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LABOR TAXES AND ECONOMIC PERFORMANCE IN PORTUGAL^(*)

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Abstract

This paper analyzes the effects of labor taxes on economic performance in Portugal. The empirical results are based on VAR estimates using output, the inflation rate, the unemployment rate, and the effective labor tax rates under different alternative definitions. This approach follows the conceptual argument that the analysis of the effects of labor taxes requires the consideration of dynamic feedback effects among the different variables. The results of the impulse-response function analysis indicate that a decrease in the effective labor tax rates would improve the performance of the Portuguese economy in the long term: it would decrease the unemployment rate and the cost of living and it would increase GDP. Moreover, these results suggest that a reduction in long-term unemployment could be achieved, albeit at the cost of a slight increase in short-term inflation, by replacing a labor tax on employers with an offsetting labor tax on workers or, preferably, by replacing labor taxes on either workers or employers with an offsetting broader based tax.

JEL Classification: C32, H55, O52.

Sumário

Neste artigo são analisados os efeitos dos impostos sobre o trabalho na actividade económica em Portugal. Os resultados empíricos são baseados nas estimativas de um modelo VAR utilizando como variáveis o produto, a taxa de inflação, a taxa de desemprego e a taxa efectiva de imposto sobre o trabalho segundo definições alternativas. Esta abordagem está de acordo com o argumento conceptual segundo o qual a análise dos efeitos dos impostos sobre o trabalho exige que se tomem em consideração os efeitos dinâmicos de feedback das diferentes variáveis. Os resultados da função impulso-resposta indicam que uma diminuição das taxas efectivas de imposto sobre o trabalho influenciam positivamente a economia portuguesa: no longo prazo, a taxa de desemprego e o custo de vida diminuiriam e o PIB aumentaria. Adicionalmente, os resultados da função impulso-resposta sugerem que uma redução no desemprego no longo prazo pode ser obtida, ainda que à custa de uma ligeira subida da inflação no curto prazo, através de uma substituição de impostos sobre as empresas compensada por impostos sobre os trabalhadores, ou, preferencialmente, substituindo os impostos sobre o trabalho, quer sobre os trabalhadores quer sobre as empresas, por um imposto com uma base mais alargada.

Labor Taxes and Economic Performance in Portugal

1. Introduction

The objective of this paper is twofold: first, to study the effects of a reduction in labor taxes on economic performance in Portugal; second to analyze how the effects of a reduction in labor taxes may depend on the legal incidence of such taxes between workers and employers. In both cases, we will focus on the effects of reductions in the labor taxes on the unemployment rate, the inflation rate, and the GDP.

There is currently a growing concern over the evolution of labor markets in Portugal. Indeed, the unemployment rate in Portugal, while still far from the EU average, has recently increased from 4% in 1991 to 7.3% in 1996 (all the data presented in this introduction are from the Statistical Annex of European Economy, June 1997). While it can be argued that this change in the unemployment rate is mostly cyclical, the fact that there has been a deceleration in the decline of real unit labor costs cannot be ignored. In fact, in 1996 real unit costs of labor were at 97.4% of the 1991 levels, whereas over the corresponding part of the previous business cycle, i.e., 1986-1990, they averaged 92.7%. In turn, labor's share of the GDP went from an average of 70.4% for the period 1986-90 to 76.1% for 1991-95 and to 75% in 1996.

The recent evolution of labor costs is also a matter of concern given the objective of keeping inflation low. In fact, the current inflation rates of around 3% is very low by historical standards and represents a great stride toward the fulfillment of the requirements for joining the EMU. Keeping inflation low and stable is a matter of the utmost importance, and any development that can jeopardize this goal, such as the deceleration in the decline of the real unit costs of labor, should be regarded with great concern. Clearly, one should not expect the negative evolution of the real unit labor costs to have permanent long-term effects on inflation. Given the current policy constraints, however, negative short-term effects are bad enough.

