

Union Density, Productivity and Wages

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Paris

2nd November 2017

- Causal evidence on the effects of unions on firm performance is scarce
 - absence of exogenous variance in unionisation
- We exploit exogenous variance in the price of union membership to estimate the causal impact of unionisation on firm productivity and wages
- We find increases in union density raise firm productivity and wages

- A normal good
 - Demand will fall (rise) with increase (fall) in net fee
- Changes in tax subsidy induce changes in net price
- These changes are sizeable in the Norwegian case
- These are plausibly exogenous with respect to firms' wages and productivity as we will show
- The degree to which a firm is affected by the tax subsidy is a function of time-variance in the subsidy and the potential union fee faced by workers in the firm
- Both workforce composition and the setting of the fee may themselves be endogenous so we hold values constant at period 1
- More detail in a minute

- Positive
 - Capital intensification
 - Efficient bargaining with local unions (Barth et al., 2014)
 - Union as agent solving management problems (Vroman, 1990)
 - Voice increases information for management and reduces quits (Freeman and Medoff, 1984)

- Negative
 - Sub-optimal labour deployment via wage-effort bargain (Metcalf, 1989)
 - Worker insurance -> shirking
 - Hold up problem (Grout, 1984)

- Endogenous union density
 - Returns to organizing higher in high rent firms
 - Workers seek insurance when firms in difficulty
 - Direction of selection effects uncertain
- Worker selection
 - More (less) able workers less (more) likely to unionise given their market outside options but employers pick from the queue so direction of selection uncertain
 - Low wage workers with low attachment, temporary jobs etc have difficulties organizing collective actions
- Higher wages: bargaining power or productivity effects?
- We don't know much: little guidance from theory or from observed regularities or casual observations

- Partial correlations
 - No credible instruments
 - selection on observables or panel accounting for time-invariant unobservables and time-varying observables
- Primarily household survey data
 - Employer omitted variables result in upward bias (Blanchflower and Bryson, 2004)
 - Unable to estimate firm-level outcomes like profitability
- Mostly Anglo-US
 - Can't generalise to countries where centralised or co-ordinated bargaining predominates (Doucouliagos et al., 2017)

- DiNardo and Lee (2004)
 - RDD using Wagner vote threshold
 - New unionisation has little impact on wages or productivity but....
 - Often intention to treat cause don't get to first contract (Ferguson 2008)
 - Unions likely weaker at 50% margin than at higher density levels (confirmed in Lee and Mas, 2012 comparing RDD and event history on firm equity value)
- Frandsen (2012)
 - Quantile RDD
 - Unions compress wages, raising them at lower end, reducing returns to skill at the top
- Sojourner et al. (2015) on nursing homes
 - Same RDD. Unions negative for staffing levels but no impact on care quality suggesting productivity improvements

- Augment Cobb-Douglas production function with union density
 - Firm fixed effects models so change in productivity/wages within firm and change in union density over time
- Exploit exogenous shifts in net price of union membership due to tax subsidy
- Calculate subsidy relative to price (occupation cells) for each individual worker then take firm average
- “Shift share” - occupation cell and membership fee kept constant - interacted with subsidy
 - (fee possibly endogenous - + control in second stage when appropriate)
- Our instrument is average net fee at firm*tax subsidy

- Account for worker selection into (non)union firms by controlling for average worker fixed effects in firm based on individual earnings regressions
- Account for skill-biased technological change by adding skill trends
- Estimate firm average wages accounting for endogeneity of both union density and firm productivity
- Account for endogeneity of labour and unobserved firm productivity using Levinsohn, Petrin and Wooldridge
 - control function + lagged employment as IV

- Keep union fee and distribution of workers across job classes constant over time (first year of observation) so only subsidy is time-varying
- Since union fee setting may be endogenous we control for inverse of net union membership fee directly when instrument
- Identification rests on variation in tax subsidy over time interacted with net union price based on fixed fees and job-class shares
- Condition on worker quality using average individual fixed effects from individual earnings regressions with year and age vigintiles included.

