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Turning Non-members into Members: Do Public Subsidies to Union Membership Matter?

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Abstract

Using linked employer-employee data for Norway we estimate the impact of changes in tax subsidies for union membership on individuals' membership probabilities. Increased subsidisation of the unions increases union take-up, while increased union fees reduce the demand for membership. The price elasticity of demand for union membership is -9 percent in 2012, though effects are heterogeneous across workers. In the absence of the hikes in tax subsidies and holding workforce composition constant aggregate private sector union membership density would have fallen by 5 percentage points between 2001 and 2012. But it would have fallen by 10 percentage points among those on temporary contracts, for instance.

Key-words: trade unions; union membership; wages, tax subsidies
JEL codes: J01, J08, J50, J51

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1. INTRODUCTION

Union membership is on the decline and has been falling for several decades. This is true in major industrial countries such as the UK and Germany, but also in the previously strongly organised Nordic countries (Addison et al., 2011; Schnabel, 2013; Bryson et al., 2019; OECD, 2017).[4] The decline in union membership rates appears to go hand in hand with an increase in non-typical employment relationships, such as temporary work, part-time jobs, and with growth in transitory low-wage jobs in the service sector. By sorting and selection, these jobs are dominated by immigrants and workers with weaker attachment to the labour market, such as youth, i.e., by groups with lower membership rates than the typical adult worker (Bryson et al., 2005; Aleks et al., 2020; Cools et al., 2021; Høgedahl and Møberg, 2022). Recent trends towards a polarization in the labour market (Autor et al, 2006; Goos and Manning, 2014; Goos et al., 2014), with increasing demand for workers at the bottom of the occupational earnings distribution, appear to occur in parallel with a deterioration of pay and working conditions. The dwindling influence of unions is likely to amplify the impacts of these trends. Furthermore, given OECD (2018) arguments that unions and collective bargaining could potentially play an important role in creating more and better jobs, labour market inclusiveness, and resilience and adaptability, declining unionization could be problematic.

The tax subsidization of union fees is one policy measure that may help to uphold union membership rates. Union membership attracts a tax subsidy in many countries including Germany (where work membership is deductible) and the UK, and until recently attracted a tax subsidy in the United States.[5] Assuming that union membership is a normal good, one would expect demand for that good to reflect its net price. Thus, changes in net membership fees induced by changes in the tax subsidy should affect individuals' membership decision in the same way as tax subsidies affect the demand for other workplace-provided goods and services.

Unlike most of the OECD where unionisation rates are in the decline, unionization rates in Norway have been relatively stable. In the period from 2000 to 2012, union membership was practically flat in Norway, whereas the decline continued in most other countries. During the same period, the tax subsidy on union membership fees quadrupled in Norway, raising a question as to whether this policy played some part in maintaining unionization rates.

In this paper we analyse how sensitive the demand for unionisation is to the union fee and how it responds to tax subsidies. Our focus is on the impacts of tax subsidies on different segments of the

[4] According to the OECD (2017), average unionisation rates among employees have almost halved in three decades from 33 percent in the mid-80s to 17 percent today.

[5] In December 2017, President Trump signed the Tax Cuts and Jobs Acts into law, removing this tax subsidy opportunity. Previously, dues and initiation fees paid for union membership were entered as unreimbursed employee expenses on Line 21 of Schedule A (Form 1040) Itemized Deductions.

labour market. Perhaps tax benefits only stimulate membership rates of high wage workers in stable jobs in firms where unions are already strong? In that case, tax subsidies against union fees might exacerbate the impacts of polarization and increase inequality in the labor market. On the other hand, if the subsidies stimulate membership rates among marginal workers in low paying jobs, they may tend to offset the impacts of polarization on inequality.

Although the literature on the determinants of union membership is rich[6] it does not consider the price of union membership. Abowd and Farber (1982), Farber and Krueger (1993), and Riddell (1993) are examples of papers adopting a supply and demand framework which assumes prices are set at the intersection of demand and supply for the union good settled in equilibrium, but this price is in practice not observed. We are the first to examine the effects of tax subsidisation on the demand for the union good and for groups less attached to the labour market specifically.[7]

Unions strengthens the bargaining power of workers, but they also provide workers with an important voice that improves information flows both at the workplace and in the political arena (Freemand and Medoff, 1982). Union representation at the workplace is necessary to enhance information flows and to reap possible gains from trade within the company. In Barth et al (2020) we find that union membership within firms increases both wages and productivity. Public policies often rely on trade unions to supply worker voice, both in fashioning policy and in delivering what the European Union often refers to as "social dialogue", that is, discussions between representatives of workers and employers. The decline in unionisation rates may reduce union effectiveness in supplying worker voice and, in many cases, workers will simply lack credible representation, raising questions about the viability of a policy approach based on social dialogue (Forth et al., 2017). In bargaining systems with coordination at higher levels of bargaining, broad-based union membership is key to ensure that coordination internalizes externalities across bargaining units, such as the impact on prices (Calmfors and Driffill, 1988) or unemployment (Nickell et al 1991).

It is conceivable that union decline is due to falling demand for the union good, the problems unions face in supplying the union good, or a mixture of the two. Our contribution to this literature, which is reviewed in Section Two, is to establish the price elasticity of demand for the union good, holding the quality of the union good constant, using exogenous variance in its net price arising from changes in its tax subsidisation. We know from studies of other workplace-provided goods and services that

[6] For example, see the book edited by Bennet and Kaufman (2007), Schnabel and Wagner (2007) and the survey-articles of Mason and Bain (1993), Riley (1993) and Schnabel (2013).

[7] In Barth et al. (2020), we study the effect of union density on Manufacturing firms' productivities and use the same tax subsidies as an instrument for union density in firms and provide some results on individual membership in the discussion of the first stage. Similarly, Dodini et al. (2022) and Kostøl and Svarstad (2022) apply the changes in tax subsidies as IVs in analyses of wage inequalities and relative labour demand.

demand for them is strongly linked to tax subsidisation. For example, Gruber and Lettau (2004) estimate that removing the subsidization of employer-provided health care would reduce insurance spending by 45 percent. Similarly, Gutiérrez-i-Puigarnau and Van Ommeren (2011) find that the subsidization of a "company" car by the tax system leads to households demanding a more expensive car and driving more miles privately. Beneficial tax treatment increases employees' demand for stock options (Austin et al., 1998) as well as employers' supply, since employees tend to exercise stock options when corporate taxable income is high, shifting corporate tax deductions to years with higher tax rates (Babenko and Tserlukevich, 2009).

Our setting is Norway, a place that has seen substantial changes in the rate of tax subsidy for union membership in recent years, as we show in Section Four. The exogenous change in tax treatment of the union good should induce a change in the net price of the good which, assuming there are no instantaneous adjustments to the quality of the union good offered, permits us to capture the price elasticity of demand for that good net of quality adjustments. We find increased subsidisation of the union good increases union take-up, while increased union fees reduce the demand for membership. The price elasticity of demand for union membership is -9 percent in 2012 (the last year for which we have data).

Our results show that tax subsidies tend to stimulate union membership in segments of the labour market where workers are more vulnerable. We find that young workers, immigrants, part-time workers, and low-wage workers have a significantly larger elasticity of union membership with respect to the subsidy than their counterparts. Workers in typical entry level occupations for youth and occupations with a higher share of temporary workers also respond more to the subsidy than other occupations. Furthermore, workers in small firms, young firms, and firms with low productivity and levels of capital are more sensitive to the subsidy. The only results that counter this persistent pattern is that high-skill workers appear to be more sensitive to the subsidy than low-skill workers. While high-skilled workers are not among the vulnerable groups in the labour market, they are still among the groups with low union membership.

Consistent with these observations, we find the elasticity of response to tax subsidies is lower where initial workplace union density was higher. Thus, the tax subsidy stimulates union membership in the segments of the labour market where unions have low representation in the first place, including segments of the labour market where workers are most vulnerable.

The structure of the remainder of the paper is as follows. In the next section we discuss the current literature on the demand for unionisation and of the relationship between unionisation and wages. In Section 3 we present a simple model for union membership. In Section 4 we present the Norwegian

system for tax deductions for union membership fees and the development over time. Data is presented in Section 5. In section 6 we describe the development in union density over time for public and private sectors and for major industries. In Section 7 we study the relationship between the tax deductions, union fees and union membership. Finally, in Section 8 we study in more detail who responds how much and where they work. Section 9 briefly concludes.

2. PREVIOUS LITERATURE

In many industrialised countries the number of individuals purchasing membership began to decline in the early 1980s. This has serious consequences for unions for a number of reasons. First, in most countries, including Norway, unions are voluntary membership organisations largely reliant on membership fees for their revenue. Their financial viability, and thus the supply of the union good, can be jeoparised if workers are less inclined to pay union dues (Willman et al., 2019; Willman and Bryson, 2009). Second, union density is often treated as a proxy for union bargaining power on the grounds that unions' ability to restrict the supply of labour to an employer (for example, through the threat of strike action) rises as the proportion of workers it represents rises. There is ample evidence from the union wage effects literature to confirm that this is the case (eg. Stewart, 1987; Lee and Mas, 2012). If that bargaining power wanes, so too does unions' ability to procure the union good that members are paying for.

