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Frode Johansen and Tor Jakob Klette

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Abstract:
Using a panel of manufacturing plants we study how payroll taxes and investment subsidies affect wages and demand for labor and capital. We exploit the regional subsidy schemes for labor and capital in Norway. Our empirical analysis finds that a large part of changes in payroll taxes is shifted over to wages. This result suggests that changes in payroll taxes have a limited direct effect on employment. Our study of investment subsidies finds evidence of substitution between labor and capital, with an elasticity of substitution of about 0.4 at the plant level. This indicates that increased taxation of capital will have a positive substitution effect on the demand for labor.

Keywords: Wages, Labor Demand, Business Taxation.

JEL classification: E24, H25.

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Address: Tor Jakob Klette, Statistics Norway, Research Department,
P.O.Box 8131 Dep., N-0033 Oslo, Norway. E-mail: tjk@ssb.no

Frode Johansen, Statistics Norway, Research Department

1 Should payroll taxes be reduced?

The paradox that labor payroll taxes are high while taxes on capital and energy are low in many European countries has been pointed out by a number of people, e.g. Dreze and Sneessens (1994). Given the widespread concern about unemployment, it would seem more natural to have low (payroll) taxes on labor while taxing substitutable factor inputs such as capital and energy. This issue has been debated for a number of years in Norway in relation to investment subsidies that have been introduced to promote employment in depressed regions[1]. A recent debate has discussed the possibility of achieving a "double dividend" through increased taxes on polluting activities, i.e. energy use, while reducing taxes on labor; see The Ministry of Finance (1996). However, the employment effects of tax reforms, with reduced taxes on labor and increased taxes on capital and/or energy, depend on the extent to which the reduced payroll taxes are transferred to wage increases. The employment effects of such reforms also depend on the possibility for substitution between labor and capital (or energy). This paper examines both the wage effects of a reduction in payroll taxes and the possibility for substitution between labor and capital in Norwegian manufacturing.

The basis for our analysis is the regional subsidy schemes for labor and capital that have been active in Norway for a number of years. These subsidy schemes create significant variations in both payroll taxes and investment costs; e.g. in 1990, payroll taxes varied between 2.2 and 16.7 percent while investment subsidies from the Regional Development Fund (RDF) could amount to 40 percent of total investment costs in some areas. Our analysis focuses on the impact of these variations in payroll taxes and investment subsidies using a comprehensive panel of Norwegian manufacturing establishments, covering almost all establishments with more than 5 employees.

In the first part of our analysis, we compare the wage differences between establishments located in regions with different payroll taxes. Over the last 15 years there have been considerable changes in the payroll taxes, both in terms of the size of the tax rates and to some extent also in terms of what regions have been covered by the different tax rates. We argue that the most interesting results are obtained by comparing longitudinal differences in wage growth between establishments located in regions subject to different changes in payroll taxes. We find that, comparing establishments in the same industry but located in different regions, changes in pay roll taxes are almost fully passed over to wage growth. The estimates of the pass over effect varies between 60 and 100 percent.

[1]Cf. e.g. Aamo (1982), Dyrstad (1992) and Østbye (1995). In 1982, the chairman of the RDF gave three reasons for subsidizing capital, see Aamo (1982): (i) the subsidies were implicit labor subsidies as priority was given to projects which created jobs; (ii) whether labor or capital is subsidized makes little difference as there are limited possibilities for substituting capital for labor; (iii) firms in remote regions are undercapitalized as a result of capital market imperfections.

In the second half of our analysis, we compare the differences in capital labor ratios between establishments located in regions with different payroll taxes and different investment subsidies. Our estimates suggest an elasticity of substitution between capital and labor around .4 comparing plants within the same industry (at the 5 digit ISIC level).