One of the most ominous developments in the past decade has been the sharp increase in spending on social protection activities. This development is critical since these activities are mostly, although not exclusively, financed by labor taxes. In fact, social security contributions increased from an average of 10.5% of the GDP in 1986-1990 to 11.6% for the period 1991-1996. In addition, direct taxes, which are in great part labor taxes, increased from an average of 7% in 1986-90 to 9.6% in 1991-96. There is, therefore, the concern that the increase in effective labor tax rates to finance such expansion in social protection may be an important contributing factor to the negative evolution of labor costs in the economy. This concern is plausible since, as mentioned before, labor costs represent a very large share of production costs. Indeed, the increase in labor taxes accounts for an estimated 50% of the increase in labor costs over the last decade, the remaining 50% being explainable by cyclical factors.

Thus far we have suggested that the increase in effective labor tax rates is closely related to the evolution of labor costs and is a factor leading to increased unemployment and increased short-term inflationary pressures. As a corollary to these conjectures it is likely that great benefits could potentially be achieved from reducing labor taxes.

One possible counter-argument to our conjecture is the suggestion that since Portugal is a small open economy in the context of great international flexibility of financial flows, labor is a relatively fixed factor with a relatively rigid supply. Under these circumstances workers would mostly bear the burden of the tax in the form of lower real wages, and the effects on unit costs of labor and unemployment would be relatively small. Clearly, the extent to which labor taxes generate the negative effects on labor costs for the firm, unemployment, and inflation depend on the degree of relative flexibility actually displayed by labor viz-a-viz other production inputs. Accordingly, the determination of the actual effects of labor taxes is a question to be determined empirically. This is the first objective of this paper.

The second objective of the paper follows naturally from the first. We want to investigate how the effects of a reduction in labor taxes depend on the legal incidence of such reduction. Labor taxes in Portugal are levied both on workers (contributions to social security as well as part of the income tax) and on employers (contributions to social security). Obviously, the difference in legal incidence does not necessarily imply differential effects on the economy since one can imagine many scenarios under which the legal incidence is of no guidance to the understanding of the economic incidence of labor taxes. In our counter-argument above the implicit view is that labor taxes are either levied on workers or shifted to workers in such a way that workers bear the burden of the tax regardless of the legal incidence. It is clearly the case, however, that to the extent that workers and employers are unable to shift the burden of their taxes, that is, to the extent that the economic incidence is close to the legal incidence, the taxes on workers and employers have differential effects: taxes on workers affect real wages and implicitly the costs of living and taxes levied on employers increase the costs of labor and reduce employment. Again the extent of such differentiated effects will be investigated empirically.

In this paper we seek to measure the long-term effects of changes in labor tax rates on the unemployment rate, the inflation rate, and the GDP. To do so, we follow an unrestricted vector auto-regressive (VAR) approach and base our results on the associated impulse response functions. This approach follows the conceptual argument that the analysis of the effects of labor taxes requires the consideration of dynamic feedback effects among the different variables. In fact, one would expect the effects of labor taxes on the other variables to be the result of a complex web of dynamic interactions. Our approach simultaneously accommodates the ideas that labor taxes affect economic performance through time and that economic performance itself can also affect the evolution of labor taxes. Ultimately, the effects of labor taxes on economic performance have to account for both the initial shocks in labor taxes, the subsequent dynamic interactions among the different variables, and the long-run relationships among the variables. Finally, the unrestricted approach is consistent with an *a priori* agnostic view on issues like the incidence of labor taxes, the nature of the unemployment movements, the long term effects on

inflation, etc. It allows the data to determine whether or not our preconceived notions on these topics are satisfied rather than pre-imposing them.

The paper is organized as follows. In Section 2. We provide information about data sources and definitions. In Section 3, we report and analyze the empirical results, including univariate analysis, analysis of cointegration, and VAR specification and estimation. In Section 4, we discuss the impulse response functions associated with our VAR estimates, the basis for our analysis. In Section 5, we analyze the effects of labor tax rate changes on economic performance in Portugal through the orthogonalized impulse response functions and variance-decomposition techniques. In Section 6, we analyze the effects of the labor taxes under alternative definitions of the labor taxes. Finally, in Section 7, we provide a summary and consider some of the policy implications of our results.