- 70% of private sector workplaces covered, 4/10 have local bargaining (Barth et al., 2015) which covers over half of all workers
- Half private sector employees are union members; mean workplace union density is 40% (Bryson et al., 2015)
- Firms can choose between sectoral bargaining, firm bargaining, combination of the two or neither
- We use firm fixed effects in our analyses. There is little movement within firm between regime over time
- Union density positively associated with higher wages in Norway (Bryson et al., 2015; Barth et al. 2015; Barth et al., 2000)

- Two attributes:
 - wage premium ($W_U > W_N$)
 - Insurance $p_I^U \leq p_I^N$ ie price lower or equal for union member
- Purchase where $V_U > V_N$ accounting for P , S and $\varepsilon = 0$ when preference based on econ. costs and benefits
- Become member when

$$V^U - V^N = K \left\{ [W_U - (P - S)(1 + \varepsilon)] - \left[\frac{p_I^U}{p_I^N} \right]^\alpha W_N \right\},$$

- When $P = \beta_0 + \beta_1 W_U$ worker joins when

$$\delta + \delta \left(\frac{S}{P - S} \right) + \beta_0 \delta \left(\frac{1}{P - S} \right) > \varepsilon, \text{ where } \delta = \frac{1 - g}{\beta_1} \text{ and}$$

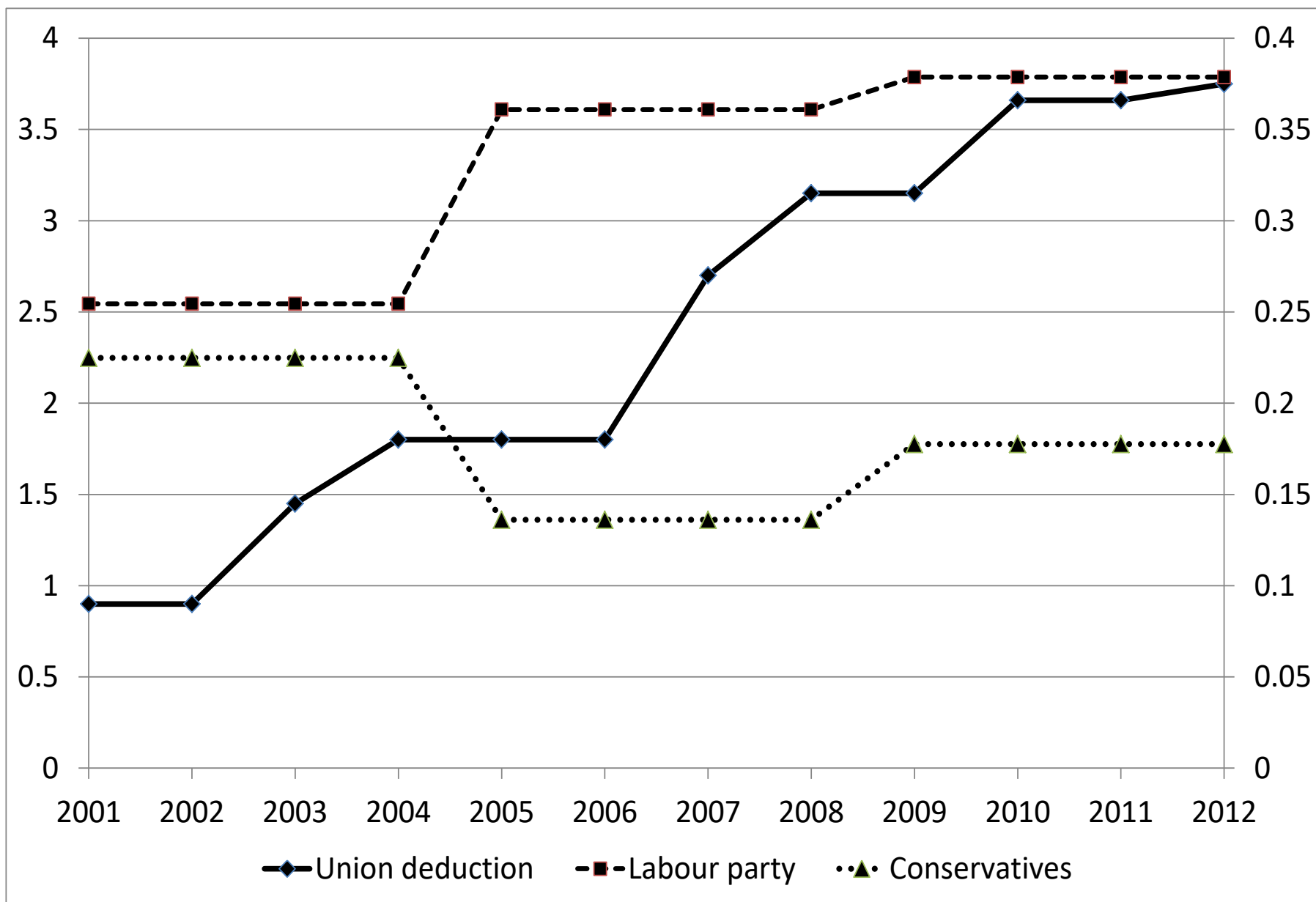
$$g = \frac{1}{\gamma} \left[\frac{p_I^U}{p_I^N} \right]^\alpha \text{ where } \gamma \text{ is union wage premium.}$$

