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Taxation and redistribution in an open economy

Alberto Alesina [a,b,c], Roberto Perotti [d,*]

[a] *Department of Economics, Harvard University, Littauer Center, Cambridge, MA 02138, USA*
[b] *NBER, Cambridge MA, USA*
[c] *CEPR, London, UK*
[d] *Department of Economics, Columbia University, International Affairs Building, New York, NY 10027, USA*

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1. Introduction

If one asks the average European citizen what is the most important fiscal problem in Europe now, the answer would probably be something like: "the effects of the welfare state – both its expenditure and its financing sides – on the operation of labor markets and competitiveness". This paper argues that this hypothetical European citizen might have good reasons to be worried.

Academic macroeconomists studying fiscal policies in open economies have largely focused on the effects of government consumption, i.e. purchases of goods and services, rather than on purely redistributive policies. While this disparity of attention might have been justifiable on empirical grounds a few decades ago, it is less so now. In fact, Table 1 shows that in the 60s government consumption was indeed larger than redistributive expenditure in virtually every European country; by the end of the 80s, however, this situation had been reversed everywhere, with redistributive expenditure exceeding government consumption by 50% on average.

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Table 1
Government purchases of goods and services and social expenditure in the EEC, as shares of GDP [a]

	Soc. exp. 1960	Govt. cons. 1960	Soc. exp. 1988	Govt. cons. 1988
Belgium	12.3	12.4	27.7	15.2
Denmark	11.1	13.3	29.3	12.6
France	11.7	14.2	28.1	18.5
Germany	13.5	13.4	28.3	19.7
Ireland	10.4 [b]	22.4	12.5	16.4
Italy	10.6	12.0	23.1	16.9
Luxembourg	13.1	9.8	26.2	16.3
Portugal	5.5	10.5	17.0	16.0
Spain	4.0	8.3	17.2	14.8
United Kingdom	10.9	16.4	22.1	19.7
Average	10.4	12.3	24.7	17.7

expenditure includes the following types of benefits: sickness; invalidity/disability; employment injury; old age; survivors; maternity; family; unemployment; vocational training; housing.
[b] 1966.
Sources: EUROSTAT (social expenditure) and OECD (government consumption).

This paper studies theoretically and empirically the effects of distortionary taxation used to redistribute income in an open economy characterized by unionized labor markets. Our purpose is to highlight channels of influence of fiscal policy on aggregate outcomes which are different from those studied by standard open economy macroeconomics and closer to the views that we have attributed to the average European citizen.

When it comes to the effects of fiscal policy, the three standard macro models for an open economy – the Mundell–Fleming model, the dependent economy model, and the representative agent model – reveal an important common feature: fiscal policy has real effects mainly by altering the size and/or composition of demand at the existing prices. In particular, government expenditure is generally assumed to increase the demand for the good with a higher content of domestic labor. Not surprisingly, then, it increases the consumption wage and causes an improvement in the terms of trade, or an appreciation of the real exchange rate, depending on the model.

These approaches to the analysis of fiscal policy have two important implications. First, the only role of taxation is to shift spending power from the private sector to the government, and therefore to alter the intra- and/or inter-temporal structure of demand. For this purpose, lump-sum taxation is sufficient; the effects of distortionary taxation on production costs are absent from the analysis. Even those contributions that do consider distortionary taxes, like Frenkel and Razin (1987, Chs. 8 and 9), or Summers (1988), focus on the distortions induced in the savings and investment decisions rather than on static distortions in labor markets. Second, in general redistributive fiscal policy would have no real effects in all

these approaches, since it merely redistributes income between agents with the same propensities to spend on the different goods.

Yet, these two missing elements (the effects of taxation on costs and the role of redistribution) are among the hottest points of contention in the contemporary debate on fiscal policy in Europe. Of course, we are not claiming that these elements *could not* be introduced into the mainstream open economy analysis; our point is simply that, with the exceptions that we note below (and undoubtedly there are more), they were largely neglected. In our view, there are at least three reasons why these two elements have been comparatively neglected by the mainstream approaches to international macroeconomics.

First, the emphasis on government consumption probably reflected an implicit judgment on the relative empirical importance of the different types of fiscal policy. In the '60s, when the Mundell–Fleming and the dependent economy model were developed, government consumption was indeed bigger than redistributive expenditure in virtually all OECD countries. As shown in Table 1, however, this exclusive focus on government consumption is no longer justified.

Second, the heavy reliance on representative agent models leaves obviously little room for a meaningful redistributive policy. An exception is the overlapping generations model, where meaningful redistribution can occur among different generations. But even in this case, a purely redistributive fiscal policy financed by lump-sum taxation in general would have no effects as long as preferences are homothetic and a bequest motive is operative.

