I Z A Institute of Labor Economics

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DISCUSSION PAPER SERIES

IZA DP No. 12546

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AUGUST 2019

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ISSN: 2365-9793

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ABSTRACT

Creative Destruction, Social Security Uptake and Union Networks*

Does the creative destruction induced by unions entail increased social security uptake? Creative destruction implies the closures of less productive workplaces, and if the regional benefits from this process is not large enough, the displacements caused by workplace closures cause increased social security uptake. In this paper we apply a shift-share approach and historical unionisation data from 1918 to study the impact of regional unionisation changes in Norway on regional social security uptake during the period 2003-2012. As regional unionisation increases, inflows to regional unemployment and disability decrease, but the outflow to retirement increases.

JEL Classification: D24, J30, J51

Keywords: trade unions, creative destruction, unemployment, disability insurance, retirement

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* We thank participants at the Institute for Social Research's Seminar Series and the Trygdeforskningsseminaret 2018 in Bergen, for fruitful discussions and comments on earlier versions of the paper. We gratefully thank the Norwegian Research Council for funding (grant numbers No 255595 and No 257603).

I. Introduction

Union membership has been on the decline for several years (Addison et al., 2014; 2016; Barth et al., 2017; OECD, 2017; Schnabel, 2012). On average, across all member states from the mid-80s to today, OECD (2017) reports of a decline from 33 percent unionisation to 17 percent. This decline is potentially problematic. OECD (2018:76) argues that unions and collective bargaining could potentially play a central role in creating *more* and better jobs, labour market inclusiveness, and resilience and adaptability. Barth et al. (2017), utilising a tax reform affecting the price of union membership to draw causal inference, find that as firm union density increases, firm productivity and wages grow. Dale-Olsen (2018), utilising historical unionisation figures and endorsing a shift-share approach, find that increased unionisation contributes to local productivity growth through creative destruction, i.e., the least productive workplaces are forced to close due to facing higher wages, while entry of new productive workplaces are unaffected by the unionisation.

In this paper, we ask whether the process of creative destruction induced by unions, presents challenges for social security utilisation and thus highlights the need for social security policies, or alternatively, this process generates so much benefits that any negative effects are more than offset.[1] Following plant closures and job displacements in Norway, several authors have identified inflow to welfare recipiency, either as short-term unemployment insurance or as long-term disability insurance and permanent withdrawal (Rege et al., 2009; Huutunen et al., 2010, Bratsberg et al., 2013). Thus creative destruction will affect workers, potentially negatively and even in the long-run. To test these notions explicitly, we utilise regional differences in Norway to study

[1] Our starting point is that unions compress wages but increase wage levels, particularly for firms with large market shares or those covered (Fitzenberger et al., 2013; Breda, 2015; Bryson, 2014; Card et al., 2007; 2018), and that unionisation causes the productivity of incumbent firms to increase (Barth et al., 2017), while causing the least productive firms to close due to facing higher wages (Dale-Olsen, 2018). Meta-studies reveal mixed evidence on the association between unions and productivity between countries and even between industries within countries (Doucouliagos and Laroche, 2003; Doucouliagos et al., 2017). See also Hirsch (2004).

the impact of unionisation on short- and long-term social securityutilisation such as unemployment, short- and long-term disability enrolment and retirement. To avoid the selection issues and confounding factors related to local unionisation and local outcomes, we apply a shift-share approach (Autor and Duggan, 2003; Kovak, 2013; Autor et al., 2013) by using information on the historical distribution of unionisation across industries. OECD (2018) defines the wage setting in Norway as *Organised decentralised and Co-ordinated*. Sector-level agreements are important, with coordination across sectors and bargaining units, but with room for lower-level agreements. One can trace this regime back to the early 20th century.[2]

Following Dale-Olsen (2018), we argue that areas strongly unionised historically have established networks and cultures affecting unionisation today. Holmes (2006) noted such a linking between historical unionisation and unionisation today in the U.S., an economy less characterised by collective arrangements than Norway. He argued that unionism in coal mines and steel mills from the 1950s strongly relates to unionism today in the same area but in other industries, like hospitals and supermarkets. In Norway, a geographically long and narrow, sparsely populated country, unions were similarly embedded locally, by mining industries, by sawmills and by other power-demanding industries (established close to Norway's major energy source in the 19th and early 20th century: waterfalls and rivers). Thus, as Kovak (2013) and Autor et al. (2013) use historical information and aggregate trade flows today to draw inference on local outcomes today, historical

[2] The establishment of trade unions in Norway was by no means unique, and followed as in the UK and continental Europe through labour movements during the late 19th and early 20th century. In many countries, these movements favoured political activism and contributed to the establishments of Labour parties (e.g., the UK the Labour party was founded in 1906, the Norwegian party was founded in 1887). In the UK, the Trade Union Act of 1871 accepts unions legally for the first time. (https://www.britannica.com/topic/trade-union). The first Norwegian Work-Conflict Law ("arbeidstvistloven") of 1915 defines a union as an association of workers or of worker organizations established on the purpose of working for and protecting worker rights against employers.

information and aggregated unionisation flows can provide information on local wages, productivity and job creation and destruction.

The structure of the remainder of the paper is as follows: Section II reviews the previous literature, while Section III describes the data. Section IV presents our empirical strategy. The Norwegian unionisation in the early 20th century and today is described in Section V. Section VI presents our results, while Section VII briefly concludes.

II. Previous literature on unionisation, creative destruction and social security utilisation

From at least on theoretic strain of works one can infer that unions contribute positively to job creation, and that they cause job destruction. This theoretical literature link how unions bargain for wages and how this affects innovation, job creation and destruction, and employment (Moene and Wallerstein, 1997; Barth et al, 2014; Haucap and Wey, 2004; Braun, 2011). Local union bargaining stifles job creation and innovations, but also reduces job destruction and firm exit. Bargaining at sector-level or at the national-level, on the other hand, yield the opposite results. Thereby unions, through higher level bargaining, could be important vessels of creative destruction (Schumpeter, 1942: 82-83). On the other hand, Boeri (2015) argues that two-tiered wage bargaining causes allocative inefficiencies due to a decoupling of wages from productivity.

The empirical literature finds conflicting evidence on the relationship between unions and creative destruction. The direct empirical evidence on how unions cause job creation and destruction is limited and mixed, and only DiNardo and Lee (2004) and Dale-Olsen (2018) provide causal evidence. On U.S. data, DiNardo and Lee (2004) find no significant relationship during the period 1983-99. On Norwegian data for 2003-12, Dale-Olsen (2018) finds no impact on regional job creation, but a strong positive impact on job destruction, driven particularly by low productive firms forced to pay higher wages. The correlation studies reveal that unions act as entry deterrence

(Chappell et al., 1992), but also these reveal that higher unionisation increases the closure rates (Bryson, 2004a; Freeman and Kleiner, 1999). Still, a considerable heterogeneity exists (for example, over time). Furthermore, the empirical evidence on the correlation between unionisation and employment growth imply that unionisation is associated with 2-4 percent reduced employment growth (Long, 1993; Wooden and Hawke, 2000; Bryson, 2004b), but no causal evidence is available. Still, Addison and Belfield (2004) call the employment effects of unions as the "one constant".

Several important empirical papers link the closures of establishments and firms, induced by creative destruction, to welfare utilisation, i.e., to uptake of unemployment and disability insurance, and to withdrawal from the labour market in the form of retirement. Particularly relevant is the literature on the consequences of job displacement. Since the late 1980s, numerous studies have identified negative income effects associated with job displacement (Hamermesh, 1987, Jacobson et al. , 1993; Hallock, 2009; Huutunen et al., 2010), while later studies have identified additional detrimental health effects associated with the displacement process (Vahtera et al., 2004; Martikainen et al., 2007; Sullivan and von Wachter, 2009; Kuhn et al., 2009).[3] Since displacement induces detrimental health effects, it should come as no surprise that one also identifies a positive inflow to disability pension enrolment following job loss and plant closures (Black et al., 2002; Autor and Duggan, 2003; Rege et al., 2009; Bratsberg et al., 2013), although Bratsberg et al. (2013) argue that part of this inflow is unemployment in disguise.