- We use the tax subsidy as a share of the net membership fee as our instrument
 - $\text{Subsidy}/(\text{gross fee} - \text{subsidy})$.
- Imputed membership fees to non-members based on member fees in 2-digit SIC code X 3-digit occupational code (circa 7,000 cells).
- There is no empirical evidence on the relationship between taxation and demand for membership
- But there is evidence for other fringe benefits
 - Increases demand for stock options (Austin et al., 1998)
 - Subsidy for company cars leads to greater demand for more expensive cars and driving more miles (Gutierrez-i-Puigarnau and Van Ommernen, 2011)
 - Its removal from employer-provided health care would reduce insurance spending in the US by 45% (Gruber and Lettau, 2004)

- Union membership fee is a tax deductible allowance
- Ministry of Finance announcement at end of previous tax year
- Subsidy is 28% of gross union membership fee
- Subsidy rises 4-fold; average fee rises 1.5 times
- In 2001: subsidy is 7% of average union membership fee
- In 2012: subsidy is >20% of average membership fee
- 10 NOK=1.09 Euros

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Gross tax deduction	900	900	1450	1800	1800	1800	2700	3150	3150	3660	3660	3750
Subsidy	250	250	410	500	500	500	760	880	880	1020	1020	1050
Average fee	3430	3580	3740	3860	3990	4060	4240	4360	4510	4640	4820	4980

Gross union tax deduction (1000 NOK, left hand axis) and share of parliamentary seats (right hand axis)



- Statistics Norway's administrative register
 - Norwegian Tax Authorities and Social Services information on individuals and jobs: income, earnings, hours, membership fees
 - 2.5 million observations per year, all workers, all firms
 - Calculate the average job cell union fee based on members only and link this to all workers in job cell (~7000 cells, 3-digit occupationX2-digit SIC)
- The Capital Data Base
 - provides data on value added, revenues, inputs
 - VA=operating income less operating costs, wage costs, depreciation and rental costs
 - Predominantly manufacturing firms
 - Linked via firm unique identifier
 - 2.4 million obs on workers,
 - 6-6,500 firm observations per annum
 - Final regressions 8,000 firms, 50,000 observations

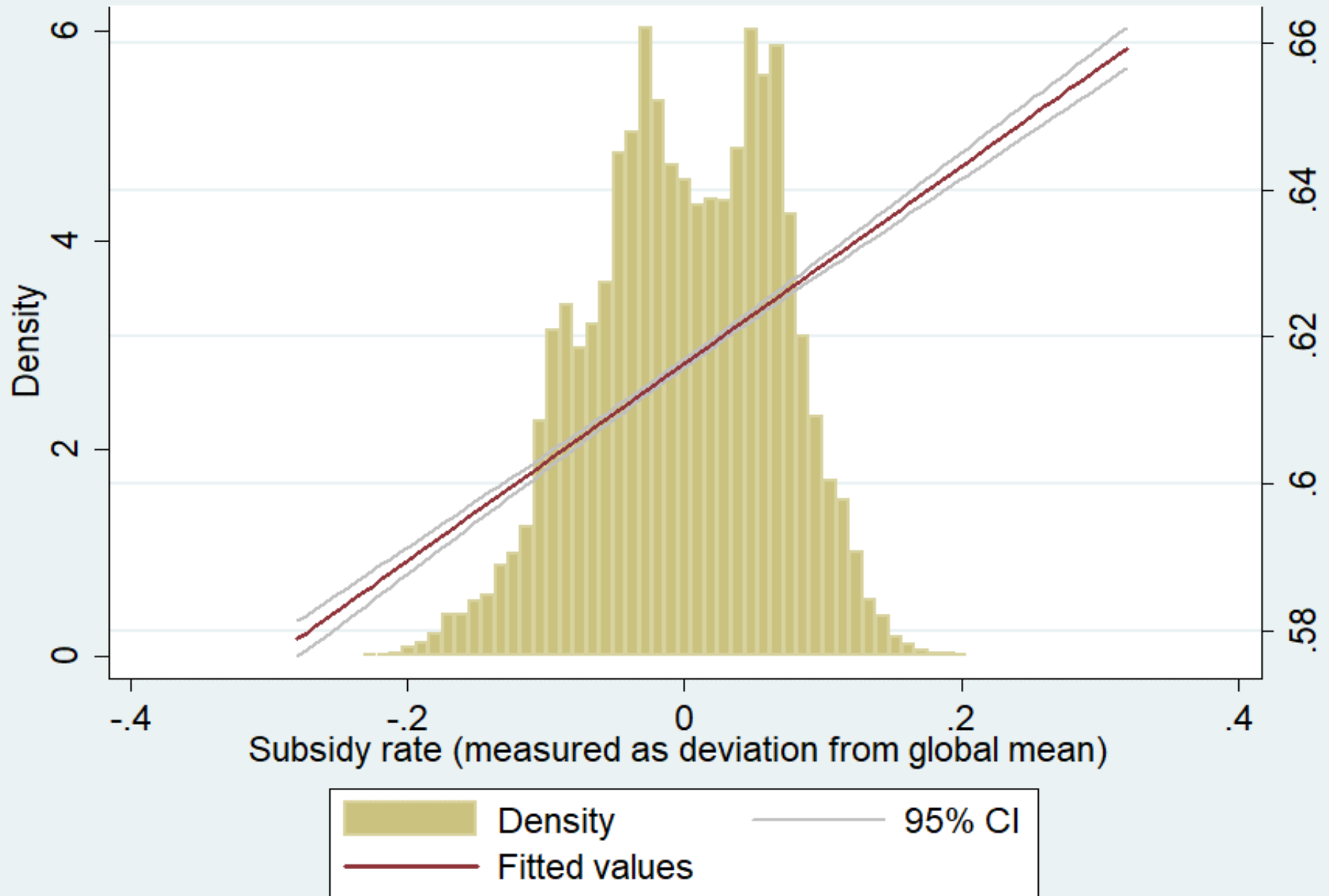
- Subsidies matter for membership
- Worker level analysis (companion paper)
- Simple probability model of membership