Third, the effects of redistributive expenditure are closely linked to and require an explicit modelling of the structure of the labor market. Clearly, if one gives up the assumption of lump-sum taxation, redistribution can have important effects on wages and costs under one of the two following sets of assumptions: either the labor market is competitive and the individual labor supply is sufficiently elastic, or, if the individual labor supply is inelastic, the labor market is unionized. Neither set of assumptions proved to be very popular: the former, because the individual labor supply is widely regarded to be inelastic; the latter, because any departure from the assumption of perfectly competitive labor markets necessarily make the conclusions of the analysis dependent on the type of departure which is being assumed. [1]

While the first objection, namely that individual labor supplies (particularly for men) are relatively inelastic, is rather uncontroversial, we do not regard the second objection as necessarily a weakness. After all, labor markets in Europe *are* unionized, and union contracts are often binding even for non-unionized firms and workers. Thus, we build our model from the assumption of unionized labor

[1] Models with unions were indeed used in international macroeconomics, but in a rather different context. For instance, Marston (1982) extends the staggered wage models of Fischer (1977) and Gray (1976) to study the effects of nominal rigidities in open economies.

markets, and use this framework to study the effects of various types of fiscal policy.

Thus, in order to analyse redistributive issues we abandon the representative agent assumption and we consider instead a model with three types of agents: employers and employees, who together form the productive sector of the economy, and an unproductive sector, which we call retirees. In our analysis of redistributive fiscal policy we go to the extreme by considering *purely redistributive fiscal expenditures*, i.e. expenditures that leave both the size and composition of aggregate demand unchanged at the initial prices. We make this extreme choice to isolate as clearly as possible the effects that concern us in this paper.

In the labor markets, monopoly unions set the wage for their members, leaving employment decisions to employers. Redistribution towards unemployed workers – e.g. an increase in the unemployment benefit – therefore induces higher wage demands and lowers employment. [2] By contrast, redistribution towards retirees in itself has no cost or demand effects because all agents have the same homothetic preferences.

However, both types of redistribution have an important indirect effect on the firms' costs, because of the use of distortionary taxation to finance government expenditure. For instance, with unionized labor markets, income and social security taxes are not shifted back completely to workers and therefore affect the firms' costs and their profitability. Instead, under a common set of assumptions in the literature, i.e. competitive good and labor markets with inelastic individual labor supplies, these taxes would be completely shifted to workers and would have no aggregate effects. Moreover, we emphasize that, always because of the presence of unions, not only social security and payroll taxes but also income and indirect taxes could affects costs and employment. This is important because in recent years there has been a growing concern about the use of social security and payroll taxes, as opposed to income taxes, as sources of revenues for redistributive expenditure (see, for instance, Gordon (1987)).

In the empirical part of this paper we investigate the effects of taxes on unit labor costs and the relative price of nontradables. We find that on average, in the sample of 10 European countries we use, an increase by 1% in the share of labor taxation in GDP leads to an increase in relative unit labor costs by between 1% and 1.7%. These effects are very robust to several specifications of our basic regression equations and several definitions of labor taxation. Thus, our results confirm the empirical relevance of the fiscal channel operating through the cost side of firms, which we emphasize in our model.

[2] While for expository purposes in this paper we consider the case of monopoly unions only, all the conclusions of this paper could be derived from a model with bargaining on the wage or on the wage and on employment.

Our paper is related to three quite different strands of research. First, in open economy macroeconomics, the study of the effects of fiscal policy in open economies has typically focused on the role of government purchases of goods and services and on its effects on the relative price of nontradables. An extension of the two-sector model of Selten (1959) and Swan (1960) to include the government sector shows that an increase in government spending on goods and services, falling more heavily on labor-intensive nontradable goods, leads to an appreciation of the relative price of nontradables via an increase in the demand for labor. Recent research by Froot and Rogoff (1991), De Gregorio et al. (1993) and De Gregorio et al. (1994) generally finds empirical support for this theory.

Second, at the intersection of public finance and labor economics, several contributions have looked at the effects of taxation on wages and costs. Examples of these contributions are Knoester and van der Windt (1987) and Padoa-Schioppa (1990). The latter, in particular, is an antecedent to our approach in that it studies the role of labor unions in the shifting of the burden of taxation. Minford (1983) models the effects of labor taxation in an open economy with unionized labor markets, and using quarterly data for the U.K. finds a positive effect of taxation on wages.

The third strand of literature somehow related to our present contribution is the literature on the wage gap. Three contributions that discuss the role of fiscal policy in that context are Branson and Rotemberg (1980), Bruno and Sachs (1985), and Courant (1987). Finally, in a recent important study on the determinants of structural unemployment, Phelps (1994) shows that in a sample of 17 OECD countries payroll and income taxes have adverse effects on employment and that the sensitivity to shocks in corporatist countries is lower than in the other countries.

This paper is organized as follows. Section 2 presents a brief description and the main intuition for the model, which is developed fully in Alesina and Perotti (1994). Section 3 presents the empirical analysis. Section 4 discusses some econometric issues. The last section concludes.

2. The model

In this section, we sketch the model underlying our regressions. Because the main intuition is fairly straightforward, and the model is fully worked out in Alesina and Perotti (1994), we limit ourselves to a brief and mainly verbal exposition.

We consider a world composed of two countries that produce traded and nontraded goods. The two countries are symmetric in all respects, except the structure of their labor markets. Specifically, in each country the tradable sector is composed of a total mass 1 of firms, each producing a differentiated good with a

constant returns to scale technology using only labor as income. [3] The nontradable sector has a similar structure.