There is a large number of studies of manufacturing wage formation in Norway; see Stølen (1995,1996) for surveys. Almost all these studies are based on time series analysis of aggregate data. In Stølen (1996) he explicitly focuses on how the existing studies predict the effects of changes in payroll taxes. Considering studies by Hoel and Nymoen (1988), Nymoen (1989), Johansen (1995), Johansen (1996), and Stølen (1995), he concludes: "Most of the empirical analysis indicate that a large part of changes in pay-roll taxes is shifted over to wages in the long run at the national level....A pass over effect of about 70 to 80 percent in the long run may be a reasonable estimate". However, he also emphasizes that "The effect on wage formation in Norwegian manufacturing industries from changes in pay-roll taxes is not precisely determined in any empirical analysis". Our study gives new and different evidence with results in line with aggregate studies. A recent study by Dyrstad and Johansen (1995) suggests that the pass over effect for regional variations in the payroll taxes is lower. Their analysis is based on regional variation in payroll taxes as is our study, but they use aggregate (manufacturing wide) data rather than establishment data as in our study. Dyrstad (1991) uses both cross sectional and longitudinal variation in the payroll tax rate. Analyzing industry level data by region, he finds that a reduction in the payroll tax increases employment and wages. A similar data set is used by Østbye (1995) who analyses both the payroll tax and RDF subsidies. He finds the RDF grants to have little effect on employment compared to the payroll tax.

While there are many studies of the wage determination for Norway, surprisingly few have studied the second problem we focus on in this paper; the possibilities for capital-labor substitution in Norwegian manufacturing [2]. The international literature on estimation of firms' interrelated factor demands is vast, from theoretical considerations of functional forms to estimation procedures and empirical applications. Regardless of methods used, however, identification of key parameters, such as elasticities of demand and substitution, is completely dependent on good price data. Empirical research in this field encounters at least two fundamental problems. First, prices may not inhibit sufficient variation. For some factors of production, it is often difficult to obtain prices other than at aggregate levels, which limits the information that can be obtained from cross sections of data. This problem is encountered when constructing a user

[2]One exception is Alfsen, Bye, and Holmøy (1996) which, based on time series data at the industry level, find elasticities of substitution between capital and labor in the range 0.8 to 1.9.

cost of capital for the study of investment. A second problem is that cross sectional or longitudinal variation in factor prices may reflect quality differences or other forms of heterogeneity. Variation in hourly wage rates calculated from plants' wage bills and hours worked, for example, may reveal little information about real cost differences if labor is not homogeneous. Though these problems are well understood, there is no easy solution.

In this paper we seek to overcome the difficulties by using *policy induced* variation in factor prices as quasi-experiments. We study a panel of manufacturing plants that face different factor prices due to regional taxes and subsidies. The idea that explanatory variables should be exogenous dates back to early econometric studies, but the recent literature on quasi-experiments has reemphasized the importance and advantages of knowing the source of variation of the explanatory variables. See Meyer (1995) for a discussion of the quasi-experiment literature. There are also some related studies for other countries. Bohm and Lind (1993) study the effect of the 1984 cut in the payroll tax for Norrbotten county in Sweden. Using a quasi experimental method, the paper compares the growth in employment in the area to that of a control group. The analysis finds little effect of the tax reduction on employment. Cummins, Hassett, and Hubbard (1994) study investment demand using tax induced variation in the cost of capital.

Our paper is organized as follows. In the next section we describe the regional differences in payroll taxes and investment subsidies in Norway. Section 3 gives additional information about our data set. In section 4 we present our econometric framework. Section 5 presents our analysis of wage formation and of capital labor substitution. Conclusions and final remarks are given in section 6.

2 Regional taxes and subsidies

The payroll tax was introduced in 1967 to finance the Social Security System. Starting in 1975, the tax rates were differenced across municipalities, according to each employee's dwelling. Tax rates were 17, 16 and 14 percent, with the lowest rates corresponding to more remote areas. Since 1980, new zones have been introduced and the difference in rates between the zones has increased. In addition, some municipalities have been reassigned to zones with lower or higher tax rates. Particularly for the most remote areas, the rates have been substantially reduced. In 1990 there were five zones with rates of 16.7, 13.2, 10.0, 7.7 and 2.2 percent. Figure 1 shows the payroll tax rates by year. See Hervik and Johansen (1992) for a discussion of the payroll tax, and Hervik (1996) for estimates of the fiscal costs of the regional subsidy schemes.