The reasons why union membership is in decline are disputed, but analysts point to a number of proximate causes which, it is often asserted, are consistent with a decline in the demand for the union good. One part of the literature emphasises the role played by structural changes in the economy, such as the decline in employment in heavy industries characterised by manual labour where the demand for unionisation has been traditionally strong (Bain and Elsheik, 1976). Others speculate that cohort effects may be at play, with younger workers – referred to by Bryson et al. (2010) as the Facebook generation - less inclined to think in terms of collective action than the previous generations of workers who entered the labour market as the proportion union members was rising. Acemoglu et al. (2001) suggest skills-biased technological change has resulted in deunionisation by increasing the outside (non-union) options of skilled workers (effectively reducing their desire for union membership), thus undermining coalitions of skilled and unskilled workers in support of unions.

Another tranche of the literature suggests aspects of the union good face increased competition from union substitutes, effectively reducing demand for the union good. For instance, in European countries like Germany unions are increasingly facing competition from statutory-based forms of worker representation, such as works councils, which can be accessed without a membership fee

(Addison, 2009). Unions also face competition from employer-led initiatives to generate worker voice. In a series of papers Willman and co-authors track the growth in non-union employer-made mechanisms in Britain which, they argue, indicate employers choosing to 'make' voice as opposed to the 'buy' option implied by contracting worker voice out to trade unions (Willman et al., 2019). These employer-based systems have the potential to reduce employee demand for union-generated voice.[8]

New statutory entitlements at work may undermine union efforts to bargain for better terms and conditions of employment, thus reducing the net benefits to membership, and thus demand for the union good. For example, Forth and Bryson (2019) show statutory increases in holiday entitlements reduced the paid holiday premium associated with union membership. Similarly, growth in employment protection legislation may limit the value of the insurance component of the union good.

In a recent development in the literature unions are viewed as a cost disease sector (Willman et al., 2019). Cost disease organisations are highly labour intensive and, as such, unable to avail themselves of the productivity-increasing advantages of technological inovation. This, in turn, leads to sliggish productivity growth, resulting in price stickiness relative to the other goods and services workers may wish to purchase. As such the relative price of the union good rises and, unless this is matched with a commensurate rise in the quality of service, so demand for the good may fall.[9]

Whereas these trends might betoken a decline in demand for the union good, direct measures of change in demand for unionisation are lacking in most studies and the union demand story is not the only possible explanation. For instance, while it may be the case that heavy industies dominated by manual labour did engender higher demands for unionisation (eg. because they were risky, hazardous places to work), their large plants may simply have been easier for unions to organise, thus reducing the costs unions faced in supplying the union good at a given level of demand. A related literature tracking direct measures of demand for unionisation challenges the assertion that demand has fallen over time. Indeed, most of the literature for the Anglo-Saxon world suggests there is what Towers (1997) referred to as a 'representation gap' wherein many workers desirous of unionisation did not get it. This gap has been growing in recent years among workers in the United States (Bryson and Freeman, 2013). There are, perhaps, two primary reasons for the persistence of a representation gap and declining union membership. The first is a supply-side problem associated with unions'

[8] The situation is a little different in the United States since the Wagner Act places strict limits on employers' ability to invest in alternative non-union forms of voice where unions have won the right to operate as employees' sole bargaining agent following a successful campaign for union recognition (Bryson et al., 2019).

[9] Unions may increase their use of what Willman and co-authors term "off-balance sheet" resources to supply the union good. These off-balance-sheet resources include union lay-representatives, that is, volunteers from the employee workforce prepared to take on the mantle of union representative. There is indeed evidence that unions in Britain have responded by doing so (Willman and Bryson, 2009).

increasing inability to organize and represent workers wishing to purchase union membership. This supply-side problem may reflect the marginal costs of organizing (especially in growth sectors of the economy where workers are hard to locate, and difficult to mobilise) – what we might think of as part of Olson's (1965) first order collective action problem. It may also reflect unions' recognition that they face substantial marginal costs associated with servicing such workers (Olson's second order collective action problem) which limits the value of organizing non-union workers, even if they desire union membership.

The second possibility is that the representation gap does not really exist, in the sense that, although individuals claim they would 'vote' union or purchase union membership if it was available, in practice they discount the costs of purchasing the good when asked the question in a survey. When faced with the actual costs of organising and purchasing membership, perhaps they forgo the opportunity to generate the union good and purchase it? This is plausible, not least because the costs of unionisation to a worker extend beyond the pecuniary costs of membership. In the absence of a union, workers must organise to trigger the supply of a union good. This can often entail organising in the face of employer opposition, something that can result in vulnerability to dismissal or actions short of dismissal which limit one's career chances. These practices are well-documented in the United States but recent work by Breda (2013) has shown that, even in a country like France, those who volunteer to be union representatives suffer a substantial wage penalty relative to what they might have earned if they had not become union representatives.

Even where unions are organised, that is, where there is a supply of the union good, there is a large public good component to what unions do which can lead to free-riding behaviour whereupon non-members benefit from union coverage without paying dues. The classic solution to this problem discussed by Olson (1965) was the closed shop which required the purchase of membership where unions were present. However, in countries like the UK the closed shop is no longer legally enforceable, resulting in a sizeable rise in free-riding behaviour (Millward et al., 2000; Bryson, 2008).[10] Unions may have responded by putting more effort into the procurement of private excludable goods which were only available to members, but there is little evidence that this has happened.

The union good is co-produced by those who purchase it. In the case of the union wage premium, for example, higher union density is usually linked to a higher union wage premium due to increased

[10] In the United States free-riding remains relatively uncommon because states usually require workers in unionised workplaces to pay a union fee in recognition of their bargaining services, even if the individual chooses not to be a member. This arrangement does not exist in what have been called 'right to work' states, and recently more states have switched to a 'right to work' arrangement which, it is anticipated, will lead to an increase in free-riding.

union bargaining power (Stewart, 1987). One might therefore have thought that, with falling union density, the quality of the union good may have declined, such that the quality-adjusted price of membership may have risen over time.[11] But there is no clear evidence that this has happened. Indeed, evidence suggests relative stability in the union wage premium over time (Blanchflower and Bryson, 2007).

The above presupposes that unionisation is, broadly speaking, a normal good. However, in a series of papers Gomez and co-authors have portrayed union membership as a good with both search components (the union wage premium) and experience components. The experience good model has important implications for the propensity of workers to purchase union membership once membership has begun to decline. Given the experiential component to the union good, the chief way in which workers establish the value of union membership for themselves is reports from colleagues and friends (Bryson and Davies, 2018). These recommendations are less frequent in a world where a growing percentage of employees are never-members (Bryson and Gomez, 2005). One way to increase the likelihood of purchasing an experience good is to offer it at a discount initially, to induce purchase, then raise the price subsequently in the expectation that the purchaser will be prepared to pay the full price having recognised the quality of the good. In practice, this rarely happens, although there are instances in which students or newly qualified professionals do qualify for lower membership rates (eg. in teaching and nursing).

What remains unresolved in this literature is just how much workers are prepared to pay for the union good holding the quality of the good constant. Changes in the tax subsidy for membership, plus the actual union dues paid by workers, provide an opportunity to estimate the price elasticity of demand for union membership by looking at the proportion of workers flowing into and out of union membership as the net price of membership changes. We can do this in the Norwegian case, a setting where local bargaining at workplace level remains very important, even though there are also union bargaining structures in place at sectoral and, sometimes, firm level.

3. UNION MEMBERSHIP AND TAX SUBSIDIES, WHAT TO EXPECT?

Building on a rich literature on the determination of union membership we presented in Barth et al (2020) a simple model of the worker's choice between becoming a union member or not in the

[11] Booth (1985) presents a social custom model of union membership in which the cost of unionisation is partly offset by foregoing the reputational damage of non-membership in an environment where unionisation is the norm or custom. Also see Booth (1994). In recent times, where the norm is non-membership, this reputational damage is reduced or no longer exists, thus reducing (increasing) the relative cost of (non)-membership.

presence of tax subsidies. Since this is the key choice that we study in our empirical analysis, we provide a brief recap of the model here to motivate our empirical strategy. The union provides two kinds of services attractive to workers; they may increase the wage, and they may provide various forms of insurance and legal services at discounted prices. Assume that the utility of each worker can be expressed by a Cobb-Douglas utility function, depending on insurance, I, and consumption (or a composite good), C:

(1) $U = I^{\alpha} C^{(1-\alpha)}$,

Each worker faces a budget set, which differs depending on union membership:

(2) Union: $p_I^U I + C + P - S = W_U$,

Non-union: $p_I^N I + C = W_N$,

Where C is the numeraire good, $p_I^U \leq p_I^N$ are the prices of insurance for union and non-union members, P is the union membership fee, S is a tax subsidy amount on union membership, and the Ws are wages. Let $\tilde{\alpha} = [\alpha^{\alpha}(1-\alpha)^{1-\alpha}]$, so that the indirect utility functions may be written as:

(3) Union: $V^U = \tilde{\alpha}\left[\frac{1}{p_I^U}\right]^{\alpha}[W_U - (P - S)(1 + c)]$,

Non-union: $V^N = \tilde{\alpha}\left[\frac{1}{p_I^N}\right]^{\alpha} W_N$.

