The Impact of Taxation on Unemployment in OECD Countries

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There have been numerous studies of the impact of labor market rigidities on unemployment rates. The general conclusion for both OECD as well as other countries is that rigidities explain a significant part of the observed international variation in unemployment rates (Layard, Nickell, and Jackman 1991).

The primary interest of the present paper is the impact of taxation on unemployment in OECD countries. The relation between unemployment and taxation has recently attracted special attention. For example, Nickell (1997) has found that taxation is a significant factor in explaining differences in unemployment rates across countries (see also Scarpetta 1996; Nickell and Layard 1997; Heitger 1998; and Elmeskov, Martin, and Scarpetta 1998). Since high unemployment rates may lead to higher government expenditures and taxes, the question is whether the impact of the tax burden on unemployment has been estimated correctly—that is, whether the estimates are consistent and unbiased.

To evaluate the "true" impact of taxation on unemployment, Hausman specification tests can be carried out (Hausman 1978). With the help of these tests it is possible to investigate whether the impact of the tax burden on unemployment is exogenous. If the outcome is that the null hypothesis (that taxes are exogenous) has to be rejected, a two-stage least squares estimation procedure can provide unbiased and consistent estimates of the tax burden's impact on unemployment and thus correct for the simultaneity bias.

The empirical investigation will focus on total unemployment but also examine long-term and short-term unemployment. The reason is that an increase in long-term unemployment will eventually create a larger effect on government expenditures (and taxes) than will an

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increase in short-term unemployment. Since the tax burden is assumed to be only one of the structural features of the labor market in OECD countries, the impact of the other determinants also has to be estimated. The investigations are based on Nickell's (1997) data set, which contains the relevant data for two periods, namely 1983–88 and 1989–94.

Unemployment Experience in OECD Countries

Unemployment rates in OECD countries differ widely (Table 1). The rate of total unemployment in 1983–88 in Spain was 19.6 percent while the rate in Switzerland was only 0.8 percent. In 1989–94 these

TABLE 1

UNEMPLOYMENT RATES IN OECD COUNTRIES, 1983–94

	1983–88			1989–94		
	Total	Short-term	Long-term	Total	Short-term	Long-term
Austria	3.6	NA	NA	3.7	NA	NA
Belgium	11.3	3.3	8.0	8.1	2.9	5.1
Denmark	9.0	6.0	3.0	10.8	7.9	3.0
Finland	5.1	4.0	1.0	10.5	8.9	1.7
France	9.8	5.4	4.4	10.4	6.5	3.9
Germany (W)	6.8	3.7	3.1	5.4	3.2	2.2
Ireland	16.1	6.9	9.2	14.8	5.4	9.4
Italy	6.9	3.1	3.8	8.2	2.9	5.3
Netherlands	10.5	5.0	5.5	7.0	3.5	3.5
Norway	2.7	2.5	0.2	5.5	4.3	1.2
Portugal	7.6	3.5	4.2	5.0	3.0	2.0
Spain	19.6	8.3	11.3	18.9	9.1	9.7
Sweden	2.6	2.3	0.3	4.4	4.0	0.4
Switzerland	0.8	0.7	0.1	2.3	1.8	0.5
United Kingdom	10.9	5.8	5.1	8.9	5.5	3.4
Canada	9.9	9.0	0.9	9.8	8.9	0.9
United States	7.1	6.4	0.7	6.2	5.6	0.6
Japan	2.7	2.2	0.5	2.3	1.9	0.4
Australia	8.4	5.9	2.4	9.0	6.2	2.7
New Zealand	4.9	4.3	0.6	8.9	6.6	2.3
OECD	7.8	4.7	3.4	8.0	5.2	3.1
Europe	8.2	4.3	4.2	8.3	4.9	3.7
Non-Europe	6.6	5.6	1.0	7.2	5.8	1.4

SOURCE: Nickell (1997: Table 1).

two countries again reported the highest (18.9 percent) and the lowest (2.3 percent) unemployment rate. The OECD average rate of total unemployment increased only slightly from 7.8 percent in 1983–88 to 8.0 percent in 1989–94. Total unemployment in Europe was higher than in non-European countries in both periods. At the same time the variation of total unemployment rates increased.

Short-term unemployment (i.e., a duration of unemployment less than one year) also varied widely in OECD countries. Again in Switzerland in both periods the short-term unemployment rate was lowest. In contrast, Canada in 1983–89 and Spain in 1989–94 reported the highest rate (about 9 percent). The mean rate of short-term unemployment in OECD countries accounted for more than half of the rate of total unemployment—with the non-European countries showing a much higher share. The variation in short-term unemployment in Europe and non-Europe increased in the course of time, but in both periods the rate was higher in the European countries.

Long-term unemployment in non-European countries seems to have been a problem of only minor importance—1.0 percent and 1.4 percent in 1983–88 and 1989–94, respectively—compared with Europe where this type of unemployment accounted for 4.2 percent and 3.7 percent.

