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Wages, Creative Destruction, and Union Networks

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ABSTRACT

Wages, Creative Destruction, and Union Networks*

Do unions promote creative destruction? In this paper we apply a shift-share approach and historical unionisation data from 1918 to study the impact of changes in regional unionisation on regional wage and productivity growth and job creation and destruction during the period 2003-2012. As local regional-industrial unionisation increases, wages grow. Lay-offs through plant closure and shrinking workplaces increase, but entry and new hires are unaffected. Overall, the increased unionisation yields a positive impact on regional productivity, exceeding the wage growth, partly due to the closure of less productive firms, but also enhanced productivity of the survivors and new entrants.

JEL Classification: J01, J08, J50, J51

Keywords: trade unions, entry/exit, creative destruction, wages, productivity, historical data

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1 Introduction

Do unions promote or hinder job creation and destruction, and if so, is this good or bad? In many modern economies today union membership is on the decline. One observes this in major industrial countries as the UK and Germany, but also in the previously strongly organised Nordic countries (Addison et al., 2011; Schnabel, 2012; Bryson et al., 2017; OECD, 2017).[1] On average across all member states, OECD (2017) reports of a decline from 33 percent unionisation to 17 percent. Is such a decline good or bad? The implications from this decline thus depend on what unions do.[2] As we discuss in the literary review, one could argue that unions contribute positively to job creation and innovation, but also that they cause job destruction and create inefficiencies. Unions affect the economy at different levels. They influence workplaces and firms directly through actions at the workplace or firm, or by selection of workers at workplace or firm levels, but they also affect indirectly through wage bargaining at sectoral, regional or country-level, or by influencing legislations. 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.

To identify the impact of unions on job creation and destruction empirically is, unfortunately, far from easy. The main obstacle is the absence of exogenous variation in the unionisation required to draw causal inferences. In bad times, workers organise when firms perform badly and risks of closure and downsizing loom high. In good times, firms grow and unions' insider power might yield wage gains, thus inducing an inflow to unions. Worker selection by abilities might also affect performance and thus ultimately job creation and destruction. These difficulties affect the empirical relationships between unionisation and different outcomes at most levels, across workers, across firms or across regions.

Next, the implications from identifying the impact of unions on job creation and destruction are also complex. Since job destruction and economic growth inherently link through creative destruction, the process where obsolete jobs close to free resources for new productive

[1] According to OECD (2017: Fig.4.2). Two exceptions are Belgium and Iceland, where union density has been stable or even increased lately.

[2] Acemoglu et al. (2001) argue that skill-biased technological change could cause this de-unionization by increasing the outside options of skilled workers only, thereby undermining the support of unions (which try to realign the interest of both skilled and non-skilled workers).

jobs, promoting job destruction might not be bad. It is thus necessary also to study the impact of unions on wages and productivity as well.

In this paper, we utilise regional variance to study the impact of unionisation on wages, job creation and destruction associated with the entry and exit of plants, and on productivity. To solve the difficulties with unionisation, we invoke information on the historical distribution of unionisation across industries, and thus apply a shift-share approach (Bartik, 1991; Kovak, 2013; Autor et al., 2013). The wage setting in Norway is recognised as being highly centralised (Wallerstein, 1999) or what OECD (2018) define as Organised decentralised and Co-ordinated, i.e., a system were sector-level agreements are important, with coordination across sectors and bargaining units, but there is room for lower-level agreements. This wage-setting regime was established early in the 20th century, following the establishment of trade unions, worker empowerment, and widespread collective agreements between employer and worker unions. The establishment of trade unions in Norway was by no means unique, and followed 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).[3]

We argue that areas strongly unionised historically have established networks and cultures affecting the unionisation culture of new workers today. For example, Holmes (2006) observed such a linking between historical unionism and unionism 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. Thus, similarly to aggregate migrant flows and local settlement, aggregated flows of union workers can provide information correlated with local regional flows.

The structure of the remainder of the paper is as follows: Section 2 reviews the previous literature, while Section 3 describes the historical development of unionisation in Norway. Section 4 presents our empirical strategy, while data is presented in Section 5. Section 6 presents our results, while Section 7 briefly concludes.

[3] 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.

2 Previous literature

Theoretically there are several reasons to support both the notion that unions contribute positively to job creation, but also that they cause job destruction. Firstly, there is a rich literature linking how unions bargain for wages to innovation, job creation and destruction and to employment (Moene and Wallerstein, 1997; Barth et al, 2014; Haucap and Wey, 2004; Braun, 2011). In this literature local union bargaining stifles job creation and innovations, but also reduces job destruction and firm exit. Sector-wise or nationally bargaining, on the other hand, yield the opposite results, i.e., higher incentives for innovation, more job creation and destruction. Thus in this literature, unions through sector-wise or national bargaining are important vessels of creative destruction (Schumpeter, 1942: 82-83).[4]

Secondly, union takes strategic consideration when bargaining for wages (Dewatripont, 1987; Chappell et al., 1992; Pal and Saha, 2006, 2008). Since wages convey signals to the market, union pay bargaining take into account potential entrants hiring behaviour, and thus if entrants are thought to be hiring outside the pool of union workers, unions might bargain for entry deterring wages.

Finally, there is a huge literature on how unions affect productivity and wages, also yielding ambiguous predictions the relationship between unions on one hand and productivity and wages on the other (Grout, 1984, Freeman and Medoff, 1984; Acemoglu and Guerrieri, 2008; Vroman, 1990; Barth et al., 2012). Worker shirking, featherbedding and lowered capital investments are arguments associated with reduced productivity for union firms. "Voice"-effect, capitalization and capital deepening, and improved monitoring might contribute to improved productivity. Similarly, unions usually bargain for higher wages, but might if needed, actively contribute to cut wages. Furthermore, worker selection might also affect the overall productivity in a firm. Abowd and Farber (1982) argue that although union workers overall might be of inferior quality to non-union workers, since jobs are undersupplied employers might cherry-pick workers, thus causing positive selection of union workers to firms. On the other hand, Mastekaasa (2013) reveals that union workers are more absent due to illness than non-union workers. Since sick leaves are costly and absent workers hardly can be considered productive, union workers are less productive than their non-union counterparts, thus indicating a negative selection of union workers to firms. The overall

[4] Boeri (2015) argues that two-tiered wage bargaining causes allocative inefficiencies due to a decoupling of wages from productivity.

joint impact of unions on productivity and wages will thus determine job destruction and destruction.

Empirically the direct evidence on unions and job creation and destruction is limited. Chappell et al. (1992) discovers a negative association, i.e., unions act as entry deterrence. Bryson (2004) find that the unions in general raised the closure probability of workplaces during 1990s, in contrasts to the 1980s, but that considerable heterogeneity existed. The literature providing causal evidence on unions, wages and productivity is not rich, and yield mixed evidence. Deregulation of collective bargaining, from sector-wise wage bargaining towards local firm-level bargaining appears to have increased wages and wage dispersion in Denmark (Dahl et al., 2013).[5] The US-studies, motivated by the Wagner threshold, and employing a RD-approach, find little impact of union density on wages and productivity, although the impact actually vary across the distribution of wages (DiNardo and Lee, 2004; Frandsen, 2012), compressing wages at the top and lifting wages at the bottom. A follow-up study of Lee and Mas (2012) indicate that although the productivity and wage differences between firms just below and just above the threshold in the short term are minor, the financial market's evaluation in the long run differ, and unionisation then becomes quite expensive. Sojourner et al. (2015) find that unionisation reduces the required work hours of nurses, but keep the quality of care constant, which the authors interpret as improved productivity in health care. Finally, and very relevant for us, in a recent study based on Norwegian data where the authors utilise a tax reform affecting the price of union membership to draw causal inference, Barth et al. (2017) find that as firm union density increases both firm productivity and firm average wages grows, but productivity more so. Thus this paper focus on the productivity and wage effects within the firm, while dealing with unobserved heterogeneity and selection issues, but does not attempt to study spill-over effects onto the regional level. Furthermore, although they utilise an unbalanced panel of firms and thus could potentially study entry and exit, they do not attempt to do so.