III. Data

The main data set is based on public administrative register data provided by Statistics Norway comprising *all* firms, workplaces, employees and individuals in Norway 2003–2012. This data set provides information on individuals and workers (gender, educational qualifications, union

[3] The evidence on organisational change and downsizing on remaining workers' sick leaves are more mixed, some find positive effects, i.e., increased absenteeism (Kivimäki et al., 2001; Vahtera et al., 2004; Røed and Fevang, 2007), while other find no clear pattern (Westerlund et al., 2004; Østhus and Mastekaasa, 2010).

membership, earnings and income), on jobs (occupation, seniority, spell-specific earnings and fringe benefits, working hours, wages), and on welfare utilisation (sick leave spells, unemployment and short- and long-term disability enrolment). We focus on employment spells spanning December 31th each year.

The secondary data set comprise the Municipality Data Base (MDB).[4] This database comprises historical employment data and historical union membership information from the largest union in Norway: The Norwegian Confederacy of Trade Unions (LO). The first year in the MDB is 1909, 10 years after LO's establishment. Between 1918 and to the early 1960s MNB has no information. For our purpose, i.e., to use the historical data in a shift-share approach, we want the number of municipalities with no unionisation kept at minimum. Furthermore, to avoid capturing on-going long-term dynamic processes, we want to our historical data to be before World War II. We chose 1918 for our historical data (Europe is still at war in 1918, and arguably, this might influence the employment in export-related industries even in World War I neutral Norway).

The Municipality Data Base allow us to map LO union members across municipalities in 1918 at union or "branch" level. The Municipality Data Base also comprise worker (employment) figures at the municipality level based on the Norwegian 1920 Census, but these figures can only be split into 6 main industries. The historical data thus comprise union and worker information across municipalities and 6 aggregated industries.

Key variables

Our main analysis follow municipalityXindustry units over time. Let mi and t denote municipalityXindustry and year, respectively. Note $t \in$ 2003-2012. Let $l_{f(mi)t}$ and $u_{f(mi)t}$ denote the number of workers and the number of union workers employed at workplace f (in

[4] The owner of the MDB, NSD — Norwegian Centre for Research Data AS, is neither responsible for the analysis nor the interpretation of the results in this paper.

municipalityXindustry) at time t. Note that these stock variables are measured on December 31 each year. During the next year, we then measure the inflows rates for these workers to the different welfare states such as unemployment, retirement or short-term disability, while we wait until after three years to measure the inflow rate to long-term disability.[5]

Outcomes variables

Regional industry-specific inflow rate to unemployment: $ur_{mit}= \frac{\sum_{ft} u_{f(mi)t+1}}{\sum_{ft} l_{f(mi)t}}$ if f∈private sector,

Regional industry-specific inflow rate to short-term disability: $dsr_{mit}= \frac{\sum_{ft} ds_{f(mi)t+1}}{\sum_{ft} l_{f(mi)t}}$ if f∈private sector,

Regional industry-specific inflow rate to long-term disability: $sr_{mit}= \frac{\sum_{ft} dl_{f(mi)t+3}}{\sum_{ft} l_{f(mi)t}}$ if f∈private sector,

Regional industry-specific inflow to retirement rate: $rr_{mit}= \frac{\sum_{ft} r_{f(mi)t+1}}{\sum_{ft} l_{f(mi)t}}$ if f∈private sector,

Control variables

Regional industry-specific log number of workers: $LnL_{mit}= \ln(\sum_{ft} l_{f(mi)t})$ if f∈private sector,

Regional industry-specific log number of union workers: $LnU_{mit}= \ln(\sum_{ft} l_{f(mi)t})$ if f∈private sector.

Regional unemployment rate: vr_{mt}. $ur_{mit}= \frac{\sum_{t} U_{mt}}{\sum_{ft} l_{f(m)t}}$ if f∈private sector.

IV. Empirical strategy

The empirical strategy in this paper is simple linear regressions on municipalityXindustry observations from *the private sector*, but where we first-difference the observations to take into

[5] Note that we unfortunately lack information on retirement after 2012 in the individual data, thus for the last year of observation, 2012, we cannot infer workers' retirement behaviour.

account municipality-industry fixed effects. Our industry definition is, due to the use of historical data later in our shift-share approach, quite broad and just based on 6 broad categories (agricultural, mining, manufacturing, construction, transport, others).

Our empirical strategy is as follows: Let the panel unit, municipalityXindustry, be denoted by mi. Let time be denoted by t, t ∈ 2005-2012 (following the use of the first-difference operator and the presence of lagged right-hand-side variables on data spanning 2003-12). Similarly, let m denote municipality, while i denote industry. We remove municipalityXindustry fixed effects by first-differencing the data. The empirical specification (after first-differencing) can be expressed:

$$\Delta Y_{mit} = b_0 + t_t + b_1 \Delta lnU_{mit-1} + b_2 \Delta lnL_{mit-1} + b_3 \Delta vr_{mt-1} + b_4 t_{ijt} + b_5 t_{mt} + \epsilon_{mit} \quad (3)$$

where Y_{mit} denote different regional outcome variables such as the inflow rate to unemployment rate, short- and long-term disability enrolment rate and the retirement rate. Δ expresses the first-difference operator, e.g., $\Delta Y_{mit} = Y_{mit} - Y_{mit-1}$.

U_{mit-1} and L_{mit-1} denotes at time t-1 the number of union workers and the number of workers in municipalityXindustry mi, respectively. Note that our key parameter of interest, b_1, measures the impact of relative unionisation growth on growth in Y conditional on the relative growth in employment.

vr_{mt-1} denotes the municipal unemployment rate, which control for business cycle effects. The t_t and t_{mt} denote year dummies and linear municipality trends. To address linear industry trends, denoted by t_{jt}, we collapse the dummies associated with 5-digit industry codes to the 6 industries of the panel unit and multiply these shares with a linear time trend. Finally, ϵ_{mit} denotes a classical error term.

Assuming exogenous right-hand-side variables, this model can then be estimated using OLS. In such regressions, where observations constitute municipalityXindustry averages, the variance of the error terms would be diminishing by the number of observations utilised in constructing the municipalityXindustry average, thus the error-terms are heteroscedastic. To take into account this heteroscedastisity, all observations are weighted by the inverse of the number of observations within municipalityXindustry. All reported standard errors will also be cluster-adjusted on the panel unit.

Equation 3) controls for one time-varying control covariate (vr_{mt-1}), only. Fixed regional effects have been taken into account by the first-difference operator. The regressions also control for municipality and industry linear time trends.

To further take into account composition effects, which might affect the relationship between our key outcome variables and unionisation, we conduct a series of auxiliary linear probability models regressions conducted on job-level observations for private and public sectors over time (unemployment-, disability and retirement-regressions) controlling for gender, immigrant, educational qualitifactions (7 dummies), years of seniority (and squared) and Mincer-experience in years (and squared).[6] Then we let the corresponding yearly average municipalityXindustry-specific residuals calculated based on private sector observations only, replace our outcome variables in Equation 3). Thereby we avoid that changes found in outcomes over time within the municipalityXindustry unit are just reflections of changes in composition within the municipalityXindustry unit.

Still, it is difficult to discard the presence of other time-varying municipalityXindustry variables causing omitted variable bias. Thus we cannot rule out that ΔU_{mit-1} and ϵ_{mit} is correlated, which violates the assumptions making estimation of 1) by OLS valid. This is easily seen by noting that $\epsilon_{mit} = \Delta\tau_{mit} = \tau_{mit} - \tau_{mit-1}$, i.e., the classical error term in Equation 1) could express the difference of a classical error term τ over time. Then Corr (U_{mit-1}, τ_{mit-1})≠0 if somehow the local

[6] Table SA1 in the appendix presents the results from these regressions.

industry-specific shock to the outcome variable in t-1 or other time-varying omitted variables affecting the outcome could be correlated to local unionisation in the same period. One such a case would be that bad times locally make workers unionise to get insurance.

To address the endogeneity and omitted variable issues raised in the introduction and above, we invoke a Bartik-like instrument (Bartik, 1991; Kovak, 2013; Autor et al., 2013) following a shift-share approach. The motivation for the shift-share instrument is to use variation in the national flows to generate variation at the local level: The expected flow to/from unionisation in an industry in a region is a weighted average of the national flows for each industry, with weights that depend on the historical distribution of unionisation across industries. We thus exploit the fact that regions are differently affected by industry variation depending on their initial industry mix. In our case the initial mix is given by the 1918-unionisation. The historical unionisation, unionisation today and our instrument are the topics for the next section.