2. Data: sources and description

To analyze the effects of the labor taxes this paper considers the following variables: output, GDP; the unemployment rate, i.e., unemployed as a fraction of the labor force, UNR; the inflation rate as measured by the deflator of private consumption, PCD; and the effective labor tax rate, TAX. In the rest of the paper all the variables are used in natural logarithm form, denoted by the letter L before their respective name (e.g., LGDP).

The data in this study covers the sample period 1960 to 1996 and, therefore, contains 36 yearly observations. The data set is obtained from several sources. GDP is national spending in 1977 prices obtained from the long-term national accounting series published in Quarterly Bulletin of the Banco de Portugal (1992). This series is extended after 1991 by using the real GDP growth rates as published in the European Economy (1997). The private consumption deflator and the unemployment rate are obtained from the European Economy (1997). Finally, labor tax payments in nominal terms are obtained from Pinheiro et al (1997) and extended after 1993 with data from European Economy (1997). The nominal figures are converted into 1977 prices using the GDP price deflator as published in the European Economy (1997). The effective tax rates, TAX, are obtained by dividing the real labor tax payments by the GDP for the period.

In the spirit of this investigation labor taxes include not only payment by workers but also the revenues from labor taxes with legal incidence on employers. We use two measures of labor taxes. The first, which is used in the bulk of the paper, follows a narrow definition. It includes only social security contributions by both workers and employers. This narrow definition has the advantage of reflecting labor taxes in a pure and unadulterated form. It has the obvious disadvantage that it excludes payments on labor income under the personal income tax system. The broad definition includes such tax payments. Since a functional decomposition of the personal income tax payments is not available, however, all income tax payments are included, that is the “imposto profissional” and the “imposto complementar” until the tax reform and the “IRS” thereafter. This broad labor tax definition has the advantage of including all labor taxes. It has the disadvantage, however, of including tax payments on other types of income.

Therefore, literally speaking, it is a broader based tax, closer in spirit to a general tax. By using these two definitions and comparing the results one can be more confident about the robustness of the results. Finally, in each case we separate the part of the labor tax that is levied on workers from the part that is levied on employers. Accordingly, in this paper we consider six measures of effective labor tax rates: total tax rate, tax rate levied on workers, and tax rate levied on producers all three of which are under both narrow and broad definitions. It is assumed by construction, however, that the narrow and broad labor taxes levied on employers are the same.

3. Time Series Analysis: Preliminary Data Analysis and Estimation Results

All the results reported in this section consider the total effective labor tax under the narrow definition. The preliminary data analysis was also conducted for the remaining alternative definitions of labor tax rates. The results are similar to the ones reported here and are omitted for the sake of brevity.

3.1 Univariate and cointegration analysis

In order to decide on the order of integration of the variables we test the null hypothesis of a unit root on LGDP, LPCD, LUNR, and LTAX. The results of the Augmented Dickey-Fuller (ADF) t-test are reported in Table 1. The optimal lag structure was chosen using the BIC. A deterministic component was considered if statistically significant.

Table 1: Testing the Null Hypothesis of a Unit Root

Variable	Deterministic Components	Optimal Lag (BIC)	Test Statistic	Critical 5%	Value 1%
LGDP	Constant	0	-2,7167	-2,93	-3,58
LPCD	Constant & Trend	1	2,3764	-3,50	-4,15
LUNR	none	0	0,0066	-1,95	-2,62
LTAX *	none	0	-2,9388	-1,95	-2,62

Note: "*" cannot reject the null hypothesis with Phillips-Perron's z-test.

In all but one case, the value of the ADF t-test is greater than the 5% critical value. Therefore, the null hypothesis of a unit root cannot be rejected. In the case of LTAX, further experiments not reported in Table 1 suggest that the null hypothesis of a unit root cannot be rejected using the ADF t-test with any other specification of the deterministic component. Furthermore, the null of a unit root cannot be rejected, even at the 10% level, with the

Phillips-Perron's Z-test. We take all this evidence together as suggesting that stationarity in first differences is a good approximation for all the time series under consideration.