The monetary costs of union membership are P-S, and we allow for heterogeneity across workers by discounting the monetary costs by a factor $(1 + c)$. The term c varies across workers and represents their perceived costs, attitudes, or mental rewards from being member of a union. The average worker considers only the monetary costs and benefits of joining (c= 0), whereas some workers discount the costs of joining ($c < 0$), for instance because they believe in collective action, have a political leaning towards the left, have a strong attachment to the workplace, feel a responsibility towards fellow workers, or enjoy being part of the group; while other workers may have the opposite attitudes and rather tend to exaggerate the costs of joining (c> 0). The cost of membership may also be attenuated or magnified by both union and management's actions towards membership and non-membership. The non-monetary costs of joining a local union may be decomposed in to two components: a systematic component, γ_j representing relative costs or benefits as perceived by segment j in the labour market, and a random component ε with zero mean, such that for individual i, $c_{ij} = \gamma_j + \varepsilon_{ij}$.

The bargaining power of the union is represented by the difference, Δ, between the union and non-union wage:

(4) $W_U = \Delta + W_{N,}$

Union dues may be used to improve on workers' bargaining power, for instance through the size of strike funds, such that: $\Delta = \delta P + d$ with $\delta > 0$ and d>0. Different segments in the labour market typically possess different initial bargaining power, such that $\Delta_j = \delta P + d_j$ for segment j.[12]

A worker becomes a union member if V^U-V^N>0. The utility differential is given by:

(5) $V^U - V^N = K\{\Delta + g - (P - S)(1 + c)\}$,

whose sign is independent of K=$\tilde{\alpha}\left[\frac{1}{p_I^U}\right]^{\alpha} > 0$. g= $\left(1 - \left[\frac{p_I^U}{p_I^N}\right]^{\alpha}\right) W_N$ is the value of the price discount on insurance for union members and Δ is the difference between union and non-union wage. We may write the condition that $V^U - V^N > 0$ as:

(7) $\delta - 1 + \delta\left(\frac{S}{P-S}\right) + (d + g)\frac{1}{P-S} - \gamma > \varepsilon$,

We define $\frac{S}{P-S}$ as the subsidy ratio. Equation 7) shows that conditional on the union membership fee, the probability of becoming a union member is increasing in the subsidy ratio. The choice of becoming a union member may be analysed using a simple linear regression model of union membership on the inverse of the net membership fee and the subsidy ratio:

(8) M = a + b$\frac{1}{P-S}$ + $\delta\frac{S}{P-S}$ - γ + u.

Where M is a dummy variable for union membership. We have b=d+g>0. Given this functional form[13], the relationship between membership and S and P are given by $\frac{\partial M}{\partial S}$=$[\frac{1}{P-S}]^2[\Delta + g]$>0 and $\frac{\partial M}{\partial P}$= - $[\frac{1}{P-S}]^2$[d+g+ δ S]<0 and the elasticity of membership with respect the subsidy is given by:

$$E_{m,S} = \frac{\partial M}{\partial S}\frac{S}{\bar{M}} = \frac{S}{P-S}\ \frac{1}{1-\frac{(P-S)(1+\gamma)}{\Delta+g}},$$

for the average level of membership, while the elasticity of membership with respect to the fee is:

$$E_{m,P} = \frac{\partial M}{\partial P}\frac{P}{\bar{M}} = -\frac{P}{P-S}\ \frac{1}{1-\frac{(P-S)(1+\gamma)}{\Delta+g}}$$

[12] Potentially Δ might also depend on firm union density, e.g., comprising thresholds, but such modelling makes the model unduly complex for our purpose.

[13] The average union membership is 43 percent in our sample and the membership rates are within the range of 22 to 69 percent for all segments considered in this paper, and we have chosen a simple linear probability model to estimate the parameters in our model.

Segments of the labour market

We note that the elasticity of membership with respect to the subsidy is expected to be lower for segments of the labour market where the gains of membership, $\Delta_j + g$, are large. In these segments average membership levels are already high. The gains of membership are larger where firms have higher revenue per workers, such as capital intensive- or high tfp-firms as well as in industries where firms have more market power in the product market. These segments of the labour market are characterised by high wages, good working conditions, and high union density.

On the other hand, the elasticity of membership with respect to the subsidy is expected to be high where the relative non-monetary costs of membership, represented by γ_j, are perceived as large; or similarly, where the relative non-monetary gains are perceived as small. Workers with low attachment to the labour market, or perhaps with little experience, such as temporary workers, part-time workers, or youth or immigrants, may typically be workers with shorter employment spells and lower attachment towards fellow workers, and thus both smaller perceived gains and higher coordination costs, together with workers in younger firms who may face relatively larger start-up costs related to coordination efforts to solve free-rider problems. All of these are typically worker in more marginal segments of the labour market, characterized by low unionization rates, lower pay, and worse working conditions.

From this discussion, we hypothesise that the subsidy is likely to have the largest relative effect among workers with low attachment to the labour market, lower unionization rates, lower pay, and worse working conditions, while it is likely to have a smaller relative effect in segments where overall conditions for workers are better. We investigate this hypothesis by comparing the derived elasticities from our estimated models between groups of workers representing the different segments of the labour market. Note that we estimate the coefficients of the models separately for each segment (using interaction terms), allowing the coefficients to vary freely between segments, so that the estimated differences are not just artifacts of functional form.

4. DATA AND DESCRIPTIVES

We exploit population-wide administrative register data provided by Statistics Norway. *The administrative register data*, collected by the Norwegian Tax Authorities and Social Services, comprise the whole Norwegian population of workers, workplaces and firms during the period 2001-2012 (around 2,500,000 worker observations each year) and provide information on individuals and jobs including income, earnings, work hours, occupations[14], wages and union membership fees. Unique identifying numbers exist for individual workers, workplaces, and firms, thus allowing us to track these units over time. We denote the workerXfirm-combination as a worker's job. We limit the data to workers aged 20-60 years of age in private sector jobs. Our final data set contains 12097568 job observations of 1731149 workers employed each year.

Workers' hourly wage is constructed from the tax data based on job- and spell-specific annual earnings, spell length and contracted weekly working hours.

Union membership

Workers' union status is apparent from the administrative tax data containing annual union fees. To avoid volatility in union fees arising from spells of individuals not working, we focus on employed workers by October 15 reporting taxable income in year t, t∈(2001,2012), above 1G (G is the Social Service's baseline figure, 1G is equivalent to £8685 in 2011), i.e., we restrict the analyses to roughly 2,000,000 jobs each year or 24,200,641 observations over the whole period.

While the OECD (2017, 2018) documented a decline over time in union membership in many western economics, they also show that membership rates in Norway have been more stable. Table 1 shows trends in union density in our data separately for different industries and segments of the labour market.

Overall, private sector union density over the period 2001-2012 was roughly static, slightly above 43 percent. There is also substantial and persistent heterogeneity in union density rates across different parts of the private sector: almost six-in-ten workers in Manufacturing and Transport were members in 2012, compared with one-third in Construction and a quarter in Trade.

[14] Note that occupational codes are registered from 2003, but these identify occupations for workers employed previously (2001-2002). Of roughly 24 million observations, 286 000 workers have unidentified occupations, whereof 200 000 and 70 000 are employed in 2001 and 2002, respectively. For workers with missing information on occupation, we impute occupational codes based on 3-digit educational qualification codes (occupational codes and educational qualification codes do not overlap).

Table 1 Union membership across sectors and across worker, firm and occupational characteristics (in percent). 2001/2012. Private sector.

