WHO BEARS SOCIAL SECURITY TAXES? A META-ANALYSIS APPROACH(*)

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ABSTRACT

In this paper we apply the meta-regression technique to survey the empirical literature on the economic incidence of social security payroll taxes. In particular, we focus on the effects of taxation on wages, to test the conventional view that employees bear the burden due to lower net wages. Based on 45 empirical papers, we find that temporal fixed effects, key economic institutions, the tax wedge definition, and the temporal focus significantly affect the results. In the long run, workers bear between three quarters of the tax burden in Continental and Anglo-Saxon economies, and the whole tax burden in the Nordic ones. However, despite the numerous set of controlling variables, a significant part of the variability of the empirical literature remains unexplained.

Keywords: Social Security, taxes, incidence, meta-analysis.
JEL classification: C42, E24, H22.

1. INTRODUCTION

The reduction of labour taxes is a widespread policy recommendation for obtaining a rise in the rate of employment (see, for instance, the seminal reports from the European Commission, 1994 and the OECD, 1994). In broad terms, labour taxes (including income and social security contributions) drive a wedge between labour costs and net wages and have a negative effect on labour supply, structural employment and hours worked. From the academia, Prescott (2004) triggered the debate attributing to direct taxes the difference in labour utilization between the US and Europe. This author calibrated a labour supply model and found out that the divergence in hours worked per week of working-age population since the seventies between the US and France and Germany could be explained by differences in marginal tax rates on labour. In a similar line of research, Coenen *et al.* (2007) employ a calibrated version of the New Area-Wide Model developed at the ECB to simulate the effects of establishing a 'US fiscal system' in the euro area. The analysis shows that the reduction of employer social contributions to the levels prevailing in the US (from 21.9 to 7.1 percent of labour costs) may increase output by more than five points, hours worked by more than six percent, and real wages slightly less than 13 percent. These results have generated a lively debate[1].

Based on this assumption, since the nineties many European governments have followed this tax reform path, cutting social security payroll taxes, albeit using different strategies. For instance, since 1997 Spain has cut social security payroll taxes for permanent contracts and for population groups affected by long-term unemployed. Since 2000, France encouraged the transition to the 35-hour week offsetting the extra-expenditure for firms with lower employer social security contributions. Finally, in 2007 and 2008 Germany introduced cuts in unemployment insurance contributions, financed by a higher value added tax rate.

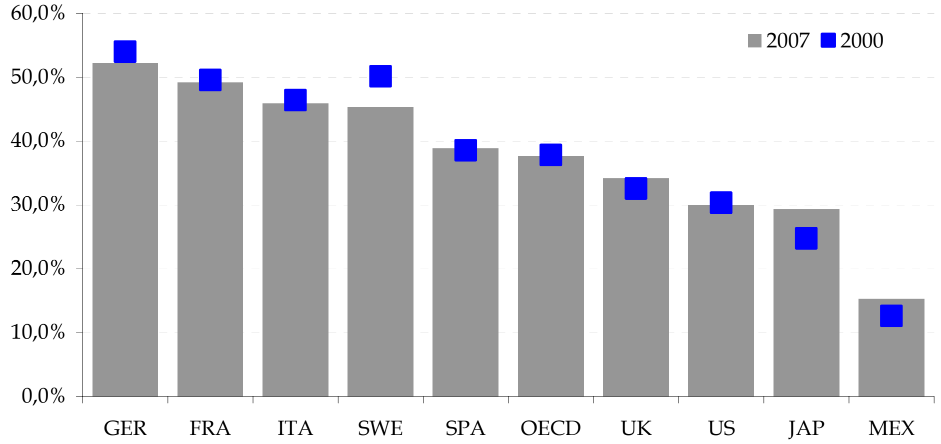
However, despite these developments, a significant fiscal gap remains within OECD countries. As Figure 1 shows, the direct tax wedge (income tax, employee and employer payroll taxes) is around 50 per cent in Germany and France and exceeds 45 per cent in Italy and Sweden, while Anglo-Saxon economies and Japan limit the burden to approximately 30 per cent.

[1] These results are supported by Ohanian et al. (2006) with a wider sample. Other authors have suggested complementary or alternative explanations. Nickell (2003) points to social protection rules, Blanchard (2004) to preferences, Alesina *et al.* (2006) to the role of labour protection and unions, Ljungqvist and Sargent (2007) and Rogerson (2007b) government inactivity benefits and the use of revenues and Rogerson (2007a) taxes and technological progress.

Figure 1

LABOUR TAXATION IN SELECTED OECD COUNTRIES

(Total average tax wedge, percentage of labour costs)



Single person at 100% of average earnings, no child.
Source: OECD taxing wages 2006-2007.

The economic effects of taxation depend ultimately on the long and short-term economic incidence, i.e., it depends on who bears the burden. In the case of employer social contributions, they can be borne by the employers (reducing the firm profits), or they can be shifted backwards to employees (reducing net wages), or forward to consumers (increasing the price level). Most of the cited papers calibrate this effect.

Empirical literature shows mixed results. In a classic survey, Hamermesh (1993) analyzed 15 seminal studies on the economic incidence of payroll taxes (mainly, social security contributions). The author rejected any robust conclusion, not even a consensus interval, since results ranged from full to null shifting. More recently, Arpaia and Mourre (2005) confirmed the effects of taxation on unemployment in recent studies, but, at the same time, highlighted the complexity of its interactions with other labour market and economic institutions. Finally, the European Central Bank (2008) documented the disincentives to work (particularly for low income workers) stemming from high marginal tax rates.

This is the appropriate field for the meta-analysis approach. In contrast to narrative surveys, meta-analysis revises relevant empirical literature in a more formal and objective way. As summarized by Stanley and Jarrel (1989)[2], the meta-analysis starts with the compilation of an exhaustive sample of literature and the choice of the dependent variable (in our case, the degree of social

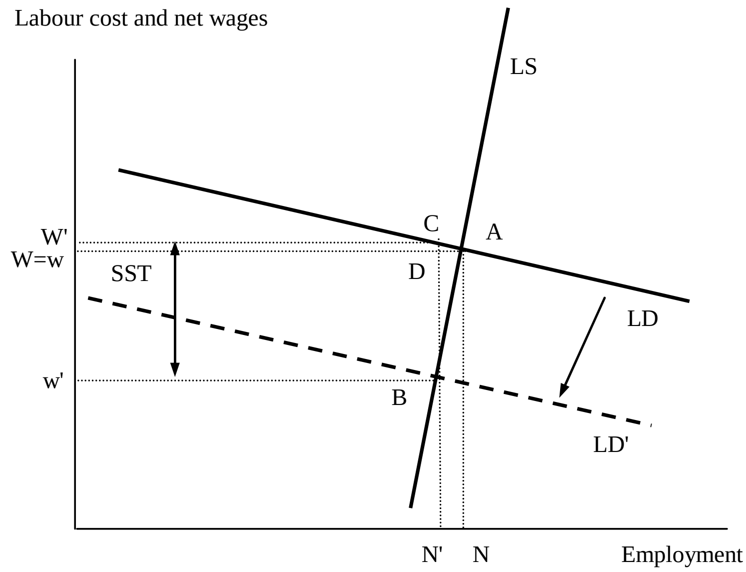
[2] This technique is being increasingly applied in labour economics. See, among others, Jarrel and Stanley (1990) for the analysis of unions and wage gap, Card and Krueger (1995) for minimum wages and employment, Nijkamp and Poot (2003) and European Commission (2005) for real wage elasticity, Longhi *et al.* (2005 and 2006) for immigration, wages and employment and Evers *et al.* (2006) for taxes and working hours. See also Stanley (1998) for a meta-analysis of the Ricardian equivalence.

contributions backwards shifting, proxied by the estimated elasticity of net wages to taxation). Afterwards, a general set of the moderators that could be influencing this result (theoretical model, sample, among others) is selected, and tabulated in each study with dummy variables. The meta-regression of the dependent variable on these moderators allows quantifying the "true dependent variable", that is, the consensus result of the whole empirical literature after controlling for methodological differences.