Characteristics of OECD Labor Markets

The theoretical framework to explain unemployment rates in OECD countries is given by the familiar model of Layard, Nickell, and Jackman (1991). The model is characterized by an upward sloping wage-setting schedule—which follows from the assumption that real wages are the result of a bargaining process between employers and employees—and a downward sloping labor demand schedule. Product market conditions and a number of wage-push factors influence the labor demand schedule and the wage-setting schedule, respectively. The intersection of the labor demand schedule and the wage-setting schedule determine the equilibrium of the structural unemployment rate and of real wages. Structural unemployment is thus a function of wage-push factors, price-push factors, and the elasticities of real wages and price markups to unemployment (Elmeskov, Martin, and Scarpetta 1998: 212–13).

The determinants of unemployment may be classified with respect to four categories: direct labor market rigidities, the treatment of the unemployed, the structure of wage determination, and taxes (Nickell 1997). The database for the 1989–94 period is given in Appendix Table 1. Some descriptive statistics are presented in Table 2.

TABLE 2

Characteristics of OECD Labor Markets (Descriptive Statistics), 1989–94

	OECD		Europe		Non-Europe	
	Mean	STD	Mean	STD	Mean	STD
Direct Rigidities						
Employment protection	10.5	5.9	12.8	4.8	3.6	2.7
Labor standards	4.0	2.2	4.7	2.0	1.8	1.3
Treatment of the Unemployed						
Benefit replacement rate	56.7	17.4	59.9	17.7	47.0	13.5
Benefit duration	2.3	1.4	2.4	1.3	2.0	1.8
Active labor market policies	12.3	12.5	14.8	13.5	4.6	1.7
Structure of Wage Determination						
Union density	40.3	19.8	43.0	21.5	32.4	11.8
Union coverage	2.7	0.6	2.9	0.4	2.0	0.7
Union coordination	2.0	0.7	2.1	0.7	1.6	0.5
Employer coordination	2.0	0.9	2.3	0.8	1.2	0.4
Taxes						
Payroll tax rate	20.6	11.5	22.4	11.7	13.2	7.8
Total tax rate	48.2	11.8	51.8	11.0	37.3	6.2

Source: Nickell (1997: Tables 4 and 5); author's calculations.

Direct labor market rigidities are present if employment legislation is stringent and labor market standards are strict. Employment legislation may be measured by the employment protection index. This index was constructed by the OECD and is based on the legal regulations with respect to hiring and firing. Countries are ranked from 0 to 20, with 20 indicating the most stringent restrictions. Southern European countries like Italy, Spain, and Portugal are the most strictly regulated whereas the United States, New Zealand, and Canada have the weakest laws. The labor standard index, also introduced by the OECD, measures the strictness of regulations with respect to several aspects of the labor market. The index is based on five characteristics: working time, fixed-term contracts, employment protection, minimum wages and employees representation rights (on work councils, company boards, etc.). Each feature is being scored from 0 (no legislation) to 2 (strict legislation), and the scores are added up. Thus, the index ranges from 0 to 10. The emerging picture is very much the same as in the case of the employment protection index (e.g., Italy and Spain rank very high whereas the United States and Canada rank lowest).

The treatment of the unemployed by social security systems is another labor market feature that appears to help explain why unemployment rates in OECD countries differ. The replacement rate—the share of income replaced by unemployment benefits—ranges from about 20 percent for Italy to about 80 percent for Sweden. Benefit duration also varies widely. Whereas the benefits in the United States, Japan, and Italy are strictly time-limited (only six months), the benefit duration in several European countries like Belgium, Germany, Ireland, and England, as well as in Australia and New Zealand, is up to four years. Active labor market policy, which aims at reintegrating the unemployed into regular work (e.g., labor market training, assistance with job search, subsidized employment, and measures for the disabled) also varies widely among OECD countries. If labor market policy is measured by the amount of active labor market spending per unemployed (as a percentage of GDP per person of the labor force), Sweden's figure of about 60 percent ranks highest. Germany comes next with expenditures of nearly 26 percent. The United States with only 3 percent spent the least.

Characteristics of the wage bargaining system also appear to be important determinants of the variation in unemployment rates (see Calmfors 1993). Union density figures give the percentage share of union members in relation to total wage and salary earners. According to this measure, Sweden and other Northern European countries rank highest. However, these numbers may be misleading because in

some countries, even those with small shares like France and Spain, union wage negotiations determine the wages of large parts of the workforce. To account for this circumstance, a union coverage index has been calculated that shows the percentage share of workers actually covered by union wage bargaining (with 3 indicating more than 70 percent covered, 2 indicating 25–70 percent, and 1 less than 25 percent covered). In all European countries except Switzerland and the United Kingdom more than 70 percent of the workforce are covered by union wage bargaining.

The next two rows indicate the degree of union and employer coordination in wage bargaining. For both measures the degree of coordination is ranked from 1 (low) to 3 (high). The coordination of the unions is highest in Northern Europe and Austria. In contrast, the non-European countries as well as Switzerland and the United Kingdom rank lowest. The ranking of employer coordination looks very much the same.