Individuals in the home country have the following homothetic preferences over consumption of tradable and nontradable goods (see Dixit and Stiglitz, 1977):

$$U=\left(\int_0^1 \tilde{C}(i)^{\frac{1}{\lambda}}\mathrm{d}i\right)^{\frac{\lambda}{2}}\left(\int_0^1 C(i)^{\frac{1}{\lambda}}\mathrm{d}i+\int_0^1 C^*(i)^{\frac{1}{\lambda}}\mathrm{d}i\right)^{\frac{\lambda}{2}}+(1-\delta)R, \quad \lambda>0. \tag{1}$$

In this expression, $\tilde{C}(i)$ denotes consumption of the ith domestic variety of nontraded goods, $C(i)$ denotes consumption of the ith domestic variety of traded goods ('exportables' from now on) and a * denotes a foreign variable, so that $C^*(i)$ is consumption of the ith foreign variety of traded goods ('importables'). λ is related to the elasticity of substitution between two varieties of traded or nontraded goods, σ, through the formula $\sigma=\lambda/(\lambda-1)$. R is the utility of leisure, and δ is an indicator variable that takes the value of 1 if the individual works and 0 if he does not work. A symmetric expression holds for the utility function of an individual in the foreign country.

According to this utility function, each individual allocates half of his income to the consumption of nontraded goods and half to the consumption of traded goods. How much of this second half is devoted to the consumption of exportables depends on their price relative to importables.

We use the foreign country as a benchmark by assuming that the labor market is perfectly competitive so that full employment always prevails. By contrast, in the home country the labor force is organized in unions. We assume that in each of the two sectors (exportables and nontradables) the wage is set by a union. Each union sets the wage in order to maximize the expected utility of its members, while in equilibrium employment is determined by the entrepreneurs given the demand function for the differentiated good they produce. The model is closed by the condition that the current account between the two countries must be balanced. This requires that the expenditure on importables by domestic residents must be equal to the expenditure on exportables by foreign residents.

In the foreign country full employment always prevails. The wage in the two sectors is the same, and all foreign firms price their goods as a constant mark-up over the marginal cost, which is equal to the foreign wage. Assuming the latter to

[3] We assume, only for simplicity, that there are no fixed costs in production. Thus, if we allowed for free entry, the equilibrium number of firms would be indeterminate in this model. Since these issues are not the focus of this paper, we assume that in both countries there is a fixed number of firms each producing a different good.

be equal to 1 by normalization, all foreign goods are priced at $p^* = \sigma/(\sigma - 1)$, where σ is the elasticity of substitution between any two varieties of goods.

In the home country, in each of the two sectors the union behaves like a monopolist that 'sells' labor at a constant (opportunity) marginal cost, the utility of leisure R. Thus, it sets the real after-tax wage, $w(1-t)/\bar{P}$, as a mark-up over R, with the mark-up being determined by the elasticity of the demand for labor facing the union.

Now consider what happens when the government increases the tax rate t and uses the proceeds to increase, say, old-age or disability pensions. At the existing prices, this policy does not have any effect on either the composition or size of demand, since all agents have the same utility function and the same propensity to spend on any given good. Thus, this policy is purely redistributive. However, at the existing prices the after-tax real wage for union members decreases; to reestablish the equilibrium, the union demands a higher wage in both sectors.

Since domestic firms too price at a constant mark-up over the wage, with the mark-up being given by $\sigma/(\sigma - 1)$, the price of tradable goods produced at home increases. As a consequence, the demand for exportables by foreign residents decreases; to maintain the balance of payment equilibrium, the demand for importables by domestic residents too must decrease. Since the price of foreign goods has not changed, this can be achieved only be a fall in domestic income. As domestic income falls, the demand for both exportables and domestic nontradables falls, and so does employment in both sectors.

In addition, if the elasticity of substitution between goods is high enough, the relative price of nontradables appreciates according to the following mechanism. As employment falls, the elasticity of the demand for labor increases in the tradable sector, since all individuals substitute away from exportables towards importables at a faster rate. As the elasticity of the demand for labor increases in the exportables sector, the mark-up of the real after-tax wage over R falls. However, in the nontradable sector there is no substitution towards foreign-produced goods. Because the mark-up of the real after-tax wage over R in the nontradable sector does not fall, the wage and the price in the nontradable sector increase more than in the tradable sector. We can summarize the main results of the model as follows:

Proposition 1. An increase in redistribution to the retirees financed by an increase in the income tax rate leads to:

(i) an increase in the price of exportables, i.e. a decrease in competitiveness;

(ii) an increase in the relative price of nontradables;

(iii) a decrease in employment in both sectors.

Even stronger effects obtain when tax revenues are used to redistribute income to unemployed workers rather than to retirees. The most intuitive way to under-

stand this is to reinterpret R, the opportunity cost of employment to the union, as an unemployment benefit indexed to the CPI. Suppose labor taxation increases in order to finance an increase in R. Now there are two reasons why the union will demand a higher wage. The first one is familiar: when the tax rate on labor increases, the wage set by the union increases to preserve the purchasing power of the real after-tax wage of employed workers. In addition, the opportunity cost of employment to the union, R, has increased: this induces the union to demand a further increase in the wage. Thus, when labor taxes are used to redistribute income to unemployed workers rather than retirees, one should expect even stronger effects of an increase in taxation on relative unit labor costs.