3 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 2 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

[5] Using country-level data over time, OECD (2018) presents a similar pattern or correlations: firm-level wage bargaining appears to compress wages more than no collective bargaining at all, but sector-wise bargaining appears to compress wages the most.

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), founded in 1887.[6] In 1935 the first centralised cross-sectoral agreement between LO and the employer union were signed, and the establishment of the Labour government in the same year, the cabinet comprise two ministers from LO. When the war started, LO comprised over 350 000 members. During the post-war years LO continued to grow, and it close link to the Labour Party ensured that it continued to be an important political organisation fighting for improved wages and working conditions for its members. Although competing unions were established during 1980-90s, LO is still by far the largest union in Norway with over 900 000 members employed in all sectors and industries. Although this number vary slightly over the business cycle, LO organise 35-45 percent of all workers in Norway. However, sectoral differences exist. LO stands stronger in the classical manufacturing industries, where it roots once where. Competing unions are at least equally important in the public sectors.

The development of union membership over time is by no means unique for Norway. In Figure 1 we show the growth in union members during the 20th century for UK and Norway (Norway's numbers are depicted in 100 on the left-hand-side axis, UK on the right-hand-side axis in 1000). Of course, UK having a population 10-folds greater and a longer industrial history, has more than 10 times the number of union members, but we see a quite similar pattern in the growth. In both countries, unionisation grows in the first years of the century, experiences a temporarily set back in the 1920s, for then to experience massive growth during post-second world war years.[7] Similarly, Ebbinghaus and Visser (2000:62) show that both UK and Norway experienced long-term growth in unionisation from 1950 to 1975, but then that the countries split paths; unionisation went on the decline from the 1980s in the UK, while it remained stable, until the recent years decline.

[6] See Bjørnhaug et al. (2000) for a detailed historical account of LO across the last century.

[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 has multiplied 20-fold to over 111000.

[Figure 1 around here]

Of course, we do not argue that the development of industrial relations in these countries has been equal. Historical background, law and institutions all contribute to differences. Zeitlin (1985:175-6) argues that relatively speaking employer organisations in the UK were weaker and lacked internal coherence than 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 in the wake of the Taff Vale Case. This case forced unions to turn to parliamentary politics, in order to change the common law constraints (Ebbinghaus and Visser, 711). 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. In Germany, the U.S. and the Norway legal support for collective bargaining and trade union recognition also defined managerial prerogatives (Zeitlin, 1985). In the Norwegian case, the Work Environment Act of 1997 clearly states this.

Figure 2 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)(see Section 4 on data). Although a majority of the municipalities were not unionized in 1918, the unionized municipalities are spread around the country, reflecting the localization of heavy manufacturing.

[Figure 2 around here]

There is a tendency that the areas around the capital and other cities are more unionized than other areas. We also see that the central part of Norway was less unionized, since this mountainous area comprises agricultural activities dominated in those days by small farms. In 2003, this picture is completely different. We see that Norwegian municipalities today are heavily unionized.

4 Empirical strategy

The empirical strategy in this paper is linear regressions on municipalityXindustry observations form the private sector, but where we first-difference the observations to take into account municipality-industry fixed effects. Let the panel unit, municipalityXindustry, and time be denoted by p and t, respectively. Similarly, let m denote municipality, while i denote industry. The empirical specification (after first-differencing) can be expressed:

1) $\Delta Y_{pt} = b_0 + t_t + b_1 \Delta lnU_{pt-1} + b_1 \Delta lnL_{pt-1} + b_3 \Delta X_{mt-1} + b_4 t_{it} + b_5 t_{mt} + \epsilon_{pt}$,

where Y_{pt} denote different dependent variables such as the average log hourly wage, the hiring rate due to plant entry, the quit rate due to plant closure, employment or a measure of tfp (total factor productivity added labour productivity).

U_{pt-1} and L_{pt-1} denotes the number of union workers and the number of workers, respectively. X_{mt-1} denotes a vector of exogenous control variables. In practice, this vector only comprise the local unemployment rate. The t's denote year dummies and linear industry and municipality trends. Finally, ϵ_{pt} denotes a classical error term. Assuming exogenous right-hand-side variables, this model can then be estimated using OLS. In the regressions, since observations constitute municipalityXindustry averages, to take into account the heterogeneity, 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.

Our industry definition is, due to the historical data, quite broad and just based on 6 categories (agricultural, mining, manufacturing, construction, transport, others). Since heterogeneity obviously exists within these 6 categories, we construct from auxiliary regressions more homogeneous left-hand-side variables. The estimation is quite straightforward. Based on all observations, i.e., both private and public sector job level data, we estimate log hourly wage regressions and linear probability models controlling for human capital variables such as women, immigrant, seniority (and squared), experience (and squared), educational qualification (6 dummies) and 5-digit industry code. Table A2 in the appendix presents the results from these regressions. From these regressions, we estimate the residuals, and then take the municipalityXindustryXtime average of these residuals for the private sector workers. Similarly, we also calculate the wage dispersion (variance of the residuals, and the 5^{th} and 95^{th} percentile of the wage distribution within the panel unit).

Total factor productivity (TFP) is not observed directly in the data. We conduct an auxiliary regression based on firm data motivated by a simple Cobb-Douglas production function to measure TFP. We regress log value added on log capital, log employment, shares of workers within 8 occupational groups, shares of workers within 6 educational groups, and municipalityXbroad industry(6)Xtime fixed effects.[8] These fixed effects can then be interpreted as time-specific regional- industry total factor productivity, cleansed for human capital differences, employment and capital. Table A3 in the appendix presents the results from this regression. We also calculate

[8] Note we cannot control for detailed industry (5-digit codes), since this is more detailed than the industry-level defining the panel units, which is the basis for the fixed effects. Thus in the later productivity regressions on the aggregated municipality-industry data, we will add controls for 5-digit industry shares, thus eliminating variation due to industry composition.

the residuals from this regression within municipalityXbroad industry(6)Xtime, to get a measure of productivity dispersion and high and low productivity (5^{th} and 95^{th} percentile within the local productivity distribution) within the panel unit.

However, in this setting, we cannot rule out that U_{pt-1} and $\epsilon_{pt}$is correlated, thus violating the assumptions making estimation of 1) by OLS valid. Thus we invoke a shift-share instrument (Bartik, 1991; Kovak, 2013; Autor et al., 2013) to handle the potential endogeneity of unionisation in these regressions. 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 depends on the historical distribution of unionisation across industries.

Our instrument in levels can be expressed:

$$2) \quad \widetilde{U_{pt-1}} = \left(U_{t-1} - U_{pt-1}\right)\left(\frac{U_{p0}}{U_0}\right).$$

Subscript 0 in Equation 2) denote time 0, i.e., 1918. We use the historical distribution of unionisation across municipalities and industries to define the shares of the aggregate flows today.