The last two rows present information on the tax burden on labor. Payroll taxes, which are defined as the ratio of non-wage labor costs to wages, vary widely. On the one extreme is Denmark, which levies nearly no payroll taxes. At the other extreme are Italy and France where payroll taxes account for about 40 percent of wages. The total tax burden, which is based on national income accounts, shows less variation but nevertheless varies considerably. The figures range from 28.7 percent for Australia to 70.7 percent for Sweden. These data indicate the magnitude of the tax wedge in the labor market—that is, measure the difference between real labor cost and real take-home pay and thus give a better impression of the real tax burden on labor (Nickell 1997: 62). The differences between Europe and non-Europe with respect to labor market rigidities seem to be rather great. This is especially true for the total tax rate which in 1989–94 in OECD countries was 48.2 percent but was 51.8 percent in Europe compared with 37.3 percent in non-Europe.[1] In the following analyses the impact of this last feature of the labor market in OECD countries as a determinant of unemployment performance is the center of attention.

Labor Market Rigidities and Total Unemployment

In evaluating the importance of taxes on unemployment records in OECD countries properly, the impact of other possible determinants

[1]If Switzerland, which may be regarded as an untypical European country in this respect, is excluded from the European sample, the difference between Europe and non-Europe increases further.

has to be taken into account. This will be done by multiple regression analyses.

Concerning the relationship between labor market institutions and unemployment, a correlation matrix of the endogenous and exogenous variables has been calculated (Appendix Table 2). The correlations for the endogenous variables indicate that short-term and long-term unemployment are highly correlated. With respect to the hypothesized determinants of unemployment, the strong correlation between the degree of employer's coordination in the wage bargaining process and total (as well as short-term and long-term) unemployment is worth mentioning. A low level of coordination seems to have contributed to a higher rate of unemployment. The duration of benefits also appears to have played a significant role in the determination of total and long-term unemployment. A long benefit duration was positively related with the rate of unemployment. Active labor market policies were also significantly correlated with unemployment. The higher the level of active labor market policies the lower was the total (as well as the short-term and long-term) unemployment rate. Direct rigidities of the labor market such as employment protection legislation and labor standards only had a significant positive impact on long-term unemployment. The simple correlation coefficients of the remaining possible determinants of unemployment turn out to be not significantly correlated with unemployment.[2] This is also true for the two tax variables (the ratio of payroll taxes and of total taxes) and unemployment.

The correlation matrix also presents evidence regarding whether or not the labor market features are correlated among themselves. A high partial correlation between exogenous variables may serve as a first indication of possible problems of multicollinearity in the regression analyses. As can be seen the two measures for direct rigidities on OECD labor markets, namely employment protection and labor standards, are highly correlated. The same is true for the relationship between these two measures and the two tax variables. Furthermore, labor standards are significantly correlated with measures of active labor market policies, unionization, and union coordination, as well as with wage coordination on the employer's side. Given the measures for the treatment of the unemployed, it is worth noting that active labor market policies are significantly correlated with nearly all other potential determinants of unemployment. Moreover, the measures

[2]There may, however, be a significant impact on unemployment if the influence of other determinants is held constant.

that refer to the organization of the wage bargaining process are all highly correlated among themselves. Finally, the partial correlation between payroll taxes and total taxes is also highly significant.

To evaluate the impact of the hypothesized determinants on unemployment, multiple regression analyses of the underlying reduced-form equation of the labor market have been carried out. Based on these analyses it is possible to measure the influence of a potential determinant on unemployment when the impact of other determinants is held constant. The regression analyses follow Nickell (1997: 64) with some exceptions. As in Nickell, total, long-term, and short-term unemployment are investigated. The regressions are based on a panel analysis for the OECD countries using a combination of two cross-sections from two time periods (1983–88 and 1989–94). Of the potential determinants of unemployment, direct rigidities were left out of the analyses. The reason is that employment protection did not—at conventional significance levels—exert a significant influence on unemployment. The impact of labor standard legislation was not significant either.[3] As in Nickell (1997), all three variables that refer to the treatment of the unemployed (benefit replacement rate, benefit duration, and active labor market policies) are treated as exogenous variables. The variables that describe the institutional wage bargaining process are all highly correlated (Appendix Table 2). To avoid possible problems of multicollinearity, only two of these variables enter the regression analyses. Finally, only the impact of total taxes will be investigated. The reason is that the total tax rate, compared with payroll taxes, is a better indicator of the real tax wedge in OECD countries (Nickell 1997: 68–69).