The RDF was established in 1961 to promote employment in regions with unemployment or weak

industrial base. The RDF administers a wide selection of policies and the investment subsidy used in this study was introduced in 1971. Contrary to reductions in payroll tax, the subsidy is not automatic. An application for a subsidy can be rejected, and subsidies can be granted at rates below maximum. Originally, maximum rates were 35, 25, 15, and 0 percent, with the highest rates corresponding to more remote areas. There have been some changes: a 40 percent rate was introduced in 1984, and in 1988 some municipalities lost their RDF privileges. While until the early 1980s priority was given to projects which gave jobs, profitability is now a more important criterion. Other forms of support, such as guaranties and loans, are also available from RDF. See Hervik, Johansen, and Berge (1993) for a discussion of the RDF. Total RDF investment subsidies in 1990 were 549 million NOK, and about 60 percent of this sum went to manufacturing.

Table 1 shows the number of establishments with different combinations of payroll tax and RDF subsidy rates for 1990. Two aspects are worth noting: (i) There is not a one to one correspondence between the two measures, and there is considerable variation in both prices and relative prices of labor and capital across establishments. (ii) For some levels of payroll tax there exist multiple levels of RDF rates (and opposite), thus we can fix one of the rates while studying responses to variations in the other. To summarize, there is substantial cross sectional and time series variation in the tax and subsidy rates over time. These are the "experiments" used in the paper.

3 Data

The data set we employ is a panel of plants from the Annual Manufacturing Census of Statistics Norway. This census covers all plants in the manufacturing industry, except plants where the owner is the only person employed. In our cross section analysis we use observations from 1993. When using the longitudinal variation within plants we use observations from the years 1983-1993. Each plant's record contains information on variables such as employment, production, costs, capital stock, investment, and location (municipality). See Halvorsen, Jenssen, and Foyn (1991) for documentation of the Manufacturing Statistics. Information about the payroll tax and RDF subsidy rates of each municipality is merged in from other sources.

Our analysis covers all manufacturing industries (ISIC 31-39). Constructing the final sample we use all plants that completed the extended questionnaire in the survey[3]. We eliminated plants under construction and auxiliary units.

[3]For the years 1983-91 all plants with more than five employees received this questionnaire, for 1992-93 plants with more than ten employees received the questionnaire.

We measure labor, L_t, as man hours. Capital stock in year t, K_t, is computed as the mean of the fire insurance value of buildings and machinery at the end of year $t-2$, $t-1$ and t. We eliminated observations with missing or extreme values for wages, value added per hour and capital labor ratio[4].

4 Effects of payroll taxes on wages

4.1 Empirical framework

When studying the effects on wages of changes in the payroll tax rate, we estimate the equation:

$$\ln(W) = \beta_1 \ln(1+t_L) + \beta_2 \ln(VA/H) + \beta_3 \ln(WA) + dummies + \epsilon \quad (1)$$

Where W is the wage per hour paid to workers in a given plant, and t_L the rate of payroll tax. We also include two variables which often occur in wage bargaining models: a measure of plant profitability, value added per hour, VA/H, and an alternative wage rate, WA. The alternative wage rate is constructed as the mean wage of other plants in the same municipality and two digit ISIC industry. Instead of deflating the variables we use time dummies (and time dummies interacted with industry dummies) to account for wage and price growth. Other variables that occur in wage formation models, e.g. macro variables, will be accounted for either by the dummies or by the error term. The crucial assumption for identifying β_1 is that the left out variables, which will be captured by the error term, are independent of t_L. We will return to this issue below.

