1} X $\overline{F_{ft}(\Delta^s_{ft})}$				**7.199****
				(1.562)
First stage strength of instruments				
Kleibergen-Paap F-value	811.72	442.75	427.25	200.89
Controls				
In all regressions, yearFEs, Age group Fes, Worker FEs, income vigintile FEs				
Industry			Yes	Yes
W	647,783	647,783	647,783	647,783
N	2503,178	2503,178	2503,178	2503,178

Note: Details on first stage estimates, available from the authors upon request. *$p < 0.05$, *** $p < 0.001$ (se clustered on workers).
** $p < 0.01$,.

In Table 4, we ask whether the presence of performance pay alters our previous findings. We repeat the analyses of Models 1–2 in Table 3 while adding information on performance pay.

In Model 1, we just add a dummy identifying whether the job is salaried or if pay also incorporate bonuses. In Model 2 we also add dummies for industry because the occurrence of bonuses is highly related to industries and occupations.

In Model 3 we interact bonus pay, marginal taxes and the predicted probability of receiving a better wage offer, making it possible to study differential impacts depending on pay regime. Models 1 and 2 reveal a similar picture to Table 3 regarding the impact of marginal taxes and the probability that a better job offer is received. More interesting is the finding in both models that separations drop when bonus pay is utilised. This is of course only a correlation, but it suggests that those in bonus pay jobs do not dislike them. Adding industry controls in Model 2 has little impact. Finally, in Model 3 we see strongly significant results, but qualitatively they appear unchanged from previous findings with one exception: the job search intensity parameter becomes much more negative under fixed pay than under bonus pay.

To ease interpretation as we did for Table 3, we present in Fig. 6 the marginal effects from Model 3 associated with the tax rates and the predicted probabilities that a worker receives a better job offer. The left-hand side of the figure plots the marginal effect on the separation rate of a better job offer across the 10–90 percentiles of the marginal tax distribution. The right-hand side of the figure plots the marginal effect on the separation rate of higher marginal taxes across the 10–90 percentiles of the job offer distribution.

Fig. 6 reveals differences between the two pay regimes in how wage policies and labour taxes shape the separation patterns across firms, differences which becomes significant at the very top and the very bottom of the distributions. Employees under salaried contracts behave as seen in the previous tables and figures. If a worker is located at the bottom of the tax distribution, firm pay policies have a strong impact on his mobility, but as one moves upwards in the tax distribution, firm pay policies diminish in importance. For a worker employed by a low-paying firm, the tax policy has a strong impact on this worker's search behaviour and expected gains from search and thus astrong impact on the mobility decision. When employed by a high-wage firm, on the other hand, future gains from mobility are limited which itself should reduce job search intensity. Additional changes in the tax rates should have minor impacts on search but still induce mobility due to wage contract-effort misalignment.

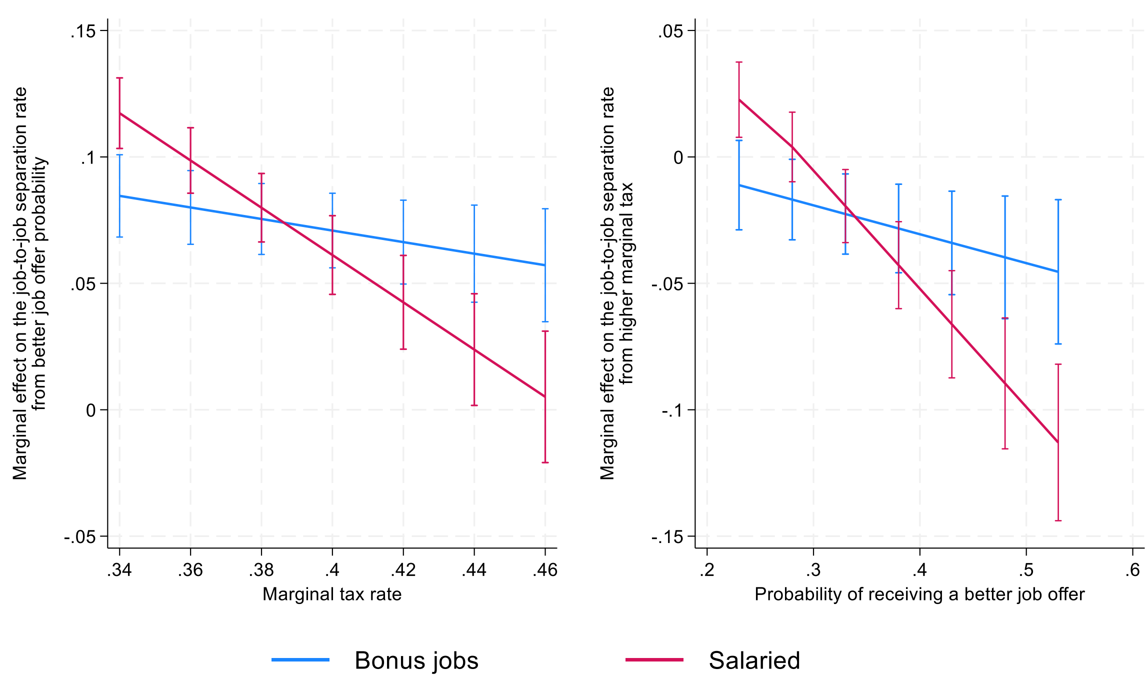

Fig. 6. The marginal impacts on the job-to-job separation rate from higher marginal tax and better job offers changes under different pay regimes.
Note: The marginal effects are estimated based on the parameter estimates of Model 3 in Table 4.