This instrument is then introduced as an instrument for the log number of unionised workers in a set of IV-regressions based on first-differenced data, where the panel unit is municipalityXindustry. In the first-differenced regressions the instrument can be expressed as $\Delta\widetilde{U_{pt-1}}$. Since the historical shares are fixed, identification in then ensured by variation in the treatment intensity over time (where aggregate variation induces the variation in treatment intensity).

Dependent variables in the regressions are typically growth in average log hourly wage, aggregated wage residuals from individual wage regressions, or the similar residuals from quit- and hire-regressions. Growth in lagged regional-industrial log number of unionised workers is the main covariate of interest, although to control for business-cycle effects and trends, regressions also include the municipality unemployment rate, and linear industry and municipality time trends. To avoid size effects we also include log number of all workers in all regressions but one. When addressing productivity impacts, we do not include (growth in) lagged log number of workers as control, since employment has already been taken into account when estimating the TFP-measure.

5 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 (unemployment spells, gender, educational qualifications, union membership, earnings and income), on jobs (occupation, seniority, spell-specific earnings and fringe benefits, working hours, wages), and on firms-and establishments/workplaces (employment, industry, sector and municipality/location). Active employment spells December 31th each year defines employment.

The secondary data set comprise the Municipality Data Base. 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 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 (1918/1920) thus comprise union and worker information across municipalities and 6 aggregated industries.

The third data set is the Statistics Norway's Structural Statistics linked to the Accounting Registers. The Structural Statistics provide information on value added and industry. All public limited companies are required to report to the Accounting register. From this register we get information on capital assets. Finally, we link these data to our previously defined job files by the firm identifier, to get information on workplace location. This provide information on key firm characteristics such as value added, capital, different kinds of costs and revenues, employment and industry-code (5-digit). It is linkable to the other data by a firm-specific identifying number.

6 Results

6.1 Background and motivation for IV

We start in Table 1 by looking closer on the union distribution across municipalities within our 6 broad industries in 1918 (Panel A), and then how the same distributions look in 2003 (Panel B). We see that in 1918 unionisation primarily occurred in Manufacturing and Mining, but in all industries a considerable of municipalities were not unionised at all. All industries experience a massive growth in unionisation, particularly Construction and Transport. One could suspect that

the unionisation of regions for nearly a century ago was uncorrelated with the unionisation today. However, as we see in Figure 3 this is not the case.

[Table 1 around here]

[Figure 3 around here]

This figures plot the regional union density in 1918 against the density in 2003, as well as we see a simple linear prediction of the same relationship. While variation in unionisation obviously occurs from 1918 to 2003, we see that high levels of unionisation in 1918 usually imply high levels of unionisation in 2003, and vice a versa.

We therefore apply the historical regional industry-specific shares to aggregate figures during the period 2003-2012 and then predict the local number of union members within each industry. This will be our instrument for local industry-specific log unionisation in the regression analyses to come. Our regression analysis focus changes to take care of localXindustry-specific fixed effects. Thus we first-difference the data. How then is this relationship? In Figure 4 we have divided the changes in predicted local number of union members within each industry into 20 equal-sized bins, computed the means of the predicted union member change and the changes in log observed unionization within each bin, and created a scatterplot of these data points.[9] 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 4 around here]

6.2 Wages

We turn next to the regional-industrial wage regressions. Our purpose is to reveal the impact of unionisation growth on wage growth. Figure 5 depicts the distribution of wages across municipalityXindustry (our panel units) for two different periods; 2003-4 and 2011-12. We see that the growth of observed wages in latter period is higher than in the early period. This relationship twists around when we focus on the distribution of wage residuals, i.e., where we have taken into account human capital and industry differences. Not only are these distributions naturally distributed around zero, but the residual wage growth is less in 2011-12 than in 2003-4.

[9] Beforehand the observations have been residualized, by applying a regression controlling for year dummies, lagged regional unemployment and lagged log workforce size.

Then we turn to the actual regressions. Table 2 presents the results from these regressions. We start by estimating these by OLS (Panel A), then turn to the IV-analyses (Panel B), presenting the first-stage results (Panel C) and reduced form estimates (Panel D). The dependent variables are municipal-industry average of log hourly wage (Models 1-3) or the similar average of the wage residuals from individual regressions controlling for human capital variables (women, migrant, years of education, experience, and seniority) and 5-digit industry (Models 4-6). Model 1(4) just control for the lagged municipality unemployment rate and year dummies. Model 2(5) adds lagged log employment to the control vector. Model 3(6) then finally incorporate linear industry trends and linear municipality trends. Since all estimations are conducted on first-differenced observations, municipality-industry fixed effects are taken into account in all specifications.

[Table 2 around here]

The OLS-analyses of Panel A) indicate that wage growth is unrelated to local growth in unionisation. No model reals any significant relationship. However, as is indicated previously, we expect that local inflow to unionisation could be related to 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 in Panel C) that our instrument in the first-stage regressions are strongly significant and clearly pass the test for strong instruments. Second, in Panel B) increased unionisation implies higher wages, typically yielding wage elasticity estimates of 0.04-0.08, i.e., if local unionisation increases by 1 percent, then wages grow by 0.04-0.08 percent. To provide an alternative interpretation, we have in Panel A) and B) also calculated the marginal effect of the number of union workers on log wages. We see that by increasing the number of unionised workers by 100 workers, then local wages increase by 0.8-1.5 percent.

6.3 Robustness checks

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, this could be a problem, but we think this is less of a concern 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. Note that 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.

Third, we are less concerned for bias due to labour supply shocks. Our main specifications analyse wage- and hiring-/separation-residuals, cleansed for human capital characteristics (women, immigrant, education, seniority, experience) as well as 5-digit industry characteristics, and the first principal component of the matrix of the 1918 industry shares across municipalities is mostly uncorrelated to most other local human capital characteristics of 2003 (see Table A4 in the appendix). The exception is municipality size, but most regressions control for size differentials.

Fourth, following Jaeger et al. (2017) and addressing worries regarding different short- and long-run impacts, as seen in Table A5 we still find positive effects from lagged unionisation growth on wages, and the inclusion of log unionisation lagged two periods does not change the estimate associated with lagged unionisation growth qualitatively. However, (growth in) log unionisation lagged two periods does not have any significant impact on wages.

Fifth, we have cleansed the wage growth from what we would predict based on our instrument, and then examined how this residualised wage growth influences future values of our instrument. This yields a positive, but non-significant correlation (table not shown).

Sixth, finally we have tested for over-identification. We have used the historical union industry shares and estimated the first principal component of the matrix of the 1918 industry shares across municipalities, and then constructed a IV-vector comprising the first principal component across municipalities multiplied by the year dummies. It is these interactions (the varying impact of the union industry shares over time), that ensure identification. Then we have re-estimated the model. Table A6 in the appendix presents the results. We see that this instrument vector remains strong and passes the over-identification test. Thus we find no evidence indicating that the monotonicity-assumption is not satisfied. The final wage elasticity impact is 0.04, which is in line with the previous estimates.