$$U_{jt} = \delta_0 + \delta_1 \left(\frac{S}{P - S} \right) + \delta_2 \left(\frac{1}{P - S} \right) + \delta_X X_{jt} + \varepsilon_{jt},$$

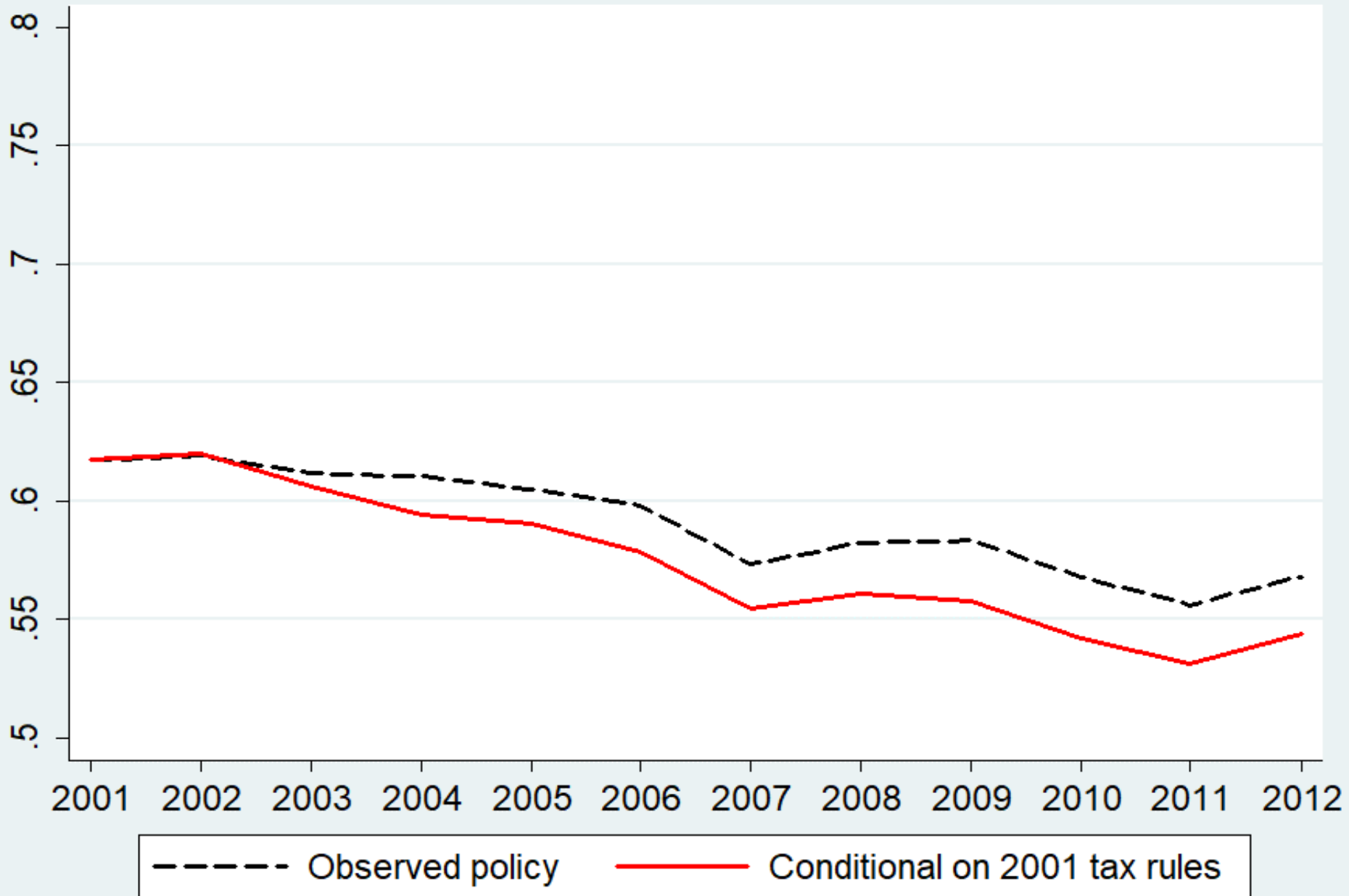
- where U is a dummy variable taking the value of 1 if worker j is a union member, ε_{jt} is a standard normal error term, X is a control vector, while $S/(P-S)$ and $1/(P-S)$ are the net subsidy rate and the inverse of the net union membership fee, respectively