	2001	2012	Growth		2001	2012	Growth
Sectors				Workplace/firm characteristics			
All	43.3	43.5	0.2	Hourly wage (fe)-low	29.8	27.1	-2.7
Manufacturing	60.0	55.1	-4.9	Hourly wage (fe)-high	54.4	51.8	-2.6
Construction	35.4	30.7	-4.7	Workforce size-small	12.7	14.9	2.2
Trade	23.5	22.8	-0.7	Workforce size-large	64.3	60.1	-4.2
Transport	56.8	57.3	0.5	Capital (value)-low	16.2	19.4	-3.2
Worker characteristics				Capital (value)-high	62.7	61.0	-1.7
Women	38.1	36.7	-1.4	Productivity(tfp)-low	19.9	22.6	2.7
Men	43.1	39.6	-3.5	Productivity(tfp)-high	54.2	57.6	3.4
Natives	42.2	41.1	-1.1	Workplace young(2 years)	27.9	26.8	-1.1
Western immigrants	30.4	23.5	-6.9	Workplace old (30 years)	63.4	56.5	-6.9
Non-western immigrants	33.1	31.9	-1.2	Occupational characteristics			
Young	28.8	30.1	1.3	Temporary work –low	38.9	35.7	-3.2
Old	50.6	49.0	-1.6	Temporary work –high	35.3	32.4	-2.9
Full-time	43.7	40.5	-3.2	Physical strain-low	47.8	48.9	1.1
Part-time	31.1	29.9	-1.2	Physical strain-high	44.2	32.7	-11.5
Education-low	40.9	32.3	-8.6	Psychol. strain-low	46.7	40.6	-6.1
Education-high	37.4	39.9	2.5	Psychol. Strain-high	41.5	37.5	-4.0
Hourly wage (fe)-low	39.4	38.2	-1.2	Entry occupation youth	36.2	33.8	-2.4
Hourly wage (fe)-high	34.7	33.4	-1.3	Not entry occup. youth	45.3	40.7	-4.6

Note: Population: Workers between 20 and 60 years of age, employed by December 31th each year. Low and high (young/old, small/large) groups are defined based on the 10th and 90th percentile in the distribution of the relevant characteristic. Education is measured by years of schooling above compulsory schooling. Hourly wage (fe) for workers and firms expresses fixed worker and fixed workplace effects estimated from a log hourly wage regressions based on observation from the years t-4 to year t (i.e., for each year, estimated based on the last 5 year). Capital is measured as the value of fixed assets. Productivity is estimated for each firm as unobserved TFP based on a Trans-log value added production function using standard ACF-estimation (Ackerman, Caves, and Frazier, 2015). Except the information on the entry occupations, the occupational characteristics are based on information from the Level of Living Surveys 2003, 2006, 2009 and 2013, and express the share of workers in the occupation that: i) respond that they work in temporary positions, ii) that are physically tired each working day, and iii) psychologically tired each working day. Entry occupation youth is defined as the 10 most prevalent 3-digit occupations for workers below 26 years of age.

Not surprisingly, Table 1 also reveals that membership is low in the more vulnerable segments of the labor market. Young workers, immigrants, and part-time workers have lower membership rates, as have workers in typical entry level occupations for youth and occupations with a higher share of temporary workers. Furthermore, workers in low paying firms, small firms, young firms, and firms with low productivity and levels of capital show lower membership rates.

Union fees, tax subsidies, and the subsidy ratio

Since it is not possible to know the union fee for union non-members we have followed the simple rule of designating each worker a job class based on their main economic activity (2-digit SIC code X 3-digit occupational code, resulting in a total of roughly 7,000 cells). The job cell is used as a proxy for the trade union where the worker would belong. We then calculate the average union fee for each job class based on union members only, and then link this fee to every worker in the job class, regardless of membership status.

Union membership is subsidized in Norway as a deduction on taxable income. Table 2 shows the development of the deductions allowed for union membership given by the tax system over the period 2001-2012. Row 1 is the gross deduction. Employees benefit from the subsidy amount reported in row 2, calculated as 28% of the deduction in income, since that is the marginal tax rate on income after dedications.[15] The third row shows the average gross fee. The subsidy amount rose more than four-fold over the period, whereas the average membership fee rose 1.5 times, such that the subsidy was equivalent to 7% of the average membership fee in 2001, rising to 21% in 2012. Between 2012 and 2022 the subsidy amount has been kept constant, and for that reason we do not use data after 2012 in our analysis.

Table 2 Subsidy of union membership 2001-2012. (NOK)

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Union fees (gross)												
Private sector	3318	3452	3609	3740	3912	3951	4136	4219	4406	4505	4656	4794
Manufacturing	3793	3977	4113	4262	4536	4567	4822	4822	5101	5214	5375	5548
Construction	4183	4434	4669	4844	5105	5187	5417	5641	5819	5885	6099	6285
Trade	3085	3201	3314	3444	3582	3640	3858	3875	4111	4173	4313	4442
Transport	3408	3523	3752	3918	4021	4101	4234	4301	4485	4607	4885	5004
Tax subsidies												
Income deduction	900	900	1450	1800	1800	2250	2700	3150	3150	3660	3660	3750
Tax Subsidy	250	250	410	500	500	630	760	880	880	1020	1020	1050

Note: Income deduction is the maximal deduction in taxable income and the tax subsidy amount is 28% of the deduction in income (Barth et al 2020). The average gross union fee is calculated from our data and our population of workers between 20 and 60 years of age. All measures in NOK (in 2011 1£=9.032NOK and 1$=5.607NOK).

The government determines the size of the subsidy at the end of the previous tax year. No explicit pronouncements were made as to why the tax subsidy rose, but it is linked to changes in political

[15] Norway has a progressive tax system, but the progressivity arises at the level of gross taxable income. For income after deductions, the tax rate is basically flat at 28 percent over the period we consider.

power in Norway. The tax subsidy associated with union membership was cut by 50% between 1998-99 by the liberal-conservative Bondevik-coalition government (from 1800 NOK to 900 NOK) leading to union protests. In the October 2005 election the Labour Party gained power at the expense of a liberal-conservative coalition. It retained power in the election of 2009.

We define the subsidy ratio for union member i belonging to job class c at time t as:

$$S\_ratio_{ict} = \frac{s_t}{\overline{p_{ct\notin\iota}} - s_t}$$

where s_t is the subsidy amount in year t, while $\overline{p_{ct\notin\iota}}$ is the leave-out-mean union membership fee of workers belonging to job class c (where worker i is excluded).[16] Similarly, we define the net union fee inverse for worker i belonging to job class c at time t as:

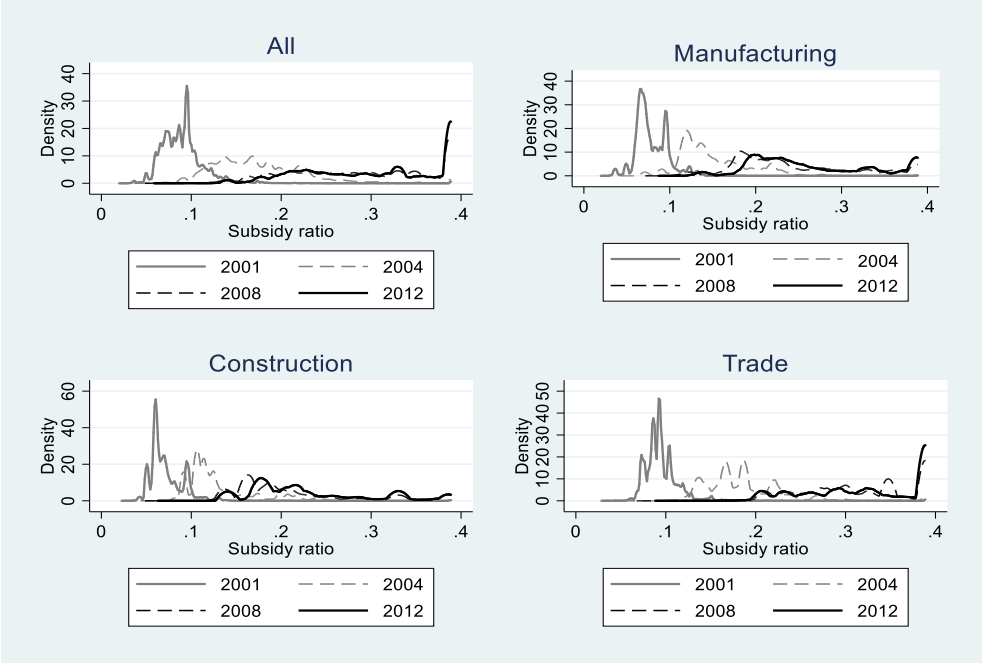
$$N\_fee_{ict} = \frac{1}{\overline{p_{ct\notin\iota}} - s_t}.$$

Since we calculate membership fees among union members by job class, we may allocate a potential fee to non-members as well, using information on their job class. We thus use information on membership fees to calculate the subsidy ratio for all workers.

The distribution of the subsidy ratios for all workers and for the three major industries are presented in Figure 1. The distribution is shown for four different years, 2001, 2004, 2008 and 2012. The figure shows that the subsidy ratio rises from a little under a median of 10% at the beginning of the period to between 25% and 30% at the end of the period. We also see that the distribution of the subsidy ratio becomes more dispersed over time.

[16] The leave-out-mean is given by $\overline{p_{ct\notin\iota}} = \frac{(\sum_{jc} f_{jct} - f_{ict})}{(n_{jct} - 1)}$, where j denotes all workers in job class c (including worker i).

Figure 1 Distribution of the subsidy ratio over time. Across workers. Private sectors.



Note: Private sector workers 20-60 years of age, employed by October 15th each year.