IV. Unionisation in Norway in the early 20th century and today

The first major trade union, The Norwegian Confederacy of Trade Unions (LO), was established in 1899, with 1600 members in two unions. In 1907 LO was part in the first comprehensive sectoral trade union agreement in Norway (governing iron- and metal- workers). During the next 20 years LO experienced massive growth. In 1920 LO comprised close to 150000 members in over 20 unions. Most of these unions are typical manufacturing unions such as book binder union, iron- and metal workers union, meat producing workers union, paper mill worker union, typographers, and tailor and textile worker union), but also unions within construction (painters, carpenters, masons and brick workers), transport (sailors, stokers, transporters), and agriculture (peasant and forest workers). Even some classical service occupations were represented (barbers). Then, after a series of less successful strikes and interventions, membership dropped markedly.

During the 1930s, with economic turmoil in most western economies, LO continued to grow, and at the same time, the worker movement gained political power as important contributor to the Norwegian Labour Party (Arbeiderpartiet), which had been founded in 1887 (Bjørnhaug et al., 2000). In 1935, LO and the employer association sign the first centralised cross-sectoral agreement. When the first Labour government was established the same year, the cabinet comprised two ministers from LO. LO comprised over 350000 members when the World War II started. During the post-war years LO continued to grow, and its close link to the Labour Party ensured that it continued to be an important political organisation fighting for improved wages and working conditions. Although competing confederacies of unions were established during 1980s and 1990s, LO is still by far the largest confederacy of unions in Norway, comprising over half of all union workers in Norway with over 900000 members employed in all sectors and industries. Although this number varies slightly over the business cycle, LO organise 35-45 percent of all workers in Norway. However, sectoral differences exist. LO is stronger in the classical manufacturing industries, where its roots once were. Competing confederacies of unions are equally important in the public sectors. The development of union membership levels during the first half of the 20th century was not unique for Norway.[7]

Still, historical background, law and institutions all contribute to industrial relation differences. In Germany, the U.S. and Norway legal support for collective bargaining and trade union recognition, also defined managerial prerogatives (Zeitlin, 1985). The Norwegian Work Environment Act of 1997 clearly states that unions are to be recognised. Zeitlin (1985:175-6) argues that relatively speaking employer associations in the UK were weaker and lacked internal coherence

[7] For Germany, Müller (1985) reports membership levels in the Free Association of German Trade Unions around 6-6500 1905-10, but when this is changed from a localist union and re-founded as the Free Worker's Union Germany in December 1919, the number of members had multiplied 20-fold to over 111000. See Wolman (1937) and Wrigley (2002) for British union figures, revealing similar pattern until the decline from 1980s.

compared to the German, Scandinavian and American employers' associations, and this weakness was reinforced by state policies and law, where the Parliament ensured that unions were immune from civil prosecutions.[8]

Holmes (2006) noticed in the U.S. that coal mines and steel mills embedded unionization locally even after these industries were long gone. We argue that in Norway a similar process has occurred. Norway is a geographically long and narrow, sparsely populated country. At the turn of the 19th century sawmills and other power-demanding industries were established close to Norway's major energy source in the 19th and early 20th century: waterfalls and rivers. Mining towns had been established long ago, as well as cities important for export and trade (e.g., at the coastline or along waterways). These industries embedded unions locally, and this was enforced since unions and the labour movement of the early 20th century (Bjørnson, 1990:19-98) also were important providers of culture locally (organisers of library services, education, song and music, sports) (Ousland, 1974:392-424).

Figure 1 shows this dramatic development in unionization in Norway across regions, from 1918 to 2003. The figure depicts the development in regional union density (in percent). Although a majority of the municipalities were not unionised in 1918, the unionized municipalities are spread around the country, reflecting the localisation of heavy manufacturing.

There is a tendency that the areas around the capital and other cities are more unionised than other areas, but also note that key areas along the coastline and waterways are more unionised than the central part of Norway. The central part of Norway was less unionised, since this mountainous area comprised agricultural activities dominated in those days by small farms. In 2003, this picture is clearly different. Today, most Norwegian municipalities are heavily unionized.

[8] Ebbinghaus and Visser (2000: 709) argue that factory owners and small employers did not see the need to join employer organisations, since they already had direct political influence via the political parties. The Taff Vale Case forced unions to turn to parliamentary politics to change the common law constraints (Ebbinghaus and Visser, 711).

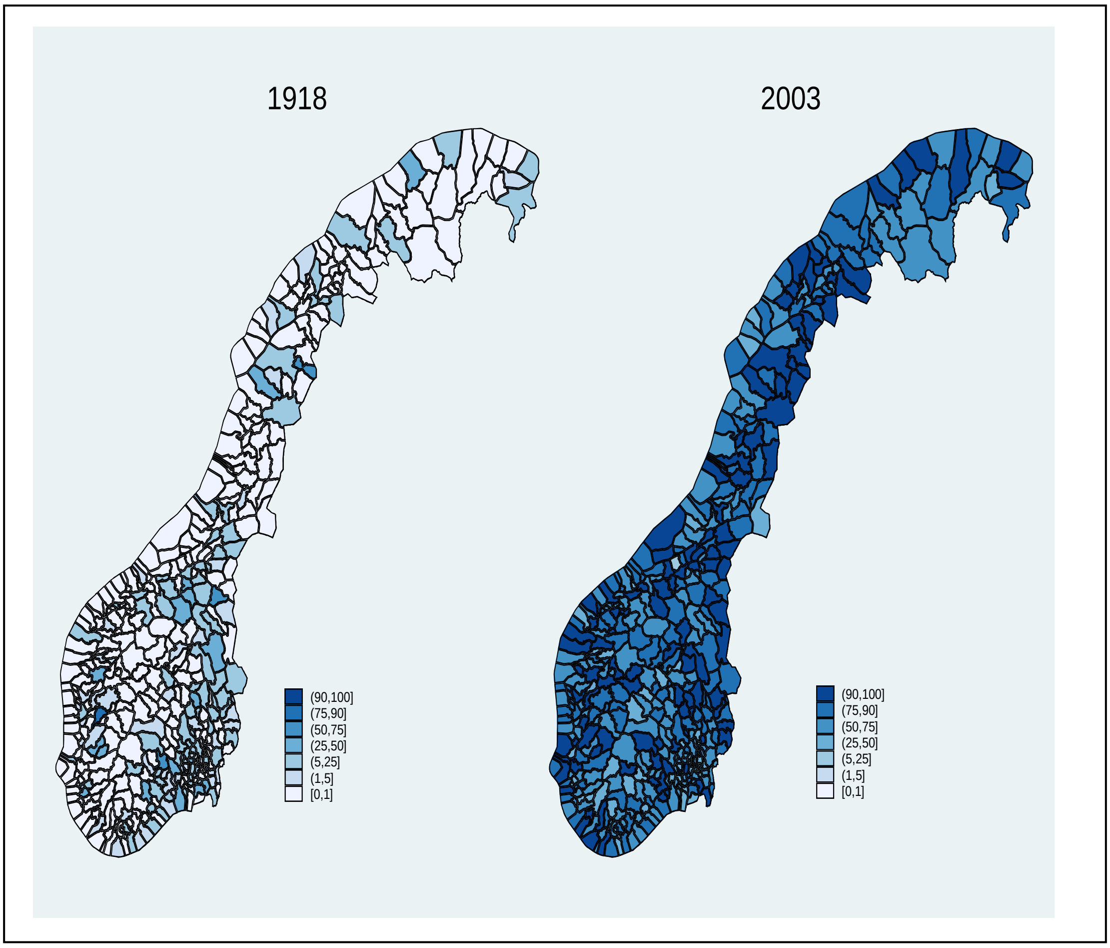

Figure 1. The development in regional union density across municipalities from 1918 to 2003.

Notes: Observation unit: municipality. The union density for 1918 is calculated from information on union members from 1918 while information on all workers are based on the Norwegian Census of 1920.

Have the industry composition of unionization changed considerably? In Table 1 we look closer on the union distribution across municipalities within our six broad industries in 1918 (Panel A), and then see how the same distributions look in 2003 (Panel B). In 1918, unionisation primarily occurred in Manufacturing and Mining, but a considerable number of the municipalities were not unionised at all. All industries experienced a massive growth in unionisation from1918 to 2003, particularly Construction and Transport.

