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The Swedish Wage Curve

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1 Introduction

The objective of this study is to estimate the degree of cyclical wage flexibility in Sweden 1999–2013. The wage flexibility is defined as the responsiveness of real wages to shocks in unemployment. In principle, there are two major approaches to measuring wage flexibility: the wage curve and the Phillips curve approaches. The wage curve approach[1] uses microeconomic data (large datasets of individual data), while the Phillips curve approach[2] measures aggregate wage flexibility relying on macroeconomic data (aggregate wages, inflation, unemployment). The conceptual difference between the two approaches is that the wage curve approach relates the level of wages to the unemployment level, while the wage Phillips curve relates wage growth to the unemployment level.

This study uses detailed microeconomic panel data from Sweden to estimate the wage curve. Individual level data makes it possible to adjust wages for individual composition effects which is important because the composition of the employed individuals varies over the business cycle. Using regional panel data to study the behaviour of wages and unemployment rates has the advantage that all time-invariant region specific factors can be controlled for by region fixed effects and all time-varying factors which are common across the regions within the country can be controlled for by year fixed effects. An additional advantage of the wage curve approach is that it is possible

[1] For example Blanchflower and Oswald (1994) and Bell et. al. (2002).

[2] For example Blanchard and Katz (1999).

to study variations in wage flexibility between different groups, for example individuals with different levels of education.

2 Empirical method

2.1 Composition correction of the regional wages

The mean wage in a region depends on the characteristics of the employed and their jobs. Changes in the composition of the region's work force affect the measured mean regional wage level and these changes can partly depend on the business cycle. Therefore, we generate a region-based model in which wages are adjusted for individual composition effects.[3] The model is estimated in two stages. At the first stage, the individual composition correction of the mean regional wage level is done by estimating the following model:

$$w_{ijt} = \alpha_i + \alpha_{jt} + \sum_k^K X_{ijtk}\beta_{jk} + \varepsilon_{ijt} \qquad (1)$$

where w_{ijt} is the natural logarithm of the monthly wage for individual *i* observed in region *j* year *t*, α_i is an individual fixed effect, α_{jt} is a region specific year effect (year dummy * region dummy), X is a set of *k=1, …, K* time-varying individual characteristics (age, age^2, dummy variables indicating whether the individual is married, has children aged 0–6 years and dummy variables indicating 3 levels of education and 16 industries). Equation (1) is estimated using individual data for years 1998–2013, separately for public and private sectors. The model is also estimated separately for men and women, for foreign-born and native-born, as well as for three different levels of education in order to study if there is any variation in the effects between the different groups. The composition parameters in the model, β_{jk}, differ across the regions but remain constant over time. Because the model is estimated with individual fixed effects, the composition parameters are not subject to biases due of any correlation between the X variables and unobserved individual effects. The standard errors in equation (1) are corrected for clustering on the individual.

The estimated region specific year effects, $\hat{\alpha}_{jt}$, are then used as the composition corrected wages in the regional panel model. At the second stage, the unit of observation is region/year cells. The second stage regional panel models are estimated with OLS and instrumental variable (IV) estimation (two-stage least squares) to correct for the endogeneity of the regional unemployment.[4] The equation has the form:

$$\hat{\alpha}_{jt} = \omega_j + \omega_t + \gamma\hat{\alpha}_{jt-1} + \delta u_{jt} + \sum_{j=2}^{J}(\mu_j' D_j)t + \sum_k^K Z_{kjt}\,\varphi_k + \nu_{jt} \qquad (2)$$

where ω_j is the region fixed effect, ω_t is the year fixed effect, u_{jt} is the natural logarithm of the regional unemployment rate in percent, D_j is a region dymmy and $\sum_{j=2}^{J}(\mu_j' D_j)t$ gives the regional trends, and Z_{kjt} are time-varying regional variables (share of population with 3 different levels of education, share of women and foreign-born in the population). In some models, the percentage share of long-term unem-

[3] This method is suggested by Card (1995) and Bell et. al. (2002).

[4] See section 2.2.

ployed of the total unemployment is also included. Region specific time trends are only included in some OLS-models and these are intended to capture systematic trends in region specific wage pressure. The year effects, ω_t, take care of aggregate price normalisation and aggregate price surprises. Equation (2) can therefore be thought of as a real wage equation, given that prices develop the same way across the regions. The parameter δ gives the short-run elasticity of wages with respect to unemployment, which is the main parameter of interest. The long-run elasticity of wages is obtained by dividing the short-run elasticity by 1 minus the coefficient of the lagged dependent variable.[5] The long-run elasticity is higher than the short-run elasticity which means that the wage adjustment takes more than one period.