5. RESULTS: UNION MEMBERSHIP AND THE SUBSIDY RATIO

In this section, we establish empirically the relationship between the subsidy ratio and union membership as outlined in our theoretical discussion in Section 3. The interaction between the union membership fee (inverse) and the subsidy amount provides variation in the subsidy ratio across job-cells (proxy unions) within the same year, even if the amount of the subsidy each year is the same for all workers. The following simple linear probability model for individual i in firm j at time t utilizes this variation:

$$(8) \qquad U_{it} = \beta^X X_{it} + \beta^S S\_ratio_{ct} + \beta^F N\_fee_{ict} + \theta_a + \gamma_t + \varepsilon_{it},$$

where U is a dummy variable for union membership, X_{it} is a control vector comprising age vigintile dummies and a dummy for part-time work, the subsidy ratio (S_ratio) and membership fee (N_fee) varies across job cells (proxy unions)[17], θ_a are fixed effects covering job-cells (a=c) and come

[17] Since the union fee is calculated as leave-out-mean it varies between workers within job-cell as well, however, since all job cells encompass large numbers of workers this source of variation is negligible and to emphasize the significant source of variation, we drop index i on the union fee.

specifications and job-spells (a=ij, where j is the firm in which the worker is employed) in other specifications, γ_t are year fixed effects, and ε_{it} is a standard error term.

Table 3 presents the results from the estimation of Equation 8) for all private sector workers. Models 1 and 2 present the results when job-cells (proxy unions) are defined by 3-digit occupation and 2-digit industry. The first model conditions on job-cell fixed effects, producing an elasticity of membership with respect to the subsidy ratio of .39, and a price elasticity of -.44. The second model identifies the model based on within job-spell variation, producing the corresponding estimated elasticities of .19 and -.20. By taking care of all fixed worker and firm characteristics, observed and unobserved, this is our preferred estimator.

Since variations in union fee and the subsidy ratio use job-cells as proxies for trade unions, we also present results that rely on different definitions of job-cells. The next two columns provide results from the same specification, using job-spell fixed effects, but where variation in union fees and subsidy ratio are defined by different aggregations of job cells (proxy unions). Model 3 calculates the subsidy ratio and net union fee by job-cells defined by 1 digit occupation and sector, whereas in Model 4, 1-digit occupation and 1 digit-industry defines the job-cells. We note that the estimated elasticities with respect to the subsidy ratio are very similar regardless of the coarseness of the job-cell definition, while the price elasticity is smaller (in absolute value) when estimated using the coarser definitions.[18]

.

[18] In a working paper version of this paper, we report from further robustness checks, investigating how sensitive our results are to other definitions of a job class (or union). We do this for 6 different definitions: 1) Blue/white collarX14 main industriesXprivate sector, 2)1-digit occupational codeXmain industryXprivate, 3)Blue/white collarX2-digit SIC code, 4) 1-digit occ. code X2-digit SIC code, 5) 2-digit SIC code X 3-digit occ. code Xprivate, and 6) 5-digit SIC code X 3-digit occ. code Xprivate. Thus the number of job class varies from 36 in 1) to over 20000 in 6), and then repeat the analysis of Model 2 of Table 4 and those of Table 5 for all workers. Our main results remained qualitatively unchanged across different defintions of the job class (union). Even with our most broad definition, Blue/white collarX14 main industriesXprivate sector, with variation in the union price across only 26 different job classes or unions, we still identify qualitatively similar albeit somewhat weaker estimates to those we found in Tables 4 and 5. When we specify a specification providing more variation, our estimates become very similar to our previous estimates.

Table 3 The impact of the subsidy ratio on the probability of union membership. Different definitions of job-cells. Private sector.

Job cell:	3-digit occupation X 2-digit industry		1-digit occupa-tion	1-digit occupation X 1-digit industry
	Model 1	Model 2	Model 3 – robust 1	Model 4 – robust 2
Subsidy ratio	0.4780***	0.2292***	0.2737***	0.2864***
	(0.0476)	(0.0414)	(0.0773)	(0.0928)
Net union fee inverse	51.9251***	7.1107**	-137.2928***	-145.7976**
	(17.9251)	(5.0415)	(8.6637)	(78.1502)
Controls				
Age, woman, part-time	Yes			
Fixed job cell effects	Yes			
Fixed job effects		Yes	Yes	Yes
Elasticities:				
Subsidy elasticity 2012	0.3918***	0.1850***	0.1974***	0.2062***
Price elasticity 2012	-0.4442***	-0.1988***	-0.1204***	-0.1243***
W (job cell)	3573	3405	24	118
J (jobs)	26008301	2595301	2587467	2587467
N (observations)	13627474	12196503	12154431	12154431

Note: Dependent variable: dummy taking the value of 1 if worker is a union member. Private sector workers between 20 and 60 years of age. Population denoted by column head. FE (within)- linear regressions. Panel unit: job-cell and job-spell (workerXfirm). Baseline job cell is defined as sectorX3-digit occupationX2-digit industry. In Model3, job cell is defined as just 1 digit- occupational code. In Model 4, we let job cell be defined as 1-digit occupational codeX1-digit industry code. All models include the following control-vector: year dummies, part-time dummy, age vigintile dummies. Standard errors adjusted for worker-clustering presented in parentheses. ** and * denote 1 and 5 percent level of significance.

We have estimated the model separately by industry, allowing for different effects for blue- and white-collar workers within each industry using interaction terms. Table 4 reports the estimated elasticities[19]. We find that workers in Trade are more sensitive to the subsidy than workers in the other industries. Outside of manufacturing it seems that white collar workers are more sensitive than blue collar workers, a pattern reflected in the price elasticity as well.

This section has shown that on average, across the economy and separately for key industries, the public tax policy stimulates union membership. In the next section, we study our key focus, how changes in tax rules affect different segments of the labour market. We also conduct counterfactual analyses, to simulate what would have happened if no tax changes occurred.

[19] The regression models are presented in Table A3 in the appendix

Table 4 The impact of the subsidy and the union fee on the probability of union membership within key private industries. Elasticities. 2012.

	Manufacturing		Construction		Trade		Transport	
	White	Blue	White	Blue	White	Blue	White	Blue
Subsidy elasticity	0.1916***	0.1849***	0.2076**	0.3593***	0.4004**	0.4921***	0.1539**	0.2237***
Price elasticity	-0.2054***	-0.1919***	-0.2269***	-0.2464***	-0.4303**	-0.5204***	-0.1646**	-0.2347***

Note: Workers between 20 and 60 years of age. Population denoted by column head. White and blue denote white-collar and blue-collar workers, respectively. See Table A3 in the Appendix for details on the regressions. ** and * denote 1 and 5 percent level of significance.

6. SEGMENTS OF THE LABOUR MARKET

Does the public tax policy stimulate membership in some segments of the labour market more than others? To answer this question, we repeat the analyses based on Model 2 of Table 4 separately for different worker and firm groups. Groups of workers are selected using worker, occupational, and firm characteristics. Table A1 in the appendix provide the share of workers in each segment in our data.

The elasticities of the probability of union membership with respect to the subsidy are presented in Table 5. The elasticities are calculated for 2012 based on regression results reported in Tables A3 and A4. Consider worker characteristics first. The effect of subsidies is significantly larger for *women* than for men. This means that the same increase in the subsidy induces a larger relative impact on union density among women than among men. Similarly, there is a large difference in the impact of the subsidy on *immigrants* and non-immigrants, with membership of non-western immigrants being the most sensitive to subsidy changes. Workers *below 40 years of age* are much more impacted than older workers, and *part-time* workers respond more than full-time workers. There is also a significant, but not very large, difference between *low*- and high-wage workers. The pattern is clear; workers with lower pay, lower attachment, and lower unionization rates are more sensitive to changes in the subsidies.

Next, we look at characteristics of the occupation. We have defined a set of *entry jobs for youth* as the 20 most prevalent 3-digit occupations for young people in their first job after their graduation[20], comprising about 75 percent of all the entry jobs for youth. Workers in these occupations are more sensitive to tax subsidies than worker in other occupations. We also defined a set of occupations with

[20] We used the sample of workers between 25 and 35 years of age in 2018 and went backwards to find the occupation of their main job in May the year after graduation from their highest attained level of education. See online appendix for a description of the entry jobs.

a high prevalence of *temporary contracts.*[21] We have also defined a set of occupations with high prevalence for physical- and psychological strain (see online appendix for details).

We see that for all groups the elasticities associated with the subsidy are significantly positive. Workers in entry jobs for youth and workers in occupations with a high share of temporary contracts have higher elasticity than other occupations. While a high share of physical strain does not appear to make a difference, occupations with a high share of psychological strain are somewhat more sensitive to tax changes than other occupations.

Table 5 How subsidizing union membership affects the uptake of union membership for different groups. Subsidy elasticities 2012. Private sector.