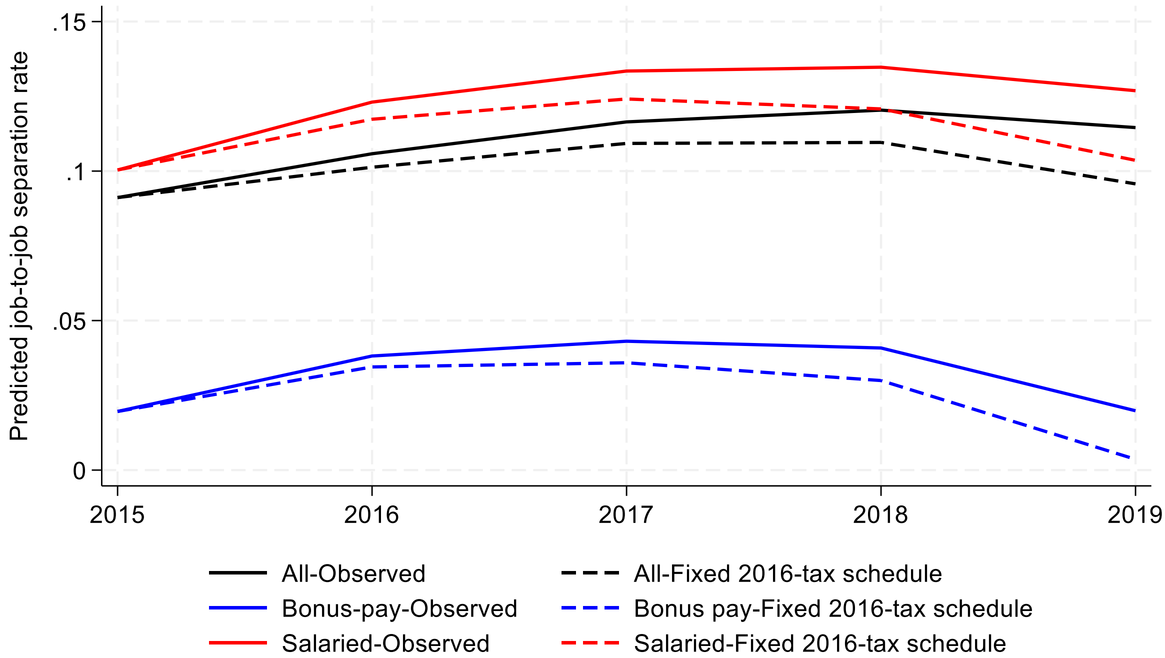

Fig. 7. Contrafactual development of job-to-job quits based on no marginal tax changes since 2016
Note: Figure on wage distribution is based on Model 2 in Table 3, while figure on pay schemes are based on Model 3 in Table 4. The graphs Fixed 2016-schedule express the contrafactual development, where we have kept the tax schedule of 2016 fixed for all years, except that we let the labour income brackets be adjusted by the growth in the National Insurance Basic Amount (G). Except for the marginal tax rate, all other variables are measured as observed, and we also assume that the population of workers, employers, industry and occupational choices are unaffected by the tax schedule.

These relationships for the salaried workers appear to be true for bonus-pay workers as well, but they appear much weaker. The mobility decision of bonus-job workers appears to be more sensitive to the wage premiums of firms at high tax levels but less at low tax levels, and their search decision is similarly less affected by the taxes. Whether this is true because these workers have less control over their actual pay (the pay of salaried workers is fixed and completely transparent) making it more difficult to evaluate search and mobility cost versus mobility gains, or whether there is another aspect associated with performance pay that influences mobility, we do not know.

6.3. *Contrafactual development*

In this final sub-section, we ask whether these changes in the tax schedule really matter, when it comes to job-to-job turnover. While the previous analyses clearly document that job-to-job turnover is affected in a statistically significant way, these impacts might not be economically sizeable and important. To shed light on this question, we present a simple, admittedly unrealistic, exercise. First, we assume that any changes in the tax schedule do not affect the number of jobs, pay and pay structure, work effort, occupational choices, or firms, except via the impact on job search and job-to-job turnover. These are highly unrealistic assumptions. We start our contrafactual analysis in December 2015 and stop in December 2019. Second, we fix the tax schedule to what is observed for 2016, i.e., no changes in the tax schedule occurred afterwards, except that we let the bracket intervals be inflation-adjusted by the National Insurance Scheme's Basic Amount (1 G). Then we predict a contrafactual development for all workers based on Model 2 in Table 3. Similarly, to highlight the importance of pay schemes, the same strategy is used, but where we apply the estimates from Model 3 in Table 4. For comparison, we use the observed values of the marginal tax to predict the realised job-to-job turnover pattern over time given the observed tax-schedule changes.