3. Empirical evidence

In this section we estimate the effects of fiscal policy on unit labor costs in the tradable sector and the relative price of nontradables using a panel of ten European countries. [4] The key predictions we test in this section are: (i) an increase in labor taxation relative to the other countries causes an increase in relative unit labor costs in the tradable sector; (ii) an increase in labor taxation causes an appreciation of the relative price of nontradables. We use data on unit labor costs and multifactor productivity from the OECD *Intersectoral Dataset*, and data on fiscal variables from the OECD *National Income Accounts* and *Revenue Statistics of the Member Countries*.

We take manufacturing to represent the tradable sector: in spite of the increased trade in some services, this is still a good approximation to reality, as De Gregorio et al. (1994) have shown recently. We use relative unit labor costs rather than relative prices in manufacturing to test our model because the former is a much better indicator of the labor cost effects of fiscal policy that we emphasize in our paper. In our model unit labor costs and prices behave identically since the markup is constant. In the real world, however, this is clearly not the case; aside from issues of countercyclicality of the markup, international competition places more constraints on the movements of good substitutes than our formalization admits.

We define labor taxation as the sum of direct taxes on income paid by households, payroll taxes and social security taxes. We obtain very similar results using less encompassing definitions of labor taxation, such as direct taxes paid by households or direct taxes paid by households and social security taxes paid by employees, or more encompassing definitions, such as the one we use plus indirect taxes. To facilitate comparison with the effects of the other fiscal policy variables emphasized by the literature, we divide these measures of tax revenues by GDP.

[4] These countries are: Belgium, Denmark, Finland, France, Germany, Italy, Netherlands, Norway, Sweden, and United Kingdom.

Table 2
Labor taxation in Europe, 1965–1990 [a]

	TAX / GDP, 1965–90	*TAX / GDP*, 1965	*TAX / GDP*, 1990
BEL	0.253	0.163	0.288
DEN	0.242	0.150	0.293
FIN	0.168	0.119	0.185
FRA	0.223	0.177	0.261
GER	0.222	0.164	0.233
ITA	0.183	0.131	0.243
NET	0.289	0.240 *	0.288
NOR	0.236	0.248 * *	0.253
SWE	0.315	0.203	0.388
UK	0.175	0.138	0.176

[a] *TAX*: direct taxes on households plus social security contributions paid by employers and employees plus payroll taxes.
* 1970.
* * 1975.
Source: OECD.

We show later that the results are not significantly affected when we divide labor tax revenues by total wages rather than GDP. Table 2 documents the importance of labor taxation in European countries, and the well-known fact that it has increased considerably between 1965 and 1990 in virtually all European countries (except Netherlands and Norway).

Table 3
Taxation and unit labor costs [a]

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
TFP	−0.32 * *	−0.36 * *	−0.30 * *	−0.36 * *	−0.36 * *	−0.32 * *	−0.39 * *	−0.34 * *
	(0.084)	(0.095)	(0.087)	(0.100)	(0.100)	(0.100)	(0.102)	(0.099)
TAX	0.38 * *	0.40 * *	0.36 * *	0.40 * *	0.38 * *	0.41 * *	0.35 * *	0.39 * *
	(0.090)	(0.093)	(0.094)	(0.097)	(0.098)	(0.107)	(0.107)	(0.103)
GDPGAP					0.30		0.26	0.09
					(0.232)		(0.237)	(0.232)
SLACK						0.39		
						(0.319)		
Country dummy?	no	yes	no	yes	yes	yes	yes	yes
Year dummy?	no	no	yes	yes	yes	yes	yes	yes
Adj. R^2	0.150	0.148	0.130	0.113	0.116	0.225	0.147	0.153
NOBS	204	204	204	204	204	169	187	193

[a] Dependent variable: multilateral unit labor costs in manufacturing. Data on *SLACK* for Norway are not available. All variables are in rates of change. Standard errors in parentheses.
* * Significant at the 5% level.

Table 3 presents the first estimates of the effects of taxation on unit labor costs. The dependent variable is relative unit labor costs in manufacturing (*ULC*), defined as unit labor costs for each country divided by a GDP-weighted geometric average of unit labor costs in the other countries in the sample, all expressed in a common currency.

In the first four columns we estimate the most basic specification of the model: the regressors are relative total factor productivity (*TFP*) and relative labor taxation (*TAX*). All variables on the r.h.s. are constructed in the same way as relative unit labor costs, i.e. as the ratio of each country's variable to a GDP-weighted average of all other countries in the sample. Indeed, it is intuitive that an increase in productivity would lead to a fall in relative unit labor costs. [5] Finally, because of the high persistence in the data, we log-differenced all the variables before running all our regressions.

The only difference between the first four columns of Table 3 concerns the treatment of time and country dummies. Including year dummies might be particularly important for at least two reasons: first, our sample covers different exchange rate regimes; second, year dummies might help partial out the effects of adverse supply shocks. As one can see, the results are fairly independent of which type of control is included: in all four columns, both coefficients of the two variables of interest, total factor productivity and labor taxation, have the expected sign and are strongly significant, both statistically and quantitatively. To gather an idea of the effects implied by these estimates, notice that the average value of the labor tax rate in the sample is about 24%, with a standard deviation of 5.8%. Given a coefficient of *TAX* of 0.40, when the tax rate on labor increases by 1% of GDP to 25%, relative unit labor costs increase by about 1.66%; when the tax rate increases by one standard deviation, relative unit labor costs increase by 9.63%.