Although it is outside the immediate scope of this paper, it is worth mentioning that the evidence that the unemployment rate is I(1) is consistent with the full hysteresis (see, for example, Blanchard and Summers, 1986). This suggests that temporary shocks in the other variables, in this case effective labor taxes, have permanent effects on the unemployment rate.

In order to investigate the existence of cointegration among the different variables, LGDP, LPCD, LUNR, and LTAX, the ADF t-test was applied to the residuals from the regressions of each variable on the remaining variables for each sector. The results are shown in Table 2. Again, the optimal lag structure was chosen using the BIC and a deterministic component was considered if statistically significant. In addition, four cases were considered, the endogenous variable in the regression being the residuals of the variable indicated.

Table.2: Testing the Null Hypothesis of No Cointegration

Variable	Deterministic Components	Optimal Lag (BIC)	Test Statistic	Critical 5%	Value 1%
LGDP	Constant & Trend	1	-4,0200	-4,16	-4,65
LPCD	Constant & Trend	0	-3,3700	-4,16	-4,65
LUNR	Constant	0	-2,9612	-4,11	-4,73
LTAX	Constant	0	-3,2457	-4,11	-4,73

In all cases the value of the t-statistic is larger than the 5% critical value. This means that the null hypothesis of a unit root in the residuals cannot be rejected and the evidence is against the existence of co-integration among these variables.

3.2 VAR specification and estimates

Now that we have determined that all the variables have the same order of integration and there are no relations of cointegration, we can develop a multivariate stochastic model free of any cointegration constraints. Given the non-stationarity of the variables and following the standard procedure in the literature, all the estimates are in first differences of log-levels, i.e., in growth rates. These variables are denoted by, DLGDP, DLPCD, DLUNR, and DLTAX.

Table 3: Specification for the Vector Autogressions

Deterministic Components	Lags	AIC	BIC
None	1	-23,181	-22,434
Constant	1	-23,512	-22,898
Constant & Trend	1	-23,751	-23,271
None	2	-24,393	-22,884
Constant	2	-24,504	-23,193
Constant & Trend	2	-24,541	-23,309

The general specification of the VAR model for the different sectors is provided in Table 3. A second order specification with both constants and trends is suggested by both the BIC and the AIC criteria. Likelihood ratio tests on both the second order coefficients and the deterministic components confirm this choice. The VAR estimates are reported in Table 4. The matrix of contemporaneous correlations among the estimated residuals is given in Table 5.

Table 4: Estimates: The Vector Auto-Regressive Model

	DLGDP	DLPCD	DLUNR	DLTAX
Constant	0.067 (0.030)	-0.065 (0.036)	0.374 (0.203)	0.112 (0.073)
Trend	0.001 (.001)	0.001 (0.001)	-0.005 (0.005)	-0.003 (0.002)
DGDP-1	0.220 (0.217)	0.811 (0.265)	-5.575 (1.467)	-0.504 (0.527)
DLPCD-1	-0.392 (0.151)	0.971 (0.183)	1.666 (1.014)	0.292 (0.364)
DLUNR-1	0.009 (0.034)	0.090 (0.041)	-0.202 (0.229)	-0.242 (0.082)
DLTAX-1	0.032 (0.110)	-0.105 (0.133)	0.447 (0.738)	0.317 (0.265)
DLGDP-2	-0.044 (0.287)	0.137 (0.349)	0.182 (1.932)	-0.279 (0.695)
DLPCD-2	0.321 (0.160)	0.067 (0.194)	-2.053 (1.075)	-0.264 (0.386)
DLUNR-2	0.012 (0.034)	-0.071 (0.041)	0.148 (0.229)	0.005 (0.082)
DLTAX-2	-0.035 (0.087)	0.323 (0.106)	0.413 (0.587)	0.030 (0.211)
Rbar-square	.36	.84	.38	.23
D-W	1.86	1.98	2.17	1.96

Table 5: Estimates: Matrix of Contemporaneous Correlations among the VAR Residuals