The estimated regional wage equation includes the lagged dependent variable in order to calculate how much the wages adjust to the regional unemployment in the long-run. When such dynamic models are estimated with fixed effects the coefficient of the lagged dependent variable is subject to Nickell (1981) bias of order 1/T. In this case T=15 and the potential bias may not be very large. However, we have also estimated models excluding the dynamic component from the equation (2). The overall wage flexibility estimate is fairly unchanged when the dynamic component is excluded.

It is possible that unobserved labor quality and autonomous wage pressure, for instance arising from variations in rent capture and the extent of product market competition, vary both over time and differentially across regions. Failing to capture these factors will then typically lead to an upward biased coefficient for the lagged dependent variable, γ. It is hard to control for all these effects adequately, but adding region specific trends is a way to try to control for this. This may be a sensible approach in the OLS-models where the local unemployment is treated as exogenous. However, adding regional trends in the IV-models is problematic because the used instrument is highly correlated with the regional trends (see section 2.2). Therefore, only results from IV-models without the regional trends are reported in the tabels.

The standard errors in equation (2) are corrected for clustering on region. There are only 21 counties, which can be problematic for cluster correction. We have also estimated the models with robust standard errors which turned out to be very similar to the clustered standard errors. In most models the clustered standard errors are slightly larger. Therefore, the standard errors clustered on region are reported in the tables.[6]

2.2 Instrumenting the regional unemployment

In this study the variation in the regional labour market conditions over the business cycle are measured with the regional unemployment rate. There is a simultaneity problem when estimating the effect of regional unemployment on the regional wage level in equation (2) since a high wage level in a region can also lead to a high regional unemployment rate. Instrumental variable estimation (two-stage least squares) is used to correct for this endogeneity. The regional unemployment is instrumented with a Bartik style instrument.[7] The instrument is intended to measure exogenous variation in

[5] The long-run elasticity = $\frac{\delta}{1-\gamma}$.

[6] Conventional standard errors are smaller than clustered standard errors.

[7] Bartik (1991, 2002).

the regional labour demand. The regional employment growth is affected by interactions between the region's industry mix and the national growth of the industry whereas the national employment growth in an industry is dependent on the demand of the industry's products and therefore not directly affected by the regional wages. The employment level for each region as of year *t* is predicted assuming that each two-digit industry grew at its national average from 1998 to *t*. The equation to create this instrumental variable is:

$$instrument_{jt} = \sum_b \left(\frac{E_{bj98}}{E_{j98}}\right) * E_{bt}^{tot} \quad (3)$$

where E_{bj98} is the number of employed in industry *b* in region *j* in year 1998, E_{j98} is the total number of employed in region *j* in year 1998, E_{bt}^{tot} is the number of employed at the national level in industry *b* in year *t*. Only the private sector's employment is included in the instrument. The IV-models are estimated excluding the regional trends because the instrument is constructed so that it at least partly captures these trends and they are highly correlated with the instrument.

The instrument ensures that the variation in regional unemployment derives from the labour demand side. However, the IV-estimates give no information on whether the wages are affected by the regional unemployment per se or some other aspects of labour demand which covary with unemployment.

3 Data

The two main data sources used in this study are Statistics Sweden's LISA database and the Swedish wage structure data. Both data sources are used for the years 1998–2013. LISA is an individual level panel database which is mainly used for studying different aspects of the Swedish social insurance and the Swedish labour market.[8] LISA includes the whole Swedish population aged 16 years or more, but in this study the analysis is based on the population aged 20–64 years. LISA includes rich information on individuals' characteristics (e.g. gender, age, region of origin, level and type of education, marital status, number and ages of children, family type, county of residence), take-up of different kinds of social insurance benefits and different types of annual income. The database also includes information on whether the individual was registered as unemployed at the Public Employment Services (PES) in November and the number of unemployment days each year. Further, the database includes register-based information on individuals' employment status in November. There is also information on employer characteristics (e.g. number of employees and industry) for the employed individuals. Unfortunately, there is no information on hourly or monthly earnings or working hours, only the annual income, which is reported by the employers.

The annual wage income largely depends on how many months or hours the individual has worked during the year, which is highly correlated with the business cycle. In order to study effects of unemployment on wages it is essential to have a wage measure that does not have a built-in mechanical relationship to the business cycle because the dynamic wage curves are easily corrupted by measurement errors in the wages.

[8] See SCB (2016) for more information on the LISA database.