A sensible starting point in our case is Fuchs *et al.* (1998). Based on a survey to the Economic Departments of the 40 top US universities, the authors conclude that employers bear 20 per cent of firm social contributions, while employees bear the remaining 80 per cent, via lower net wages. In other words, the conventional wisdom, in line with public economics textbooks, is that the relatively higher rigidity of labour supply with respect to labour demand determines that the market adjustment is mainly concentrated on wages, and not on employment[3]. Figure 2 represents this case. An increase in employer social security taxes (SST) would generate a downwards shift in the labour demand curve. Market equilibrium would move from A to B, generating a limited negative employment effect (from N to N'), since labour costs hardly augment (from W to W'). Workers would bear the major part of the tax burden (BD over BC), since net wages fall from w to w'.

Figure 2

ECONOMIC INCIDENCE OF EMPLOYER PAYROLL TAXES



[3] This degree of shifting is coherent with the labour supply and demand elasticities reported in the survey, 0.15 and -0.50 respectively. In partial equilibrium, shifting can be calculated as 0.50/[0.15-(-0.50)], that is 0.77. Therefore, employees would bear 77 per cent of social security tax burden. Roughly speaking, the simulations by the aforementioned Coenen *et al.* (2007) imply a shifting of nearly 86 percent, since real wages augment 12.7 percent following the 14.8 percentage points reduction of firm social security contributions.

The basic aim of this paper is to check whether this estimate is consistent with empirical literature on the subject In order to do so, we quantify the effect of the different methodological approaches, and temporal and geographical coverage. We place more weight on methodological variables that stem from economic theory or from generally accepted empirical results, such as those related with nominal rigidities, the wage bargaining characteristics or the pension system design.

The paper is organized as follows. In the second section, we present a brief description of the empirical literature of taxation and wages/labour costs. In the third section we report the basic methodology and the results of the meta-analysis regressions. They are grouped under three headings: 'basic moderators' that capture country and temporal fixed effects, 'economic moderators' to control the impact of the most relevant economic features, and 'other moderators', mainly reflecting the econometric techniques. We also perform various robustness checks, based on the sample of estimates, the econometric methods and the procedure of specification selection. Finally, in section four we present the main conclusions and some general economic policy recommendations.

2. A BRIEF SURVEY OF THE EMPIRICAL LITERATURE

2.1. Basic methodology

Public economics highlights two alternative definitions of the nature of social contributions. On the one hand, they can represent a deferred salary, if the link between social contributions and social benefits (pensions and unemployment benefits) is high. This is the case of pension systems with defined contributions. On the other hand, they might be a regular payroll tax (such as labour income tax), if the tax-benefit link is weak, as is the case in many defined benefit pension systems. In this paper we opt for an intermediate position, so social contributions would be treated as a particular payroll tax, whose revenues are partially affected to social security financing. Therefore, we will concentrate on the labour market dynamics to analyze the incidence of social security taxes.

The focus will be placed on its 'economic incidence', i.e., who effectively bears the tax burden and what are its main economic effects (on wages, labour costs and equilibrium employment), instead of on the legal incidence[4]. This

[4] Additionally, public economics literature defines 'differential incidence' if the analysis is focused on the economic effects of substituting one tax by another, leaving total revenues constant. Finally, 'distributive incidence' focuses on the income distribution effects of taxes.

implies the analysis of the change of behaviour of economic agents after the establishment of the tax. In the case of social contributions, the literature points to two basic shifting processes. Consumers may bear the burden if firms have enough market power to adjust prices to the new tax rates. This is known as 'forward shifting'. Alternatively, employees may bear the burden if the firm offsets the new tax burden with a (net) negative wage variation, leaving labour costs constant, process known as 'backwards shifting'.

Therefore, the benchmark equation in the studies takes the form of a general wage equation

$$f(w_{it}) = g(p_{it}, Y_{it}/N_{it}, U_{it}, h(TAX_{it}), X_{it}) \qquad (1)$$

where w stands for the net nominal wage (or the labour cost), p the price level (the GDP or the consumption deflator), Y/N the labour productivity, U the unemployment rate, TAX the tax wedge, and X a set of control variables. Focusing on the latter, theoretical and empirical literature shows that tax incidence does depend not only on competitive factors (such as labour supply and demand elasticities, or factor substituibility[5]), but also on the effect of economic institutions such as the degree of wage bargaining centralization and union power, employment protection legislation, unemployment benefits, minimum wages or social security fairness (we will develop these issues in section 3). Finally, functions f and h denote levels or growth rates (long or short run results), and g is generally a linear function of the regressors. Every variable is specified for country or populations group i, and time t.

The dependent variable is, therefore, the net wage elasticity to taxes. As previously stated, this figure proxies the degree of backwards shifting. A –1.0 coefficient represents the full shifting scenario, where workers bear 100 percent of taxes. A null elasticity implies that workers do not bear even part of the (null shifting). Obviously, intermediate results are more frequent, and imply partial shifting processes[6].

2.2. Database

We have assembled a database of 559 estimates of the impact of taxes on net wages from 45 papers, covering most of the OECD countries and some Latin

[5] See Fullerton and Metcalf (2002) for a complete revision of tax incidence.

[6] Sometimes, the dependent variable of equation 1 is defined as the labour cost, that is, inclusive of employer social security contributions, W=w(1+SST). In this case, tax elasticities range between 0.0 (equivalent to –1.0 in the wage equation, if there is a full internal compensation of wages and taxes that leave labour costs constant), and 1.0 (equivalent to 0.0 in wage terms, when tax increase fully impacts labour costs). We will use this equivalence in the next section.

American economies[7] (see Melguizo, 2009 and the Annex of this paper for the details). We normalized the results to the wage elasticity (based on the labour cost-wage equation equivalence explained in footnote 7), and directly chose this variable as the dependent one.