	DLGDP	DLPCD	DLUNR	DLTAX
serror	0.0208	0.0254	0.1403	0.0504
DLGDP	1.0000			
DLPCD	-0.3479	1.0000		
DLUNR	-0.2530	-0.1557	1.0000	
DLTAX	-0.4189	-0.0672	0.6398	1.0000

4. Impulse-Response Analysis

4.1 Methodological considerations

The analysis of the effects of changes in effective labor taxes on economic performance is based on impulse response functions associated with the estimated VAR system. The impulse response function is designed to identify the effects of an unanticipated 1% temporary increase in the growth in one variable in the system on the growth of the other variables in the system. We will focus on the long-term accumulated elasticities of output, inflation, and the unemployment rate with respect to the effective tax rate. The long-term elasticity is obtained by allowing all the variables to respond over time to the shock to the effective labor tax rate in the first step. It measures the long-term accumulative effects of changes in the effective labor tax rate on the growth of output (and the other variables) at the last step. Because of the dynamic interactions among the variables, the short-term effects of changes in the effective labor tax rate growth on the growth of output (or the other variables) can be enhanced or dampened in the long term.

It is well known that the results of impulse response analysis depend on the specific ordering of the variables under investigation. Since the estimated matrix of contemporaneous variances and covariances among the estimated residuals is not diagonal, orthogonalization is necessary before we can conduct a meaningful impulse response analysis. The orthogonalization strategy, however, is not unique. We confine our discussion of orthogonalization strategies to the use of triangular matrices under the Choleski decomposition method. This method uses all the information in the matrix of contemporaneous correlation among the estimated residuals. In our case, there are five sets of possible scenarios depending upon whether changes in the effective labor tax rate growth is ranked first, second, third, or fourth. These four sets of scenarios completely determine the range of results in the impulse response analysis.

Among the four possible sets of scenarios, one seems to be the most plausible *a priori*. Our analysis in the central scenario will focus on the case in which changes in the effective labor tax rate growth is ranked first. Here shocks to changes in the effective labor tax rate affect the other variables contemporaneously, but shocks from the other variables have no contemporaneous effect on changes in the effective labor tax rate growth. The choice of this case is based on the view that the effective labor tax rate growth is a variable which can be, to a large extent, determined independently by the federal government in the very short term, i.e., within a one year period. Since our central scenario is based on orthogonalizations in which innovations in the effective labor tax rate are ranked first for each variable there is a single estimated elasticity with respect to changes in the effective labor tax rate regardless of the order of the remaining variables.

To establish the robustness of the results from this central case, we computed the values of the impulse response functions under all of the alternative orthogonalization

strategies referred to above. Specifically, there are a total of four factorial (twenty four) possible orthogonalizations for our four variable VAR system. The sensitivity analysis considering the whole range of results across all possible orthogonalizations for the long-term elasticities establishes that the qualitative nature of the results to be discussed below is very robust. For the sake of brevity only the results under the second most plausible scenario are reported. This scenario is the one where shocks in the effective labor tax rates are ranked last; that is, the effective labor tax is affected by all the other variables contemporaneously without affecting any of them. This is the opposite of the central scenario we elected as the most plausible.

4.2 On the estimated impulse response functions

Figures 1-4 show the impulse responses in our central scenario to a one time increase in the effective labor tax rate growth of one percent. As Figures 1-4 illustrate, all of the impulse response functions display a very smooth evolution. To obtain long-term elasticities we set the maximum number of steps for the impulse response analysis at fifty. Although we carry out the simulations for fifty periods, convergence is achieved in each case after a period of approximately ten years.

In turn, Figure 5 gives the accumulated impulse responses to the shock in the effective labor tax rate. The accumulated impulse response functions show the effects of the shock to the effective labor tax rate on the levels of the other variables as opposed to the growth rates which are displayed in Figures 1-4.