Thus, it is not appropriate to use annual wage income to study the effects of unemployment on wages. We use data on monthly wages from the Swedish wage structure database and merge these with the individual background information from the LISA database. This merged data set is then used to estimate the individual wage equations. The wage measure is the full-time equivalent monthly wage which, besides basic monthly wage, also includes some supplementary payments, for example any extra pay to compensate for managerial duties, inconvenient working hours and shift work. However, the wage measure does not include any overtime pay which is highly sensitive to the business cycle. It should be stressed that the monthly wage measure is very accurate because it is reported by the employers, who are legally required to comply. The wages are collected each year in September or November for the public sector and usually in September for the private sector. The wage data cover all public sector employees. For the private sector wages are collected from all employers with at least 500 employees and from a stratified sample of smaller employers.[9] In total, the wage data cover roughly 50 percent of all the private sector employees each year.[10] Thus, there is a large panel element in the wage data. These individual monthly wages are used to construct the regional wages. The public and private sectors are treated separately. The private sector data consist of between 800,000 and 1 million individuals each year, adding up to 14.7 million observations 1998–2013. The public sector data consist of roughly 1.3 million individuals each year, which adds up to 20.7 million observations 1998–2013.

All regional variables except the wages are constructed from the LISA database. This means that the unemployment and employment measures are register based.[11] The regions used in the analysis are the 21 Swedish counties. The regional unemployment rate is the registered unemployment at PES in percent of the regional labour force. The regional labour force is the sum of the employed[12] and the registered unemployed at PES in each region. In addition, long-term unemployed in percent of the total unemployment in the region is controlled for in some models to see whether long-term unemployed exert lower wage pressure than short-term unemployed. Long-term unemployed are defined as individuals who have at least 180 days[13] of unemployment per year and who are unemployed in November. Other regional variables that are calculated from LISA include county population shares of women and foreign-born as well as shares of population with different levels of education. Each industry's fraction of the total employment in the county is based on the two-digit industry classification (SNI2007) of the employees in November.

Differences in the regional unemployment in Sweden are quite persistent over time. Diagram 1 shows the relationship between the region's mean unemployment in 1999–2001 and in 2011–2013. The ranking of the regions is roughly the same in both time

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[9] The strata are based on industry and employer size. In 2013, about 8 000 employers were included in the private sector wage sample.

[10] For further information on the wage structure data, see http://www.scb.se/Statistik/AM/AM0110/_dokument/AM0110_BS_2013_SL_140612.pdf.

[11] The reason for not using Labour Force Survey (LFS) measures for unemployment and employment is that we do not have access to regional LFS series before 2005.

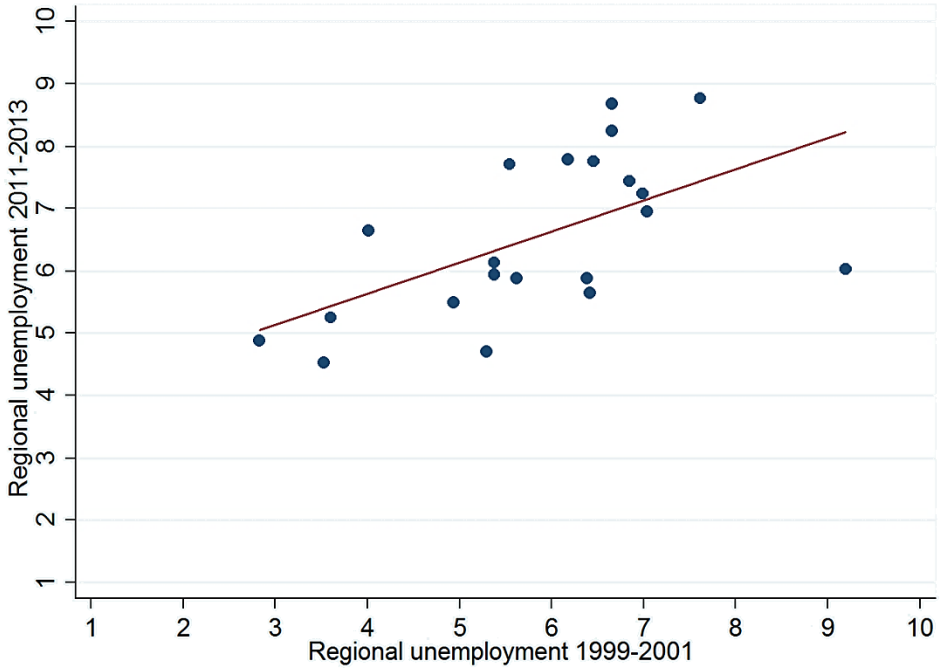
[12] Register based employment as defined in LISA database. For details, see http://www.scb.se/Statistik/_publikationer/AM9901_1990I09_BR_AM76BR1104.pdf

[13] Defining long-term unemployed as having 365 days of unemployment yields similar results.

periods. In 1999–2013 the regional unemployment varied between 2.2 and 10.5 percent, with a mean of 5.6 percent and a standard deviation of 1.6 (see Diagram 2).