The regression results for total unemployment are presented in Table 3 (Column 1). Generous benefit systems tend to raise the rate of total unemployment. A high benefit replacement ratio seems to lead to an upward pressure on wages from employees. In addition, a high benefit replacement ratio allows the unemployed to be more selective. For the same reasons, a long duration of entitlement also contributes to a higher total unemployment rate. Active labor market policies, through measures to bring unemployed persons back to work, have succeeded in reducing the unemployment rate.[4] The features of the wage bargaining process also had an impact on unemployment. A high union density increases unemployment rates. In

[3]In the course of this analysis the variable labor standards instead will serve as an instrument in further testing.

[4]Because of possible "reverse causation" this variable has been instrumented (Nickell 1997: Table 6).

TABLE 3

Regressions to Explain Log Total Unemployment Percentage Rate 20 OECD Countries, 1983–94

Equation[a]	(1) OLS	(2) OLS	(3) OLS	(4) TSLS
Endogenous Variable[b]	UNEMP	TAX	UNEMP	UNEMP
Exogenous Variables[c]				
C	0.416	29.613	−0.341	−0.341
	(1.14)	(4.72**)	(−0.66)	(−0.56)
RRATE	0.013	0.006	0.015	0.015
	(3.12**)	(0.06)	(3.56**)	(3.01**)
BENEFIT	0.121	−0.022	0.100	0.100
	(2.81**)	(−0.023)	(2.33*)	(1.98†)
ALMP	−0.025	0.211	−0.035	−0.035
	(−3.44**)	(1.29)	(−4.08**)	(−3.46**)
UDEN	0.014	−0.047	0.017	0.017
	(3.29**)	(−0.49)	(3.91**)	(3.31**)
EMCORD	−0.724	3.171	−0.847	−0.847
	(−6.82**)	(1.36)	(−7.11**)	(−6.02**)
TAX	0.031		0.051	0.051
	(4.56**)		(4.22**)	(3.57**)
DUM90	0.233	0.581	0.231	0.231
	(1.94†)	(0.22)	(2.00†)	(1.69†)
LSTAND		2.692		
		(3.59**)		
RES			−0.028	
			(−1.98†)	
Adjusted R^2	0.67	0.46	0.70	0.58
S.E. Regression	0.37	8.31	0.36	0.42
N (countries, time)	40 (20; 2)	40 (20; 2)	40 (20; 2)	40 (20; 2)
F-Test	12.36**	5.82**	12.29**	9.17**
(p-value)	(0.00)	(0.00)	(0.00)	(0.00)
Jarque-Bera-Test	0.62	2.34	0.95	0.48
(p-value)	(0.74)	(0.31)	(0.62)	(0.79)
White-Test	0.62	0.72	0.77	0.82
(p-value)	(0.82)	(0.75)	(0.70)	(0.68)

[a]Estimation using a combination of two cross-sections from two time periods (1983–88 and 1989–94); t-test statistics in parentheses; †significant at 90 percent, *at 95 percent, and **at 99 percent; OLS, ordinary least squares; TSLS, two-stage least squares.

[b]UNEMP, log of total unemployment percentage rate; TAX, total tax share.

[c]RRATE, replacement rate; BENEFIT, benefit duration; ALMP, active labor market policies; UDEN, union density; EMCORD, employer's coordination; DUM90, dummy variable (1989–94 = 1); LSTAND, labor standards; RES, residual.

Sources: Table 1 and Appendix Table 1; Nickell (1997); author's calculations.

contrast, highly coordinated wage bargaining on the employer's side (and perhaps as well on the side of the unions, given the highly significant partial correlation between employer's coordination and union's coordination, shown in Appendix Table 2) strongly contributes to lower rates of total unemployment. Finally, high tax wedges lead to a rise in the rates of total unemployment. Thus, all the regression coefficients show the expected signs and are statistically significant even at the 99 percent level, whereas the insignificance of the dummy variable for the second period (1989–94) at the conventional significance level of 95 percent implies that the two sub-samples are homogenous. The determinants of this approach "explain" about two-thirds of the variation in OECD unemployment rates during the 1983–94 period.

Are Taxes Exogenous?

One might object that problems of "reverse causation" may jeopardize these results. Above all one can suppose that a rising unemployment rate also implies higher unemployment benefits payments and more expenditures on active labor market policies. Thus, a higher unemployment rate may also lead to a higher tax rate. If taxation is in fact an endogenous variable that is simultaneously determined, this simultaneity can cause ordinary least-squares parameter estimates to be biased and inconsistent (Pindyck and Rubinfeld 1998: 353–55). If so, an alternative estimation method must be used.

To test whether the tax variable is really exogenous or is simultaneously determined with the total unemployment rate, one can run a Hausman specification test by an auxiliary regression. In this regression the total tax rate is regressed on the above hypothesized exogenous variables (the constant, the replacement rate, benefit duration, active labor market policies, union densities, the employer's coordination, and the "dummy" variable for 1989–94) and an instrumental variable. As an instrumental variable we chose the index of labor standards (LSTAND), which is highly correlated with the total tax rate (Appendix Table 2). The results of this regression are given in Table 3 (Column 2). The residuals from this regression are saved in a variable called RES.