It should be pointed out that, as Figure 5 shows, a one-time innovation of one percentage point in the policy rule for changes in the effective labor tax rate induces a total accumulated change in the effective labor tax rate of 0.78 percentage points. The fact that a one-time shock in changes in the effective labor tax rate induces an accumulated long-term effect in the effective labor tax rate itself, which differs from original shock, is a direct consequence of the fact that the effective tax rates are not considered exogenous. In fact, changes in the evolution of the effective labor tax rate affect the other variables, and changes in the other variables, in turn, feed back into the evolution of the effective labor tax rate.

Figure 1: IRF of DLGDP wrt DLTAX

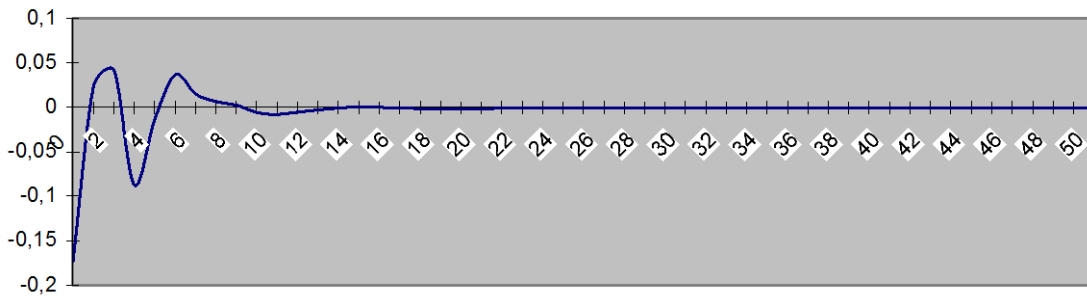


Figure 2: IRF of DLPCD wrt DLTAX