We restricted our core sample to the preferred estimate in each study, in most cases based on the author's judgement (when absent, we use the usual statistic tests). This limited the sample to 111 observations from the 45 papers (named 'baseline sample'). This option remains controversial. Some authors claim that excluding some estimates may bias the study, weakening the main advantage of meta-analysis over other surveying techniques. However, the inclusion of all the estimates is not cost-free: it may bias the analysis towards those studies that report more results (if their results are similar), or may increase the variability of the results even if the authors manifest their preference for some estimates (if their results vary).

Table 1 summarizes the main statistics of this baseline sample (see Table A1 in Annex for the definition of the moderators). On average, a 1.0 per cent increase in taxation reduces wages by 0.65 per cent. Therefore, employees bear nearly two thirds of social security contributions. However, studies display a very high dispersion of results, ranging from 0.9 to -2.5. This significant dispersion can be due to differences in the statistical methods, in the temporal and geographical coverage, or can stem from different institutional design. Depending on the main methodological alternatives, the highest degree of shifting is obtained in cross section analysis and in book publications, where elasticities reach -0.9. By contrast, studies focused on Continental and Mediterranean economies or published in journals tend to limit the elasticity to -0.5.

The empirical literature highlights the role of economic institutions, in particular, the centralization of wage bargaining and union presence. Centralized economies with strong unions or decentralized wage bargaining with weak unions, exhibit the best economic performance (they specifically have a lower rate of unemployment). In addition, public sector effectiveness may compensate the disincentives from a high taxation, since agents perceive the tax-benefit linkage. Broadly speaking, Nordic and Anglo-Saxon economies enjoy the systems with the best equilibria, while Continental and Mediterranean economies are in an unfavourable intermediate position. Figure 3 seems to confirm this hypothesis partially suggesting than Nordic economies, characterized by their high centralization, strong trade unions and effective governments are different. The mode estimate is full shifting (-1.0 elasticity),

[7] Latin American economies are particularly interesting due to the implementation of structural pension reforms, starting in 1981 in Chile, and followed in the mid nineties in Argentina, Colombia, Mexico and Peru. See Melguizo and Vial (2008) for an analysis of the Chilean case.

while in Anglo-Saxon, Continental and Mediterranean economies workers seem to bear half of the tax burden (-0.5)[8]. Are these differences statistically significant? Do the *a priori* results hold when controlling for the complete set of methodological differences? The meta-analysis, performed in the next section is precisely meant to answer quantitatively these questions.

Table 1

TAXATION AND WAGES (Selected descriptive statistics)

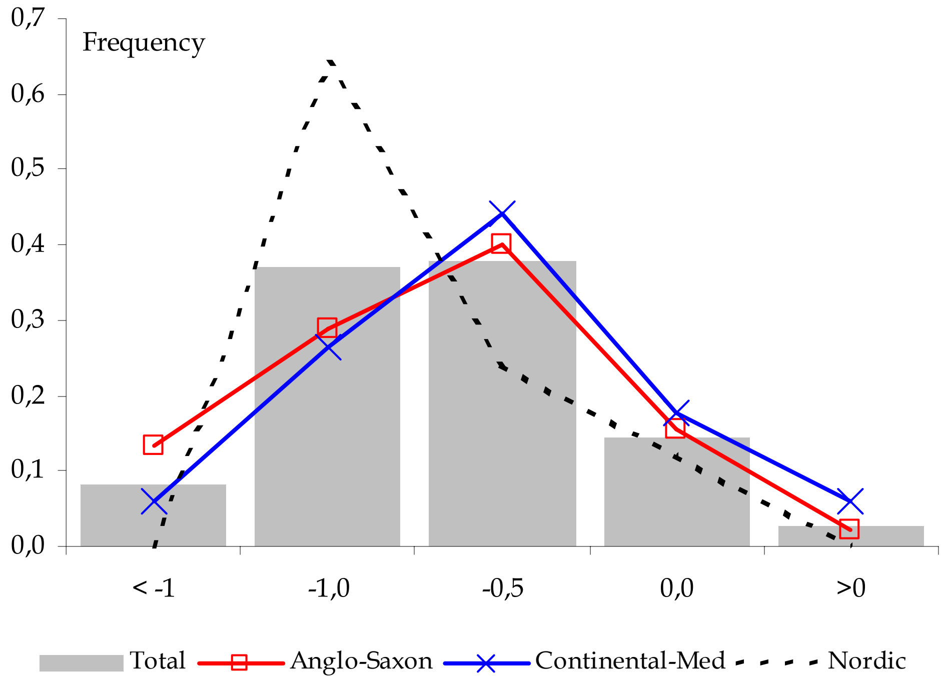
Total	Moderator	No.	Mean	s.d.	Min	Max
		111	**-0,65**	**0,49**	**0,91**	**-2,54**
Publication	Journal	49	-0,53	0,47	0,41	-1,56
	Book/Chapter	21	-0,89	0,52	0,06	-2,54
	Working Paper	37	-0,67	0,48	0,91	-2,07
	Mimeo	4	-0,90	0,13	-0,73	-1,00
Economic model	Anglo-Saxon	45	-0,69	0,57	0,40	-2,54
	Continental-Med	34	-0,52	0,47	0,91	-1,26
	Nordic	25	-0,75	0,36	0,17	-1,00
Social Security	Bismarckian	50	-0,62	0,45	0,91	-1,26
	Beveridge	54	-0,68	0,54	0,40	-2,54
Fiscal wedge	Salary wedge	25	-0,79	0,30	0,06	-1,26
	Fiscal wedge	8	-0,69	0,38	0,00	-1,00
	Direct taves	22	-0,64	0,42	0,41	-1,00
	Social taxes	56	-0,60	0,59	0,91	-2,54
Focus	Short run	74	-0,74	0,46	0,91	-2,54
	Long run	37	-0,49	0,51	0,41	-2,07
Coverage	Total economy	58	-0,73	0,38	0,91	-1,26
	Private economy	53	-0,59	0,59	0,41	-2,54
Approach	Time series	81	-0,65	0,49	0,91	-2,54
	Cross section	3	-0,92	0,49	-0,41	-1,39
	Pannel	27	-0,66	0,52	0,41	-2,07
Geography	LatAm	6	-0,49	0,43	-1,12	-0,14
	Spain	12	-0,43	0,60	0,91	-1,00
	US	27	-0,77	0,66	0,40	-2,54
	OECD	67	-0,68	0,37	0,17	-1,44

[8] See Figures A1 and A2 in Annex for parallel analysis depending on the tax wedge definition and short- and long-run results.

Figure 3

DISTRIBUTION OF WAGE ELASTICITY TO TAXES

(Elasticity of net wages to taxation)



3. META-REGRESSION ANALYSIS

3.1. Meta-analysis approach

Given the recent arrival of the meta-analysis technique in economics, there is no standardized empirical strategy. As previously justified, we restricted the sample to 111 observations (from a sample of 559 estimates), although we will use the complete dataset to test the robustness of the results. Equations are estimated using ordinary least squares (OLS) as described in Stanley and Jarrel (1998). Nevertheless, we will also use weighted least squares (WLS) to control for the quality of the studies, based on the number of *Google Scholar* citations.