4.2 Results

Table 5 shows results from estimating the model in equation 1 on the pooled 1983-93 cross sections. The results in table 5 account for within plant correlation in residuals by a so-called "random effects" error term specification[5]. In column (1) we find a strong positive relationship between the payroll tax rate and the wage paid to workers. This relationship can also bee seen in the summary statistics in table 3. We believe that there are three major reasons for this finding: (i) heterogeneous labor combined with higher education/training in central areas. (ii) local wage bargaining combined with higher profitability and alternative wages in central areas. (iii) endogenous policy: the payroll tax rate is low in areas with low income/wage levels.

We next include more extensive sets of industry dummies (interacted with time dummies) to con-

[4]Extreme values were defined as values larger than $Q_{75} + 2(Q_{75} - Q_{25})$ and smaller than $Q_{25} - 2(Q_{75} - Q_{25})$, where Q_X is the X'th percentile of Q in each year.

[5]See Hsiao (1986) ch. 3 for panel data estimation with random effects.

trol for labor heterogeneity across industries. In addition, if reductions in pay roll taxes were directed towards regions with certain industries, we control for some of the "political endogeneity problem" by making within industry comparisons. In columns (2) and (3) we find that this substantially reduces the estimated parameter, but it is still positive. In columns (4) through (6) we try to account for local wage bargaining by including value added per hour and the alternative wage. We find that this further reduces the estimated parameter, but it is still positive and significant. The conclusion must be that our *cross section analysis* has little to say about how payroll taxes cet. par. affect wages.

A plausible explanation for our finding is that we do not sufficiently correct for differences in labor heterogeneity and the endogeneity of the payroll tax rate. In table 6 we try to account for these factors by using only the longitudinal variation in the data. We estimate the wage model with fixed effects using the panel of plants for the period 1983-1993. As in the cross section analysis we include time dummies to account for changes in the real wage level.

Our point estimate of the pass over effect in column (1) of table 6 suggests that 80 percent of a change in payroll taxes is shifted over to wages. Both the profitability term and the alternative wage appear to affect wages in a positive manner. The main intuition behind our result can be seen by studying the summary statistics in table 4, which shows that mean wage growth from 1983 to 1993 has been highest in the municipalities that received the largest reductions in the payroll tax rate. When separate time dummies for each two digit ISIC industry are added in column (2) we obtain a lower pass over effect (about 40 percent).

We also check the sensitivity of our results to dynamic specification issues by estimating two dynamic versions of the model. In column (3) and (4) we report results for a model where we included an extra lag of the independent variables (rewritten as a level and a one year difference). Our estimated long run pass over effect is above 65 percent when we include industry specific time dummies (col. 4). Finally, in column (5) and (6) we report results for a model where we included a lagged dependent variable. Here the point estimate of the pass over effect is even above 100 percent in the long run. The estimated pass over effect is not very precise, and a 100 percent pass over effect is within the 95 percent confidence interval. The model in columns (5) and (6) is estimated in first differences with $\Delta \ln(W)_{t-2}$ as an instrument for $\Delta \ln(W)_{t-1}$. See Hsiao (1986) ch. 4.2 for a discussion of instrument variable estimation for models with a lagged dependent variable and fixed effects.

We conclude that our estimated pass over effect is in the range of 60-100 percent, which implies that reductions in payroll taxes have a limited effect on employment through reducing wage costs.

5 Demand for Labor and Capital

5.1 Empirical framework

We derive a model of demand for labor and capital from a CES production function:

$$F(K,L) = A[\delta K^{\rho} + (1-\delta)L^{\rho}]^{1/\rho} \tag{2}$$

First order conditions for L and K give:

$$\left(\frac{K}{L}\right) = \frac{\delta}{1-\delta}\left(\frac{(1+t_L)W}{(1+t_K)C}\right)^{\sigma}. \tag{3}$$