The next step is to reestimate the unemployment equation (Column 1), including the residuals from the auxiliary regression. The results are presented in Column 3. Under the null hypothesis that taxes are exogenous, the variable RES in this second-stage regression should not be significantly different from zero. As can be seen, the t-statistics indicate that the coefficient is only significant at the 90

percent level. Thus, at the conventional 95 percent significance level the null hypothesis for this variable cannot be rejected. Total taxes with respect to the total unemployment rate in fact may be assumed to be exogenous.

If instead—to illustrate the alternative estimation procedure—a significance level of 90 percent is assumed to be sufficient, the null hypothesis has to be rejected. Under this assumption ordinary least squares (OLS) estimates of the total unemployment equation (Column 1) must be considered as biased and inconsistent. To receive unbiased and consistent estimates, a two-stage least squares (TSLS) estimation technique can be employed. In such an estimation the hypothesized exogenous variables (C, RRATE, BENEFIT, ALMP, UDEN, EMCORD, DUM90) and the instrumental variable LSTAND serve as instruments. The results of the TSLS estimation are shown in Column 4. The estimated coefficients are the same as in Column 3, but the standard errors and t-statistics are now estimated correctly. Compared with Column 1 the coefficients and the significance levels have changed but slightly. The coefficient of the benefit duration now is significant only at the 90 percent level. The coefficient of the tax variable under the assumption of simultaneity has increased slightly. The equation "explains" about 60 percent of the variation in OECD total unemployment in 1983–94.

The Impact of Taxation on Short-term and Long-term Unemployment

Whether taxes are exogenous or endogenous appears to depend on the underlying significance level. But if the conventional level of 95 percent is applied the total tax rate must be considered as exogenous with respect to the total unemployment rate. Thus the original estimation (Column 1) seems to be unbiased and consistent. However, with respect to short-term and long-term unemployment rates things could be different. One might hypothesize that, in the case of long-term unemployment, a simultaneity problem exists. The reason is that long-term unemployment seems to be accompanied by higher government expenditures for the unemployed, which in turn might lead to a higher total tax rate. Thus, the relation between taxation and long-term unemployment could be mutually reinforcing.

The respective empirical tests are first applied to short-term unemployment (Table 4). Column 1 presents the basic OLS estimates. The replacement rate, active labor market policies, union density, employer's coordination, and the total tax share exert a significant

TABLE 4

REGRESSIONS TO EXPLAIN LOG SHORT-TERM UNEMPLOYMENT PERCENTAGE RATE 19 OECD COUNTRIES, 1983–94

Equation[a]	(1) OLS	(2) OLS	(3) OLS
Endogenous Variable[b]	SUNEMP	TAX	SUNEMP
Exogenous Variables[c]			
C	0.216	29.634	0.260
	(0.61)	(4.57**)	(0.49)
RRATE	0.016	0.007	0.016
	(3.73**)	(0.073)	(3.59**)
BENEFIT	0.050	–0.055	0.051
	(1.18)	(–0.05)	(1.15)
ALMP	–0.019	0.211	–0.018
	(–2.70*)	(1.25)	(–2.14*)
UDEN	0.014	–0.046	0.014
	(3.44**)	(–0.47)	(3.13**)
EMCORD	–0.671	3.092	–0.664
	(–6.14**)	(1.19)	(–5.18**)
TAX	0.022		0.021
	(3.44**)		(1.71†)
DUM90	0.226	0.671	0.227
	(1.92†)	(0.24)	(1.89†)
LSTAND		2.698	
		(3.48**)	
RES			0.002
			(0.12)
Adjusted R^2	0.57	0.45	0.56
S.E. Regression	0.36	8.58	0.36
N (countries, time)	38 (19; 2)	38 (19; 2)	38 (19; 2)
F-Test	8.04**	5.30**	6.80**
(p-value)	(0.00)	(0.00)	(0.00)
Jarque-Bera-Test	1.17	2.53	1.23
(p-value)	(0.56)	(0.28)	(0.54)
White-Test	2.07	0.93	0.65
(p-value)	(0.30)	(0.63)	(0.80)

[a]Estimation using a combination of two cross-sections from two time periods (1983–88 and 1989–94); t-test statistics in parentheses; †significant at 90 percent, *at 95 percent, and **at 99 percent; OLS, ordinary least squares.

[b]SUNEMP, log of short-term unemployment percentage rate; TAX, total tax share.

[c]RRATE, replacement rate; BENEFIT, benefit duration; ALMP, active labor market policies; UDEN, union density; EMCORD, employer's coordination; DUM90, dummy variable (1989–94 = 1); LSTAND, labor standards; RES, residual.

SOURCES: Table 1 and Appendix Table 1; Nickell (1997); author's calculations.

impact on the short-term unemployment rate. These features of the labor market (significantly) "explain" 57 percent of short-term unemployment in OECD countries. The insignificance of the dummy variable (at the 95 percent significance level) implies that the two subsamples are homogenous, and the Jarque-Bera-test and White-test indicate that the residuals are normally distributed and homoscedastic.