TABLE 1

Union distributions within industries 1918 and 2003

	Agriculture, forestry, fishing	Mining	Manufac-turing	Constru-tion	Transport	Others
Panel A) Union distribution 1918						
5	0	0	0	0	0	0
25	0	0	0.15	0	0	0
50	0	0.14	0.40	0.01	0.10	0
75	0	0.60	0.46	0.06	0.22	0.005
95	0.22	0.80	0.58	0.07	0.22	0.005
Mean	0.03	0.27	0.33	0.02	0.11	0.003
Total workers	99479	4000	161709	133358	91669	291003
Panel B) Union distribution 2003						
5	0.05	0.22	0.36	0.08	0.34	0.23
25	0.13	0.49	0.48	0.26	0.54	0.29
50	0.19	0.54	0.59	0.39	0.56	0.29
75	0.26	0.63	0.69	0.48	0.62	0.37
95	0.46	0.87	0.83	0.64	0.77	0.44
Mean	0.20	0.55	0.59	0.37	0.57	0.32
Total workers	19239	19134	235691	105202	135664	683580

Note: Percentiles and averages calculated across municipalities separately for each industry. The union distribution in 1918 is calculated from unionisation figures from 1918 but Census employment figures from 1920.

One could suspect that the unionisation within regions for nearly a century ago was uncorrelated with the unionisation within regions today. As seen in Figure 2, this is not the case. To take into account that the underlying industry composition might have changed, and thus that the unionisation within industries is not related over time, we have residualised the regional industry-specific union density in 1918 and the regional industry-specific union density 2003 by conducting the within-transformation. We then divided the transformed union density in 1918 into 20 equal-sized bins, and computed the means of the transformed union density 2003 within each bin. Figure 2 then plots the regional union density in 1918 against the density in 2003, as well as we see a simple linear prediction of the same relationship. Even in this rough non-parametrical example, we see a strong positive relationship within municipalities between industry-specific union density of 1918 and the union density of 2003.

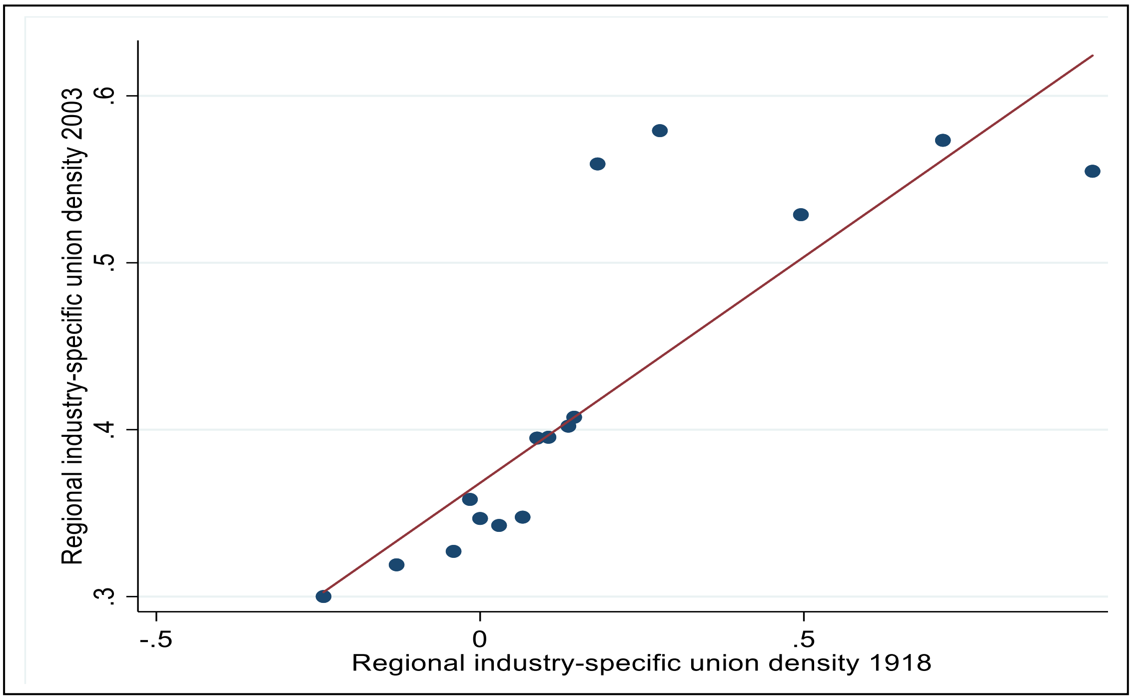

Figure 2. The correlation between regional industry-specific unionisation 1918 and the regional industry-specific union density 2003. Within municipality.

Notes: The figures are based on averages of 20 equal-sized binned observations of the regional industry-specific union density 1918 and the regional industry-specific union density 2003. Union density in 1918 is calculated from unionisation figures from 1918 but Census employment figures from 1920. Note that one has a priori residualised these by absorbing the municipality.

Instrument variable

We derive our instrument by the following strategy. Let the historical distribution of unionisation be denoted by $\frac{U_{mio}}{U_{io}}$, where subscript 0 denote time 0, i.e., 1918. Subscripts i and mi still denote industry and municipalityXindustry, respectively.

Following Autor and Duggan (2003), we then calculate the leave-one-out aggregate growth in unionisation in absolute numbers, i.e., $\Delta\ddot{U}_{mit-1} = \Delta(U_{it-1} - U_{mit-1})$, where Δ expresses the first-difference operator, U_{it-1} expresses the national level of unionisation industry i and U_{mit-1}

expresses the number of union workers in municipalityXindustry mi. Thus for each observation the national growth in unionisation in absolute numbers is cleansed from the local contribution. The reason for avoiding log-transform in our case is that a considerable number of the industries within the municipalities have no unionised workers in 1918. Our instrument is then expressed as:

$$\Delta \widetilde{U_{mit-1}} = \Delta \ddot{U}_{mit-1} \left(\frac{U_{mi0}}{U_{i0}}\right). \quad (4)$$

Thus, we use the historical distribution of unionisation across municipalities and industries to define the shares of the aggregate unionisation flows today, thereby predicting the growth in regional industry-specific unionisation.

To avoid size effects, we will include growth in log number of all workers in all future regressions. Otherwise, one might worry that our instrument just picks up a mechanical relationship: large cells have more union workers just by being large, and if true for today, this would be true for 1918. Such a mechanical relationship does not exist when conditioned on size. We find no evidence supporting this notion in levels. Neither is it obvious that the variance in unionisation is larger in large cells than small cells when conditioned on employment changes.

How does the predicted growth in regional industry-specific unionisation (our instrument) relates to growth in log regional industry-specific observed unionisation? In Figure 4 we have divided the changes in predicted local number of union members within each industry into 20 equal-sized bins, and computed the means of the predicted union member change and of the changes in log observed unionization within each bin. Then we created a scatterplot of these data points. Even in this rough non-parametrical example, we see a strong positive relationship between the growth in the predicted number of union members and the percentage growth in observed union members.

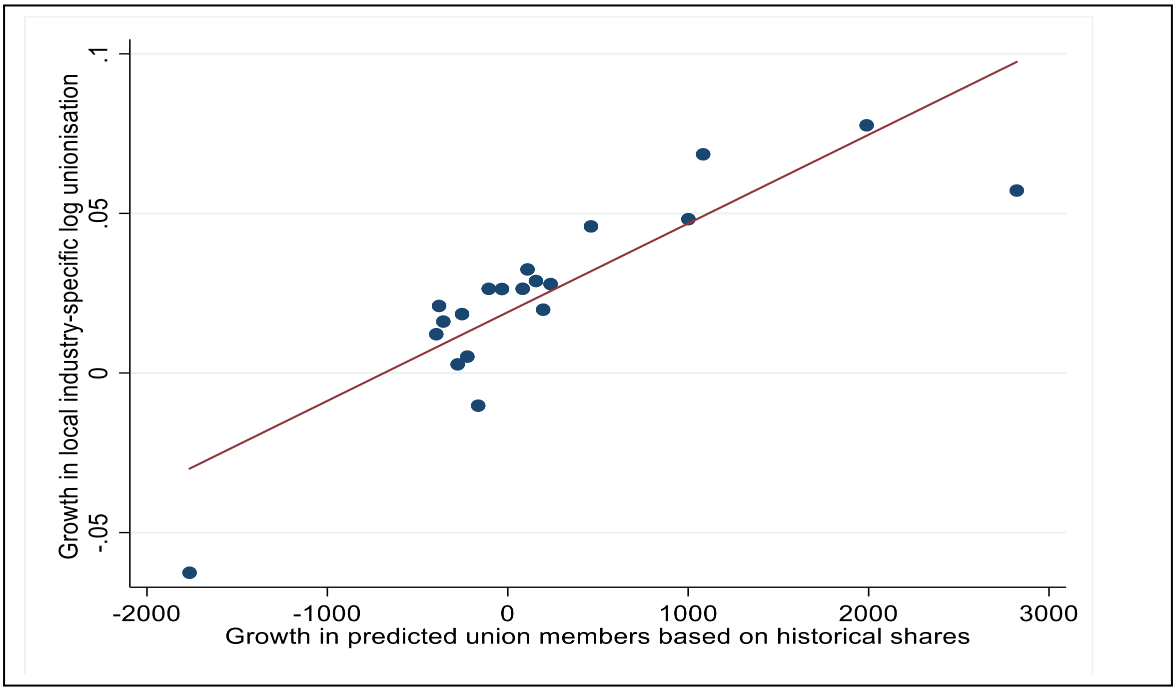

Figure 3. The correlation between changes in regional industry-specific unionisation and changes in the predicted numbers of regional industry-specific union members.