Here t_K is the rate of investment subsidy, C the cost of capital and σ the elasticity of substitution. Note that this expression is valid even if plants differ in terms of the productivity parameter A. Taking logs of both sides and adding miscellaneous dummies and a stochastic error term gives:

$$\ln\left(\frac{K}{L}\right) = \sigma \ln\left(\frac{(1+t_L)W}{(1+t_K)C}\right) + dummies + \epsilon \tag{4}$$

Which can also be written:

$$\ln\left(\frac{K}{L}\right) = \sigma \ln((1+t_L)W) - \sigma \ln(1+t_K) + dummies' + \epsilon' \tag{5}$$

We assume that in a given year, all plants in the same industry face the same cost of capital, C, which will be accounted for by the time dummies. The fundamental identifying assumption for σ is that the left out variables, are independent of the price variables, t_L, W, and t_K. In addition, the variation in the price variables, t_L, W, and t_K, must be real. If the payroll tax is shifted over to wages or wage differences reflect quality differences, we will obtain a biased estimate of σ using the variation in t_L or W. We will return to this issue below.

5.2 Results

We next study how plants' interrelated demand for labor and capital responds to changes in the payroll tax, the wage, and the investment subsidy rate. Our primary concern is to what extent plants that face a low price on labor relative to capital will substitute labor for capital. Though the theoretical framework and our discussion below presume a CES production function, the analysis can also be considered as a more descriptive study of how the capital labor ratio varies with variations in factor prices.

To the extent that changes in payroll taxes are shifted over to wages, variation in the payroll tax rate can not be used to identify plants' demand for labor. We therefore include wage costs, $(1 + t_L)W$, as a single variable. As discussed above, variation in the wage across plants may reflect heterogeneous labor and not true variation in labor costs. See Lucas (1969) for a discussion of how this will bias the estimated elasticity of substitution. It is thus important to control for industry or plant characteristics.

In the analysis below we first study the 1993 cross section[6]. As opposed to the payroll tax rate, it is less clear cut what investment subsidy rate each plant faces in each year. In the analysis we have set the actual investment subsidy rate equal to 100 percent of the maximum rate. A lower percentage will give a simple reinterpretation of the coefficients estimated below.

As in the above analysis of wages, our analysis proceeds by performing regressions controlling for increasingly detailed industry and plant effects. In each regression we obtain two different estimates of σ by studying the plants' responses to variations in the wage costs and the investment subsidy rate.

Table 7 shows results from estimating equation 5. The results in column (1) give a point estimate of σ of .46 using the variation in the investment subsidy rate. Note that as more detailed industry dummies are added in columns (2) and (3) the estimated elasticity of substitution falls to .22. That is, the possibility of factor substitution is larger at the macro level (within manufacturing) than within narrowly defined industries. When the variation in wage costs is used, we find a quite similar point estimate of σ in column (1), but a higher estimate in column (2) than we found using the variation in the investment subsidy. A possible source of bias for our estimated σ is that the wage, W, is correlated with industry specific labor quality. In column (3) we see that when more detailed industry dummies are added, the difference between the two estimates of σ is reduced, but the F-test reveals that they still differ significantly. Given the large variation in the capital labor ratio we find the similarity between the estimates in column (1) and (4) somewhat surprising. We had expected to find a much larger substitution effect when the model was estimated without industry dummies.

In column (4) we estimate σ by using only the within size group and industry variation in the data. This is done by including industry dummies interacted with five size dummies, constructed by dividing the plants into five equally large groups in terms of revenues. The results do not differ very much from those found in column (3), but we now see that our F-test can not reject the hypothesis that our two estimates of σ are equal.

Our final table, table 8, reports results for a model with fixed (plant) effects. As plants do not adjust

[6]Our capital stock measure is a beginning of the year stock, and we use the investment subsidy rate of the previous year in the analysis.

their capital each year, we study their response to changes in the investment subsidy and wage costs over 10 years. The results show that there is too little variation in the investment subsidy rate from 1983 to 1993 to identify the elasticity of substitution. The estimate obtained from using variation in wage costs appears to be consistent with what we found using the cross section in table 7, with a point estimate of σ around 0.4. Here too, an F-test can not reject the hypothesis that our two estimates of σ are equal.