The Hausman specification test to examine whether taxation is exogenous with respect to short-term unemployment again consists of an auxiliary regression (Column 2). The total tax rate is regressed on all the exogenous variables of the OLS regression and an instrumental variable (LSTAND). The residuals from this regression are again stored in a variable called RES. In the second step this variable is added to the original equation.

The estimates are presented in Column 3. As can be seen, the variable RES turns out to be insignificant. Thus, the null hypothesis that total taxes are exogenous with respect to short-term unemployment cannot be rejected. The OLS estimates (Column 1) thus seem to be consistent and unbiased.

The respective tests for long-term unemployment are shown in Table 5. In the basic OLS equation, benefit duration, active labor market policies, employer's coordination, and the total tax rate all turn out to be significant parameters of long-term unemployment. The residuals from an auxiliary regression (Column 2) turn out to be significant at the 95 percent significance level (Column 3). Thus, the null hypothesis that the total tax rate with respect to long-term unemployment is exogenous has to be rejected. Long-term unemployment and the total tax rate seem to be simultaneously determined. The equation in Column 3 gives the adjusted coefficients for the exogenous variables. However, the standard errors from this OLS regression are not correct. To obtain correct standard errors (and t-statistics) a TSLS regression was run (Column 4). In this equation the same variables as in the original equation (Column 1) turn out to be statistically significant. But the values of the coefficients have changed.[5] While the coefficient of benefit duration has decreased, the coefficients of the other variables have increased. The parameter of the total tax rate turns out to be more than twice as high, at a higher level of significance, as in the original OLS estimation. Thus, the

[5]The adjusted coefficient of determination is also much lower but still significant at the 99 percent level. One reason for the decrease seems to be that TSLS estimation uses up a larger number of degrees of freedom.

TABLE 5

REGRESSIONS TO EXPLAIN LOG LONG-TERM UNEMPLOYMENT PERCENTAGE RATE 19 OECD COUNTRIES, 1983–94

Equation[a]	(1) OLS	(2) OLS	(3) OLS	(4) TSLS
Endogenous Variable[b]	LUNEMP	TAX	LUNEMP	LUNEMP[c]
Exogenous Variables[d]				
C	–1.464	29.634	–3.710	–3.710
	(–1.70†)	(4.57**)	(–3.19**)	(–2.40*)
RRATE	0.005	0.007	0.009	0.009
	(0.49)	(0.07)	(0.99)	(0.74)
BENEFIT	0.360	–0.055	0.296	0.296
	(3.50**)	(–0.053)	(3.04**)	(2.29*)
ALMP	–0.040	0.211	–0.067	–0.067
	(–2.30*)	(1.25)	(–3.54**)	(–2.67*)
UDEN	0.010	–0.046	0.019	0.019
	(0.98)	(–0.468)	(1.92†)	(1.45)
EMCORD	–0.609	3.092	–0.977	–0.977
	(–2.27*)	(1.19)	(–3.46**)	(–2.61*)
TAX	0.043		0.102	0.102
	(2.71*)		(3.80**)	(2.86**)
DUM90	0.291	0.671	0.282	0.282
	(1.01)	(0.24)	(1.07)	(0.80)
LSTAND		2.699		
		(3.48**)		
RES			–0.084	
			(–2.62*)	
Adjusted R^2	0.46	0.45	0.55	0.20
S.E. Regression	0.88	8.58	0.80	1.07
N (countries, time)	38 (19; 2)	38 (19; 2)	38 (19; 2)	38 (19; 2)
F-Test	5.46**	5.30**	6.56**	4.16**
(p-value)	(0.00)	(0.00)	(0.00)	(0.00)
Jarque-Bera-Test	0.08	2.53	1.37	0.31
(p-value)	(0.96)	(0.28)	(0.50)	(0.86)
White-Test	0.76	0.93	1.20	2.28
(p-value)	(0.72)	(0.63)	(0.34)	(0.27)

[a]Estimation using a combination of two cross-sections from two time periods (1983–88 and 1989–94); t-test statistics in parentheses; † significant at 90 percent, * at 95 percent, and ** at 99 percent; OLS, ordinary least squares; TSLS, two-stage least squares.
[b]LUNEMP, log of long-term unemployment percentage rate; TAX, total tax share.
[c]RRATE, replacement rate; BENEFIT, benefit duration; ALMP, active labor market policies; UDEN, union density; EMCORD, employer's coordination; DUM90, dummy variable (1989–94 = 1); LSTAND, labor standards; RES, residual.
SOURCES: Table 1 and Appendix Table 1; Nickell (1997); author's calculations.

impact of taxation on long-term unemployment turns out to be much larger than in the first estimate.