6.4 Entry and closure of plants

After having established that increased local unionisation causes local wage growth, we then turn to the issue of how this affects the entry and closure of plants locally, with emphasis on the number of jobs created or lost. We also look closer on job creation and destruction in surviving workplaces. Table 3 presents the results from several entry hire/closure layoffs/hires in growing workplaces/separations in shrinking workplaces-regressions, based on both OLS- and IV-estimation. We only present one set of models, where we control for lagged unemployment rate, time trends and linear industry and municipality trends. As for wages, we conduct the analyses based on residuals from linear probability models, where we already have taken into account human capital and industry differences.

[Table 3 around here]

Neither entry nor closure appear strongly related to unionisation in the OLS-analyses, but the both job creation and destruction for the surviving workplaces appear positively correlated with unionisation. However, the IV-analyses reveal no impact for neither entry nor job creation, but increased layoffs rates due to closures and increased separations when workplaces reduce their size. Thus, the increased wages following unionisation we found in Table 2 comes at a cost, in the form of job losses. Furthermore, the impact is much stronger for jobs lost to closures than for the job loss due to reduced labour demand of survivors. The wage growth following unionisation thus forces the least productive workplaces to close. Job creation, either by plant entry or by job growth in existing plants, is unaffected, i.e., the wage growth following unionisation does not deter entry of new productive plants. This could be interpreted as evidence that unionisation contributes to creative destruction. If this is the case, then we should witness productivity growth following increased unionisation.[10]

6.5 Productivity

Our final issue is thus whether local unionisation affects local productivity. Unfortunately, we do not have information on productivity in all the panel units (municipalitiesXindustries), thus we are forced to do these analyses on a subset of the data. For comparison purposes, we therefore also

[10] Note also that when increased unionisation contributes to higher job destruction rates among existing workplaces and increased job loss through workplace closure, but leaves entry and job creation unaffected, this implies that employment drops and unemployment should increase. We have tested the impact on unemployment (not shown), and this is indeed the case: in the short run, increased regional unionization also causes increased unemployment.

repeat the wage analyses on this subset of the data. At the same time, we also look closer on the impact on wage dispersion. We then conduct a set of productivity regressions. Table 4 presents the results of these regressions, where we only focus on the IV-regressions.

[Table 4 around here]

First, we see that the wage regression yield similar results as before, when it comes to the average wage impact (we focus on the wage residuals, thus having already taken into account human capital and industry-differences). The IV-regression yields an union wage elasticity estimate of 8.6 percent, which very close to our estimate of 8 percent, which we found in Model 6 of Table 2. Rather surprisingly, no impact is found on wage dispersion, but we see that although the difference is not significant, the point estimates indicate that unions raise wages more strongly at the bottom of the wage distribution (in our case measured by the 5-percentile) than at the top (i.e., the 95 percentile). Thus we do observe a tendency towards wage compression caused by unions.

Next, we turn to the productivity analyses. First, we see that unionisation growth causes regional TFP growth, i.e., if local unionisation increases by 1 percent, total factor productivity increases by 0.07 percent. Thus increased local unionisation increases productivity even more than wage costs (since the elasticity of wages w.r.t. unionisation is 0.086 and the elasticity of value added on labour is 0.6 as seen in Table A3). Second, when we study closer the impact on local productivity dispersion, we find that unions strongly compress the productivity dispersion. This is as expected, since the least productive firms are forced to close due to unions raising the overall market wages. However, when we look closer at what happens at the top and bottom of the productivity distribution, we find no significant impact of unionisation, although the point estimates indicate that a lifting of the floor occurs at the bottom, while the roof is lowered at the top. Thus taken at face value, the point estimates implies that the least productive firms are forced to close, but at the same time, a reduction in the productivity of the most productive firms.

7 Conclusion

During the last decades trade unions have been on the decline, thus potentially weakening the collective bargaining power of workers. In this paper we look closer of the impact of regional unionisation growth on regional wage and productivity growth, as well as lay-offs and hires. Since the process of unionisation might reflect local economic conditions, which might bias our analyses, we utilise information on the historical distribution of unionisation, and then follow a shift-share

approach. Thus we in practice compare municipalities with low historical unionisation with high unionisation, and see how they differ when it comes to wage and productivity growth.

Our analyses reveal that local unionisation growth causes wage growth. On one hand, this wage growth then causes plants to close, and thus layoffs increase as well. On the other hand, hires following plant entry appear less sensitive to unionisation growth. So for some workers, the wage growth has a price, they will be laid off, while other workers benefit from the wage growth.

What about the employers, those that do not close? They will clearly have to pay higher wages. However, we also show that increased unionisation yields productivity gains, and this productivity gain is larger than the wage growth (since wage growth only affect through the labour share). Overall the surviving employers benefits from unionisation growth. In this respect, our results support Barth et al. (2017), which finds positive effects of firm union density on firm productivity. In their case, they argue that the tax reform induces enough workers to join a union so that union the union can demand union agreements and thus influence work organisation and policies at the firm level to a greater extent what just implied by the increase in union members. Such a mechanism would generate positive productivity effects manifested at the local regional level as well. One could also argue that such an effect would manifest in stronger impact at local level through a local multiplier, contributing to transforming the local community.

Finally, our paper show that 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. Thereby increased unionisation contributes to creative destruction. One implication from this is that the recent decline in union membership discussed in the introduction could potentially contribute to stagnancy by less creative destruction, and thus this decline is worrisome.

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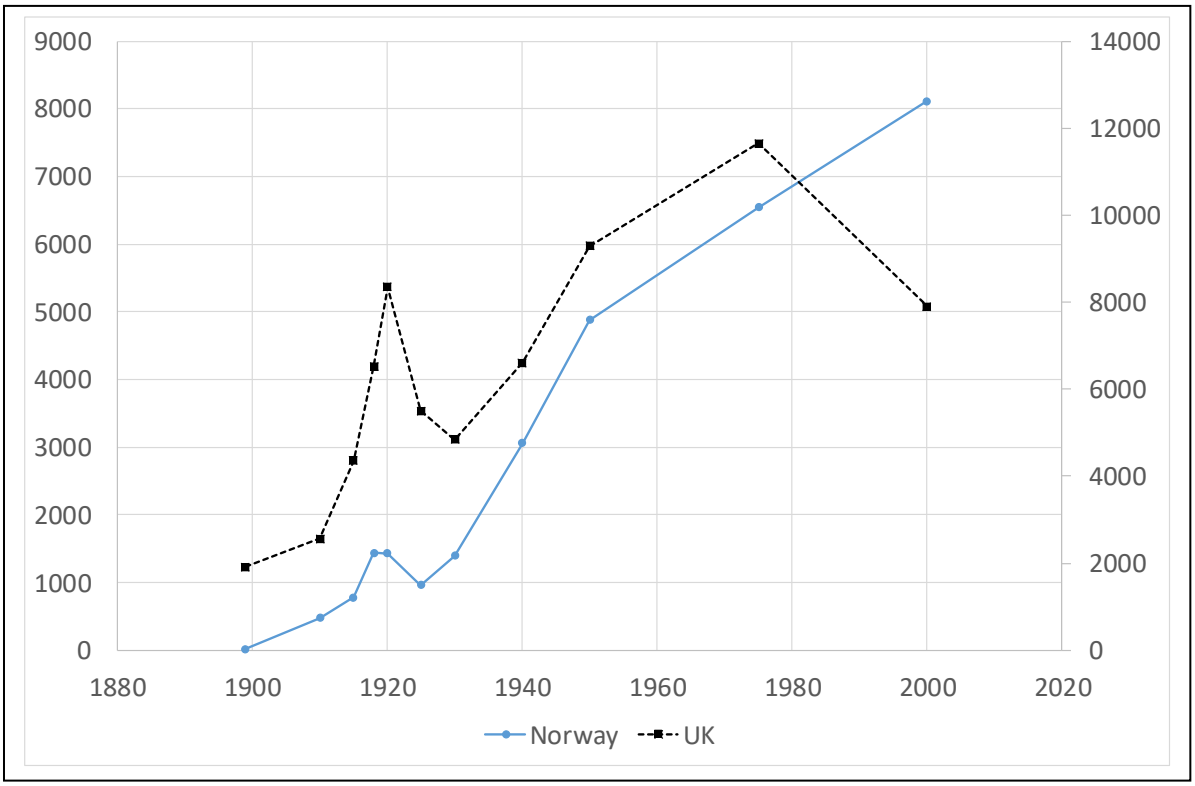
Appendix