We opt for a sequential approach, in line with Knell and Stix (2003) or Evers *et al.* (2006). Firstly, we test the significance of geographical and temporal (by decades, from the fifties to the 2000s) moderators, in the spirit of panel data fixed effects estimation. This enables us to obtain a basic specification, in which we will include, as a second step, the main economic and methodological moderators (see Table A1 in Annex, for the complete set). Instead of including all of these moderators simultaneously, we opt to include them one by one, to avoid multicollinearity problems. Afterwards, we incorporate the significant moderators in a combined specification. As a final check, we will perform an 'extreme-bounds analysis' to evaluate if results are influenced by the sequence of estimations[9].

In what follows, we will concentrate on reporting the significant results and will focus on the role of economic moderators, since they suggest naturally economic policy recommendations[10]. The meta-regression specification, based on equation 1, is straightforward.

$$\beta_s = b + \gamma_1 \alpha_{s,i} + \gamma_2 \alpha_{s,t} + \gamma_{3,m} X_{s,m} + u_s \tag{2}$$

where β_s is the reported wage elasticity to taxes in study s (defined as the impact of taxes on net wages), b is the 'true' elasticity, $\alpha_{s,i}$ and $\alpha_{s,t}$ are vectors with geographical and temporal 'fixed effects', $X_{s,m}$ is a vector of moderator variables, and u_s is the error term. All the independent variables are represented by dummies (for instance, if a study sample covers the period 1980-2008, D50 to D70 will be marked as column of 0s for the particular study, while D80 to D00 will be represented by a column of 1s). The matrix $X_{s,m}$ will basically reflect imperfect competition variables stemming from the theoretical and empirical literature, such as the public sector effectiveness, labour market institutions (unions, wage bargaining), social security rules, or tax wedge mix.

3.2. Results

Baseline specification ('fixed effects' moderators)

In the first place we aim to get a baseline specification, in the spirit of fixed effect panel estimation. Alternative estimations rejected robust geographical effects (we tested for differences in studies analyzing Latin America, Spain and the US, vs. other OECD economies). For this reason, and since some of the economic moderators may be correlated, the basic specification (column 1 in Table 2) does not include them. By contrast, estimations suggest including temporal fixed effects, due to the significance of the 1960s dummy.

Another issue that should be controlled from the beginning in order to avoid spurious results is the presence of publication bias. It may arise from the

9 As proposed in Levine and Renelt (1992).

10 See Table A1 for whole the set of moderators, and Table A2 for additional specifications. As usual, the complete set of estimates is available upon request.

tendency to report and/or to publish just the significant results, rejecting the null hypothesis of no effect. An usual approach to control this effect is to test the significance of the standard deviation in the meta-regression. In the presence of publication bias, the higher the standard deviation, the higher the elasticity. Both the regression and the graphical analysis (see specification VII in Table A2 and Figure A4) reject this bias, once the impact of two studies is controlled[11].

In this benchmark specification, the wage elasticity to taxes is –0.56, so workers bear slightly more than half of the tax burden. The degree of shifting seems significantly lower in the sixties, when workers only bore a third of the burden, -0.35 (-0.56+0.21).

Economic moderators

The attention devoted to the economic effects of labour taxation from international organizations, policy makers and academia, ranks among the highest in applied macroeconomics, generating an enormous amount of research. However, the main issues affecting our results can be restricted to the following: the role of taxes under different institutional settings, the role of the social security model, the tax wedge composition, and short- vs. long-run results.

Economic institutions matter. Theoretical and empirical literature show that the impact of labour taxes on labour costs and unemployment is higher in economies with an intermediate centralization of the wage bargaining process and a strong trade union presence (see Calmfors and Driffill, 1988, Alesina and Perotti, 1997 and Daveri and Tabellini, 2000). In this context, common to Continental and Mediterranean countries, the discipline effect of competition or the internalization of externalities are weak. This contrasts with the behaviour in decentralized Anglo-Saxon economies, and unionized centralized Nordic countries. Our analysis partially confirms this hypothesis. Column II shows that the average elasticity is close to –0.58. However, the degree of shifting is much higher in Nordic countries, -0.81 (-0.58-0.23). This could be an indicator of the benefits of good governance, since Nordic public sectors are among the most effective ones (see for instance Sapir, 2006).

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[11] In our case, if the meta-regression does not control the results from Brittain (1972) and Anderson and Meyer (1998), the estimates support the publication bias hypothesis (the slope of the curve is negative and the coefficient of the standard deviation significant). For a detailed explanation of this issue and other methodologies to test it based on the sample size, see Ashenfelter at al. (2000).

Table 2
MAIN RESULTS
(Ordinary Least Squares estimation)

Equations	Moderators (a)	I	II	III	IV	V	VI
Incidence	C	-0,56***	-0,57***	-0,73***	-0,69***	-0,87***	-0,76***
		(0,13)	(0,12)	(0,14)	(0,13)	(0,16)	(0,14)
Economic model	NORD		-0,23**			-0,25**	-0,26***
			(0,11)			(0,11)	(0,11)
Fiscal wedge	SALFISC			-0,33**		-0,07	-0,37***
				(0,14)		(0,16)	(0,13)
Short run	DEPVAR				0,22**	0,07	
					(0,10)	(0,10)	
Coverage	ECO					-0,05	
						(0,11)	
Dependent	LC					-0,27**	
						(0,12)	
Study dummies (b)	D3	-0,75**	-0,79**	-0,76**	-0,91***	-1,04**	-0,80**
	D8	-1,50**	-1,51***	-1,54***	-1,38***	-1,74***	-1,56***
Fixed effects	D50	-0,19	-0,22*	0,01	-0,11	0,23	-0,00
	D60	0,21*	0,27**	0,20*	0,15	0,34**	0,28**
	D70	-0,07	-0,06	0,01	-0,05	-0,07	0,03
	D80	-0,07	-0,02	0,10	-0,00	0,45**	0,18
	D00	-0,22	-0,11	-0,00	-0,12	0,15	0,14
N		111	111	111	111	111	111
Adjusted R2		0,18	0,21	0,22	0,22	0,32	0,26
SER		0,45	0,44	0,43	0,44	0,41	0,42
DW		1,66	1,73	1,65	1,69	1,91	1,75

(a) Default especification: Long-run labour taxation effects in an OECD/LatAm market economy in the 90s, with a Bismarckian pension system.
(b) D3: Anderson and Meyer (1998), D8: Brittain (1972).
Standard errors in parentheses. ***, **, * denote significance at 1, 5 and 10 percent levels.

Another key institutional issue that has to be tested is one related to the social security model. In particular, the literature highlights a potential role of the 'linkage effect', that is, the perception of the link between contributions and social benefits (see Gruber and Krueger, 1990, Gruber, 1994a and 1994b and

Disney, 2004). Social contributions have no effect on the equilibrium employment rate if agents perceive a full linkage effect, since they become a deferred salary (positively shifting the labour supply curve). This tends to be the case in contributory *Bismarckian* social security systems, in contrast to redistributive pension systems *à la Beveridge*. Our empirical analysis obtains the expected sign, but rejects a significant differential effect of taxes (column VIII in Table A2)[12].