The Relative Importance of Taxation

Because the variables in the foregoing regressions are defined in different units with different variances, the estimated coefficients do not tell anything about the relative importance of the different features of OECD labor markets on unemployment. One method to get such information is to calculate standardized regression coefficients ("beta coefficients"). The standardized regression coefficient adjusts the estimated slope parameter by the ratio of the standard deviation of the independent variable to the standard deviation of the dependent variable. For example, a standardized coefficient of 0.6 means that a change of one standard deviation of this independent variable leads to a change of 0.6 standard deviation in the dependent variable.

The standardized regression coefficients of the correctly specified regressions with respect to total, short-term, and long-term unemployment are presented in Table 6. The calculations for total unemployment reveal that the independent variable with the greatest relative importance is employer's coordination in the wage bargaining process. The standardized coefficient for this variable implies that an

TABLE 6

STANDARDIZED REGRESSION COEFFICIENTS[a]

Endogenous Variable[b]	UNEMP	SUNEMP	LUNEMP
Exogenous Variables[c]			
RRATE	0.409**	0.534**	0.148
BENEFIT	0.225†	0.135	0.371*
ALMP	–0.624**	–0.419*	–0.681*
UDEN	0.492**	0.496**	0.304
EMCORD	–1.120**	–1.042**	–0.697*
TAX	0.882**	0.467**	0.992**
DUM90	0.179†	0.210†	0.120

[a]"Beta-coefficients": †significant at 90 percent, *at 95 percent, and **at 99 percent.

[b]UNEMP, SUNEMP, and LUNEMP, log of total, short-term, and long-term unemployment percentage rate, respectively.

[c]RRATE, replacement rate; BENEFIT, benefit duration; ALMP, active labor market policies; UDEN, union density; EMCORD, employer's coordination; TAX, total tax share; DUM90, dummy variable (1989–94 = 1).

SOURCES: Tables 3, 4, and 5; author's calculations.

index of this variable that is one standard deviation above the mean (e.g., 2.9 instead of 2.0) is related to a 1.12 standard deviation lower total unemployment rate (i.e., a rate of total unemployment about 2.1 percentage points lower than the mean total unemployment rate of 7.9 percent). The relative importance of the total tax rate ranks second. The standardized regression coefficient is 0.88. Thus, a total tax rate of 60 percent instead of 48.2 percent implies that total unemployment is 0.88 standard deviation of the log of the total unemployment rate. This would increase the total rate of unemployment by 1.8 percentage points. The ranking of the other variables is active labor market policies, union density, and the replacement rate. The rank of benefit duration (which is significant only at the 90 percent level) is the lowest.

The respective calculations for short-term unemployment indicate a slightly different ranking. In this case, a total tax rate of one standard deviation above the mean implies a 1.4 percentage points higher rate of short-term unemployment.

Finally, from the calculations for long-term unemployment, it can be seen that the total tax rate is the variable with the greatest relative importance. The standardized regression coefficient of about 1 implies that a total tax rate of one standard deviation above the mean is related to a long-term unemployment rate that is about 3.25 percentage points higher.[6]

Conclusion

The aim of this study is to assess the impact of taxation on unemployment. To estimate this relation properly it was necessary to also take account of other possible determinants of unemployment. In the estimations—holding the other determinants (i.e., the replacement rate, benefit duration, active labor market policies, union density, and employer's coordination in wage bargaining) constant—the total tax rate turned out to be a significant and important determinant of the total, short-term, and long-term unemployment rate.

Because one might assume that a higher unemployment rate could also lead to higher taxation in the economy—because of rising government expenditures—it was also investigated whether the impact of taxation on unemployment is really exogenous or whether it is en-

[6]In a quite different approach than the one pursued here, namely, an unemployment-growth model, Daveri and Tabellini (1997) estimated that the rise of 9.4 percentage points in effective labor market taxes between 1965–75 and 1976–91 in Europe can account for a rise in the unemployment rate of about 4 percentage points.

dogenous (i.e., simultaneously determined). The empirical tests turned out to be negative for total and short-term unemployment but positive for long-term unemployment. The correction of this "simultaneity bias" with the help of an instrumental variables approach and TSLS estimation techniques revealed a slope parameter of the total tax rate that was much higher than the one originally received from OLS estimation. The reason seems to be that the relationship between taxation and long-term unemployment is a mutually reinforcing one: a rising total tax rate leads to higher long-term unemployment rate (and government expenditures) which in turn leads to a higher tax rate.

Additional calculations revealed that a reduction in the total tax rate of about one standard deviation (11.5 percentage points)—a magnitude that is smaller than the difference between the total tax rate in Europe and non-Europe[7]—leads to a reduction of long-term unemployment in the order of 3.2 percentage points. This magnitude is within the range of the difference of the long-term unemployment rate between Europe and non-Europe.

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[7]See Table 2.