Notes: The figures are based on averages of 20 equal-sized binned observations of the change in regional industry-specific log unionization and the numbers of union members predicted from historical shares and aggregate union member figures from the period 2003-2012. Note that one has a priori first-differenced data and then residualised these by applying a regression controlling for year dummies, lagged regional unemployment and lagged log workforce.

In Table 2, we present yearly descriptive statistics on the key variables lagged unionisation, lagged predicted unionisation, and lagged employment. We have split the data in three categories depending on growth in the lagged predicted number of unionised workers.

Note that there is a group of panel units (municipalityXindustry)(mid-column) which do not experience any growth in the lagged predicted unionisation. The reason for this is that these units were not unionised historically, which again implies that the predicted number of unionised workers will be zero.

TABLE 2

Descriptive statistics on unionisation, predicted unionisation and employment. Across panel units.

Year	**$\Delta\widetilde{U}$ <0**			**No change**			**$\Delta\widetilde{U}$ >0**		
A) Mean and standard deviation of yearly growth									
	ΔU	$\Delta\widetilde{U}$	ΔL	ΔU	$\Delta\widetilde{U}$	ΔL	ΔU	$\Delta\widetilde{U}$	ΔL
2005	-27	-11	-34	-3	0	8	143	92	218
	(74)	(39)	(114)	(42)	(-)	(68)	(862)	(427)	(1178)
2006	-9	-8	8	-1	0	4	17	7	85
	(100)	(27)	(155)	(47)	(-)	(57)	(180)	(32)	(563)
2007	-81	-18	-105	4	0	4	35	26	66
	(166)	(43)	(222)	(29)	(-)	(48)	(196)	(153)	(365)
2008	33	-2	48	7	0	19	57	43	154
	(165)	(2)	(227)	(42)	(-)	(87)	(368)	(284)	(874)
2009	7	-8	-4	5	0	11	58	52	131
	(118)	(33)	(242)	(37)	(-)	(66)	(637)	(304)	(1088)
2010	-42	-23	-81	3	0	5	251	250	243
	(253)	(99)	(520)	(78)	(-)	(109)	(1179)	769)	(1166)
2011	-200	-132	-253	-7	0	-8	22	14	26
	(1333)	(667)	(1537)	(79)	(-)	(107)	(239)	(50)	(340)
2012	-11	-8	-2	1	0	6	11	15	118
	(104)	(32)	(205)	(29)	(-)	(63)	(133)	(76)	(608)
B) Sums of yearly levels									
	ΣU	$\Sigma\widetilde{U}$	ΣL	ΣU	$\Sigma\widetilde{U}$	ΣL	ΣU	$\Sigma\widetilde{U}$	ΣL
2005	158047	90974	286871	216376	17	566830	129301	113141	372706
2006	152898	87625	281892	213915	35	573863	134152	115154	387304
2007	35930	23975	66053	220529	44	578374	256927	184649	615931
2008	4462	2309	9066	234882	198	61556	305547	218513	717720
2009	85603	42390	153495	244329	327	637572	236494	187812	598168
2010	134819	78713	246734	251352	115	647028	186436	155956	493183
2011	219963	169292	549915	237002	55	629651	76911	49382	158838
2012	111469	69919	207659	238739	124	641274	183837	148803	514405

Note: , $\widetilde{U}$, and L denote lagged number of union workers, lagged predicted number of union worker and lagged total employment, respectively. Δ denotes the first-difference operator, while Σ denotes aggregate sum. Due to the presence of lagged variables in the regression equation, 2005 is the first year of observation utilised in the regression. Panel unit: municipalityXindustry. Population: 15284 yearly municipalityXindustry-observations (averages, sums) based on *all private sector* jobs over the period 2005-2012. As denoted by column head, data is split into three categories depending on whether predicted unionisation declines, grows or show no changes. Panel A) presents descriptives (mean/standard deviation) on growth in lagged unionisation, growth in lagged predicted unionisation (our instrument) and lagged employment growth. Panel C) presents yearly aggregate sums of i) lagged observed unionisation, ii) lagged predicted unionisation, and iii) lagged employment.

In Table 2, Panel A) presents descriptive statistics (mean/standard deviation) on growth in lagged unionisation, growth in lagged predicted unionisation (our instrument) and lagged employment growth. Panel B) presents descriptive statistics (mean/standard deviation) on the level of lagged unionisation, the level of lagged predicted unionisation and lagged employment levels.

Panel C) presents the yearly aggregate sums of i) lagged unionisation, ii) lagged predicted unionisation, and iii) lagged employment. Table 2 reveals large variation over time, but for the variables measured in growth and in levels. In Panel A), we see that unionisation and predicted unionisation correlate positively across the years. Even under the financial crisis considerable growth occurred. Panel B) shows that although many workers are employed in panel units not historically unionised, over half of the private sector workforce is employed in panel units unionised historically.

Growth in lagged predicted unionisation will then be used as an instrument for the growth in log number of unionised workers in a set of IV-regressions based on first-differenced data, where the panel unit is municipalityXindustry. Since the historical shares are fixed, variation in the treatment intensity over time ensure the identification (where aggregate variation induces the variation in treatment intensity).

By applying this approach, one avoids that correlations between local industry-specific shocks to the outcome variable and local unionisation in the same time-period contaminate and bias the regressions. However, this comes at a cost. In contrast with the OLS estimates, we assume heterogeneous treatment effects and that our IV is capturing a local average treatment effect. Our analyses compare municipalityXindustries historically heavily unionised to those less unionised or without any historical unionisation. However, for the municipalityXindustries with no historical unionisation our instrument does not vary over time, i.e., they will not contribute to the identification. This means that our IV-analyses provide no information on the municipalityXindustry units with no historical unionisation, but these units employ a minority of the worker (although admittedly still a considerable number).

Finally, one should note that recently the shift-share approach has been criticized for not being able to eliminate the bias arising in the OLS-regressions, partly for not recognising the different sources of bias and partly for letting the identification rest on an assumption the industry shares are exogenous (Jaeger et al., 2017; Goldsmith-Pinkham et al., 2018). Potentially, these concerns cause problems, but we think they are minor issues in our case. First, our industry shares are measured close to 100 years earlier, thus most direct labour supply and demand responses related to local industry shocks in the early 20th century should have died out many years ago, and since they are fixed, no worries regarding serial correlation arises. Second, we control for fixed industryXmunicipality effects. This eliminates bias caused by permanent productivity differentials between these industries within municipalities. If unionisation varies consistently between high and low productivity industries, even within municipalities, this will not influence our estimates. In Dale-Olsen (2018), we also conducted several robustness checks, which addressed issues related to bias due to labour supply shocks, different short- and long-run impact and worries related to the monotonicity-assumption. When we addressed these issues, we did not discover any problematic result.

VI. Results

We start our empirical analyses by looking closer at the development of social security uptake over our period of observation (2003-2012). Figure 4 shows the inflow to different social security schemes for workers employed at the end of year t. The inflows are then measured during the next consecutive year. We also measure the rate for workers still on disability insurance after 3 years. Top half of the figure depicts these flows for the total economy, while the bottom half shows the flows for the private sectors. Figure 4 clearly reveals the business cycle in Norway. We see that the inflow to unemployment is high 2003-4, then drops, for then again to raise during the Financial Crisis of 2008-9. Temporary disablement reveals similar pattern, albeit much weaker. This indicate that bad times influence the inflow to disability and supports the notion that part of the enrolment to disability is unemployment in disguise.