	Group	Subsidy elasticity	Group	Subsidy elasticity	Difference in elasticity
Worker characteristics					
Gender	Men	0.1623***	Women	0.4042***	0.2419***
Country of origin I	Native	0.2204***	Western Immigrant	0.5512***	0.3308***
Country of origin II	Native	0.2204***	Non-western Imm.	0.8907***	0.6702***
Age worker	Young	0.5581***	Old	0.1268**	-0.4313***
Education	Low educ.	0.2249***	High educ.	0.3576**	0.1327***
Work hours	Fulltime	0.0771**	Part-time	0.2034**	0.1265**
Hourly wage (worker fe)	Low wage	0.2884***	High wage	0.2320***	-0.0564***
Occupational characteristics					
Entry occupation youth	Non-entry	0.2162***	Entry	0.3720**	0.1557***
Temporary work	Low share	0.1988***	High share	0.4177***	0.2188***
Physical strain	Low share	0.2412**	High share	0.2243**	-0.0169
Psychological strain	Low share	0.1867**	High share	0.2676**	0.0809**
Workplace/firm characteristics					
Age of plant	Young	0.3740***	Old	0.1898***	-0.1842***
Hourly wage (plant fe)	Low wage	0.3493***	High wage	0.1958***	-0.1534**
Workforce size	Small	0.4763**	Large	0.1903***	-0.2860***
Capital (value)	Low	0.4281***	High	0.1930***	-0.2351***
Productivity (tfp)	Low	0.4071***	High	0.1917***	-0.2153***

Note: The subsidy elasticities and differences are estimated based on the parameters from several linear probability models as those in Table 3, but where we have added cross-terms associated with the relevant characteristic (see Appendix tables A4-A5 for parameter estimates and other details). The subsidy elasticities and differences are then estimated based on the 10th and 90th percentile values in the distribution of the relevant characteristic (exception gender, country of origin, work hours). ** and * denote 1 and 5 percent level of significance.

The elasticity of union membership with respect to tax subsidies varies considerably according to workplace characteristics as well. Membership in *young plants, low wage plants, small plants, less*

[21] A list of occupations with high prevalence of temporary jobs is reported in the online appendix.

capital intensive, and low productivity plants are more sensitive to tax changes. Low union density is a common factor between these categories of plants.

Table 6 shows the elasticity of membership with respect to tax subsidy by *workplace union density*. Both for white- and blue-collar workers we find a declining pattern by workplace union density.

Table 6 The impact of the union subsidy on the probability of union membership over the union density distribution. Subsidy elasticities. 2012. Private sector and selected industries.

	Workplace union density			
	1-21	22-50	51-75	76-100
A) Private sector				
White collar	1.0469***	0.5089**	0.2878**	0.1434**
Blue collar	0.7458***	0.4066***	0.2078***	0.0886***
B) Manufacturing				
White collar	0.8465***	0.4705**	0.2697**	0.1375**
Blue collar	0.7965***	0.4031***	0.2202***	0.1567***
C) Construction				
White collar	0.7192***	0.3733**	0.1272**	0.0460**
Blue collar	0.8758***	0.4370***	0.1983***	0.1129***
D) Trade				
White collar	1.2246***	0.6098**	0.3765**	0.2053**
Blue collar	0.8064***	0.3611***	0.2808***	0.1889***
E) Transport				
White collar	0.9615***	0.5245**	0.2248**	0.1117**
Blue collar	0.7631***	0.4856***	0.2614***	0.1340***

Note: Based on workers between 20 and 60 years of age and observations from 2002-2012. The first year of observation for all firms and their employees is discarded. The workplace union density distribution is estimated as lagged leave-out-mean union rate at the workplace. Population denoted by column head. See Table A5 in the Appendix for details on the regression. ** and * denote 1 and 5 percent level of significance.

Actual and Counterfactual Trends

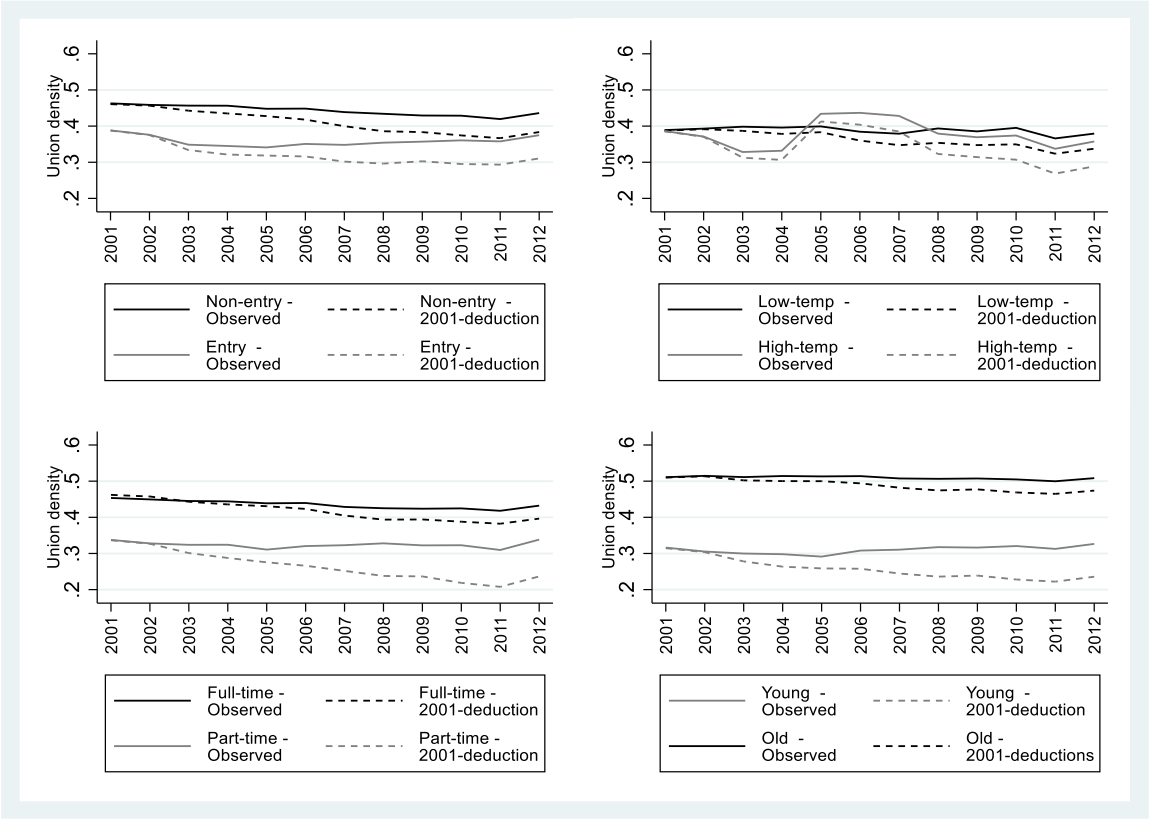
The estimated elasticities are statistically significant but appear not very large in size.[22] One way to assess the impact of the changes in tax rules is to simulate what would have happened if no tax changes occurred. We use our estimated model to predict union density each year *keeping the tax rules from 2001 unchanged* and find that union density would have declined from 43.3 percent to about 38.5 percent without the increase in subsidies, compared with the actual tiny growth from 43.3 to 43.5. Union density would thus have been 5 percentage points lower in 2012 under the constant

[22] Compared to employer provided benefits union membership appears to be more inelastic. Consider for example health-related benefits. In their review article, Pendziak et al. (2016) find optional primary health care elasticities ranging from -0.1 to -1 in the U.S., and between -0.6 and -4.2 in Germany.

tax regime compared to the actual development with increasing subsidies. However, these aggregate impacts across all workers are not our key topic. How did the changes in tax rules stimulate the union take up among workers less attached to the labour market?

In Figures 2 and 3 we show the actual and counterfactual development of union density for five selected groups of workers and jobs (and comparison groups): entry jobs for youth, occupations with many temporary contracts, occupations with many part-timers, young workers, and immigrants.

Figure 2 Counterfactual analysis of union membership for young and old workers, entry-occupations for youths, temporary contract occupations, and part-time workers. Constant compositions of jobs.



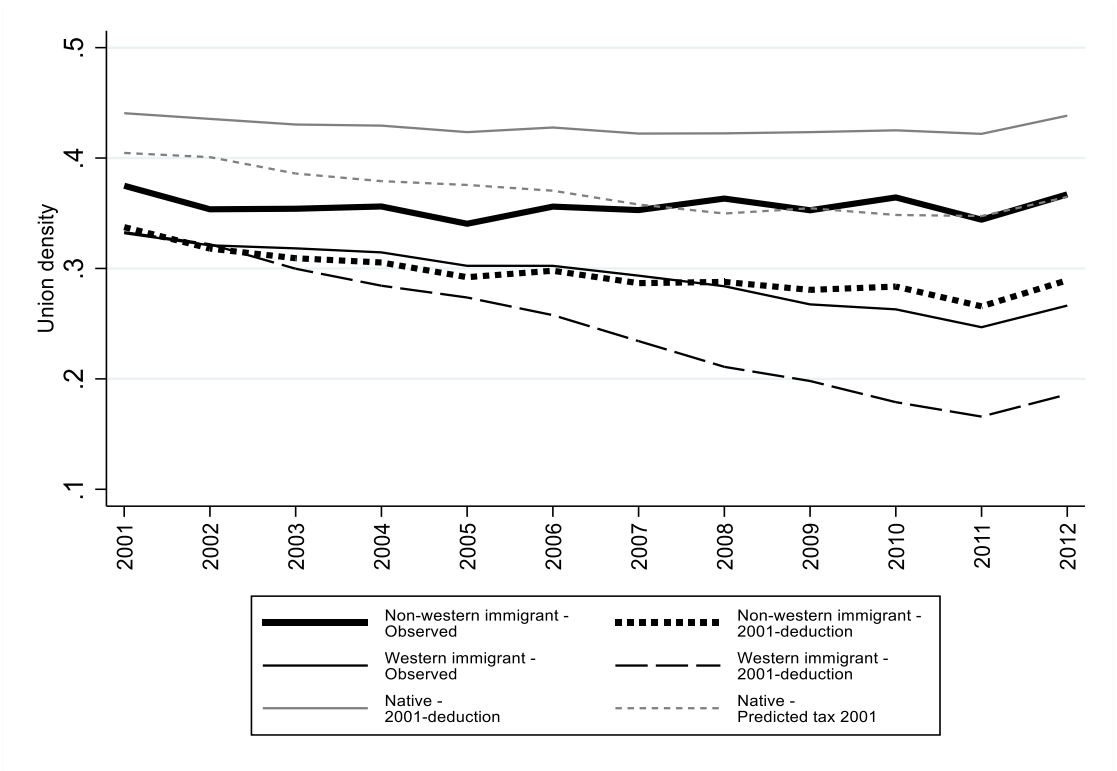
Note: Population: Private sector workers between 20 and 60 years of age, employed by December 31th each year. Entry and non-entry denote workers employed in occupations which are typically entry occupations (or not) for youths. Low-temp and high temp denote workers employed in occupations with low share and high share of temporary contracts, respectively. Full-time and part-time denote workers employed full-time and part-time, respectively. Young and old denote young and old workers, respectively.