6 Conclusion

Using a panel of manufacturing plants we study how payroll taxes and investment subsidies affect wages and demand for labor and capital. Our empirical analysis finds that changes in payroll taxes have a limited effect on employment due to a high pass over effect on wages. One should, however, be careful extrapolating the results to a situation with a general change in the payroll tax level, particularly if a general change in the payroll tax level takes place at the same time as other tax changes that affect firms' profitability and thereby workers bargaining position. In this case one must also take into account the effects on profitability and the alternative wage as described in our model.

The analysis of investment subsidies finds evidence of substitution between labor and capital, indicating that increased taxation of capital will have a positive, but quite small, substitution effect on the demand for labor. The estimates of the elasticity of substitution are in the range .3-.4.

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7 Tables

Table 1: Rates of Payroll Tax and RDF Subsidy, 1993

RDF subsidy (1+tK)	Payroll tax (1+tL) 1	1.053	1.066	1.108	1.143	Total
.6	66					66
	1.91					1.91
.65	11	276	15	20		322
	0.32	8.00	0.43	0.58		9.33
.75			5	339	27	371
			0.14	9.83	0.78	10.75
.85				283	213	496
				8.20	6.17	14.38
1				57	2138	2195
				1.65	61.97	63.62
Total	77	276	20	699	2378	3450
	2.23	8.00	0.58	20.26	68.93	100.00

Notes: Each cell shows frequency of establishments and percentage of sample.

Table 2: Summary of $\ln(K/L)$ by Payroll Tax and RDF Subsidy Zone, 1993

RDF subsidy (1+tK)	Payroll tax (1+tL) 1	1.053	1.066	1.108	1.143	Total
.6	-1.28	.	.	.	.	-1.28
	.70	.	.	.	.	.70
	63	0	0	0	0	63
.65	-1.53	-1.27	-1.57	-1.07	.	-1.28
	.70	9 .89	.36	.86	.	.86
	10	259	15	20	0	304
.75	.	.	-2.15	-1.29	-1.18	-1.29
	.	.	1.23	.96	.94	.96
	0	0	3	332	26	361
.85	.	.	.	-1.43	-1.49	-1.45
	.	.	.	.80	.89	.84
	0	0	0	279	212	491
1	.	.	.	-1.26	-1.41	-1.41
	.	.	.	.72	.90	.90
	0	0	0	57	2125	2182
Total	-1.31	-1.27	-1.67	-1.34	-1.42	-1.39
	.70	.89	.58	.88	.90	.89
	73	259	18	688	2363	3401

Notes: Each cell shows mean, standard deviation and frequency.

Table 3: Summary of wage per hour by Payroll Tax and RDF Subsidy Zone, 1993

RDF subsidy (1+tK)	Payroll tax (1+tL) 1	1.053	1.066	1.108	1.143	Total
.6	116.50	.	.	.	.	116.50
	22.91	.	.	.	.	22.91
	63	0	0	0	0	63
.65	113.78	119.92	111.61	121.78	.	119.43
	12.69	23.05	17.10	17.19	.	22.22
	10	259	15	20	0	304
.75	.	.	92.27	117.25	124.94	117.60
	.	.	5.41	19.87	20.03	20.01
	0	0	3	332	26	361
.85	.	.	.	116.67	119.53	117.91
	.	.	.	20.76	20.25	20.57
	0	0	0	279	212	491
1	.	.	.	116.84	132.31	131.91
	.	.	.	21.78	27.53	27.50
	0	0	0	57	2125	2182
Total	116.13	119.92	108.39	117.12	131.09	126.97
	21.76	23.05	17.30	20.30	27.13	26.19
	73	259	18	688	2363	3401

Notes: Each cell shows mean, standard deviation and frequency.