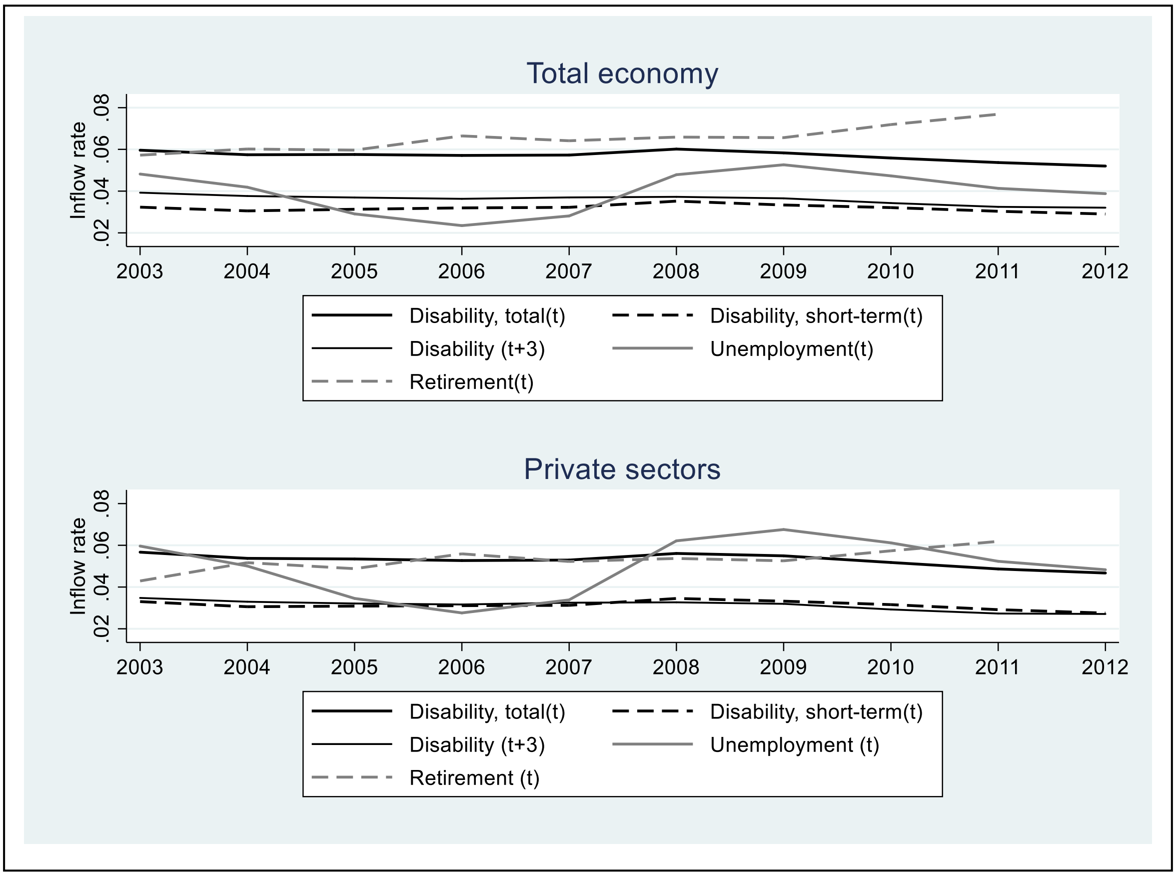

Figure 4. Changes in social security uptake over time.

Notes: The figures are based on workers employed year t and the inflow to social security the next year (except disability (t+3) which are measured after 3 years) from the period 2003-2012.

Figure 4 also reveals that a considerable share of the workers entering disability (short- and permanent), will be enrolled on disability insurance still after three years. Finally, we see that the inflow to retirement is increasing during our observation period. This partly reflects Norway's ageing population.

Do these changes in social security uptake over time contain regional variation as well? In Figures 5-7 we depict for the years 2005, 2008 and 2011 the variation across Norway's municipalities when it comes to the inflows to unemployment, to total disability and to retirement.

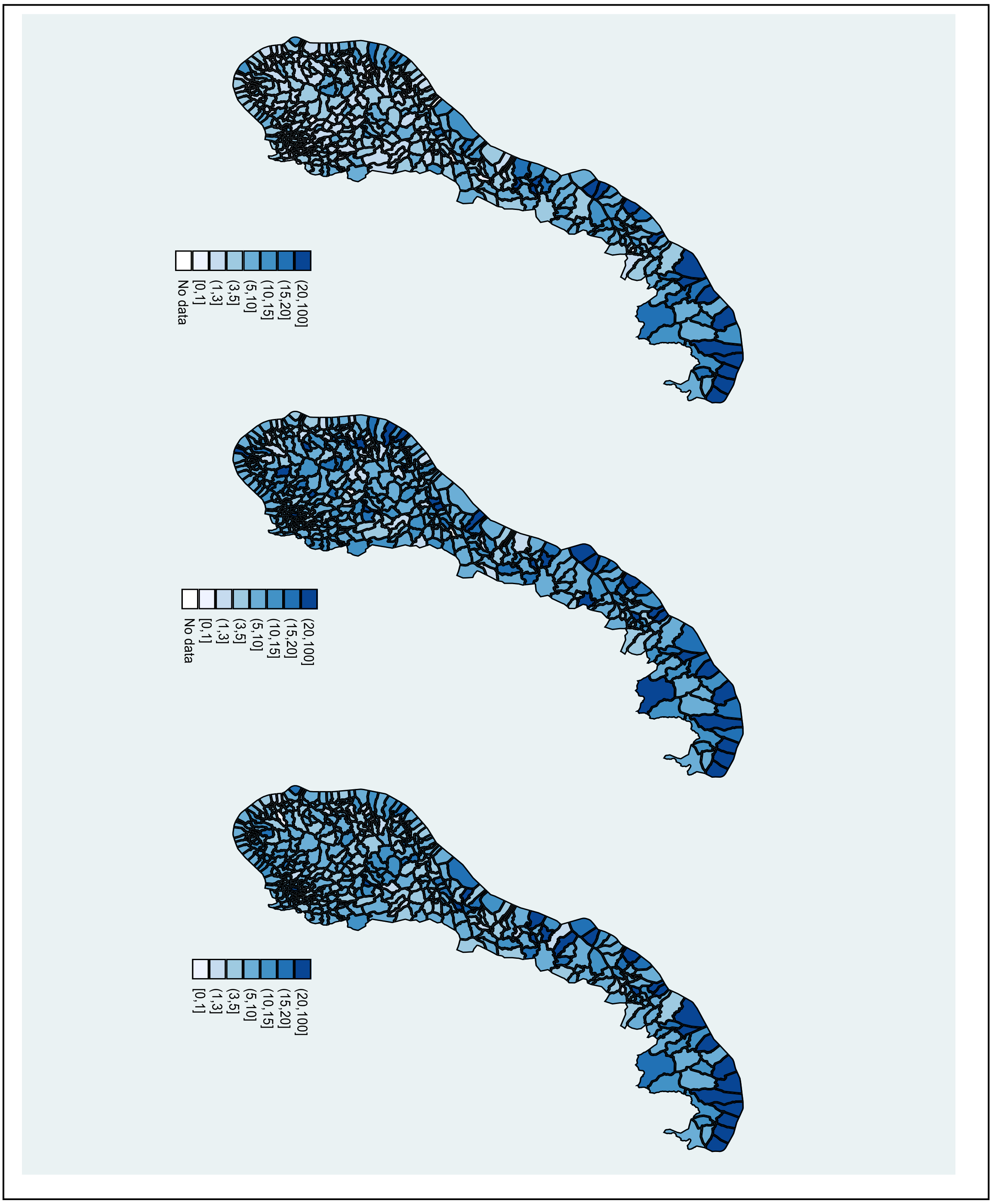

Figure 5. Regional changes to the inflow to unemployment over time.

Notes: The figures are based on municipality averages from the period 2005, 2008 and 2011. Top figure expresses 2005, middle 2008 and bottom figure 2011.

Figure 6. Regional changes to the inflow to disability over time.