To control for the effects of economic activity on tax collection, in the next two columns we control for indices of economic activity: *GDPGAP* and *SLACK*. We construct *GDPGAP* as the ratio of the fitted value from a regression of real GDP on a time trend (allowing for a structural break in 1975) to the actual value of real GDP. *SLACK* is the ratio of potential output (again from the OECD *Historical Statistics*) to actual output. [6] Thus, an increase in either variable indicates a

[5] Because of the presence of monopoly power, we estimate total factor productivity growth using the formula $TFP = \mathrm{d}y - \mu' \cdot s_L \mathrm{d}l - (1 - \mu' \cdot s_L)\mathrm{d}k$, where y, l and k are the logarithms of value added, labor and capital respectively, s_L is the share of labor in value added and μ' is the value-added-based mark-up. We constructed μ' from the formula $\mu' = (\mu(1 - s_M))/(1 - \mu s_M)$, where μ is the output-based markup and s_M is the share of intermediate input in output. We assumed a value of 1.57 for μ, which is the average value obtained by Hall (1988) for manufacturing, and $s_M = 0.5$, which is also typical in this literature. We also experimented with lower values of μ, and the results did not change substantially.

[6] Data on potential output are not available for Norway, which accounts for the lower number of observations in column (6).

Table 4
Taxation, government spending, and unit labor costs [a]

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
TFP	−0.36 **	−0.42 **	−0.32 **	−0.35 **	−0.28 **	−0.30 **	−0.34 **
	(0.100)	(0.104)	(0.103)	(0.100)	(0.143)	(0.105)	(0.114)
TAX	0.39 **	0.31 **	0.43 **	0.39 **	0.39 **	0.43 **	0.40 **
	(0.104)	(0.110)	(0.107)	(0.104)	(0.103)	(0.103)	(0.110)
GDPGAP	0.33	0.21	0.09	0.32	0.45	0.49 *	0.36
	(0.240)	(0.243)	(0.320)	(0.240)	(0.254)	(0.250)	(0.256)
CGNW	−0.06	−0.13	−0.18	−0.04	−0.05		
	(0.118)	(0.121)	(0.122)	(0.119)	(0.118)		
CGW		0.37 **	0.50 **	−0.24	−0.41		
		(0.167)	(0.302)	(0.323)	(0.309)		
SOCSEC						−0.22 *	
						(0.128)	
TOTEXP							−0.102
							(0.192)
Adj. R^2	0.112	0.132	0.110	0.114	0.121	0.123	0.113
NOBS	204	204	199	204	204	204	204

[a] Dependent variable: multilateral unit labor costs in manufacturing. *CGNW* is nominal non-wage government consumption divided by nominal GDP. In column (2), *CGW* is nominal government expenditure on wages divided by nominal GDP. In column (3), *CGW* is nominal government expenditure on wages deflated by the value added deflator of 'Producers of government services', divided by real GDP. In column (4), *CGW* is government employment. In column (5), *CGW* is government employment divided by total employment. All variables are in rates of change. Standard errors in parentheses.

** Significant at the 5% level.

* Significant at the 10% level.

downturn in economic activity. As one can see, the coefficient of the tax variable remains largely unaffected by the inclusion of these indices of economic activity. Similar results obtain when we use capacity utilization and unemployment as indices of economic activity.

Since the tax system is progressive, and tax brackets are generally not indexed, in periods of high inflation tax revenues might increase purely because of a bracket-creeping effect. To control for this possibility, in columns (7) and (8) we have excluded all those observations where the difference between the inflation rate of a country and the weighted average of its partners is greater than 5% (column (7)), or where the inflation rate was higher than 15% (column (8)). As one can see, the coefficient of the tax rate is not significantly affected.

In Table 4 we add several government expenditure variables to the regressions of Table 3. There are two main reasons for doing so: first, certain government expenditure variables might proxy for demand effects; second, we want to assess the relative empirical importance of the more standard effects of fiscal policy, operating through government expenditure, and of the channel we are emphasizing in this paper, operating through taxation.

In column (1) we start by controlling for the non-wage component of government consumption (*CGNW*), which on average accounts for about 1/3 of total government consumption. [7] Its coefficient is insignificant, and moreover its inclusion does not affect the coefficient of the tax rate significantly. However, the component of government consumption that the traditional theory implicitly focuses upon is government expenditure on wages (*CGW*), which tends to fall more heavily on nontraded, labor-intensive services and through this channel puts upward pressure on wages and unit labor costs. This immediately implies that the wage component of government consumption is likely to be endogenous, as wage increases in the government and manufacturing sector are likely to be correlated. In fact, the coefficient of *CGW* in column (2) is large and strongly significant; notice, however, that the coefficient of the tax variable drops only slightly, to 0.31, and remains significant at the 5% level.

To obtain an idea of the relative importance of the two channels of operation of fiscal policy estimated in these regressions, we will use the estimates of column (2), since the change in *CGW* has a more immediate interpretation here. The average value of government consumption on wages as a share of GDP in the sample is 13%, with a standard deviation of 2.8%. Using the coefficient of 0.37 on *CGW* in column (2), when government consumption on wages increases by 1% of GDP, unit labor costs increase by 2.8%. Using a coefficient of 0.31 for *TAX* in the same regression, when labor taxes increase by 1% of GDP, unit labor costs increase by 1.3%. When government consumption and taxation increase by one standard deviation, unit labor costs increase by 7.8% and 7.5% respectively.