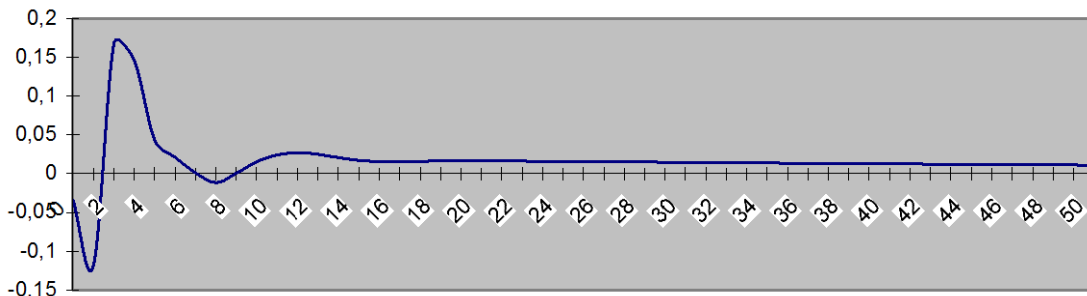


Figure 3: IRF of DLUNR wrt DLTAX

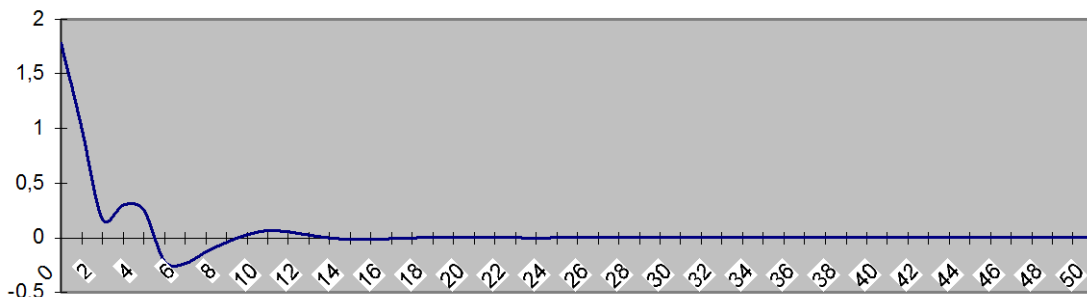
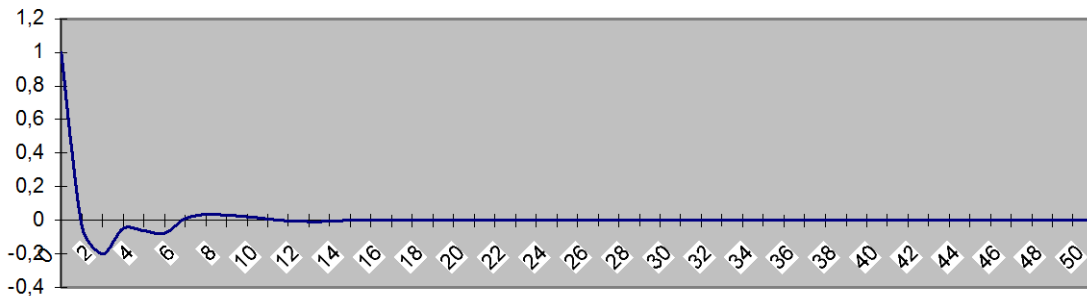
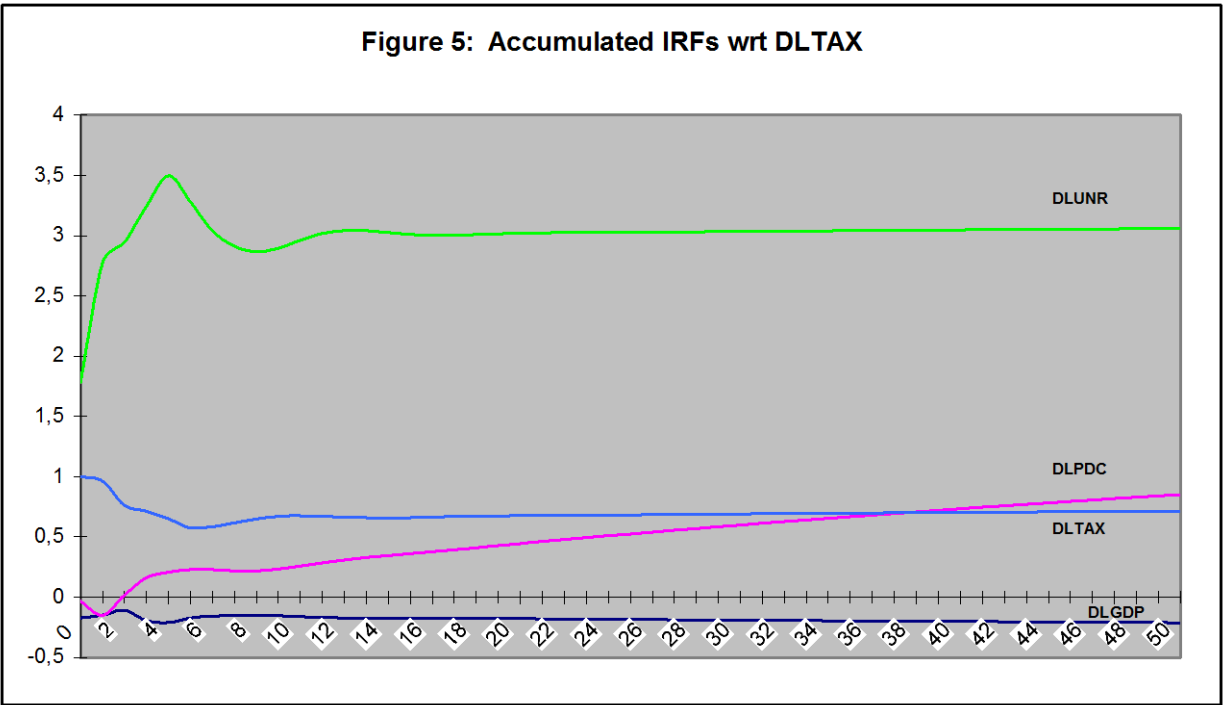


Figure 4: IRF of DLTAX wrt DLTAX





This fact has important implications for the interpretation of the effects of shocks in the effective labor tax rate on the other variables. Whatever the accumulated long-term effects on the other variables may be, they are the result not just of the initial one percentage point shock in the effective labor tax rate but rather of the total change in the effective labor tax rate induced by both the initial shock and the dynamic feedbacks. In the discussion below we refer to the effects on the other variables per unit of accumulated long-term change in the effective labor tax rate as long-term accumulated elasticities.