Notes: The figures are based on municipality averages from the period 2005, 2008 and 2011. Top figure expresses 2005, middle 2008 and bottom figure 2011.

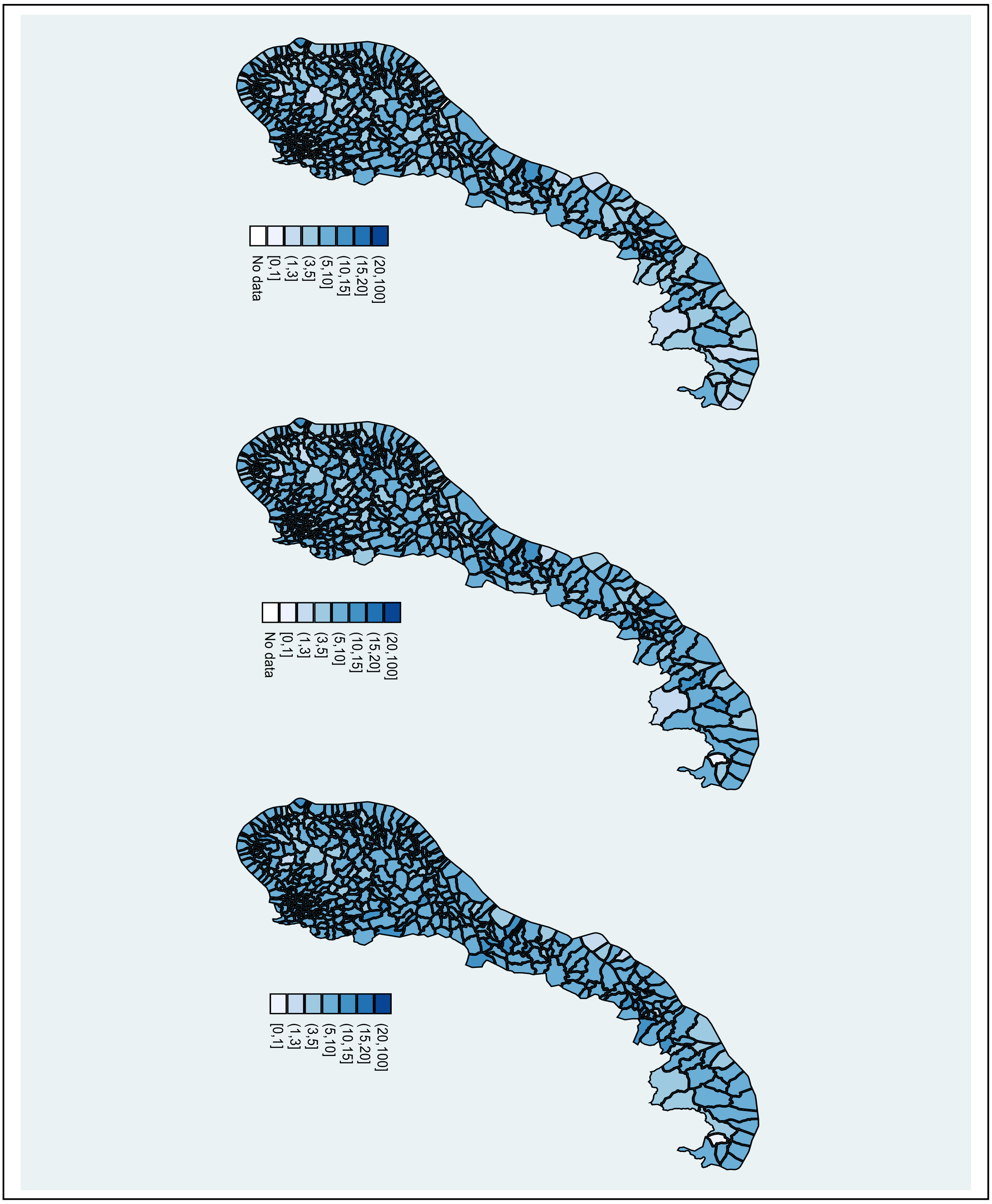

Figure 7. Regional changes to the inflow to retirement over time.

Notes: The figures are based on municipality averages from the period 2005, 2008 and 2011. Top figure expresses 2005, middle 2008 and bottom figure 2011.

The figures reveal quite large differences between municipalities as well within municipalities over time. The largest differences are seen in Figure 5 for unemployment, where we clearly see that unemployment varies quite strongly over the business cycle and that unemployment is a greater challenge up north and in certain coastline municipalities than in central areas. The smallest differences are seen in Figure 7 for the regional inflow rates into retirement.

Next, we turn to the regional-industrial regressions. Our purpose is to reveal the impact of unionisation growth on changes in social security uptake. Table 3 presents the results from these regressions. We start by estimating these by OLS (models 1-4) (Panel A), and then turn to the IV-analyses (models 5-8)(Panel C). Table 3 also presents the reduced form estimates (Panel B) and the first-stage results (Panel D). The dependent variable in the regressions of Panels A, B and C) is the municipal-industry average of the inflow to social security as indicated by the column head.

Since all estimations are conducted on first-differenced observations, municipality-industry fixed effects are taken into account in all specifications. In the first-stage regressions of Panel D), the dependent variable is growth in the municipalXindustry log number of union workers.

The OLS-analyses indicate that local growth in unionisation is, with once exception, uncorrelated to growth in social security uptake. Growth in unionisation appears to reduce unemployment. No other model reveals any significant or robust relationship. However, as is indicated previously, we expect that the variation in local inflows to unionisation is affected by local unobserved economic conditions, thus making these estimates biased.

The IV-analyses and the reduced form-estimates reveal a starkly different picture. First, we see that our instrument in the first-stage regressions are strongly significant and clearly pass the test for strong instruments. Second, the 2nd stage results reveal that increased unionisation implies reduced inflow to unemployment, and to disability in the short- and long-run, but that the inflow to retirement increases. The impact on unemployment is quite strong, if unionisation increases by 1 percent, local unemployment drops by 1.1 percentage point.

TABLE 3

The impact of regional industry-specific unionisation growth on growth in industry-specific regional social security schemes. First-difference linear OLS- and IV-regressions.

	OLS					IV				
	Unemployment(t)	Disability, short(t)	Disability, total(t)	Disability, t+3	Retirement(t)	Unemployment(t)	Disability, short(t)	Disability, total(t)	Disability, t+3	Retirement(t)
	1	2	3	4	5	1	2	3	4	5
PANEL A)			**OLS**			**PANEL C)**	**IV 2.step**			
ΔLagged lnU	-0.005*	0.001	0.001	-0.001	-0.001	-0.110**	-0.015**	-0.023**	-0.020**	0.012*
	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.016)	(0.003)	(0.004)	(0.003)	(0.006)
ΔLagged lnL	0.008	0.002	0.001	0.001	-0.001	0.141**	0.022**	0.032**	0.026**	-0.017*
	(0.004)	(0.001)	(0.002)	(0.001)	(0.003)	(0.020)	(0.005)	(0.006)	(0.004)	(0.008)
Controls										
Basic	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
PANEL B)			**OLS Reduced form**			**PANEL D)**	**IV 1. Step**			
$\widetilde{\Delta U}$	-0.001**	-0.0002**	-0.0003**	-0.0002**	0.0002**	0.012**	0.012**	0.012**	0.012**	0.012**
(in 1000)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
ΔLagged lnL	0.002	0.003**	0.002**	0.001	-0.002	1.264**	1.264**	1.264**	1.264**	1.277**
	(0.003)	(0.001)	(0.001)	(0.001)	(0.002)	(0.041)	(0.041)	(0.041)	(0.041)	(0.044)
Strength										
F-value						105.129	105.129	105.129	105.129	101.756
MxIxT	15784	15784	15784	15784	13824	15784	15784	15784	15784	13824

Note: Panel unit: municipalityXindustry. Population yearly municipalityXindustry-sum and averages based on *all private sector* jobs. Dependent variable in Panel A), B), and C): Δaverage regional industry-specific utilisation of social security schemes as indicated by column head. Dependent variable in Panel D): ΔLagged log number of union workers. Control vector: Basic=lagged municipality unemployment rate, year dummies. Each observation is weighted by the number of workers. Standard errors adjusted for panel unit-clustering reported in parentheses. ** and * denote 1 and 5 percent level of significance, respectively.