We can think of two ways of tackling the endogeneity problem pointed out above. First, one can deflate the wage component of government consumption by its deflator, rather than the GDP deflator, as suggested by Dornbusch (1991). [8] When we do this (column (3)), contrary to our expectations the coefficient of *CGW* increases to 0.50. Notice, however, that the coefficient of the tax rate too increases by about 1/3, to 0.43. Second, one can use government employment, rather than the wage component of government consumption, as a proxy for the demand pressure in labor markets originating from the government sector. We do this in columns (4) and (5) of Table 4. In column (4), *CGW* is now government employment, relative to the other countries (again, recall that in all our regressions all variables appear in rates of change); in column (5), it is the ratio of government employment to total employment, always relative to the other countries of the sample. Interestingly, in both cases the coefficient of *CGW* becomes insignificantly different from 0, while the coefficient of the tax variable returns to a value of 0.39.

[7] Like the tax variables, all expenditure variables are expressed as shares of GDP, and relative to a weighted average of the other countries in the sample.

[8] Specifically, to deflate the wage component of government consumption we use the value added deflator for 'Producers of government services' from the OECD *Intersectoral Dataset*.

In columns (4) and (5) we control for expenditure on social security by the government (*SSEXP*) and total current expenditure net of interest payments (*TOTEXP*) respectively. Both coefficients are insignificant; moreover, the coefficient of the tax rate is practically unaffected.

The main conclusions we draw from Tables 3 and 4 is that the channel that we have identified, namely the effects of taxation on labor costs, appears to be robust and, at a minimum, of similar quantitative importance to other, more studied channels of operation of fiscal policy, in particular government consumption.

So far, we have not allowed for nominal factors to play a role in our regressions. Of course, in our real model purely nominal factors should not matter; empirically, however, it is easy to imagine situations where they might play a role. For instance, an increase in inflation that is passed on to wages through indexation clauses might cause an increase in relative unit labor costs in a fixed exchange rate regime. The obvious problem one faces in testing these effects is that exactly in these circumstances inflation is clearly an endogenous variable in our regressions. This is a standard problem in macroeconomic wage equations; in our case it is even more serious because of the absence of good instruments. For instance, the difference between the CPI and the GDP inflation rates, which captures the role of indirect taxes and the price of imports, is often used as an instrument for CPI inflation, as it is arguably little correlated with wage shocks. A similar argument refers to the price of imports. In our regressions, however, we cannot use these instruments as unit labor costs of foreign manufactured goods appear on the l.h.s. of our regression, and clearly the price of imports and unit labor costs of foreign manufactured goods are highly correlated. For all these reasons, we have decided to present in Table 4 estimates of OLS regressions similar to those of the previous two tables, with the only addition of the CPI inflation rates to the set of regressors. [9] As one can see by comparing the estimates of Table 5 to the corresponding estimates in the previous two tables, controlling for inflation does not significantly affect the coefficients of any of the fiscal policy variables.

Table 6 reports estimates obtained with slightly different definitions of the tax rates. Namely, the labor tax rate *TAX* is now defined as labor taxation divided by total wages rather than GDP. Using this new definition of the tax rate, this table reestimates the main regressions of the previous tables. Thus, columns (1) and (2) estimate the basic regressions, corresponding to columns (4) and (5) of Table 3. In column (3), we exclude all observations with an inflation rate higher than 15%, as in column (7) of Table 3. Columns (4) and (5) control for government consumption, and correspond to columns (2) and (3) of Table 4, respectively. As one can see, the coefficient of the tax rate remains always statistically significant, although slightly smaller than in the corresponding regressions that use the GDP-based definition of the tax rate. To obtain an idea of the effects implied by the estimates

[9] Using the rate of change of the GDP deflator would give very similar results.

Table 5
Taxation, inflation, and unit labor costs[a]

	(1)	(2)	(3)
TFP	−0.36 * *	−0.42 * *	−0.31 * *
	(0.100)	(0.104)	(0.103)
TAX	0.35 * *	0.28 * *	0.41 * *
	(0.100)	(0.111)	(0.110)
GDPGAP	0.18	0.18	0.09
	(0.231)	(0.240)	(0.319)
CGNW		−0.10	−0.17
		(0.123)	(0.122)
CGW		0.34 * *	0.45
		(0.168)	(0.306)
INFL	0.34	0.27	0.23
	(0.209)	(0.212)	(0.217)
Adj. R^2	0.125	0.136	0.111
NOBS	204	204	199

[a] Dependent variable: multilateral unit labor costs in manufacturing. *CGNW* is nominal non-wage government consumption divided by nominal GDP. In column (2), *CGW* is defined as nominal government expenditure on wages divided by nominal GDP. In column (3), *CGW* is defined as nominal government expenditure on wages divided by the value added deflator of 'Producers of government services', divided by real GDP. All variables are in rates of change. Standard errors in parentheses.

* * Significant at the 5% level.