Table 4: Wage Growth vs Payroll Tax Change, 1983 to 1993

Change in Payroll tax (% Points)	Summary of % Wage Growth Mean	Std. Dev.	Freq.
< -6	103.76	32.32	37
[-6 , -2.5]	101.03	40.02	196
> -2.5	96.63	38.70	1872
Total	97.16	38.74	2105

Table 5: Wages and payroll tax, Random effects results for 1983-1993

Dependent variable: $\ln(W)$

	(1)	(2)	(3)	(4)	(5)	(6)
$\ln(1+t_L)$	.99	.68	.71	.68	.36	.41
	(.07)	(.07)	(.06)	(.07)	(.07)	(.06)
$\ln(VA/H)$				.21	.21	.21
				(.00)	(.00)	(.00)
$\ln(WA)$				.18	.07	.06
				(.01)	(.01)	(.01)
Dummies:	YEAR	YEAR* ISIC(2)	YEAR* ISIC(5)	YEAR	YEAR* ISIC(2)	YEAR* ISIC(5)
R^2	.49	.58	.01	.63	.68	.21
OBS	63637	63637	63637	56011	56011	56011

Notes: Standard errors in parentheses. W = wage per hour. t_L = rate of payroll tax. VA/H = Value added per hour. WA = Alternative wage. (Mean wage of other plants in same municipality and two digit ISIC industry.) The R^2 in columns (3) and (6) does not account for the dummies included in the regression.

Table 6: Wages and payroll tax, Fixed effects results 1983-1993

Dependent variable: $\ln(W)$

	(1)	(2)	(3)	(4)	(5)	(6)
$\ln(1+t_L)$	-.80	-.41	-1.18	-.65	-1.10	-.98
	(.15)	(.15)	(.19)	(.19)	(.29)	(.30)
$\ln(VA/H)$	.20	.20	.22	.22	.19	.20
	(.00)	(.00)	(.00)	(.00)	(.01)	(.01)
$\ln(WA)$	.04	.02	.05	.03	.01	-.01
	(.01)	(.01)	(.01)	(.01)	(.01)	(.01)
$\Delta\ln(1+t_L)$			.51	.18		
			(.24)	(.24)		
$\Delta\ln(VA/H)$			-.02	-.02		
			(.00)	(.00)		
$\Delta\ln(WA)$			-.02	-.01		
			(.01)	(.01)		
$\ln(W)_{t-1}$					.28	.27
					(.03)	(.03)
Dummies:	YEAR	YEAR* ISIC(2)	YEAR	YEAR* ISIC(2)	YEAR	YEAR* ISIC(2)
R^2	.87	.87	.87	.87	..	..
OBS	56011	56011	44802	44802	34177	34177

Notes: Standard errors in parentheses. W = wage per hour. t_L = rate of payroll tax. VA/H = Value added per hour. WA = Alternative wage. (Mean wage of other plants in same municipality and two digit ISIC industry.) The model in columns (5) and (6) is estimated in first differences with $\Delta\ln(W)_{t-2}$ as an instrument for $\Delta\ln(W)_{t-1}$.

Table 7: Elasticity of substitution, Cross section results for 1993

Dependent variable: $\ln(K/L)$

	(1)	(2)	(3)	(4)
$\ln(1+t_K)$	-.46	-.29	-.22	-.28
	(.10)	(.09)	(.08)	(.09)
$\ln(W(1+t_L))$	.42	.72	.47	.40
	(.09)	(.09)	(.08)	(.09)
Dummies:		ISIC(2)	ISIC(5)	ISIC(5) *SIZE
F	.75	.00	.01	.23
R^2	.01	.17	.44	.46
OBS	3482	3482	3482	3482

Notes: Robust standard errors in parentheses. K/L = capital labor ratio. t_K = rate of investment subsidy. t_L = rate of payroll tax. W = wage per hour. F gives the lowest significance level at which the hypothesis that the two estimates of σ are equal can be rejected.