[Table A1]

[Table A2]

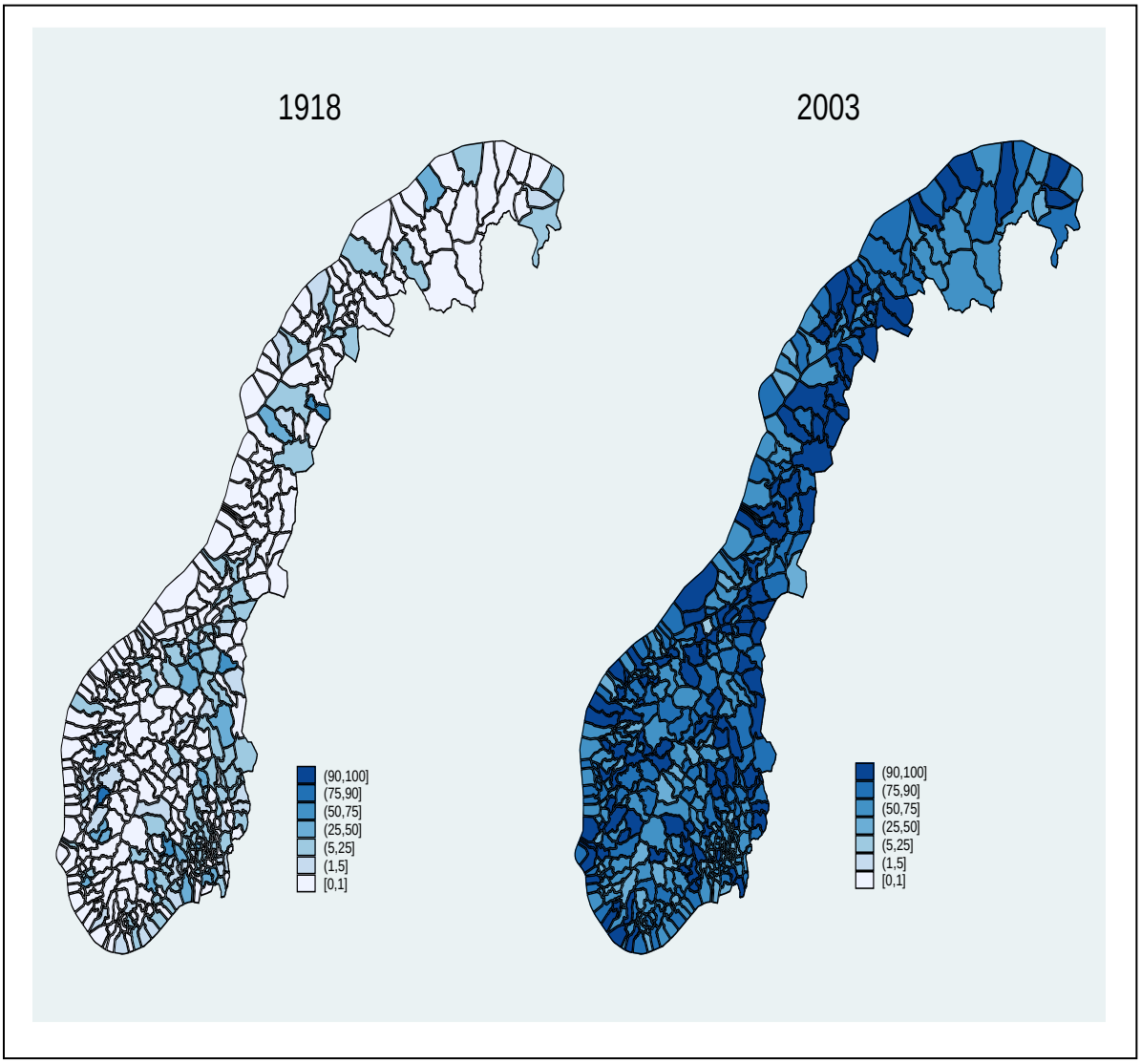
[Table A3]

Figure 1 The development of union members in Norway and the UK



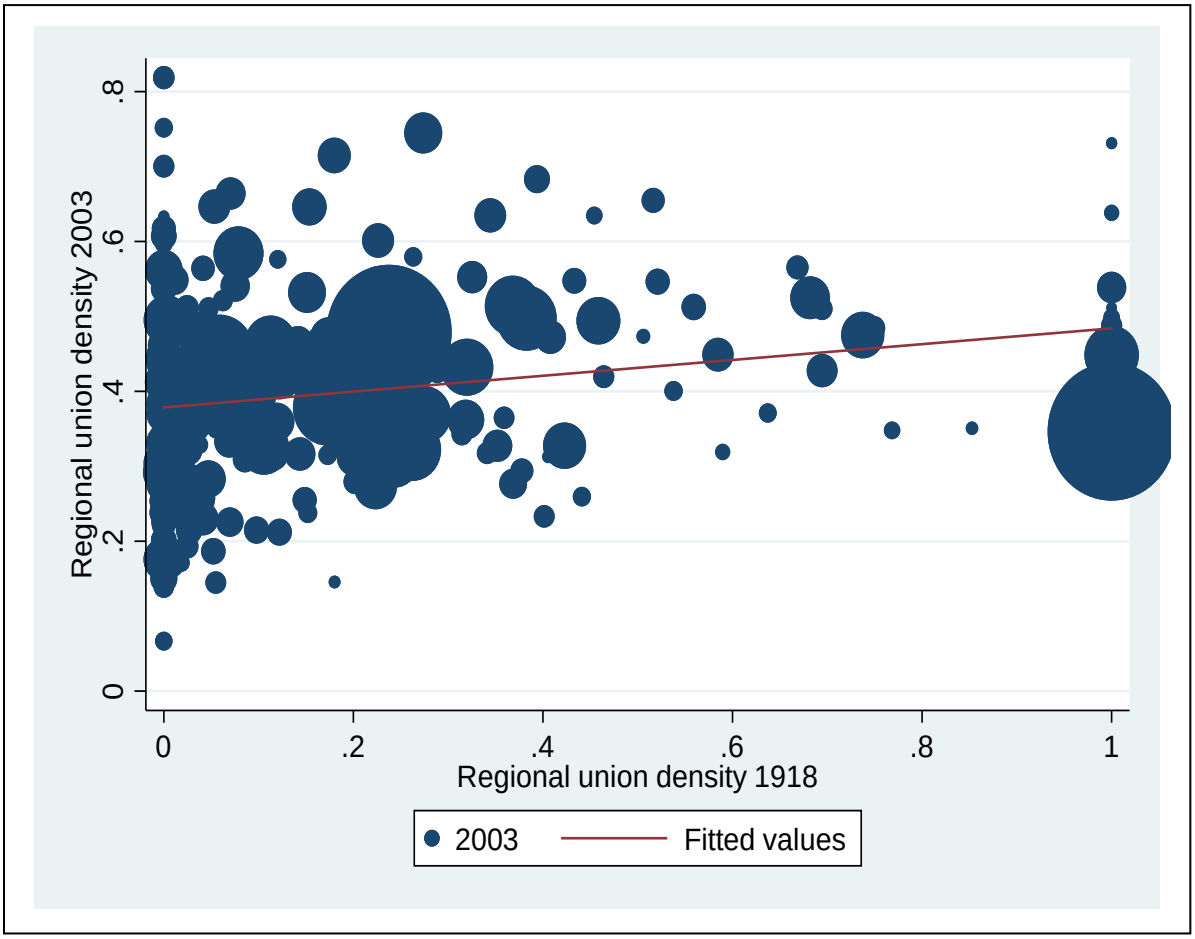
Note: The figures for Norway are measured on the left-hand-side axis in 100, while the figures for UK are measured on the right-hand-side axis in 1000. Figures from Norway: the Municipality database and register data (this study), figures from UK: Wolman (1937) and Wrigley (2002).