Fig. 7 presents our results. On average, we observe a minor growth in the job-to-job turnover rate over time, although it diminishes slightly in 2019. Similarly, workers in bonus jobs experience lower turnover and less steep growth in turnover rates than salaried workers. However, for all these groups, the job-to-job turnover rates decrease considerably when we fix the tax schedule to the level and structure of 2016. The impact is stronger on average in the economy and for those employed in salaried jobs than for those in bonus jobs. This implies that when the government reduced the progressivity of Norwegian labour taxes and reduces marginal labour taxes, they reduce labour market frictions, reduce employer monopsony power, and achieve improved reallocation of workers.

7. Conclusion

The literature on the elasticity of taxable income focuses on how taxable income changes in response to net-of-tax changes. Vattø (2020) estimates an elasticity in Norway around 0.11–0.15. Kleven and Schultz (2014) report values around 0.04–0.06 for wage earners in Denmark, but Kleven et al. (2024) find effects are more than twice as strong in the long-run than in the short-run. In Finland, Matikka (2016) identifies an elasticity of 0.16. On the other hand, Weber (2014) reports an elasticity as high as 0.86 on U.S. data from Michigan. The meta-study of Neisser (2021) reports average estimates ranging from 0.16–0.40 based on difference-in-difference analyses. Thus, the behavioural responses appear to be modest in the Nordic countries, while they can be considerably larger elsewhere. From this, one might infer that the marginal tax rates in Norway effectively ensure public finances, while contributing to redistribution. But it is worth recalling that tax responses diminish during bad times (Hargaden, 2020) and that the above-mentioned studies mix results over the business cycle. be aware that

Our starting point is somewhat different, in that our focus is on what responses (other than solely income) might follow from tax reforms and marginal tax rates. The presence of labour market frictions provides firms with monopsonistic powers, which potentially allow them to pay a mark-down on productivity (Manning, 2003; Langella and Manning, 2021). Considerable recent evidence establishes employer market power in the labour market (Dobbelaere and Kyota, 2018; Berger et al., 2022). Part of these frictions arises from the information flow related to job offers, which can be interpreted as job search intensity. A very sparse U. S. literature indicates that labour taxes affect the search behaviour of workers, and thereby the allocation of workers across firms. If search is reduced due to increased labour taxes, public tax authorities influence and provide firms with monopsonistic power, which is probably an unintended and unknown side-effect, since this means that the public authorities contribute to inequality in the labour market.

In this paper, we study how Norwegian workers' job mobility decisions are related to firms' wage policies under different tax regimes. We utilise population-wide Norwegian administrative register data for workers and firms during the period 2014–2019. The bulk of our analyses are for private sector employment relationships in firms reporting to the accounting register. However, this limitation of the data allows us to draw causal interferences.

By paying higher wages, job-to-job separation rates drop, but this negative relationship is weakened when the marginal tax increases. Higher taxes imply strictly reduced search activity, but less for workers employed in bonus jobs. For these bonus jobs, it does not matter whether the worker is located at the bottom or the top of the tax distribution, firm pay policies always have a strong impact on these workers' mobility.

Our findings are quite clear: public authorities' tax policies affect the search intensity of workers and thus they contribute to labour market frictions, thereby inducing misallocation of workers across firms and wage inequality between groups not related to productivity differentials. In Norway, during our observation period, income taxes became less progressive, thus public authorities reduced the distortion and welfare loss associated with monopsony. Our observation period is a stable period and might even be considered a good time for the Norwegian economy. Previous literature relating business cycles to search in equilibrium search models find that firms' monopsonistic power varies countercyclically, i.e., when labour demand is at its lowest, then firms' ability to pay a mark-down on wages is at its highest (Moscarini and Postel-Vinay, 2016a, 2016b; Hirsch et al., 2018). Thus, in our observation period, firm monopsony power is likely at its lowest, and workers' mobility is highly sensitive to wages. At the same time, tax responses increase during good times (Hargaden, 2020). Overall, this implies that we observe stronger behavioural responses than what we would expect in bad times. Future research should address how sensitive worker search is to variation in pay and taxes over the business cycle.

CRediT authorship contribution statement

Alex Bryson: Writing – review & editing, Writing – original draft. **Harald Dale-Olsen:** Writing – review & editing, Writing – original draft, Resources, Project administration, Methodology, Funding acquisition, Formal analysis, Data curation, Conceptualization.

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Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.labeco.2025.102750.

Data availability

The authors do not have permission to share data.

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