Throughout this paper we have used the terms 'tax wedge', 'labour taxation' and 'social security contributions' flexibly, implicitly accepting the tax invariance theorem. However, there may be several reasons to justify a differential impact of the various fiscal wedge components. Focusing on social contributions, even though they are usually a payroll tax, their tax base and tariff usually differ to that of personal income tax (apart from the linkage effect), and of consumption taxes (see OECD, 1990 and 2007). Additionally, the salary wedge also includes the price wedge, that is, the gap between producer and consumer prices. Therefore, we tested the impact of alternative fiscal wedge definitions, departing from the general salary wedge (fiscal wedge plus price wedge) down to employer social security contributions. Results confirm that different taxes have different effects on wages. While the elasticity of net wages to labour taxes is –0.73, salary and fiscal wedge (inclusive of indirect taxes, and of price wedge in the first case) have a full impact (-1.06=-0.73-0.33; column III in Table 2).

Finally, as summarized in Hamermesh (1993), the presence of lags in the shifting of social contribution is usually significant (on average, long-run shifting equilibrium takes 5.5 quarters), due to the presence of nominal rigidities. Our estimation confirms this point (column IV in Table 2). The short-run elasticity -0.47 (-0.70+0.23), is lower than the long-run counterpart, -0.70. Therefore, workers bear less than half of the burden in the short run.

Other moderators

A second set of moderators mainly reflect methodological differences, both from the data (economy-wide or private sector, and its frequency) and the estimation techniques (cross section, time series or panel, and selected estimator). Our analysis suggests that only the data coverage is relevant. Studies referred to the whole economy, and not just studies on the market economy, tend to show lower elasticities, -0.88 (column IX in Table A2). Finally, more than half of the papers include labour cost as the dependent variable, instead of

[12] The absence of gains from an increase in the actuarial fairness of the social security may stem from a divergence between the institutional design and its perception. Boeri *et al.* (2001) highlight a significant degree of lack of knowledge on basic social security institutional issues in the main economies of the EU (as the basic pay-as-you-go functioning, or even the social contribution tax rate). In this context, a more efficient institutional setting may not generate its potential benefits.

the net wage. Those studies tend to obtain a lower elasticity, close to full shifting (-0.96, column X in Table A2).

Combined results

To conclude, in column V (Table 2) we incorporated all the individually significant moderators into the specification. Every coefficient keeps its sign, but only the definition of the economic model and the dependent variable definition remain significant. Finally, column VI (Table 2) presents our baseline specification, focused on the moderators that have a more solid economic foundation. In this case, the net wage elasticity is –0.77, so workers bear 77 per cent of the tax burden via lower wages (or lower wage increases). In the Nordic economies the degree of shifting is full (-1.04 = -0.77-0.27), so all the tax changes are offset by negative wage variations. Finally, indirect taxes are more prone to be shifted, since the salary and the fiscal wedge impact on wages is –1.14 (-0.77-0.37)[13].

3.3. Robustness checks

In order to check the robustness of the results, we first tested whether the main results hold for the whole sample (559 elasticities, from the 45 papers). Results are reported in columns XI to XVI in Table A2. These additional tests confirm that in studies that include indirect taxes in the tax wedge, and in the long run, the degree of shifting is higher in the Nordic economies. However, the main difference with respect to the core sample arises from the presence of publication bias[14]. As column XI in Table A2 reports, the coefficient associated to the standard deviation is negative and significant, confirming that less precise publications tend to report higher coefficients. The best specification for the complete sample is included in column XVI. After controlling for publication bias, results are in line with the ones reported for the core sample. The net wage elasticity is only slightly lower -0.79, so workers bear 79 per cent of the tax burden. In the Nordic economies the backwards shifting process remains unchanged (-1.00), and is higher if indirect taxes are included (-1.28).

Additionally, we performed a quality control on literature, other than the publication format (books, journals, working papers and mimeos). In particular,

[13] The selected specification passes the basic econometric tests of heteroskedasticity and autocorrelation, once we ordered the papers by the year of publication, at the conventional significance levels (White test with no cross terms = 15.61, Breusch-Godfrey serial correlation LM test $\chi^2 = 2.40$).

[14] Additionally in the complete sample, the elasticity in cross section studies is lower to those of panel data, and these ones are lower than the obtained in time series, as stated in Domenech *et al.* (1997).

we used the *Google Scholar* webpage to weight each estimate for the number of citations[15]. The weighted least square estimation of the baseline sample is reported in columns XVII and XVIII in Table A2. In comparison to our baseline specification, these estimates confirm that taxation shifting is significantly higher when the tax wedge includes indirect taxes. However, the hypothesis of full shifting is accepted irrespective of the economic model, and not only in Nordic countries (-1.16).

Finally, we tested how sensitive results are depending on the procedure of specification selection. In particular, we calculated the confidence intervals of the impact of taxes on wages, based on the 'extreme-bounds analysis' suggested by Levine and Renelt (1992)[16]. The lowest bound is obtained including fixed effects and controlling for the study coverage (ECO) and the econometric approach (PANNEL+CROSS): -0.23 (-0.51 minus two standard errors). The highest one stems from a specification with the social security model (BEVSS) and the publication format (BOOK, WP+MIM): -1.30 (-0.88 plus two standard errors). Therefore, this test robustly rejects the no-shifting hypothesis.

4. CONCLUSIONS

In this paper we have applied the meta-regression technique to analyse the results from the empirical literature on the economic incidence of social taxes. In particular, we have focused on the effects of taxation on wages, to find out whether employees bear the tax burden due to lower net wages or not. This is a relevant question, both due to the significant dispersion of the results found in the literature, as well as to its economic policy implications.

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[15] http://scholar.google.com, accessed September 11, 2008. The 45 papers accumulate 4280 citations, being the most popular Alesina and Perotti (1997), Gruber (1994a, 1997) and Layard *et al.* (1991). The weight factor was the share of its citations on the total amount, divided by the number of reported preferred estimates. Alternatively, other authors use the citations reported in the *ISI Web of Knowledge* (see, for instance, European Commission, 2005). This source restricts the sample to papers published in JCR journals (23 papers out of 45 papers, in our sample). Anyway, the correlation between the alternative weighting factors is high (0.65), and the coefficient of the slope of one on the other is significant.

[16] Incidence and empirical growth analysis are both exposed to multicolinearity problems, given the variety of relevant factors highlighted in the literature. This makes difficult to choose its key determinants from exhaustive specifications. Results may also be biased in reduced specifications depending on the inclusion order of the regressors. Levine and Renelt (1992) proposed an automatic procedure to analyze the determinants of growth, based on computing the 'extreme bounds' computed from all the combinations of regressors. We concentrated on the economic incidence parameter (coefficient b in equation 2), estimating 21 specifications, available upon request. The extreme intervals were (-0.23, -0.79) and (-0.47, -1,30).