Linear Probability for Union Membership

	Model 1	Model 2	Model 3	Model 4	Model 5
Inverse of net union fee		-4.5024	-4.5689	-1.9387	-1.5360
		(3.4172)	(4.3130)	(1.4911)	(1.2308)
Subsidy relative to net union fee	0.1077*	0.1120*	0.1344**	0.2094**	0.1986**
	(0.0459)	(0.0463)	(0.0457)	(0.0435)	(0.0295)
Controls					
Years	Yes	Yes	Yes	Yes	Yes
Job class	Yes	Yes	Yes	Yes	Yes
Demography			Yes		
Human capital			Yes		
Worker-Job class (FE)				Yes	
Job-Job class (FE)					Yes
NXT	2018879	2018879	2018879	1874713	1852005
Marginal effects of increasing the subsidy by 100 Nok at average fees					
2001	0.0037*	0.0037*	0.0045**	0.0071**	0.0067**
	(0.0016)	(0.0016)	(0.0015)	(0.0015)	(0.0013)
2012	0.0035*	0.0036*	0.0043**	0.0067**	0.0064*
	(0.0015)	(0.0015)	(0.0015)	(0.0014)	(0.0013)
Marginal effects of increasing the average gross fee by 10%.					
2001	-0.0009*	-0.0008*	-0.0010**	-0.0017**	-0.0016**
	(0.0004)	(0.0004)	(0.0004)	(0.0003)	(0.0003)
2012	-0.0036*	-0.0036*	-0.0044**	-0.0070**	-0.0067**
	(0.0016)	(0.0016)	(0.0015)	(0.0015)	(0.0013)



Counterfactual Development in Union Membership Without Tax Reforms: worker-level analysis



Compliers – Individual Characteristics

	First stage	Pr(Xi=xi)	Pr(complier Xi=xi)	Pr(always union Xi=xi)	$\frac{\text{Pr}(X_i = x_i \text{complier})}{\text{Pr}(X_i = x_i)}$
Young	0.1477** (0.0211)	0.4336	0.1037**	0.5692**	2.0700
Old	0.0658** (0.0613)	0.5664	0.0091	0.6250**	0.1816
Men	0.1735** (0.0632)	0.7659	0.0585**	0.6137**	1.1630
Women	0.0725 (0.0816)	0.2308	0.0240	0.5543	0.4771
Natives	0.1629** (0.0480)	0.9054	0.0548**	0.6114**	1.0418
Immigrants	0.0638* (0.0277)	0.0946	0.0314	0.4929**	0.5970
Low wage	0.0738 (0.0605)	0.5300	0.0249	0.6042**	0.6748
High wage	0.1507** (0.0665)	0.4700	0.0504**	0.5907	1.3659
>50% union members	0.0697 (0.0515)	0.6974	0.0235	0.7535**	0.3493