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APPENDIX TABLE 1

CHARACTERISTICS OF OECD LABOR MARKETS, 1989–94

Country	Direct Rigidities		Treatment of the Unemployed		
	Employment Protection	Labor Standards	Benefit Replacement Rate (%)	Benefit Duration (years)	Active Labor Market Policies
Austria	16	5	50	2	8.3
Belgium	17	4	60	4	14.6
Denmark	5	2	90	2.5	10.3
Finland	10	5	63	2	16.4
France	14	6	57	3	8.8
Germany (W)	15	6	63	4	25.7
Ireland	12	4	37	4	9.1
Italy	20	7	20	0.5	10.3
Netherlands	9	5	70	2	6.9
Norway	11	5	65	1.5	14.7
Portugal	18	4	65	0.8	18.8
Spain	19	7	70	3.5	4.7
Sweden	13	7	80	1.2	59.3
Switzerland	6	3	70	1	8.2
U.K.	7	0	38	4	6.4
Canada	3	2	59	1	5.9
U.S.	1	0	50	0.5	3.0
Japan	8	1	60	0.5	4.3
Australia	4	3	36	4	3.2
New Zealand	2	3	30	4	6.8

continued

APPENDIX TABLE 1 (*continued*)

CHARACTERISTICS OF OECD LABOR MARKETS, 1989–94

Country	Union Density (%)	Union Coverage Index	Coordination		Payroll Tax Rate (%)	Total Tax Rate (%)
			Union	Employer		
Austria	46.2	3	3	3	22.6	53.7
Belgium	51.2	3	2	2	21.5	49.8
Denmark	71.4	3	3	3	0.6	46.3
Finland	72.0	3	2	3	25.5	65.9
France	9.8	3	2	2	38.8	63.8
Germany (W)	32.9	3	2	3	23.0	53.0
Ireland	49.7	3	1	1	7.1	34.3
Italy	38.8	3	2	2	40.2	62.9
Netherlands	25.5	3	2	2	27.5	56.5
Norway	56.0	3	3	3	17.5	48.6
Portugal	31.8	3	2	2	14.5	37.6
Spain	11.0	3	2	1	33.2	54.2
Sweden	82.5	3	3	3	37.8	70.7
Switzerland	26.6	2	1	3	14.5	38.6
U.K.	39.1	2	1	1	13.8	40.8
Canada	35.8	2	1	1	13.0	42.7
U.S.	15.6	1	1	1	20.9	43.8
Japan	25.4	2	2	2	16.5	36.3
Australia	40.4	3	2	1	2.5	28.7
New Zealand	44.8	2	1	1	—	34.8

SOURCE: Nickell (1997: Tables 4 and 5).

APPENDIX TABLE 2

CORRELATION MATRIX OF ENDOGENOUS AND EXOGENOUS VARIABLES, 1983–94

Variables[a]	UNEMP	SUNEMP	LUNEMP	EMPRO	LSTAND	RRATE
UNEMP						
SUNEMP	.87**					
LUNEMP	.87**	.54**				
EMPRO	0.18	–0.24	0.53**			
LSTAND	0.14	–0.10	0.32*	0.77**		
RRATE	–0.06	0.05	–0.15	–0.11	0.09	
BENEFIT	0.48**	0.26	0.58**	0.17	0.16	0.01
ALMP	–0.35*	–0.32*	–0.31*	0.19	0.41**	0.34*
UDEN	–0.17	–0.06	–0.17	0.02	0.13	0.23
UNION	0.26	–0.01	0.45**	0.64**	0.69**	0.08
UNCORD	–0.27	–0.19	–0.16	0.35*	0.50**	0.41**
EMCORD	–0.58**	–0.47**	–0.45**	0.16	0.33*	0.57**
PRTAX	0.00	–0.13	0.13	0.57**	0.68**	–0.07
TAX	–0.04	–0.01	–0.01	0.42**	0.67**	0.21

continued

APPENDIX TABLE 2 (*continued*)

Correlation Matrix of Endogenous and Exogenous Variables, 1983–94

Variables[a]	BENEFIT	ALMP	UDEN	UNION	UNCORD	EMCORD	PRTAX	TAX
UNEMP								
SUNEMP								
LUNEMP								
EMPRO								
LSTAND								
RRATE								
BENEFIT								
ALMP	–0.14							
UDEN	0.06	0.57**						
UNION	0.50**	0.23	0.42**					
UNCORD	0.06	0.39**	0.56**	0.58**				
EMCORD	–0.09	0.50**	0.47**	0.40**	0.63**			
PRTAX	–0.09	0.33*	–0.21	0.18	0.21	0.12		
TAX	0.06	0.51**	0.24	0.38*	0.50**	0.45**	0.82**	

[a]UNEMP, SUNEMP, and LUNEMP, log of total, short-term, and long-term unemployment percentage rate, respectively; EMPRO, employment protection; LSTAND, labor standards; RRATE, replacement rate; BENEFIT, benefit duration; ALMP, active labor market policies; UDEN, union density; UNION, union coverage index; UNCORD, union coordination; EMCORD, employer's coordination; PRTAX, payroll taxes; TAX, total tax share; *significant at 95 percent and **at 99 percent.

Source: Nickell (1997); author's calculations.