We have based our empirical analysis on an original database of 45 empirical papers, from which we extracted 111 estimates. On average, in the core sample a 1.0 per cent increase in taxation reduces wages by 0.65 per cent. Therefore, employees would bear nearly two thirds of social security contributions, in line with the literature on distributive incidence. However, the literature exhibits a very high degree of variability.

The meta-regression analysis suggests that this figure is affected by temporal fixed effects (a lower shifting in the 60s), by basic economic institutions (summarized in three 'models', namely Anglo-Saxon, Continental-Mediterranean and Nordic), and by the tax wedge definition (in particular, the inclusion of indirect taxes). Moreover, the impact of taxes on wages differs in the short as well as the long-term. In our preferred specification, the elasticity of wages to taxes is -0.77 in the default option (i.e. a non Nordic economy in the 90s). Therefore, workers bear 77 percent of taxes, which coincides with the starting estimate surveyed in Fuchs *et al.* (1998). In the Nordic economies the degree of shifting is full (-1.04), so all tax changes are offset by a wage variation. Consumption taxes are more prone to be shifted, since the salary and the fiscal wedge impact on wages is –1.14. Finally, the degree of shifting may be much lower in the short run (less than half of the tax burden).

The robustness checks carried out using the complete set of results, alternative estimators and extreme-bounds analysis, confirm this result. However, despite the numerous set of controlling variables, a significant part of the differing conclusions found in the empirical literature studied remains unexplained. A first extension would be to estimate the combined effect of the moderators. Additionally, future research may focus on the heterogeneity (by age, sex and skill of the workers, or by industries), or on the direct effect of taxes on unemployment.

With conventional caution, some tentative economic policy potential implications can be drawn from these results. Firstly policy makers should take into account that even if higher social security contributions have a limited effect on employment in the long run, these are not entirely negligible, especially in the short run. This fact has a dampening effect on the supposed benefits to be had from strengthening social security systems via higher revenues. Secondly, results imply significant employment gains from a revenue neutral tax reform, increasing consumption taxes and lowering labour taxes. Obviously, this tax shift might also involve some problematic aspects, namely a short-term inflationary effect and a change in income distribution, which should be evaluated. Finally, our estimates support that taxation in Nordic economies, characterized by a high coordination of wage bargaining and effective public sectors, is more employment-friendly.

ANNEX

Figure A1

DISTRIBUTION OF WAGE ELASTICITY TO TAXES
(Tax wedge composition)

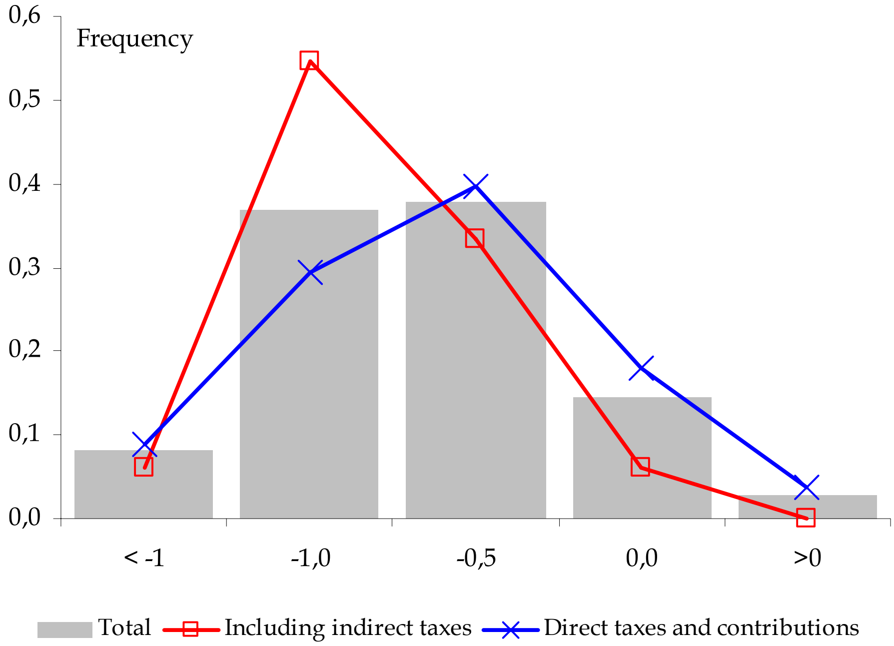

Figure A2

DISTRIBUTION OF WAGE ELASTICITY TO TAXES
(Long run vs Short run results)