Diagram 1 Regional persistens of unemployment

Percent

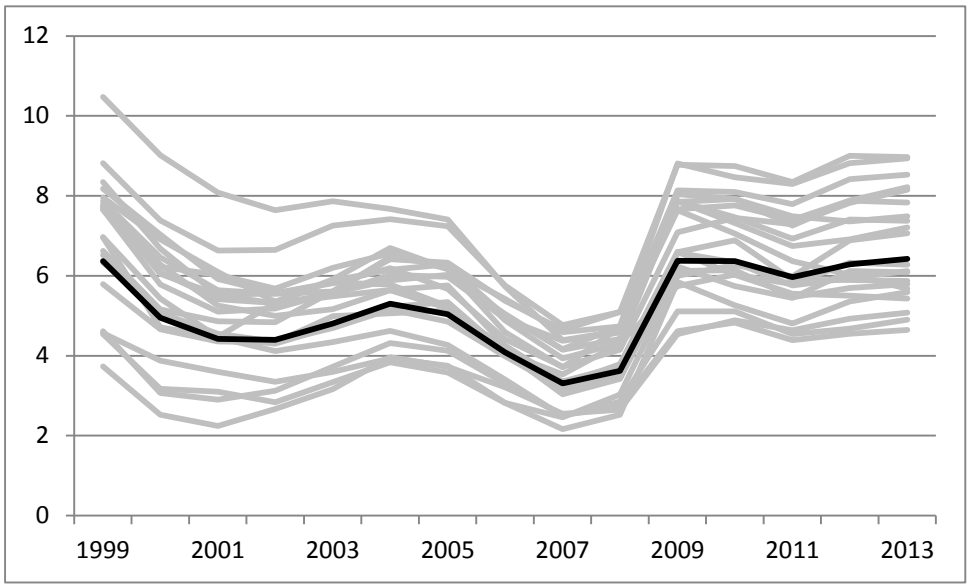


Note. Register-based unemployment.

Source: NIER.

Diagram 2 Development of regional unemployment

Percent



Note. The black line is the register-based national unemployment rate and the grey lines are the regional register-based unemployment rates.

Source: NIER.

4 Results

The results from estimating the equation (2) are presented in this section. The dependent variable is the composition corrected regional wage in log form. The coefficient of the regional unemployment rate measures the short-run wage flexibility and it is interpreted as an elasticity. The tables also report the long-run elasticity of wages with respect to the regional unemployment, which is calculated using the estimated coefficients for the short-run elasticity and the lagged dependent variable.

The results show that the regional unemployment affects the wage level. When the regional unemployment rate is treated as exogenous, the short-run elasticity of wages in the private sector varies between –0.013 and –0.021, depending on whether the regional trends are excluded or included in the models (see columns 1 and 2 in Table 1). The results from the OLS-models indicate that the long-run elasticity of wages is roughly –0.03.

Treating the regional unemployment as endogenous and instrumenting it with local labour market shocks leads to a higher wage elasticity. The short-run elasticity in the IV-model is –0.035 (see column 3 in Table 1).[14] Thus, doubling the regional unemployment rate, say from 4 to 8 percent, would lead to 3.5 percent lower regional wage level in the short-run. In the long-run the regional wage level would be roughly 9 percent lower. It should be stressed that the regional unemployment is an indicator for the regional business cycle conditions and it is not possible to distinguish whether it is the regional unemployment per se or some other factors that are correlated with the labour demand that drive the wage moderation, for example vacancies or firms' profits. However, the instrument ensures that the variation in regional unemployment derives from the labour demand side and not from variations in the labour supply.

Results in Table 1 also show that the wages in the public sector react to the regional unemployment much less than the wages in the private sector. The IV-results show that if the regional unemployment rate is doubled, the wage level in the public sector will be approximately 1 percent lower in the short-run. The public sector's short-run wage elasticity is about one third of the estimated elasticity in the private sector. In the long-run the wages in the public sector will be about 5 percent lower if the regional unemployment is doubled. The lower elasticity in the public sector is expected since the employment in the public sector is much less sensitive to the business cycle and more affected by, for example, changes in the population shares of children and elderly people.