Compliers – Firm Characteristics



	First stage	Pr(Xi=xi)	Pr(complier Xi=xi)	Pr(always union Xi=xi)	$\frac{\text{Pr}(X_i = x_i \text{complier})}{\text{Pr}(X_i = x_i)}$
Manufacturing-low tech	0.1171 (0.0730)	0.6663	0.0392 ^x	0.6011 ^{**}	0.8365
Manufacturing-high tech	0.1886 ^{**} (0.0896)	0.2558	0.0628 ^{**}	0.5972 ^{**}	1.3402
Construction	0.0460 (0.5498)	0.0081	0.0145	0.5709 ^{**}	0.3094
Trade	0.2637 (0.3881)	0.0229	0.0864	0.5938 ^{**}	1.8434
Others	0.1987 (0.1848)	0.0391	0.0660	0.5929 ^{**}	1.4085
1-25 employees	0.2768 ^{**} (0.0813)	0.1820	0.0954 ^{**}	0.2826 ^{**}	1.4182
26-100 employees	0.2715 ^{**} (0.0835)	0.2284	0.0912 ^{**}	0.5482 ^{**}	1.3557
101-500 employees	0.2083 [*] (0.0903)	0.2834	0.0701 [*]	0.7085 ^{**}	1.0421
>500 employees	0.0908 (0.0860)	0.3021	0.0305	0.7369 ^{**}	0.4534
0-25% union members	0.0860 ^x (0.0450)	0.1635	0.0287 ^x	0.0858	0.4266
26-50% union members	0.3656 ^{**} (0.0982)	0.1345	0.1219 ^{**}	0.4206 ^{**}	1.8121
>50% union members	0.0697 (0.0515)	0.6974	0.0235	0.7535 ^{**}	0.3493

$$Y_{it} = A e^{\omega_i + u_{it} + \gamma_t + \beta^D D_{it}} L_{ls}^{\beta^{ls}} L_{hs}^{\beta^{hs}} K^{\beta^k}$$

Y is value added for firm i at time t

ω_{it} is a productivity shifter known to the firm when it chooses the level of transitory inputs, but not observed by us

γ_t represents technological change

D_{it} is union density of firm i at time t

β^D captures the effect of union density on productivity.

K is capital, L is labour (ls =low skill hs =high skill)

u is a stochastic term representing idiosyncratic shocks

Firm FE models

Instrument D by the firm average across workers of the ratio of the union subsidy relative to the net union membership fee

hold union fee constant at the value observed the first time the firm enters our data: avoids potential endogeneity in union fees following changes in the subsidy