In the upper left panel of Figure 2 we see that the aggregate union density for *entry jobs for youth* would have been 9 percentage points lower under the 2001 tax rules. While the actual development shows a convergence in union density between entry jobs and other jobs, the counterfactual difference would be retained. In the upper right panel, we see that union density of occupations with *high prevalence of temporary contracts* would have been 10 percentage points lower. The impact on part-time occupations was also stark. In 2012 the union density of *part-time occupations* would be 10

percentage points lower, dropping by 1/3 from a level of 32 percent. Again, the actual development shows convergence between part-time occupations and the other occupations. A very similar pattern is revealed for *younger workers*, and we note that the difference between actual and counterfactual development is quite small for workers above 40 years of age.

Figure 3 shows the results for *immigrants* by region of origin. We see a reasonably steady development of actual union membership for non-western immigrants, but a steady decline in the counterfactual case. For western immigrants the observed decline in union membership would have been magnified and ended up below 20 percent without the increase in subsidy.

Figure 3 Counterfactual analysis of union membership for native, western immigrant and non-western immigrant workers. Constant compositions of jobs.



Note: Population: Private sector workers between 20 and 60 years of age, employed by December 31th each year. Non-western, western and native denote non-western, western and native workers.

9. CONCLUDING DISCUSSION

Although tax subsidisation of the union good is present in several countries in Europe and North America, it is not a policy tool that has been actively deployed to support union membership. We find, however, that tax subsidies in the form of taxable income deductions for union membership fees tend to increase union membership rates. Since other countries with lower density levels have similar tax treatment of unionisation, it would be wrong to claim that the subsidization of union membership

is what determines the rather high union density level in Norway. However, the subsidization has clearly counteracted an otherwise underlying negative trend. In the absence of the hikes in tax subsidies, aggregate private sector union membership density in Norway, while keeping the job composition fixed, would have fallen by 5 percentage points since 2001.

We find that tax deductions have the strongest relative impact on the margins of union membership; notably the segments of the labour market where union representation is weaker in the first place. These typically comprise newcomers to the labour market, such as younger workers, and immigrants, or workers with a more marginal attachment to the labour market, such as workers with part-time or temporary jobs. Workers in low paying firms, smaller firms, low productivity firms, and firms with low capital intensity are also more sensitive to changes in subsidies.

Younger workers and immigrant workers have the largest elasticity of union membership with respect to the subsidy. They are newcomers in the labour market with low attachment and probably face obstacles in terms of associating with trade unions. They would also be important groups for unions to capture, since union membership is likely to display high persistence for each worker over time. Note, however, that while the segments we have used are mutually exclusive within each category of characteristics, the different characteristics are not. For instance, young workers may be more prevalent in smaller firms, immigrants in temporary jobs, and so on, and separate regressions does not capture these correlations. The possibility of such correlations between the observed categories should thus be noted when interpreting these differences.

We also find that workers with higher education are more sensitive to the tax subsidy. While educated workers are neither vulnerable nor marginal in relation to labour market attachment, they are often marginal in relation to union membership. They often have better outside options, and based on their human capital, a stronger individual bargaining power within the firms.

In sum, we find larger impacts for workers with lower membership rates. This observation is supported by the observation of a strong negative relation between the elasticity of membership with respect to subsidy as we move from low union density firms towards firms with high union density. A higher elasticity for groups with lower union density is of course enforced by the fact that a given marginal effect produces a larger relative effect in groups with low union density. However, as the marginal effects are estimated in separate regressions, or with separate interaction terms for each segment, the estimated differences between segments of the labour market are not simply due to this mechanics but rather follows from models where the coefficients are allowed to vary freely between the segments.

Union tax subsidies have been promoted by a fairness argument. Employers deduct their costs before they report their taxable income, and union fees may be viewed in same way as workers' cost related

to the employment relationship. We find that union tax subsidies may have a strong influence on union membership rates, and thus strengthening workers' voice and bargaining power in the labour market. Comprehensive union coverage may also be a precondition for coordination among unions and is likely to shape the ability of confederations of unions to internalize workers' interests more broadly. The extent to which one is supportive of such subsidies should thus be strongly influenced by one's general view on trade unions' role in the economy, including possible gains and costs associated with more comprehensive coordination among unions and "social dialog" in general.

Through its impact on the bargaining power of unions, tax subsidies are likely to improve workers' pay and working conditions. As the impact on union membership is relatively stronger among more vulnerable and marginal segments of the labour market, union tax subsidy is also a policy tool that may counteract the ongoing trends towards greater inequality among workers.

Appendix

Table A1 Descriptive statistics.

	Mean	St. Dev		Mean	St. Dev
Worker characteristics			Union and tax characteristics		
Women	0.3453	0.4754	Union	0.4016	0.4902
Western immigrant	0.0597	0.2369	Union fee (gross)	4074.269	1131.214
Non-western immigrant	0.0592	0.2359	Net union fee	3389.412	1043.833
Age worker	39.2097	10.6304	Net union fee inverse	0.0003	0.0001
Years of education	3.2154	2.5536	Subsidy ratio	0.2147	0.0999
Part-time	0.1808	0.3848			
Worker fixed effect[y]	0.1035	0.5266			
Occupational characteristics					
Entry occupation youth	0.3238	0.4679			
Temporary work	0.0960	0.0767			
Physical strain[x]	0.3035	0.1072			
Psychological strain[x]	0.1556	0.0823			
Workplace/firm characteristics					
Age of plant	16.0185	11.9486			
Workplace fixed effect[y]	0.0034	0.4554			
LnWorkforce size[z]	4.4055	2.3094			
LnCapital (value)[z]	9.9206	3.3576			
Productivity (tfp)[z]	7.0699	1.2105			

Note: Workers between 20 and 60 years of age observed from 2001 to 2012. Mean and standard deviation based on 13626763 observations, except when noted [x], [y], and [z]. [x] Mean and standard deviation on 8931078 observations. [y] Mean and standard deviation on 10255820 observations. [z] Mean and standard deviation on 9681767 observations.

Table A2 The impact of the subsidy ratio on the probability of union membership within key private industries

	Manu-facturing	Construc-tion	Trade	Transport
Subsidy ratio	0.3151***	0.2250**	0.2810**	0.24736***
	(0.0321)	(0.1093)	(0.1421)	(0.0591)
Net union fee inverse	9.2816***	11.6836	9.3206	7.1813
	(2.6729)	(62.6853)	(41.2050)	(7.7604)
Subsidy ratioXblue	0.1178**	0.3768***	0.0239	0.0762
	(0.0537)	(0.0792)	(0.0525)	(0.0656)
Net union fee inverseXblue	-15.3006	-258.1734**	-6.1517	-7.2093**
	(16.6215)	(98.2665)	(32.2467)	(14.7927)
Controls				
Age, woman, part-time, blue-collar	Yes	Yes	Yes	Yes
Fixed job effects	Yes	Yes	Yes	Yes
W (job cell)	1245	92	262	358
J (jobs)	446610	265218	599019	300096
N (observations)	2442738	1277401	2795857	1465546

Note: Workers between 20 and 60 years of age. Population denoted by column head. FE (within)- linear regressions. Panel unit: job (workerXfirm). Dependent variable: dummy taking the value of 1 if worker is a union member. All models comprise the following control-vector: year dummies, part-time dummy, age vigintile dummies. Standard errors adjusted for worker-clustering presented in parentheses. ** and * denote 1 and 5 percent level of significance.

Table A3 The impact of the subsidy ratio on the probability of union membership over the union density distribution. Private sector.