There are some indications that the long-term unemployed could exert lower pressure on the private sector wages than the short-term unemployed. In the IV-model, 10 percentage points higher proportion of long-term unemployed is associated with 0.5 percent higher wage level. However, this coefficient should be interpreted with caution since there might be a simultaneity problem between the level of the long-term unemployment and the regional wages. Excluding the proportion of the long-term unemployed from the regression model does not change the estimated overall wage flexibility (see Columns 1–3 in Table 2). The results are also relatively robust to ex-

[14] The first-stage results from the IV-estimation are shown in Table 9 in the Appendix. The first-stage results are fairly similar in all model specifications.

cluding the dynamic wage component from the models (see Columns 4–6 in Table 2). Further, the results are not very sensitive to excluding individuals with very high or very low wages from the first stage composition correction of the regional wage (see Table 3). The short-run elasticity of the regional wages is around –0.03 in all the estimated IV-models and the long-run elasticity varies between approximately –0.07 and –0.09.

Table 1 Elasticity of wages in the private and public sector, 1999–2013

Dependent variable: Ln(composition corrected monthly wage in the county)

	1	2	3	4	5	6
	Private	**Private**	**Private**	**Public**	**Public**	**Public**
	OLS	OLS	IV	OLS	OLS	IV
Ln(regional wage *t*-1)	0.617**	0.363**	0.626**	0.713**	0.369**	0.748**
	(0.033)	(0.081)	(0.042)	(0.047)	(0.094)	(0.059)
Ln(regional unemployment rate)	–0.013**	–0.021**	–0.035**	–0.002	–0.006*	–0.013*
	(0.004)	(0.006)	(0.010)	(0.001)	(0.003)	(0.005)
Proportion of long-term unemployed (percent)	0.0002	0.0002	0.0005**	-0.0001	0.0001	0.0001
	(0.0001)	(0.0001)	(0.0002)	(0.0001)	(0.0001)	(0.0001)
Long-run elasticity	–0.034**	–0.033**	–0.094**	–0.007	–0.010*	–0.052*
Regional trends	No	Yes	No	No	Yes	No
Number of observations	315	315	315	315	315	315
Number of regions (cluster)	21	21	21	21	21	21

Note: ** p<0.01, * p<0.05, + p<0.1. Standard errors in parentheses are corrected for clustering on region. All models incude time-varying regional controls, regional fixed effects and year fixed effects. The time-varying regional controls are the proportion with compulsory and post-secondary education, female and foreign-born in the population. In the IV-models the regional unemployment is instrumented with local labor demand shocks.

Source: NIER.

Table 2 Elasticity of wages, without proportion of long-term unemployed and without wage dynamics, private sector, 1999–2013

Dependent variable: Ln(composition corrected monthly wage in the county)

	1	2	3	4	5	6
	OLS	OLS	IV	OLS	OLS	IV
Ln(regional wage *t*-1)	0.622**	0.369**	0.637**	-	-	-
	(0.034)	(0.084)	(0.035)			
Ln(regional unemployment)	–0.011**	–0.018**	–0.028**	–0.011	–0.032**	–0.038*
	(0.004)	(0.005)	(0.007)	(0.007)	(0.009)	(0.019)
Long-run elasticity	–0.029**	–0.029**	–0.077**	-	-	-
Regional trends	No	Yes	No	No	Yes	No
Number of observations	315	315	315	315	315	315
Number of regions (cluster)	21	21	21	21	21	21

Note: ** p<0.01, * p<0.05, + p<0.1. Standard errors in parentheses are corrected for clustering on region. All models incude time-varying regional controls, regional fixed effects and year fixed effects. The time-varying regional controls are the proportion with compulsory and post-secondary education, female and foreign-born in the population. In the IV-models the regional unemployment is instrumented with local labor demand shocks.

Source: NIER.

Table 3 Elasticity of wages, private sector, excluding outliers in the composition correction of the regional wages, 1999–2013

Dependent variable: Ln(composition corrected monthly wage in the county)

	1	2	3	4	5	6
	OLS	OLS	IV	OLS	OLS	IV
Ln(regional wage *t*-1)	0.611**	0.371**	0.618**	0.617**	0.376**	0.633**
	(0.034)	(0.076)	(0.043)	(0.034)	(0.078)	(0.038)
Ln(regional unemployment rate)	–0.013**	–0.020**	–0.033**	–0.010**	–0.017**	–0.026**
	(0.004)	(0.005)	(0.009)	(0.003)	(0.004)	(0.007)
Proportion of long-term unemployed (percent)	0.0002	0.0002	0.0004**	-	-	-
	(0.0001)	(0.0001)	(0.0001)			
Long-run elasticity	–0.033**	–0.032**	–0.086**	–0.026**	–0.027**	–0.071**
Regional trends	No	Yes	No	No	Yes	No
Number of observations	315	315	315	315	315	315
Number of regions (cluster)	21	21	21	21	21	21

Note: Individuals with very high (>99th percentile) or very low (<1th percentile) wages are excluded from the first stage composition correction of the regional wages. ** p<0.01, * p<0.05, $^{+}$ p<0.1. Standard errors in parentheses are corrected for clustering on region. All models incude time-varying regional controls, regional fixed effects and year fixed effects. The time-varying regional controls are the proportion with compulsory and post-secondary education, female and foreign-born in the population. In the IV-models the regional unemployment is instrumented with local labor demand shocks.