Figure 2 The development in regional union density across municipalities from 1918 to 2003



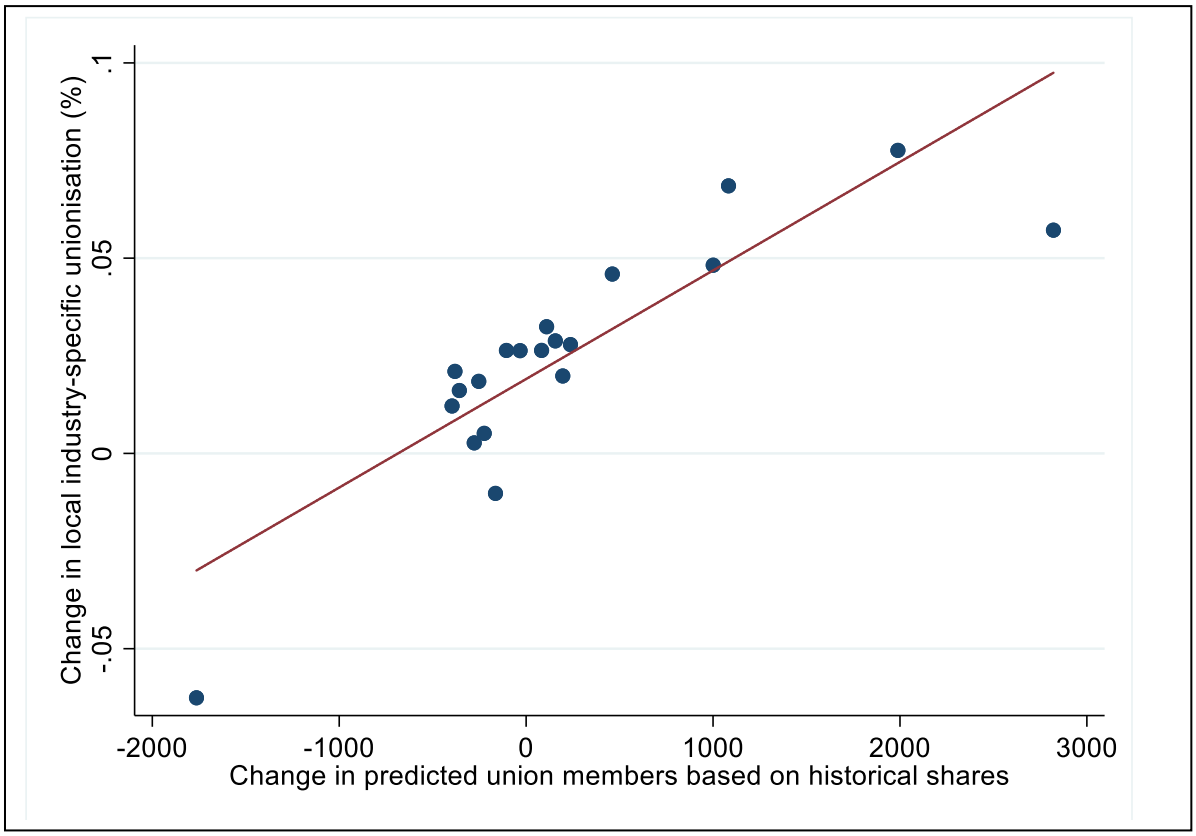
Note: Observation unit: municipality. Note that the union density in 1918, is based on information on union members from 1918, but information on all workers are based on the Norwegian Census of 1920.

Figure 3 The correlation between the regional union density in 1918 and in 2003



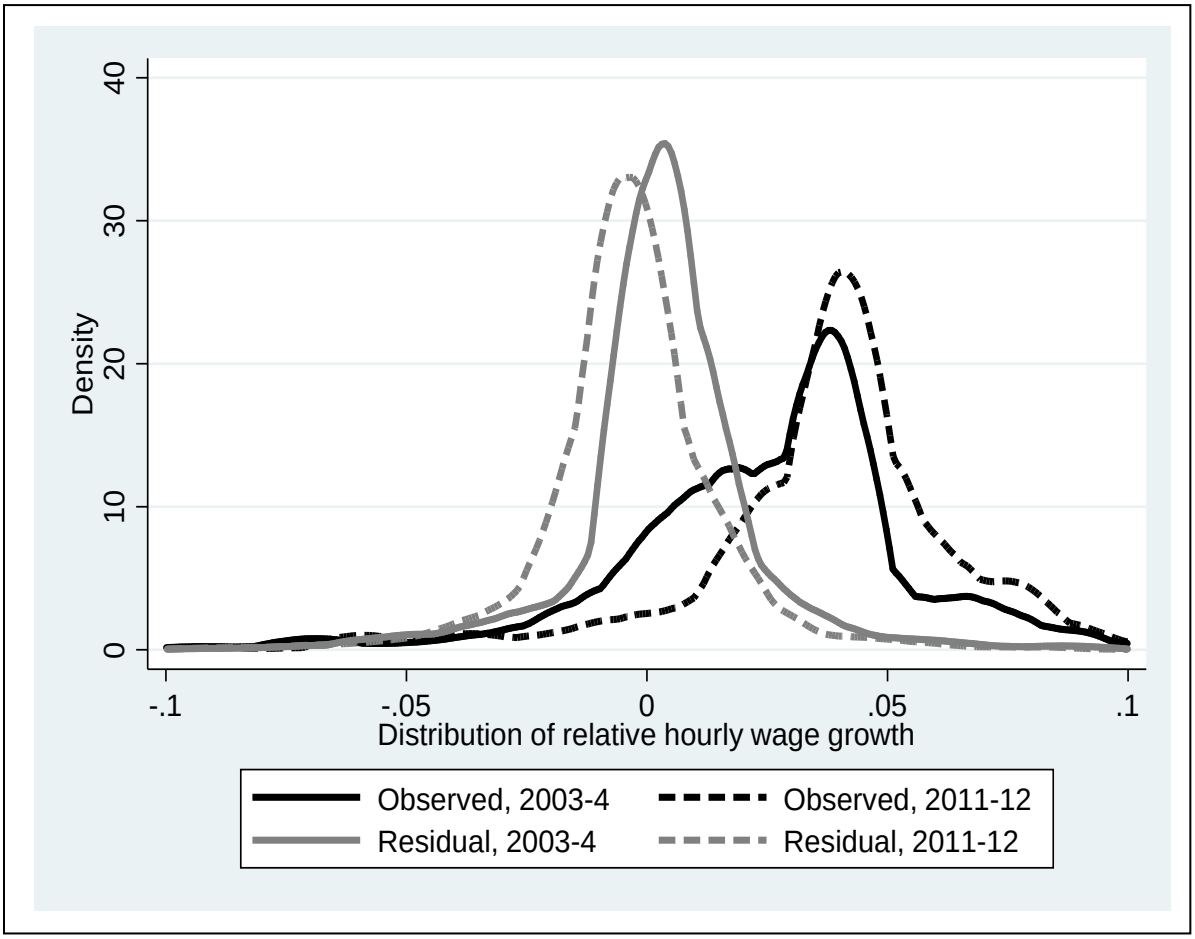
Note: Observation unit: municipality. Union density in 1918 is calculated from unionisation figures from 1918 but Census employment figures from 1920.