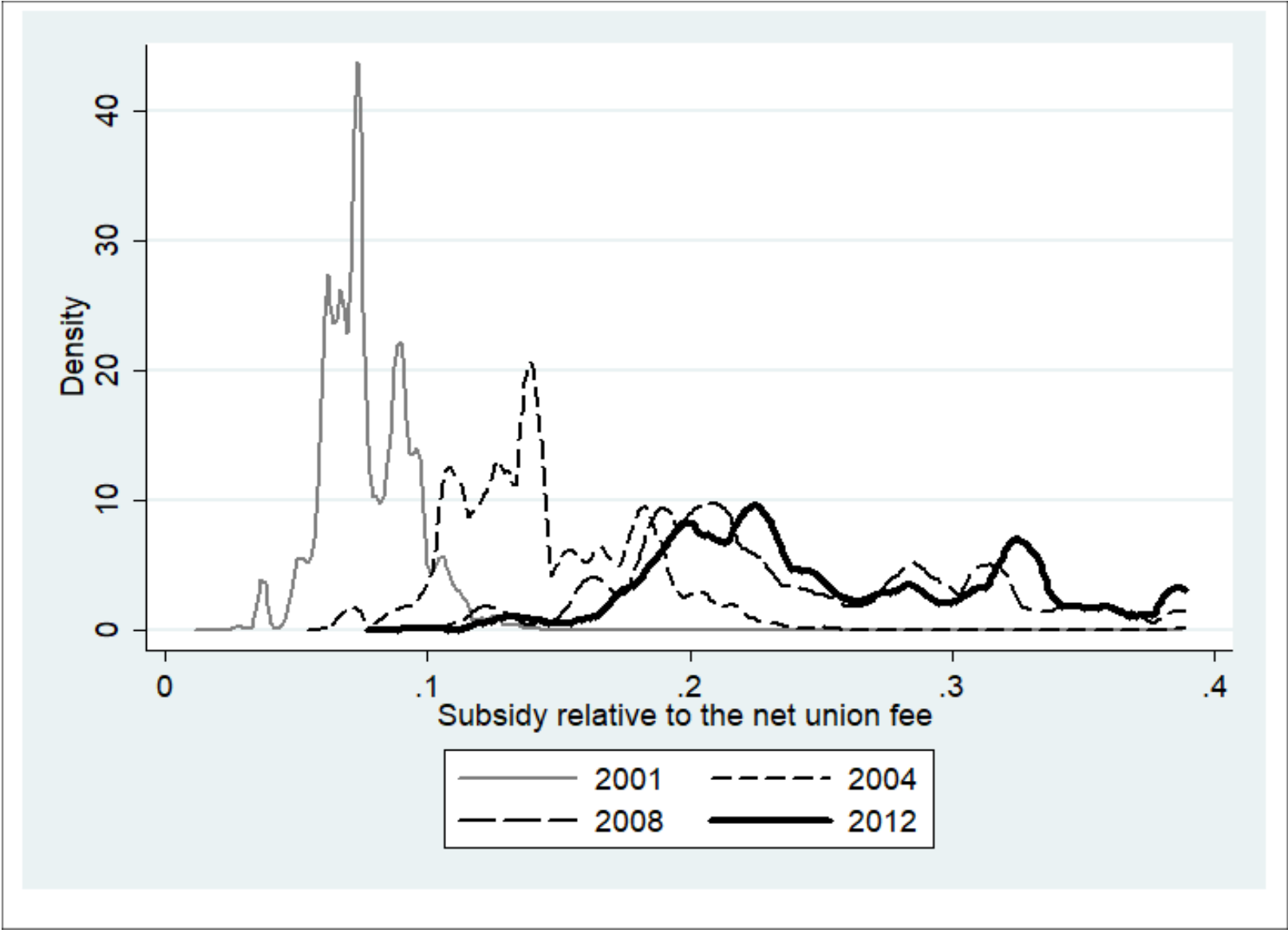
identification rests on variation in tax subsidy over time interacted with the inverse of the net union price faced by workers at the firm in first period

instrument is defined at firm X year level, varying with tax system and N workers in different job classes the first time the firm is observed in the data

assume elasticity of union membership demand is fixed and constant across workers, an assumption standard in consumption theory

since net union membership fee could be associated with productivity we condition on the inverse of the net union membership fee in all regressions

condition on firm average of individual worker F_{es} from individual earnings regressions to net out time-varying differences in worker quality which may be correlated with unionization



	Model 1 OLS	Model 2 FE	Model 3 IV	Model 4 IV
Union density	-0.0004**	0.0001	0.018*	0.017*
	(0.0001)	(0.0002)	(0.008)	(0.007)
Basic	Yes	Yes	Yes	Yes
Firm FE		Yes	Yes	Yes
High-/low-skilled				Yes
First Stage Union density				
Subsidy/Net union fee			30.594**	30.775**
			(7.961)	(7.952)
Tests weak instruments				
Cragg-Donald F:			73.25	74.01
Kleibergen-Paap F:			14.77	14.98
FXT	67016	65506	65506	65506

an increase in the firm mean of union density of around 1 percentage point raises firm productivity by 1.7-1.8%, with the inclusion of heterogeneous labour (high and low skilled) making little difference