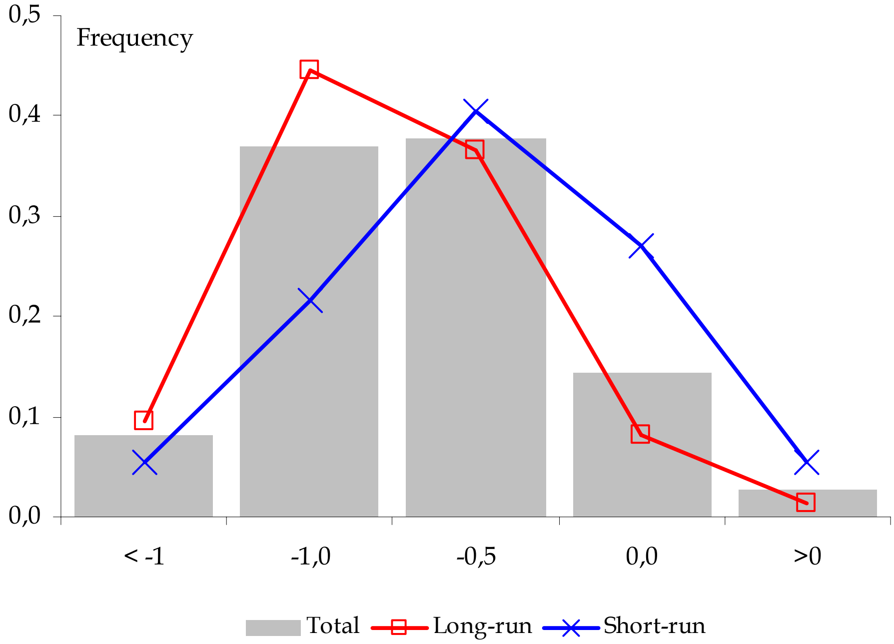

Figure A3

PUBLICATION BIAS GRAPHICAL TEST

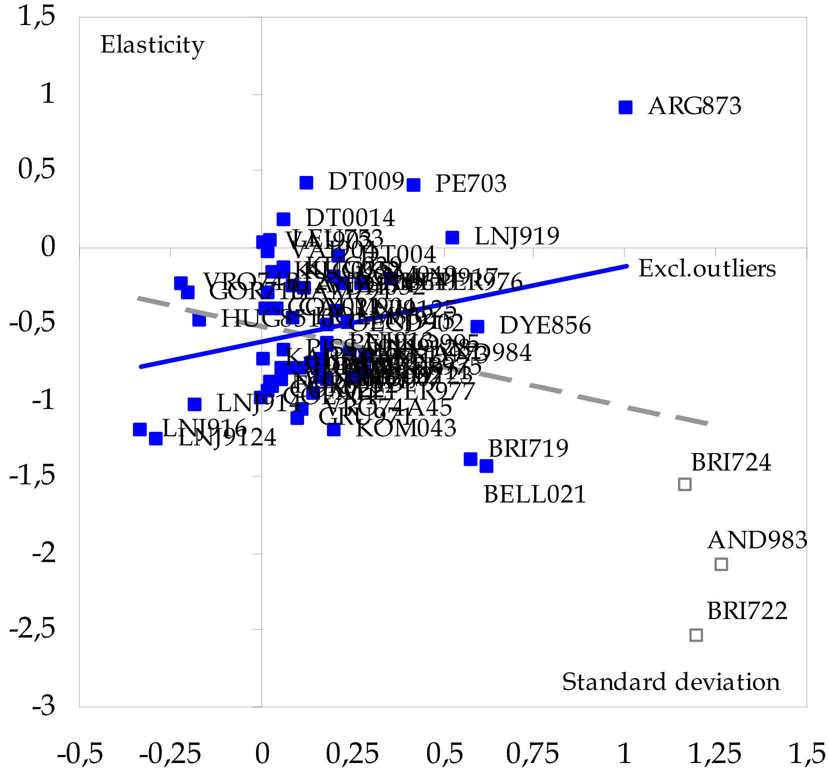

Figure A4

DISTRIBUTION OF WAGE ELASTICITY TO TAXES

(Total vs Baseline sample)

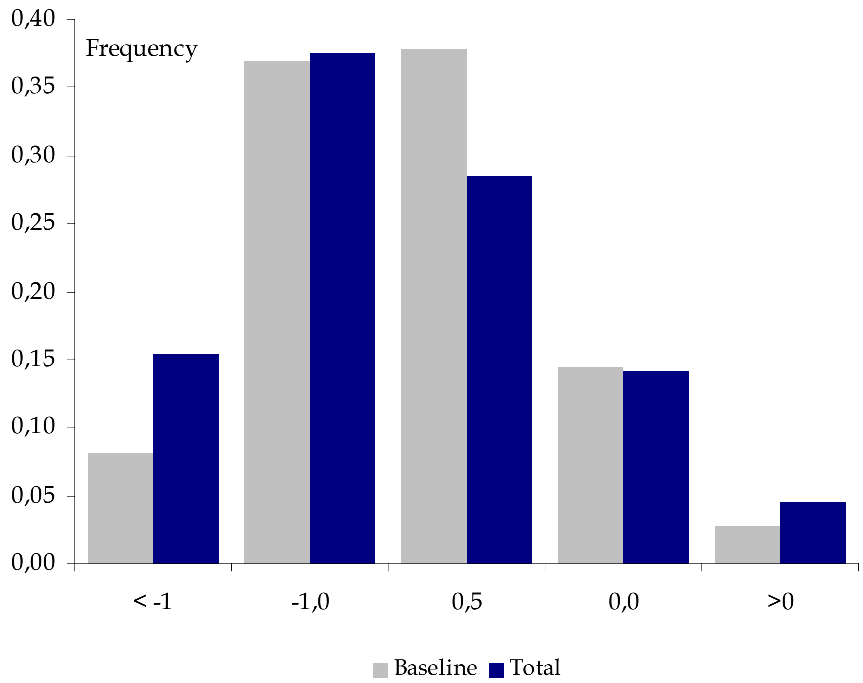

Table A1

META-REGRESSORS DEFINITION

Economic incidence	**= point estimate of net wage to taxation**	
Meta-regressors (a)		
Publication		
JOUR	= 1 ...if a study	is published in a journal
BOOK	= 1 ...if a study	is a book or a chapter in a book
WP	= 1 ...if a study	is published as working paper
MIM	= 1 ...if a study	is unpublished
Economic model (b)		
ANGLO	= 1 ...if a study	covers Anglo-Saxon economies
CONT	= 1 ...if a study	covers Continental or Mediterranean economies
NORD	= 1 ...if a study	covers Nordic economies
Social Security (c)		
BISSS	= 1 ...if a study	is referred to contributory Social Security systems
BEVSS	= 1 ...if a study	is referred to redistributive Social Security systems
Fiscal wedge		
SALWEDGE	= 1 ...if a study	defines taxation as salary wedge (prices and all taxes)
FISCWEDGE	= 1 ...if a study	defines taxation as fiscal wedge
SALFISC	= 1 ...if a study	defines taxation as salary or fiscal wedge
DIRTAX	= 1 ...if a study	defines taxation as direct/labour fiscal wedge
CONTRIB	= 1 ...if a study	defines taxation as social contributions
Focus		
DEPLEV	= 1 ...if	results are referred to the long-run
DEPVAR	= 1 ...if	results are referred to the short-run
Coverage		
ECO	= 1 ...if a study	covers the whole economy
PRIVECO	= 1 ...if results	are restricted to the market economy
Approach		
TIME	= 1 ...if a study	uses the time series approach
CROSS	= 1 ...if a study	uses cross section data
PANNEL	= 1 ...if a study	uses pannel data

(Follow)

(Continuation)

Economic incidence	**= point estimate of net wage to taxation**	
Estimation method		
OLS	= 1 ...if a study	uses ordinary least squeares
IV	= 1 ...if a study	uses instrumental variables
OTHER	= 1 ...if a study	uses other estimators
Data frequency		
QUINQ	= 1 ...if a study	uses quinquennial data
BIANNUAL	= 1 ...if a study	uses biannual data
ANNUAL	= 1 ...if a study	uses annual data
HALF	= 1 ...if a study	uses half-yearly data
QUART	= 1 ...if a study	uses quarterly data
Variable definition		
W	= 1 ...if a study	defines the dependent variable as the net wage
LC	= 1 ...if a study	defines the dependent variable as the labour cost

(a) Additionally, we control for geography (OECD, US, Spain, LatAm), for decades, and for other labour market institutions included in the specification (unions, minimum wage, unemployment benefits).

(b) Based on Alesina and Perotti (1997), Daveri and Tabellini (2000) and Sapir (2006), and own elaboration. Chile is classified as Anglo-Saxon and Colombia as Continental.

(c) Based on Disney (2004), and own elaboration.