Source: NIER.

The regional wage level is affected by the characteristics of the employed and their jobs. To study whether it is the changes the composition of the employers or the employees that matter for the elasticity of wages, the first stage model is estimated without any fixed effects, with employer fixed effects, and with employee-employer fixed effects (see Table 4).[15] It seems that it is important to control for the changes in the composition of the employees when estimating the elasticity of wages. However, the composition of the employers seems to be roughly the same over time and adding employee-employer fixed effects at the first stage yields very similar results as adding only employee fixed effects.[16]

[15] In all other models the first stage composition correction includes employee fixed effects.

[16] Restricting the data to include individuals with at least two wage observations does not change the results.

Table 4 Elasticity of wages with different fixed effects in the first stage composition correction of the regional wages, private sector, 1999–2013

Dependent variable: Ln(composition corrected monthly wage in the county)

	OLS	IV	OLS	IV	OLS	IV
Ln(regional wage *t*-1)	0.575**	0.580**	0.489**	0.497**	0.653**	0.668**
	(0.068)	(0.073)	(0.064)	(0.058)	(0.037)	(0.046)
Ln(regional unemployment)	–0.019**	–0.012	–0.009^{+}	–0.014	–0.011*	–0.033**
	(0.006)	(0.011)	(0.005)	(0.010)	(0.005)	(0.009)
Proportion of long-term unemployed (percent)	0.0002^{+}	0.0001	0.0002^{+}	0.0003^{+}	0.0002	0.0004**
	(0.0001)	(0.0002)	(0.0001)	(0.0002)	(0.0001)	(0.0001)
Long-run elasticity	–0.045**	–0.029	–0.018^{+}	–0.028	–0.032*	–0.099**
1st stage fixed effects:						
Employee*Employer	No	No	No	No	Yes	Yes
Employer	No	No	Yes	Yes	No	No
2nd stage:						
Regional trends	No	No	No	No	No	No
Number of observations	315	315	315	315	315	315
Number of regions (cluster)	21	21	21	21	21	21

Note: ** p<0.01, * p<0.05, $^{+}$ p<0.1. Standard errors in parentheses are corrected for clustering on region. All models incude time-varying regional controls, regional fixed effects and year fixed effects. The time-varying regional controls are the proportion with compulsory and post-secondary education, female and foreign-born in the population. In the IV-models the regional unemployment is instrumented with local labor demand shocks.

Source: NIER.

SMALL DIFFERENCES IN WAGE FLEXIBILITY BETWEEN INDIVIDUALS WITH DIFFERENT LEVELS OF EDUCATION

There are small differences in wage flexibility between individuals with different levels of education (see Table 5–Table 6). In these models the regional unemployment is defined as the unemployment rate of the education group in the county.[17] In most model specifications, the estimated elasticities are smaller for those with only compulsory education and for those with post-secondary education, but the elasticities are not very precisely estimated. In the IV-model the elasticities are around –0.03 for those with compulsory or secondary education while the estimated elasticity is somewhat lower and not statistically significant for those with post-secondary education.

[17] Individuals with different levels of education usually have different types of jobs and the demand for labour can vary between these groups. However, using the overall unemployment rate in the county does not change the results.

Table 5 Elasticity of wages for those with compulsory or secondary education, private sector, 1999–2013

Dependent variable: Ln(composition corrected monthly wage in the county)

	1	2	3	4	5	6
	Compulsory education			**Secondary education**		
	OLS	OLS	IV	OLS	OLS	IV
Ln(regional wage *t*-1)	0.535**	0.223*	0.524**	0.574**	0.306**	0.591**
	(0.064)	(0.087)	(0.060)	(0.047)	(0.101)	(0.044)
Ln(regional unemployment rate in the education group)	−0.006	−0.005	−0.027**	−0.013**	−0.021**	−0.030**
	(0.004)	(0.005)	(0.008)	(0.003)	(0.004)	(0.008)
Long-run elasticity	−0.013	−0.006	−0.057**	−0.031**	−0.030**	−0.073**
Regional trends	No	Yes	No	No	Yes	No
Number of observations	315	315	315	315	315	315
Number of regions (cluster)	21	21	21	21	21	21

Note: ** p<0.01, * p<0.05, + p<0.1. Standard errors in parentheses are corrected for clustering on region. All models incude time-varying regional controls, regional fixed effects and year fixed effects. The time-varying regional controls are the proportion with compulsory and post-secondary education, female and foreign-born in the population. In the IV-models the regional unemployment is instrumented with local labor demand shocks.