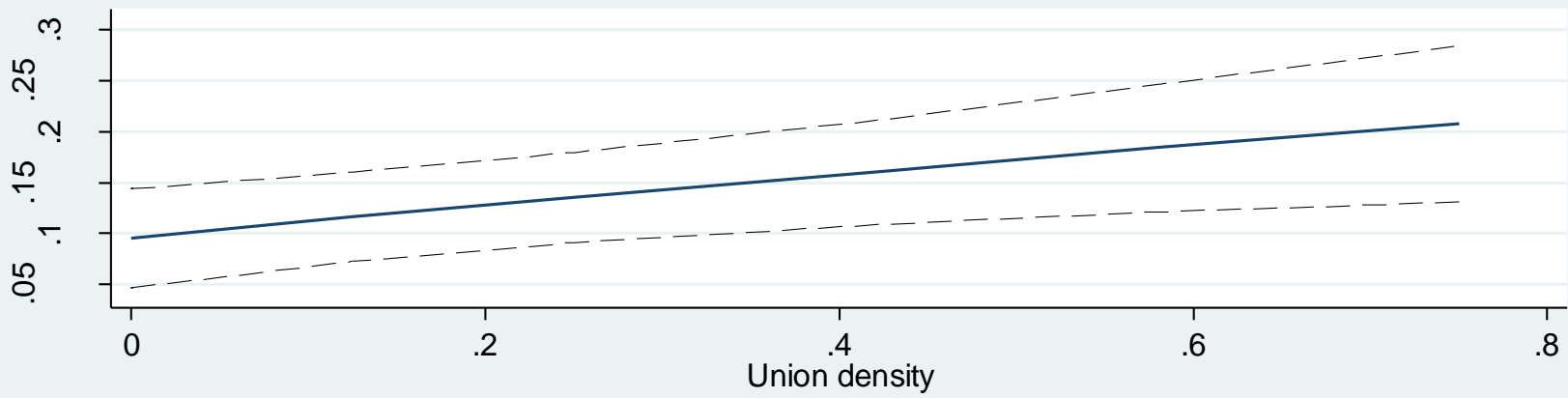
		Model 1	Model 2	Model 3	Model 4 IV	Model 5 IV
Union density		0.018*	0.020*	0.029*	0.015*	0.029*
		(0.008)	(0.010)	(0.014)	(0.007)	(0.012)
Basic, High-/low-skilled, Occupational shares, workforce age vigintile shares, Average worker effects		Yes	Yes	Yes	Yes	Yes
Firm FE		Yes	Yes	Yes	Yes	Yes
Linear industry trends			Yes	Yes	Yes	Yes
Linear skill trends				Yes		Yes
First Stage Union density						
Subsidy/Net union fee		28.141**	24.772**	22.266**	29.618**	26.061**
		(7.813)	(7.686)	(7.926)	(9.219)	(9.656)
Tests weak instruments						
Cragg-Donald F:		61.84	44.08	33.33	49.75	34.96
Kleibergen-Paap F:		12.97	10.39	7.89	10.32	7.29
FXT		65394	65394	65394	51425	51425

Impact of union density on firm average of log hourly wages

	M1OLS	M2FE	M3 IV	M4 IV	M5 IV	M6 IV	M7 IV	M8 IV
Union density (U)	-0.0004**	-0.0007**	0.013**	0.015**	0.013**	0.009*	0.012*	0.010**
	(0.0001)	(0.0002)	(0.004)	(0.005)	(0.005)	(0.003)	(0.005)	(0.004)
Ln value added per worker (VA)					0.094**	0.127**	0.125**	0.096**
					(0.005)	(0.019)	(0.023)	(0.025)
U X VA								0.0015**
								(0.0005)
Basic	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE		Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry time-trends, High-/low-skilled, age vigitile shares, occupational shares, average worker effects				Yes	Yes		Yes	Yes
Endogenous right-hand-side variables								
Union density			Yes	Yes	Yes	Yes	Yes	Yes
VA					No	Yes	Yes	Yes
Union density X VA								Yes
Excluded instruments:								
Subsidy(S)/Net union fee(F)			Yes	Yes	Yes	Yes	Yes	Yes
Ln capital (LnC)						Yes	Yes	Yes
S/F X LnC								Yes
Low (S/F X LnC)								Yes
Cragg-Donald F:			103.43	70.60	70.45	39.56	26.23	16.88
Kleibergen-Paap F:			22.94	17.47	17.42	9.14	6.60	7.07
FXT	62778	61452	61452	61452	61452	62192	62192	62192



— Marginal effect - - - - 95% Conf. Interval



— Marginal effects - - - - 95% Conf. Interval

- We exploit tax-induced exogenous variance in the price of union membership to identify the effects of changes in firm union density on firm productivity and wages in Norwegian firms over the period 2001 to 2012.
- Increases in union density cause substantial increases in firm productivity and wages.
- Two channels: increased productivity and increased bargaining power
- The wage effect is larger in more productive firms, consistent with increased bargaining power.
- If the subsidy of union density had been kept at the 2001 level union membership rates would have been roughly 3 percentage points lower, implying that these firms would have experienced a 6 percentage productivity drop.

- Compliers comprise employees at hi-tech firms, SMEs, where union workers are 25-50% of the workforce, and they tend to be young, male, more highly paid
- Overall percentage of workers affected in relatively small
- So how can they have such a large effect?
 - Tipping point or threshold effect?
- Perhaps tax reform induces enough workers to join a union so that a union represented at a firm can demand a trade union agreement between the firm and the union? This threshold usually varies between 10 to 25 percent of the workers within an occupational group at the firm. Such a trade union agreement will have profound influence on work organisation and policies at the firm level, and could thus raise productivity.
- The union density effect is not a pure worker selection effect because this is controlled for, but must reflect the fact that the union makes these young and able workers more productive

Additional Slides