Figure 4 The correlation between changes in regional industry-specific unionisation and changes in the predicted numbers of regional industry-specific union members



Note: 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 members figures from the period 2003-2012. Note that one has a priori first-differenced data and then residualized these by applying a regression controlling for year dummies, lagged regional unemployment and lagged log workforce.

Figure 5 Relative growth in hourly wages.



Note: Distribution across municipalitiesXindustries. See Table A2 for details on the auxiliary regression which the wage residuals are based on.

Table 1 Union distributions within industries 1918 and 2003

	Agriculture, forestry, fishing	Mining	Manufac-turing	Construc-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

Table 2 The impact of regional unionisation growth on growth in regional log hourly wages.

	Observed			Residual		
	1	2	3	4	5	6
Panel A) OLS						
Lagged lnU	-0.007	-0.005	-0.007	0.001	0.001	0.002
	(0.004)	(0.005)	(0.005)	(0.002)	(0.003)	(0.003)
Lagged lnL		-0.002	0.004		-0.001	-0.002
		(0.010)	(0.010)		(0.005)	(0.005)
Controls						
Basic	Yes	Yes	Yes	Yes	Yes	Yes
Linear trends			Yes			Yes
TestLagdlnW/dlagU		-0.003	-0.002		-0.001	-0.001
(X 100)		(0.002)	(0.002)		(0.001)	(0.001)
Panel B) IV 2.step						
Lagged lnU	0.018	0.071*	0.075*	0.020**	0.043**	0.080**
	(0.015)	(0.035)	(0.035)	(0.007)	(0.002)	(0.017)
Lagged lnL		-0.071	-0.103*		-0.054**	-0.103**
		(0.045)	(0.046)		(0.002)	(0.023)
Controls						
Basic	Yes	Yes	Yes	Yes	Yes	Yes
Linear trends			Yes			Yes
TestLagdlnW/dlagU		0.008	0.013*		0.008**	0.015*'
(X 100)		(0.007)	(0.006)		(0.003)	(0.004)
Panel C) IV 1.step						
Lagged lnL		1.273**	1.286**		1.273**	1.286**
		(0.042)	(0.045)		(0.042)	(0.045)
$\widetilde{U}$	0.028**	0.013**	0.014**	0.028**	0.013**	0.014**
(in 1000)	(0.002)	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)
Strength						
F-value	127.38	158.32	140.90	127.38	158.32	140.90
Panel D) Reduced form						
$\widetilde{U}$	0.001	0.001	0.001*	0.001**	0.001**	0.001**
(in 1000)	(0.001)	(0.001)	(0.0005)	(0.0002)	(0.0002)	(0.0001)
Lagged lnL		-0.009	-0.005		-0.001	-0.001
		(0.007)	(0.002)		(0.004)	(0.002)
Controls						
Basic	Yes	Yes	Yes	Yes	Yes	Yes
Linear trends			Yes			Yes
N	15284	15284	15284	15284	15284	15284

Note: Population yearly municipalityXindustry-averages based on all private sector jobs. Panel unit: municipalityXindustry. Linear regressions on first-differenced data (OLS/IV). Dependent variable (Y): log hourly wage (observed or residual, see Table A2). 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.

Table 3 The impact of regional unionisation growth on job creation and destruction.

	Hires				Exit			
	Entry		Job creation		Job destruction		Exit	
	OLS	IV	OLS	IV	OLS	IV	OLS	IV
Lagged lnU	0.001	-0.013	0.025**	-0.005	0.008**	0.033**	0.007	0.166**
	(0.005)	(0.021)	(0.008)	(0.032)	(0.002)	(0.011)	(0.004)	(0.025)
Lagged lnL	-0.073**	-0.055	-0.165**	-0.125**	-0.020**	-0.053**	-0.003	-0.210**
	(0.010)	(0.030)	(0.025)	(0.052)	(0.005)	(0.016)	(0.007)	(0.036)
Controls								
Basic	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Linear trends	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	15284	15284	15284	15284	15284	15284	15284	15284

Note: Population yearly municipalityXindustry-averages based on all private sector jobs. Panel unit: municipalityXindustry. Linear regressions on first-differenced data (OLS/IV). Dependent variable (Y): hires due to plant entry/hires in growing plants/separations in decreasing plants/layoffs due to plant closure (residuals, see Table A2). Control vector: Basic=lagged municipality unemployment rate, year dummies; Linear trends=linear industry trends, linear municipality trends. See Table 2, Panel C) on information on first step parameter estimates and strength of instrument. Standard errors adjusted for panel unit-clustering reported in parentheses. ** and * denote 1 and 5 percent level of significance, respectively.

Table 4 The impact of regional unionisation growth on regional growth in wages and productivity. IV-estimates.

	Wages				Productivity			
	Residual				TFP	TFP-residual		
	Mean	St.Dev.	5	95	Estimate	St.Dev.	5	95
2.step								
Lagged lnU	0.086**	0.012	0.138**	0.074	0.070*	-0.246**	0.149	-0.109
	(0.019)	(0.017)	(0.037)	(0.039)	(0.035)	(0.069)	(0.120)	(0.083)
Lagged lnL	-0.111**	-0.016	-0.175**	-0.100				
	(0.026)	(0.024)	(0.051)	(0.051)				
Controls								
Basic	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Detailed industry					Yes	Yes	Yes	Yes
Linear trends	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
IV 1.step								
Lagged $\widetilde{U}$	0.013**	0.013**	0.013**	0.013**	0.031**	0.025**	0.025**	0.025**
(in 1000)	(0.001)	(0.001)	(0.001)	(0.001)	(0.003)	(0.003)	(0.003)	(0.003)
Lagged lnL	1.328**	1.328**	1.328**	1.328**				
	(0.036)	(0.036)	(0.036)	(0.036)				
Strength								
K-P F-value	139.01	139.01	139.01	139.01	133.95	92.45	91.61	91.61
N	10733	10733	10733	10733	10733	9572	10060	10060

Note: Population wage regressions: yearly municipalityXindustry-averages based on all private sector jobs. Panel unit: municipalityXindustry. Linear regressions on first-differenced data (OLS/IV). Control vector: *Basic*=lagged municipality unemployment rate, year dummies; *Detailed industry*=industry-shares of 5-digit industry codes; *Linear trends*=linear industry trends, linear municipality trends. Each observation in the wage regressions is weighted by the number of workers. Note that the wage measures are based on the residuals from an auxiliary individual-level log wage regression (see Table A2), where 5-digit industry dummies are already controlled for. Note that the TFP-estimate is based on the municipalityXindustryXtime fixed effects from an auxiliary firm-level Cobb-Douglas production function estimation (see Table A3). The TFP-residuals are calculated from this regression as well. Each observation in the wage-residual regressions is weighted by the number of workers. Each observation in the regression on the TFP-estimate is weighted by the inverse of the squared standard error of the TFP-estimate. Each observation in the TF-residual regressions is weighted by the number of workplaces. Standard errors adjusted for panel unit-clustering reported in parentheses. ** and * denote 1 and 5 percent level of significance, respectively.