Source: NIER.

Table 6 Elasticity of wages for those with post-secondary education, private sector, 1999–2013

Dependent variable: Ln(composition corrected monthly wage in the county)

	1	2	3
	Post-secondary education		
	OLS	OLS	IV
Ln(regional wage *t*-1)	0.742**	0.492**	0.748**
	(0.043)	(0.069)	(0.045)
Ln(regional unemployment rate in the education group)	−0.005	−0.020**	−0.019
	(0.006)	(0.007)	(0.014)
Long-run elasticity	−0.019	−0.039**	−0.075
Regional trends	No	Yes	No
Number of observations	315	315	315
Number of regions (cluster)	21	21	21

Note: ** p<0.01, * p<0.05, + p<0.1. Standard errors in parentheses are corrected for clustering on region. All models incude time-varying regional controls, regional fixed effects and year fixed effects. The time-varying regional controls are the proportion with compulsory and post-secondary education, female and foreign-born in the population. In the IV-models the regional unemployment is instrumented with local labor demand shocks.

Source: NIER.

The wage flexibility in the private sector seems to be roughly the same for the foreign-born and native-born (see Table 7). The elasticities are, however, less precisely estimated for the foreign-born.

The results also show that in the private sector the wages of men are more flexible than the wages of women (see Table 8). This could partly be due to the fact that women in the private sector to a larger extent than men have jobs that are similar to public sector jobs, for instance jobs in privately provided health care and education. It is by no means unique for Sweden that men's wages are more flexible than women's wages.[18] The results also indicate that men's wages react less to the business cycle

[18] See exempelvis Nijkamp and Poot (2005), Baltagi et al. (2009) and Longhi (2012).

when the share of the long-term unemployed is high, but no such effect is found for women.

Table 7 Elasticity of wages for the foreign-born and native-born, private sector, 1999–2013

Dependent variable: Ln(composition corrected monthly wage in the county)

	1	2	3	4	5	6
	Foreign-born			**Native-born**		
	OLS	OLS	IV	OLS	OLS	IV
Ln(regional wage *t*-1)	0.529**	0.257*	0.537**	0.639**	0.378**	0.656**
	(0.082)	(0.117)	(0.085)	(0.037)	(0.075)	(0.045)
Ln(regional unemployment)	−0.008	−0.003	−0.036*	−0.010*	−0.022**	−0.026**
	(0.007)	(0.011)	(0.017)	(0.004)	(0.005)	(0.009)
Proportion of long-term unemployed (percent)	0.0001	−0.0001	0.0004^{+}	0.0001	0.0002	0.0003*
	(0.0001)	(0.0002)	(0.0002)	(0.0001)	(0.0001)	(0.0001)
Long-run elasticity	−0.017	−0.004	−0.078*	−0.028*	−0.035**	−0.076**
Regional trends	No	Yes	No	No	Yes	No
Number of observations	315	315	315	315	315	315
Number of regions (cluster)	21	21	21	21	21	21

Note: ** p<0.01, * p<0.05, $^{+}$ p<0.1. Standard errors in parentheses are corrected for clustering on region. All models incude time-varying regional controls, regional fixed effects and year fixed effects. The time-varying regional controls are the proportion with compulsory and post-secondary education, female and foreign-born in the population. In the IV-models the regional unemployment is instrumented with local labor demand shocks.

Source: NIER.

Table 8 Elasticity of wages for men and women, private sector, 1999–2013

Dependent variable: Ln(composition corrected monthly wage in the county)

	1	3	2	4	6	5
	Men	**Men**	**Men**	**Women**	**Women**	**Women**
	OLS	OLS	IV	OLS	OLS	IV
Ln(regional wage *t*-1)	0.582**	0.341**	0.585**	0.646**	0.347**	0.654**
	(0.032)	(0.082)	(0.043)	(0.048)	(0.085)	(0.049)
Ln(regional unemployment)	−0.018**	−0.027**	−0.045**	−0.005	−0.010*	−0.016^{+}
	(0.005)	(0.007)	(0.011)	(0.004)	(0.004)	(0.010)
Proportion of long-term unemployed (percent)	0.0002^{+}	0.0003^{+}	0.0006**	0.0001	0.0000	0.0002
	(0.0001)	(0.0001)	(0.0002)	(0.0001)	(0.0001)	(0.0002)
Long-run elasticity	−0.043**	−0.041**	−0.108**	−0.014	−0.015*	−0.046^{+}
Regional trends	No	Yes	No	No	Yes	No
Number of observations	315	315	315	315	315	315
Number of regions (cluster)	21	21	21	21	21	21