Table 6
Other definitions of taxes [a]

	(1)	(2)	(3)	(4)	(5)
TFP	−0.38 * *	−0.38 * *	−0.36 * *	−0.46 * *	−0.35 * *
	(0.105)	(0.104)	(0.101)	(0.106)	(0.108)
TAX	0.23 * *	0.22 * *	0.25 * *	0.20 * *	0.22 * *
	(0.099)	(0.099)	(0.104)	(0.098)	(0.106)
GDPGAP		0.39	0.14	0.20	0.06
		(0.239)	(0.236)	(0.249)	(0.333)
CGNW				−0.12	−0.14
				(0.125)	(0.128)
CGW				0.50 * *	0.63 * *
				(0.161)	(0.312)
Adj. R^2	0.039	0.049	0.096	0.093	0.029
NOBS	199	199	190	199	194

[a] Dependent variable: multilateral unit labor costs in manufacturing. *CGNW* is nominal non-wage government consumption divided by nominal GDP. Column (3) excludes observations with a rate of CPI inflation in excess of 15%. In column (4), *CGW* is defined as nominal government expenditure on wages divided by nominal GDP. In column (5), *CGW* is defined as nominal government expenditure on wages divided by the value added deflator of 'Producers of government services', divided by real GDP. All variables are in rates of change. Standard errors in parentheses.

* * Significant at the 5% level.

of Table 6, consider the usual experiment of increasing labor taxation by 1% of GDP, starting from the same level, 24%, as in the experiment with the GDP-based definition of the tax rate. Using the coefficient of 0.23 from column (1) of Table 6, the increase in relative unit labor costs is about 0.96%, about half the effect obtained from the estimates of Table 3. Note also that the standard deviation of the ratio of labor taxes to total wages is rather high, 13.5%; hence, when the tax rate as defined here increases by one standard deviation, unit labor costs increase by 6.21%, 2/3 of the effects of an increase by one standard deviation of the tax rate used in Table 3. We further discuss the relationship between these two sets of estimates in Section 4 below.

As mentioned above, while in our model unit labor costs and prices are linked by a constant markup, in reality the markup is obviously variable. We reran all our regressions using the ratio of the value added deflator to unit labor costs in manufacturing as our dependent variable. This variable is an indicator of profit margins in the manufacturing sector; a great advantage of using it is that its construction does not require the use of the nominal exchange rate, and is therefore independent of movements in the exchange rate that are unrelated to fundamentals. We would expect that an increase in taxation decrease profit margins as defined above, as unions shift part of the burden onto wages and firms are unable to shift all of the increase in labor costs onto prices. This is indeed what we find, with a coefficient of the tax rate (defined in terms of GDP) typically in the range of -0.30, and very significant. Interestingly, when we used the relative price of machinery and equipment, rather than the whole manufacturing, as our dependent variable, the coefficient was much lower in absolute value. One possible explanation is exactly that, because goods within the machinery and equipment sector are more differentiated, increases in labor costs can be shifted more on prices, so that the ratio of prices to unit labor costs falls less.

We now turn to the second implication of our model, namely that an increase in taxation induces an appreciation of the relative price of nontradables. In Table 7, the dependent variable is the ratio of the price of nontradables to the price of tradables. We use the value added deflator in manufacturing as our price of tradable goods. Because of data availability, and to ensure consistency in the definition of the dependent variable, the nontradable sector is represented by construction and transportation only: a more general definition would have meant losing too many countries from our sample, as several countries do not have data for other sectors. With the definition employed in Table 7, we lose only Italy from our sample. As a further check on our results we ran the same regressions using, for each country, the largest possible definition of the nontradables sector. This obviously means that we use different definitions of the l.h.s. variable for different countries, but the advantage is that for most countries we can enlarge the definition of nontradables goods and that we can include all countries in our regressions. The results, available upon request, were very similar to those of Table 7.

Table 7
Taxation and the relative price of nontradables [a]

	(1)	(2)	(3)	(4)	(5)	(6)
TFP	−0.17 **	−0.15 **	−0.14 **	−0.16 **	−0.15 **	−0.19 **
	(0.055)	(0.057)	(0.055)	(0.057)	(0.055)	(0.056)
TAX	0.17 **	0.14 *		0.15 **		0.16 **
	(0.067)	(0.072)		(0.071)		(0.066)
GDPGAP	−0.15	−0.15	−0.01	−0.11	−0.04	−0.14
	(0.195)	(0.164)	(0.150)	(0.159)	(0.147)	(0.193)
CGNW	0.11	0.09	0.12			0.09
	(0.085)	(0.086)	(0.076)			(0.084)
CGW	0.06	0.13	0.19 *	0.16	0.24 **	0.08
	(0.190)	(0.115)	(0.102)	(0.112)	(0.097)	(0.188)
INFL						0.01 *
						(0.006)
Adj. R^2	0.259	0.266	0.265	0.265	0.258	0.276
NOBS	163	163	178	163	178	163

[a] Dependent variable: relative price of nontradables to tradables. *CGNW* is nominal non-wage government consumption divided by nominal GDP. In columns (2), (3), (4) and (5) *CGW* is defined as nominal government expenditure on wages divided by nominal GDP. In columns (1) and (6), *CGW* is defined as nominal government expenditure on wages divided by the value added deflator of 'Producers of government services', divided by real GDP. All variables are in rates of change. Standard errors in parentheses.

** Significant at the 5% level.

* Significant at the 10% level.