Table A2

ADDITIONAL META-ANALYSIS RESULTS

OLS. Baseline sample. Alternative moderators						OLS. Total sample						WLS. Baseline sample	
Equations	**Moderators (a)**	**VII**	**VIII**	**IX**	**X**	**XI**	**XII**	**XIII**	**XIV**	**XV**	**XVI**	**XVII**	**XVIII**
Incidence	C	-0,55***	-0,61***	-0,58***	-0,60***	-0,60***	-0,69***	-0,88***	-0,84***	-0,87***	-0,79***	-1,39***	-1,16**
		(0,18)	(0,15)	(0,12)	(0,12)	(0,12)	(0,09)	(0,10)	(0,09)	(0,10)	(0,13)	(0,18)	(0,44)
Publication bias	SD	0,20				-0,20**					-0,24***		1,12***
		(0,27)				(0,08)					(0,08)		(0,18)
Economic model	NORD						-0,19**			-0,20**	-0,20*	-0,05	
							(0,08)			(0,08)	(0,11)	(0,08)	
Social Security	BEVSS		0,052										
			(0,10)										
Fiscal wedge	SALFISC							-0,35***		-0,36***	-0,48***	-1,06***	-1,03**
								(0,10)		(0,10)	(0,12)	(0,29)	(0,41)
Short run	DEPVAR								0,30***				
									(0,06)				
Coverage	ECO			-0,29***									
				(0,10)									
Dependent	LC				-0,35***								
					(0,10)								
Econometrics	PANNEL_2												-0,56**
													(0,25)

(Follow)

(Continuation)

OLS. Baseline sample. Alternative moderators						OLS. Total sample						WLS. Baseline sample	
Equations	**Moderators (a)**	**VII**	**VIII**	**IX**	**X**	**XI**	**XII**	**XIII**	**XIV**	**XV**	**XVI**	**XVII**	**XVIII**
Study dummies (b)	D3	-1,00**	-0,78**	-0,92***	-0,96***	-1,01***	-1,01***	-1,00***	-1,23***	-1,03***	-1,05***	-0,40	
	D8	-1,82***	-1,51 ***	-1,62***	-1,68***	-1,22***	-1,43***	-1,43***	-1,25***	-1,46***	-1,24***	-2,08***	-3,28***
Fixed effects	D50	-0,23	-0,19	-0,11	-0,08	-0,10	-0,09	0,05	-0,03	0,07	0,10	0,24	-0,22
	D60	0,29	0,22*	0,28**	0,32***	0,35***	0,36***	0,39***	0,26***	0,40***	0,40***	1,18***	1,29***
	D70	-0,12	-0,07	-0,12	-0,14	-0,26***	-0,13*	-0,09	-0,19***	-0,08	-0,19*	-0,15	-0,28
	D80	-0,01	-0,04	0,12	0,17	0,06	-0,01	0,14	0,04	0,17*	0,33**	0,40**	0,55
	D00	-0,13	-0,21	-0,11	-0,09	-0,08	-0,03	0,13	0,07	0,17	0,15	0,71	0,81
N		64	111	111	111	420	559	559	559	559	420	111	64
Adjusted R2		0,23	0,17	0,24	0,26	0,29	0,26	0,27	0,29	0,28	0,32	0,88	0,80
SER		0,49	0,45	0,44	0,42	0,63	0,57	0,57	0,56	0,56	0,62	0,56	0,43
DW		1,76	1,65	1,74	1,80	1,74	1,80	1,82	1,86	1,84	1,81	2,58	1,78

(a) Default especification: Long-run labour taxation effects in an OECD/LAtAm market economy in the 90s, with a Bismarckian pension system.
(b) D3: Anderson and Meyer (1998), D8: Brittain (1972).
Standard errors in parentheses. ***, **, * denote significance at 1, 5 and 10 percent levels.

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SÍNTESIS

PRINCIPALES IMPLICACIONES DE POLÍTICA ECONÓMICA

Los efectos económicos de la fiscalidad dependen en última instancia de su incidencia de corto y largo plazo, es decir, de quien la soporta efectivamente. En el caso de las cotizaciones sociales empresariales, éstas pueden ser soportadas por las empresas (menores beneficios), pueden ser trasladadas hacia los empleados (menores salarios), o hacia los consumidores (mayores precios).

La literatura empírica no muestra resultados robustos. En una revisión clásica, Hamermesh (1993) analizó quince estudios pioneros sobre la incidencia económica de los impuestos sobre las nóminas (fundamentalmente cotizaciones sociales), rechazando un resultado claro, ni siquiera un intervalo de consenso. Más recientemente, Arpaia y Mourre (2005) confirman el impacto al alza de la fiscalidad sobre el trabajo sobre el desempleo, pero destacan a su vez la complejidad de su interacción con otras instituciones laborales y macroeconómicas. Por último, el BCE ha documentado recientemente los desincentivos al trabajo (en particular para trabajadores de menores ingresos) derivados de la fiscalidad laboral.

Éste es el cambio apropiado para el enfoque de meta-análisis. En contraste con los *surveys* narrativos, las técnicas de meta-análisis revisan la literatura empírica de una manera más formal y objetivo. Como resumen Stanley y Jarrel (1989), el meta-análisis parte de una recopilación exhaustiva de la literatura y de la elección de la variable de interés (en este caso, el grado de traslación hacia detrás de las cotizaciones sociales, aproximado por la elasticidad de los salarios netos a los impuestos). Posteriormente, se selecciona el conjunto de 'moderadores' que pueden influir en estos resultados (modelo teórico, muestra, otros), los cuales se tabulan como variables *dummy*. La meta-regresión de la variable dependiente sobre estos moderadores permite cuantificar su 'verdadero valor', esto es, el resultado de consenso en la literatura una vez controladas las diferencias metodológicas.

El análisis empírico sobre la incidencia económica de las cotizaciones sociales, desarrollado en este documento, sugiere que los resultados de la literatura se ven afectados por efectos fijos temporales (menor traslación en la década de los sesenta), por determinadas instituciones económicas (sintetizadas en tres modelos, anglosajón, continental-mediterráneo y nórdico), y por la definición de la cuña fiscal (en particular, la inclusión de los impuestos sobre el consumo). Además, el impacto de los impuestos sobre los salarios difiere entre el corto plazo y el largo plazo. En la especificación preferida, la elasticidad de los salarios a los impuestos es de -0,77 (en una economía no nórdica en la década de los noventa). Por tanto, los trabajadores soportarían tres cuartas partes de la fiscalidad. En las economías nórdicas, la traslación es plena, de modo que los aumentos de la fiscalidad se ven totalmente compensados por reducciones salariales. El mismo efecto se encuentra en el caso de los impuestos sobre el consumo. Finalmente, la traslación es significativamente menor en el corto plazo.

Con las cautelas habituales, una serie de recomendaciones de política económica se pueden derivar de los resultados. En primer lugar, los *policy makers* deberían tener en cuenta que, si bien un nivel elevado de cotizaciones sociales tiene un efecto limitado en el largo plazo, sus efectos no son nulos, y menos aún en el corto plazo. Este hecho limita las opciones para fortalecer la financiación de la seguridad social por medio de mayores impuestos. En segundo lugar, los resultados apuntan a la existencia de beneficios en términos de creación de empleo derivados de reformas fiscales neutrales en recaudación, con mayores impuestos sobre el consumo y menores impuestos sobre el trabajo. Obviamente, este cambio fiscal debe evaluarse tomando en consideración, además, su impacto sobre el nivel de precios y sobre la distribución de la renta. Finalmente, las estimaciones son robustas en destacar que las instituciones económicas de los países nórdicos, caracterizadas por una elevada coordinación de la negociación salarial y un sector público muy efectivo, son más favorables para la creación de empleo.

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Junto al original del Papel de Trabajo se entregará también un resumen de un máximo de dos folios que contenga las principales implicaciones de política económica que se deriven de la investigación realizada.

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