	Private sectors	Manufacturing	Construction	Trade	Transport
Subsidy ratio	0.1630***	0.2011***	0.2131*	0.1664	0.1965***
	(0.0361)	(0.0451)	(0.1150)	(0.1158)	(0.0679)
Subsidy ratioX	0.0657***	0.0591**	0.0591**	0.1098***	0.0594*
Union density 1-21%	(0.0131)	(0.0268)	(0.0268)	(0.0108)	(0.0312)
Subsidy ratioX	0.1603***	0.1322***	0.1322***	0.2399***	0.2243***
Union density 22-50%	(0.0222)	(0.0261)	(0.0261)	(0.0274)	(0.0354)
Subsidy ratioX	0.1876***	0.1311***	0.1311***	0.3269***	0.1336***
Union density 50-75%	(0.0244)	(0.0269)	(0.0269)	(0.0431)	(0.0409)
Subsidy ratioX	0.0859***	0.0429*	0.0429*	0.1890**	0.0077
Union density 75%<	(0.0222)	(0.0234)	(0.0234)	(0.0849)	(0.0611)
BlueXSubsidy ratio	0.0409	0.0063	0.0791	0.0121	-0.0134
	(0.0342)	(0.0534)	(0.0687)	(0.0316)	(0.0416)
BlueXSubsidy ratioX	0.0655***	0.0722*	-0.0558*	0.0195	0.0564
Union density 1-21%	(0.0271)	(0.0414)	(0.0302)	(0.0359)	(0.0409)
BlueXSubsidy ratioX	0.1566***	0.2624***	-0.0260	-0.0078	-0.0431
Union density 22-50%	(0.0453)	(0.0594)	(0.0355)	(0.0575)	(0.0829)
BlueXSubsidy ratioX	0.1411***	0.2095***	-0.2302***	0.0754	0.1685*
Union density 50-75%	(0.0380)	(0.0371)	(0.0271)	(0.0746)	(0.0893)
BlueXSubsidy ratioX	0.0239	0.0653***	-0.1634***	0.1080***	0.1247
Union density 75%<	(0.0316)	(0.0411)	(0.0607)	(0.1097)	(0.0987)
Net union fee inverse	17.3253**	11.5603***	38.5407	91.6313	18.5316
	(8.7311)	(2.2314)	(87.4179)	(59.7659)	(66.3152)
Net union fee inverseX	45.5240***	18.0057	152.906**	-19.684	24.7368
Union density 1-21%	(15.4521)	(25.2834)	(59.3705)	(23.0192)	(23.0192)
Net union fee inverseX	-26.9362***	-12.8973	19.7893	-174.5454***	-58.6982
Union density 22-50%	(16.2872)	(26.5846)	(64.6896)	(53.7127)	(63.5916)
Net union fee inverseX	-95.7447***	-61.6911***	-60.9708	-273.587***	-78.9949
Union density 51-75%	(26.9138)	(21.4603)	(60.1288)	(64.6407)	(64.6407)
Net union fee inverseX	-40.8525**	-38.1304**	13.0219**	-275.2275**	-53.4677**
Union density 75%<	(17.4973)	(15.2397)	(67.2230)	(67.1687)	(76.6845)
BlueXNet union fee inv.	-7.9574	49.0561**	-32.4834	-52.2635	-17.4719
	(11.8437)	(23.9422)	(94.5496)	(48.2239)	(66.1440)
BlueXNet union fee inv.X	-48.0239***	-92.0273***	-209.8947***	4.5118***	-38.6958
Union 1-21%	(17.8753)	(35.0439)	(45.6268)	(25.2250)	(38.0549)
BlueXNet union fee inv.X	-54.2440*	-97.6059**	-291.8687**	87.2175**	-14.0617
Union 22-50%	(30.9476)	(39.6119)	(75.6839)	(38.6688)	(64.5383)
BlueXNet union fee inv.X	-24.5746	-41.7832	-83.8046	65.3531	-109.4022**
Union 51-75%	(31.3429)	(33.7215)	(54.0271)	(52.7998)	(54.7565)
BlueXNet union fee	30.8152	2.1526	-49.1634	29.1474	-77.1807
inv.XUnion 75%<	(26.8930)	(26.1475)	(77.8574)	(82.7421)	(79.1674)
W (job cell)	3194	1171	87	247	322
J (jobs)	2335579	410557	237465	542753	268225
N (observations)	10797707	2187406	1132601	2450703	1188082

Note: Workers between 20 and 60 years of age, and first observation year for each workplace (and their employees that year) are discarded. Union density distribution is measured for year t-1 and is based on a leave-out-mean at the workplace level. Population denoted by column head. FE (within)- linear regressions. Panel unit: job (workerXfirm). Dependent variable: dummy taking the value of 1 if worker is a union member. All models comprise the following control-vector: year dummies, part-time dummy, age vigintile dummies. Standard errors adjusted for worker-clustering presented in parentheses. ** and * denote 1 and 5 percent level of significance.

Table A4 The impact of the subsidy ratio on the probability of union membership. Private sectors.

	Age	Skills	Worker fixed effects	Workplace fixed effects	Age of plant	Entry occupationy ouths
Subsidy ratio	0.2526***	0.2266***	0.2031***	0.2128***	0.2434***	0.2252***
	(0.0438)	(0.0461)	(0.0395)	(0.0408)	(0.0434)	(0.0363)
Net union fee inverse	16.4463***	0.0666	9.2394	-5.2030	-4.5136	7.1822
	(6.5448)	(7.1504)	(13.7113)	(8.0503)	(8.1503)	(4.9927)
Subsidy ratio*X column	-0.0078**	0.0094**	-0.0754***	0.0048	0.0019***	0.0072
Head	(0.0012)	(0.0042)	(0.0083)	(0.0073)	(0.00006)	(0.02108)
Net union fee inverse*X	1.3370***	10.0714**	49.9710***	-4.8644	-1.2872**	
Column head	(0.4242)	(2.8971)	(5.5481)	(4.9504)	(0.3639)	
J (jobs)	2595301	2595301	1871948	1871948	2595301	2595301
N (observations)	12196503	12196503	12154431	12154431	12196503	12196503
	Temp occupations	Physical strain	Psycholog-ical strain	Workforce size	Capital	TFP
Subsidy ratio	0.2107***	0.2338***	0.2146***	0.2216***	0.2252***	0.2263***
	(0.0407)	(0.0547)	(0.0538)	(0.0497)	(0.0498)	(0.0491)
Net union fee inverse	8.2248	4.9016	10.1271	-14.5166	-8.2097	-6.2516
	(13.0398)	(5.6243)	(10.8501)	(12.6934)	(10.6207)	(10.1341)
Subsidy ratio*X	0.3634***	.0.0701	0.0418	0.0274***	0.0139***	0.00298***
Column head	(0.1114)	(0.1185)	(0.1069)	(0.0057)	(0.0028)	(0.0094)
Net union fee inverse*X	-163.048**	23.1971	-39.3544	-8.0190**	-4.4895**	-12.5399**
Column head	(68.8473)	(69.7979)	(77.4096)	(3.0327)	(1.8619)	(5.6927)
J (jobs)	2402908	1992567	1992567	1883484	1883484	1883484
N (observations)	13627474	7498286	7498286	8627679	8627679	8627679

Note: Workers between 20 and 60 years of age. Control variables: age vignitile dummies, part-time, fixed job effects. For entry occupations we conduct the regressions separately for these, thus this regression comprises no interaction term. Population denoted by column head. FE (within)- linear regressions. Panel unit: job (workerXfirm). Dependent variable: dummy taking the value of 1 if worker is a union member. All models comprise the following control-vector: year dummies, part-time dummy, age vigintile dummies. Standard errors adjusted for worker-clustering presented in parentheses. ** and * denote 1 and 5 percent level of significance.

Table A5 The impact of the subsidy ratio on the probability of union membership. Private sectors.

	Gender		Work hours		Country of origin
Subsidy ratio	0.1640***	Subsidy ratio	0.1781***	Subsidy ratio	0.2022***
	(0.0298)		(0.0307)		(0.0405)
Net union fee inverse	9.4749*	Net union fee inverse	8.7301*	Net union fee inverse	11.6775*
	(17.9251)		(5.2278)		(6.5351)
Subsidy ratio*woman	0.1033***	Subsidy ratio*part-time	0.1935***	Subsidy ratio*western immigrant	0.1807***
	(0.0237)		(0.0235)		(0.0236)
				Net union fee inverse*western immigrant	-152.828***
					(29.3631)
				Subsidy ratio*non-western immigrant	0.4498***
					(0.0763)
				Net union fee inverse*non-western immigrant	-83.9291**
					(40.3939)
J (jobs)	2595301		2595301		2595301
N (observations)	12196504		12196504		12196504

Note: Workers between 20 and 60 years of age. Control variables: age vignitile dummies, part-time, fixed job effects. Population denoted by column head. FE (within)- linear regressions. Panel unit: job (workerXfirm). Dependent variable: dummy taking the value of 1 if worker is a union member. All models comprise the following control-vector: year dummies, part-time dummy, age vigintile dummies. Standard errors adjusted for worker-clustering presented in parentheses. ** and * denote 1 and 5 percent level of significance.

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