Note: ** p<0.01, * p<0.05, $^{+}$ p<0.1. Standard errors in parentheses are corrected for clustering on region. All models incude time-varying regional controls, regional fixed effects and year fixed effects. The time-varying regional controls are the proportion with compulsory and post-secondary education, female and foreign-born in the population. In the IV-models the regional unemployment is instrumented with local labor demand shocks.

Source: NIER.

5 Swedish wage elasticity in an international comparison

The results in this study show that the elasticity of private sector wages to the regional unemployment is roughly –0.03 in the short run. The long-run elasticity varies between –0.07 and –0.09. The flexibility of wages is lower in the public sector. Previous Swedish studies have most often used aggregate level data. Also, the methods and time period used in previous studies on Swedish wage flexibility differ from this study which makes it difficult to compare results.[19] However, results from studies using Swedish aggregate level data from the 1960s to 1990s indicate roughly the same magnitude in the wage elasticity as the results in this study.[20]

The flexibility of wages depends largely on the labour market institutions. Thus, there is a considerable variation in wage flexibility between different countries. Empirical studies often find that Anglo Saxon countries and countries in Eastern Europe have fairly flexible wages whereas wage flexibility is considerably lower in the Nordic countries and in Germany.[21] The estimated long-run wage elasticities in the USA and in the UK are usually around –0.11.[22] In Western Germany and the other Nordic countries usually long-run elasticities between –0.02 and –0.05 are found. The short-run elasticities are also usually lower than the estimated short-run elasticities in this study. It seems that the Swedish wage elasticity is at least not lower than in Germany and the other Nordic countries. In a meta-study of 208 estimated wage curves the mean long-run wage elasticity was found to be approximately –0.07.[23] In the light of the results in this study, the Swedish private sector wage elasticity is around average compared to other industrialised countries.

[19] For example, the level of unemployment and inflation have varied considerably over time which can affect the wage flexibility. Also the definition of unemployment has varied over time.

[20] See for example Forslund (1997) and Forslund and Kolm (2004) for an overview and international comparison.

[21] See for example Dyrstad och Johansen (2000), Bell et al. (2002), Nijkamp and Poot (2005) and Baltagi et al. (2009).

[22] However, there is some evidence that the sensitivity of wages to unemployment has increased in the UK in the 2000s, see Gregg et al. (2014).

[23] Nijkamp and Poot (2005).

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Appendix

Table 9 First-stage IV-estimation results

Dependent variable: Ln(regional unemployment)

	(1) Private	(2) Public
Instrument	−0.0001** (0.00002)	−0.0001** (0.00001)
Ln(regional wage *t*-1)	1.367 (0.917)	3.587* (1.502)
Year dummies:		
2000	0.163 (0.131)	0.027 (0.143)
2001	0.159 (0.194)	−0.049 (0.210)
2002	0.197 (0.256)	−0.101 (0.284)
2003	0.161 (0.303)	−0.236 (0.352)
2004	0.416 (0.371)	−0.084 (0.434)
2005	0.372 (0.416)	−0.191 (0.489)
2006	0.288 (0.478)	−0.334 (0.551)
2007	0.111 (0.546)	−0.571 (0.623)
2008	0.343 (0.610)	−0.352 (0.670)
2009	0.563 (0.642)	−0.269 (0.736)
2010	0.771 (0.707)	−0.164 (0.821)
2011	0.826 (0.766)	−0.169 (0.884)
2012	0.924 (0.823)	−0.118 (0.940)
2013	0.904 (0.874)	−0.173 (0.985)
Proportion of long-term unemployed (percent)	0.010** (0.001)	0.009** (0.001)
County population shares of		
−Women	−4.901 (9.330)	−4.988 (7.855)
−Individuals with compulsory eduction	7.359** (2.118)	6.353** (1.882)
−Individuals with post-secondary education	−2.082 (3.034)	−2.031 (2.919)
−Foreign-born	6.562* (2.308)	6.273* (2.414)
Regional fixed-effects	Yes	Yes
Number of observations	315	315
Number of regions (cluster)	21	21
R−squared	0.92	0.93

Note: ** p<0.01, * p<0.05, $^{+}$ p<0.1. Standard errors in parentheses are corrected for clustering on region.

Source: NIER.