Table 8: Elasticity of substitution, Fixed effects results for 1983 and 1993

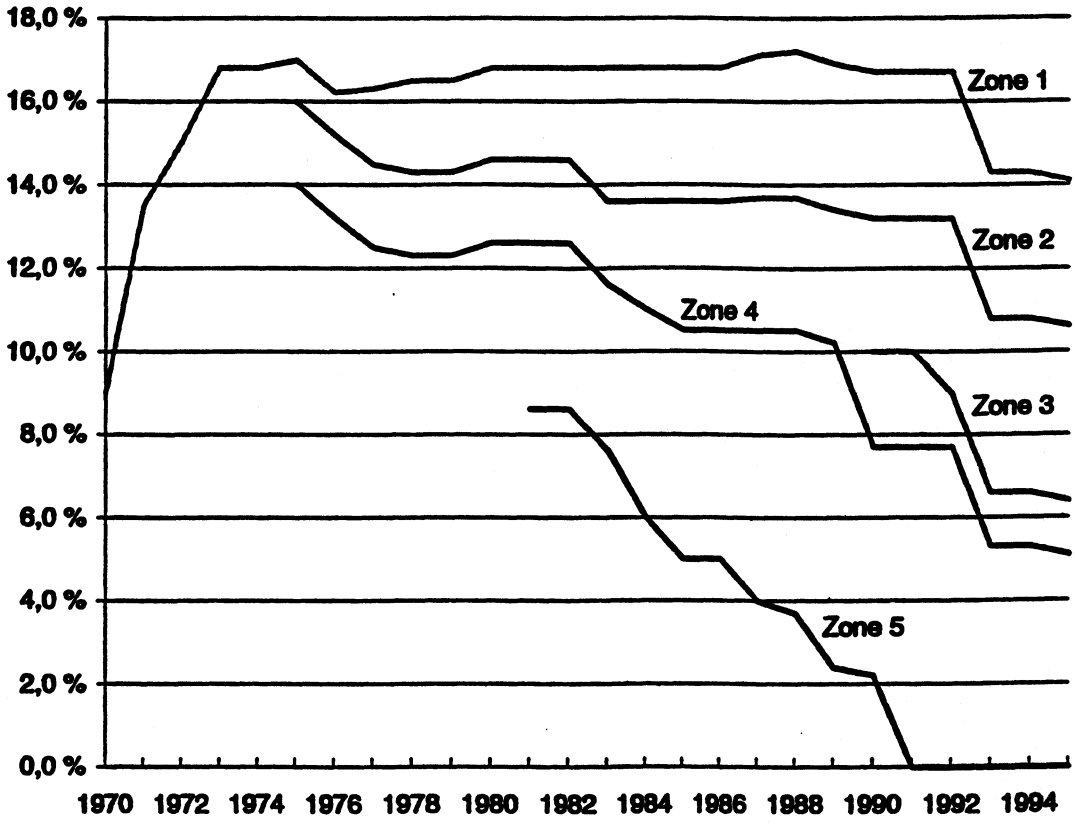
Dependent variable: $\Delta_{10}\ln(K/L)$

	(1)	(2)	(3)	(4)
$\Delta_{10}\ln(1+t_K)$	-.02	-.00	-.02	-.07
	(.28)	(.28)	(.28)	(.37)
$\Delta_{10}\ln(W(1+t_L))$	.33	.39	.39	.38
	(.08)	(.08)	(.08)	(.09)
Dummies:		ISIC(2)	ISIC(5)	ISIC(5) *SIZE
F	.29	.21	.20	.33
R^2	.01	.03	.06	.07
OBS	2158	2158	2158	2158

Notes: Robust standard errors in parentheses. K/L = capital labor ratio. t_K = rate of investment subsidy. t_L = rate of payroll tax. W = wage per hour. F gives the lowest significance level at which the hypothesis that the two estimates of σ are equal can be rejected.

8 Figures

Figure 1: Payroll tax rates by year



Notes: Source: Hervik (1996)

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