In all cases, the results are largely supportive of our theory: the coefficient of the labor tax rate is always positive and significant. A comparison of the first two columns in Table 7 shows once more the potential importance of deflating the wage component of government consumption by its appropriate deflator: when nominal government expenditure on wages is deflated using its sectoral deflator and divided by real GDP (column (1)), the coefficient of labor taxation is relatively large (0.17) and significant at the 5% level, while the coefficient of *CGW* is much smaller (0.06) and insignificant. By contrast, when *CGW* is defined as nominal government expenditure on wages divided by nominal GDP (column (2)), the coefficient of the labor tax rate drops to 0.14 and it is only significant at the 10% level, while the coefficient of *CGW* rises to 0.13, although it is still insignificant at the 10% level.

A comparison of columns (2) and (3) also suggests that those regressions in the previous literature that had omitted tax variables might have overstated the role of government consumption: when income taxation is excluded, as in column (3), the coefficient of government consumption is much bigger (0.19), and almost significant at the 5% level. Moreover, our results persist when the non-wage component of government consumption is excluded from the regressions: as one can see from

columns (4) and (5), even in this case the coefficient of *CGW* is insignificant when labor taxation is included in the regression (column (4)), and increases by 50% and becomes significant at the 5% level when taxation is excluded. In column (6) we have included the rate of change of CPI inflation as a proxy for demand factors. Column (6) is then very similar to the regressions in De Gregorio et al. (1994); the only difference is that it includes a tax variable. As one can see, this has drastic effects on the size and significance of the coefficient of government consumption variables, while the tax variable always appears to be important and significant.

4. Discussion

An important issue that we have not discussed yet is that of endogeneity. How likely is it the endogeneity in our measure of the tax rate is driving our results? This question has three dimensions to it. First, the tax rate can be endogenous because policymakers react to shocks to competitiveness. Suppose that unit labor costs increase relative to the other trading partners; a policymaker might try to boost competitiveness by lowering the tax rate on labor, particularly social security taxes. There is ample evidence of this in several European countries: for instance, during the 70s and the beginning of the 80s the Italian government repeatedly took up an increasing share of the social security taxes paid by employers. Note, however, that this source of endogeneity of the tax rate would induce a *downward* bias in our estimated coefficient.

Second, shocks that affect competitiveness and GDP might also affect the share of taxation in GDP. For instance, the progressiveness of the tax system implies that the share of income taxation in GDP in general increases in expansions. In this case, the induced bias in our coefficient would depend on the type of the shock: for instance, with a negative supply shock unit labor costs are likely to increase while GDP and therefore the average tax rate fall, but with a demand shock the pattern of correlation can be the opposite. In any case, we tried to control for this effects by including a measure of the GDP gap in our regressors and by leaving out high inflation years.

The third possible source of a bias is more subtle. Because there is not enough information on (and enough variation in) statutory tax rates, we construct the tax variables as the ratio of labor taxation to GDP. The dependent variable, unit labor costs in manufacturing, is defined as total compensation in manufacturing divided by real value added in manufacturing. Thus, two positively correlated variables, GDP and real value added in manufacturing, are at the denominator of the tax variable and of the dependent variable, respectively. Therefore, one might argue that a positive relationship between the last two variables is built-in because of the way we define them. However, note that when we define the tax rate as taxes on labor divided by total wages, the problem is exactly the opposite: now we have

total wages at the denominator of the explanatory variable, and compensation in manufacturing at the numerator of the dependent variable. Following the same reasoning as above, this should induce a *negative* bias on the coefficient of the tax rate by construction. Indeed, as we noted in the previous section, the coefficient estimate did fall, yet it remained significant; according to this estimate, the effect of a given increase in labor taxation was only about half that estimated using the GDP-based definition of the tax rate. The preceding discussion helps reconcile these differences: the estimates obtained under the two definitions of the labor tax rate can be regarded as providing the two bounds of the effects of an increase in labor taxation on competitiveness. To pick a number, and taking the mid-point of the interval between these two bounds (0.96% from the wage-based definition of the tax rate and 1.66% from the GDP-based definition), our estimates suggest that when labor taxation increases by 1% of GDP, relative unit labor costs in European countries increase on average by 1.31%.

5. Conclusions

This paper emphasizes theoretically and evaluates empirically an important effect of redistributive fiscal policies in open economies. We depart from most of the literature by stressing the effects of taxation on the cost side of firms and by focusing on the purely redistributive role of fiscal policy.

While the channel that we study is often at the center of attention of policy debates, it is comparatively less studied than the demand side effects of fiscal policy, via purchase of goods and services. We show that in a model with unions, redistributive fiscal policy can have important effects on relative unit labor costs and the relative price of nontradables. These are concepts closely related with the, perhaps not well defined, idea of 'competitiveness' which is at the heart of the debate in Europe.

Empirically, we show that the effects of taxes are of the same order of magnitude as those of government consumption. In fact, the effects of the latter are overestimated if the role of taxation is ignored.

The effects of taxation on competitiveness and employment depend on the behavior of unions and on the structure of labor markets, in particular on the degree of centralization of labor unions. The structure of labor markets varies greatly in the OECD group of countries, leading to testable implications concerning the effects of taxation on competitiveness in different countries. These issues are explicitly addressed in Alesina and Perotti (1994), who show that the effects of taxation on relative unit labor costs and the price of nontradables are nonlinear, with the strongest effects occurring in countries with intermediate levels of centralization of the wage bargaining process.

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