Table A1 Descriptive statistics. Growth.

	Mean	StD		Mean	StD
LnW	0.029	0.215	Hires-Entry (HE)	-0.003	0.113
Wage residual	0.001	0.103	HE residual	-0.003	0.136
Lagged lnU	0.008	0.416	Layoffs-Exit (LE)	-0.002	0.143
Lagged $\widetilde{U}$	0.647	64.210	LE residual	0.002	0.131
Ln employment	0.005	0.286	Hire-Increase(HI)		
Log productivity	-0.259	0.860	HI residual		
			Quit-Decrease(QD)		
			QD residual		

Note: Based on 18919 observations, except for the productivity figures, which rest on 12501 observations.

Table A2 Individual auxiliary regressions. Private and public sector workers. 2003-2012

	Log hourly wage	Hire due to plant entry	Layoff due to plant closure
Woman	-0.180**(0.001)	-0.007**(0.001)	-0.003**(0.001)
Immigrant	-0.080**(0.001)	0.016**(0.001)	0.007**(0.001)
Experience	0.018**(0.001)	-0.001**(0.0001)	-0.001**(0.0001)
Experience^2	-0.0003**(0.0001)	0.0001**(0.0001)	0.0001**(0.00001)
Seniority	0.006**(0.001)	-0.019**(0.001)	-0.003**(0.001)
Seniority^2	-0.0001**(0.0000)	0.001**(0.00001)	0.0001**(0.00001)
	+ all regressions comprise an intercept, year dummies, 6 dummies for educational qualifications, and dummies for 5-digit industry		
FxNxY	19,047,947	19,047,947	19,047,947

Note: OLS regressions. Dependent variable denoted by column head. For hire and layoffs the dependent variables are dummies. ** and * denote 1 and 5 percent level of significance, respectively.

Table A3 Firm auxiliary FE regression. Private firms. 2003-2012. Within municipalityXindustryXyear

	Log value added
Ln employment	0.641**
	(0.001)
Ln capital	0.408**
	(0.001)
+ all regressions comprise an intercept, dummies for 5-digit industry(1040), dummies for share of workers within 7 educational qualifications, share of workers within 8 occupational groups, and fixed effects for municipalityXindustryXyear	
FxNxY	830868

Note: OLS regression. Dependent variable denoted by column head. ** and * denote 1 and 5 percent level of significance, respectively.

Table A4 Correlation historic union industry-shares and 2003-labour supply characteristics.

	Model 1	Model 2	Model 3
Women	0.016 (0.016)	-0.036 (0.034)	-0.042 (0.034)
Immigrants	0.133 (0.116)	0.093 (0.088)	0.067 (0.086)
Education (years of)	0.303 (0.189)	0.188 (0.122)	0.154 (0.122)
Experience	0.216 (0.173)	0.245 (0.177)	0.285 (0.187)
Seniority	-0.002 (0.023)	-0.020 (0.032)	-0.066 (0.048)
Age	-0.178 (0.123)	-0.240(0.144)	-0.184(0.124)
Log workers 2003			0.310* (0.138)
Log workers 1920		0.383*(0.184)	
F	415	415	415

Note: OLS regressions. Unit of observation: municipality. Dependent variable: This table reports a regression of the first principal component of 1918 union industry shares on 2003-labour supply characteristics. Each characteristic is standardized to have unit standard deviation. The first principal component also has unit standard deviation. Standard errors in parentheses.. ** and * denote 1 and 5 percent level of significance, respectively.

Table A5 The short- and long-run impact of regional unionisation growth on growth in regional log hourly wages.

	1st stage		2nd stage
	lnU_{t-1}	**lnU_{t-2}**	
lnU_{t-1}			0.103**(0.015)
lnU_{t-2}			0.015 (0.009)
Lagged lnL	1.287**(0.051)	-0.152**(0.046)	-0.132** (0.021)
$\widetilde{\boldsymbol{U}}_{\boldsymbol{t-1}}$	1.3e-5** (1.1e-6)	-5.1e-7 (1.1e-6)	
$\widetilde{\boldsymbol{U}}_{\boldsymbol{t-2}}$	8.3e-7**(4.0e-7)	2.9e-5**(2.1e-6)	
Controls			
Basic	Yes	Yes	Yes
Linear trends	Yes	Yes	Yes
F-value excl.instruments	121.62	259.99	
K-P F-value			58.82
N	13102	13102	13102

Note: Population yearly municipalityXindustry-averages based on all private sector jobs. Panel unit: municipalityXindustry. Linear regressions on first-differenced data (IV). Dependent variable: log hourly wage (residual). Control vector: Basic=lagged municipality unemployment rate, year dummies; Linear trends=linear industry trends, linear municipality trends. Standard errors adjusted for panel unit-clustering reported in parentheses. ** and * denote 1 and 5 percent level of significance, respectively.

Table A6 Over-identification and monotonicity. The impact of the principal component of the historical municipality industry shares on growth in regional log hourly wages.

	1st stage	2nd stage
	lnU_{t-1}	
lnU_{t-1}		0.044** (0.016)
Hist.unionshare PC1X2005	0.285** (0.030)	
Hist.unionshare PC1X2006	0.328** (0.047)	
Hist.unionshare PC1X2007	0.229** (0.066)	
Hist.unionshare PC1X2008	0.242** (0.086)	
Hist.unionshare PC1X2009	0.378** (0.109)	
Hist.unionshare PC1X2010	0.512** (0.136)	
Hist.unionshare PC1X2011	0.186 (0.146)	
Hist.unionshare PC1X2012	0.129 (0.170)	
Lagged lnL	1.289** (0.002)	-0.057** (0.022)
Controls		
Basic	Yes	
Linear trends	Yes	
Strength/Overidentification		
K-P F-value	50.581	
Hansen P-value	0.952	
N	15284	

Note: Population yearly municipalityXindustry-averages based on all private sector jobs. Panel unit: municipalityXindustry. Linear regressions on first-differenced data (IV). Dependent variable: log hourly wage (residual). Control vector: Basic=lagged municipality unemployment rate, year dummies; Linear trends=linear industry trends, linear municipality trends. Note the instrument vector comprises the first principal component of 1918 union industry shares across municipalities is interacted with year dummies. Since the first principal component vary only across municipalities, the reported standard errors (in parentheses) are adjusted for municipality-clustering. ** and * denote 1 and 5 percent level of significance, respectively.