Alternatively, one standard deviation increase in unionisation, reduces unemployment by slightly less than one third of the standard deviation in unemployment. The impact on disability is weaker but still strong, where one standard deviation increase in unionisation, decreases regional inflow to disability by roughly one fifth of a standard deviation. The positive impact of unionisation on the outflow to retirement is weakest. Still, one standard deviation increase in unionisation implies that the outflow to retirement increases by one tenth of standard deviation.

The importance of regional composition changes and time trends

One might argue that the results in Table 3 are caused by changing regional composition or different regional time trends. To address this criticism, we do as follows. First, to take into account composition effects, which might affect the relationship between our key outcome variables and unionisation, we conduct a series of auxiliary linear probability models regressions conducted on job-level observations for private and public sectors over time (unemployment-, disability and retirement-regressions) controlling for gender, immigrant, educational qualitifactions (7 dummies), years of seniority (and squared) and Mincer-experience in years (and squared) (see Section III and the Supplementary appendix Table A2). Then we take the municipal-industry average of these residuals for the private sector workers only, and use these averages as our dependent variables. Second, we add linear industry and municipality time trends as controls in all regressions. Table 4 presents the results from the new analyses. The structure of Table 4 is identical to Table 3. OLS-results are presented in Panel A), reduced form estimates in Panel B), while the IV-results are presented in Panel C). Panel D) presents the first-stage results.

Table 4 reveals that composition changes and time trends only play a minor role for our results. With the exception of parameter-estimate associated with retirement, the other estimates are qualitatively unchanged. Increased unionisation implies reduced inflow to unemployment, and to disability in the short- and long-run.

The impact of regional unionisation on regional retirement is positive as previously, but we see that by taking into account local composition changes and linear industry and municipality time trends, the impact has become twice as large.

TABLE 4

The impact of regional industry-specific unionisation growth on residualised growth in industry-specific regional social security schemes conditional on region and industry time trends. First-difference linear OLS- and IV-regressions.

	OLS					IV				
	Uemploy ment(t)	Disability, short(t)	Disability, total(t)	Disability, t+3	Retire-ment(t)	Uemploy ment(t)	Disability, short(t)	Disability, total(t)	Disability, t+3	Retire-ment(t)
	1	2	3	4	5	1	2	3	4	5
PANEL A)	**OLS**					**PANEL C) IV 2.step**				
ΔLagged lnU	-0.005*	0.002	0.001	0.001	-0.001	-0.113**	-0.017**	-0.020**	-0.016**	0.024**
	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.015)	(0.004)	(0.004)	(0.003)	(0.006)
ΔLagged lnL	0.009*	0.001	0.001	0.001	-0.001	0.148**	0.025**	0.028**	0.021**	-0.031**
	(0.004)	(0.001)	(0.001)	(0.001)	(0.003)	(0.022)	(0.005)	(0.006)	(0.004)	(0.009)
Controls										
Basic	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Linear trends	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
PANEL B)	**OLS Reduced form**					**PANEL D) IV 1. Step**				
$\widetilde{\Delta U}$	-0.001**	-0.001**	-0.001**	-0.001**	0.0003**	0.012**	0.012**	0.012**	0.012**	0.013**
(in 1000)	(0.0002)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
ΔLagged lnL	0.004	0.003**	0.003**	0.001	-0.001	1.264**	1.264**	1.264**	1.264**	1.287**
	(0.003)	(0.001)	(0.001)	(0.001)	(0.002)	(0.041)	(0.041)	(0.041)	(0.041)	(0.041)
Strength										
F-value						105.129	105.129	105.129	105.129	61.843
MxIxT	15784	15784	15784	15784	13824	15784	15784	15784	15784	13824

Note: Panel unit: municipalityXindustry. Population yearly municipalityXindustry-sum and averages based on *all private sector* jobs. Dependent variable in Panel A), B), and C): Δaverage regional industry-specific residuals of utilisation of social security schemes as indicated by column head (see Table SA1 in the Supplementary appendix). Dependent variable in Panel D): ΔLagged log number of union workers. Control vector: Basic=lagged municipality unemployment rate, year dummies; Linear trends=linear industry trends, linear municipality trends. Each observation is weighted by the number of workers. Standard errors adjusted for panel unit-clustering reported in parentheses. ** and * denote 1 and 5 percent level of significance, respectively.

A positive relationship between unionisation and retirement rates might be explained by the fact that trade union agreements at the workplace level might comprise early retirement schemes. The probability that a workplace is covered by a trade union agreement is increasing with the number of unionised workers at the workplace. Thus, as the number of union workers in a region grows, the more likely it will be that workplaces in this region is covered by trade union agreements, and thus that early retirement schemes are prevalent.

VII. Conclusion

In a previous study (Dale-Olsen, 2018), it was found that unions were important vessels of creative destruction, they increase the wages of incumbent workers as well as the productivity of surviving firms, but at the cost of closures for low-productivity firms and the displacement of their workers.

In this paper we ask whether the creative destruction induced by unions entails increased social security uptake? Since creative destruction implies the closures of less productive workplaces, and if the regional benefits from this process is not large enough, then the displacements caused by workplace closures cause increased social security uptake. In this paper we apply a shift-share approach and historical unionisation data from 1918 to study the impact of regional unionisation changes in Norway on regional social security uptake during the period 2003-2012. In practice, we thus compare municipalities with low historical unionisation with high unionisation, and see, how these differ when it comes to changes in unemployment, disability and retirement.

We find that increased unionisation implies reduced inflow to unemployment, and to disability in the short- and long-run. The impact of regional unionisation on regional retirement is, however, positive, but this might reflect local variation in the prevalence of early retirement schemes.

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Appendix

TABLE A1

Descriptive statistics. Growth.

	Observed			**Residuals**	
	Mean	**Standard Deviation**		**Mean**	**Standard Deviation**
ΔUnemployment$_t$	-0.002	0.098	ΔUnemployment$_t$	0.001	0.074
ΔDisability-short term$_t$	-0.001	0.038	ΔDisability-short term$_t$	0.001	0.039
ΔDisability-total$_t$	-0.001	0.046	ΔDisability-total$_t$	0.001	0.045
ΔDisability- t+3$_t$	-0.001	0.034	ΔDisability- t+3$_t$	0.001	0.033
ΔRetirement$_t$	-0.007	0.057	ΔRetirement$_t$	-0.001	0.046
ΔLn employment$_{t-1}$	0.005	0.241			
Δ lnU$_{t-1}$	0.007	0.421			
$\Delta\ \tilde{\boldsymbol{U}}_{t-1}$	1.343	101.60			
MxIxT	15784			15784	

Note: Panel unit: municipalityXindustry. Population: 15284 observations of yearly municipalityXindustry-sums and averages based on all private sector jobs 2003-2012.

TABLE A2

Individual auxiliary regressions. Private and public sector workers. 2003-2012. OLS regressions.

	Unemploy-ment	**Disability short term**	**Disability total**	**Disability t+3**	**Retirement**
Woman	0.0012** (0.0001)	0.0164** (0.0001)	0.0260**(0.0001)	0.0143** (0.0001)	0.0153**(0.0001)
Immigrant	0.0191** (0.001)	-0.0067**(0.0001)	-0.0168**(0.0001)	-0.0137**(0.0001)	-0.0044**(0.0001)
Experience	0.0008** (0.001)	0.0032**(0.0001)	-0.0008**(0.0001)	-0.0031**(0.0001)	-0.0153**(0.0001)
Experience^2	-0.0001**(0.0001)	-0.0001**(0.0001)	0.0001**(0.00001)	0.0001**(0.00001)	0.0004**(0.00001)
Seniority	-0.0067**(0.0001)	-0.0019**(0.0001)	-0.0028**(0.0001)	-0.0001**(0.00001)	-0.0012**(0.0001)
Seniority^2	0.0002** (0.0001)	0.0001**(0.00001)	0.0001**(0.00001)	0.0001**(0.00001)	0.0001** (0.00001)
	+ all regressions comprise an intercept, year dummies, 7 dummies for educational qualifications, and dummies for 5-digit industry				
R^2-adj.	0.0516	0.0160	0.0541	0.0656	0.1505
JxPxT	19,214989	19,214989	19,214989	19,214989	19,214989

Note: Panel unit: Job (or individual J's employment relationship at workplace P). Dependent variable (dummy) denoted by column head. ** and * denote 1 and 5 percent level of significance, respectively.