It should be stressed that although the term elasticity is used, the term is not the same as the conventional concept of elasticity. The traditional concept is static and is obtained holding the other variables constant. In our case we allow the other variables to adjust through time. Hence, our method takes the dynamic feedback among all the variables into consideration. These long term accumulated effects, these elasticities, provide the relevant figures from a policy perspective.

5. Labor Taxes and Economic Performance

The discussion in this section is based on the results reported on Table 6, i.e., the long term accumulated elasticities of GDP, PCD, and UNR, with respect to TAX, total tax on labor under the narrow definition, as well as on the variance decomposition analysis as reported on Table 7.

Table 6: Long-term accumulated effects of a one percentage point decrease in labor taxes

Variable	Elasticities	Marginal Products
GDP	0.337	\$0.337 increase in GDP per \$1 reduction in labor taxes
PCD	-1.889	reduction of cost of living from 100.0 to 98.1 with a 1 percentage point decrease in labor taxes
UNR	-4.035	reduction in the unemployment rate from 7.3% to 7.01% with a 1 percentage point reduction in labor taxes

Table 7: Variance Decomposition: % of the changes in the variables due to changes in Labor Taxes

Variable	t=0	t=5	t=10	t=20	t=50
DLGDP	17.5	14.9	15.1	14.8	14.8
DLPCD	0.5	6.7	4.3	2.8	2.8
DLUNR	40.9	25.9	26.0	26.0	26.0
DLTAX	100.0	64.8	64.1	63.8	63.8

5.1 Economic effects of labor taxes: labor taxes and unemployment

Our results confirm our conjectures on the negative effects of labor taxes in the labor market. Indeed, the impulse response function analysis suggests that a decrease in the effective labor tax rate would lead to decreases in the unemployment rate. The long-term responsiveness of unemployment rate is 4.035. These numbers mean that a one percentage point decrease in the effective tax rate would lead to a decrease in the unemployment rate of .29 percentage point. Using current figures the unemployment rate would decrease from 7.3% to 7.01%.

5.2 Economic effects of labor taxes: labor taxes and inflation

Our results also confirm the conventional wisdom on the effects of changes in the effective labor tax rate on inflation. Indeed, the long-term accumulated responsiveness of the private consumption deflator to changes in the effective labor tax rate is -1.889. This figure means that a decrease in one percentage point in the effective labor tax rate would decrease the private consumption deflator inflation from say 100.0 to 98. It should be noted that while the change in the effective tax rate does not have long-term effects in the rate of change on the private consumption deflator, i.e., on the inflation rate, it does have positive short-term effects which translate into long-term gains in the level of this index of cost of living.

5.3 Economic effects of labor taxes: labor taxes and GDP

In the long term, the elasticity of the GDP with respect to changes in the effective labor tax rate is 0.337. This means that a \$1 permanent decrease in the tax payments would increase GDP in the long term by an accumulated total of \$0.337. This increase in the GDP can be understood as a direct result of the positive effect of reducing the labor tax rate on unemployment as well as the benefits from increased saving out of higher after-tax discretionary income.

5.4 Variance Decomposition: how much do changes in labor taxes explain?

The results of the forecast variance decomposition are reported in Table 7. These figures tell us how much of the variability of each variable is explained by shocks in the effective labor tax rate at all horizons. We find that the variability of the effective labor tax rate is explained mostly by its own shocks. In addition, approximately 26% of the variation in the unemployment rate and 15% of the variation in the GDP are explained by shocks in the effective labor tax rate. Finally, shocks in the effective labor tax rate explain a mere 2.8% of the variation of the private consumption deflator in the long term, which is consistent with the idea that inflation in the long term is essentially a monetary phenomenon.

The intertemporal evolution of the variance decomposition is interesting in itself. It suggests that changes in the effective labor tax rate have a greater power explaining the variation of all the other variables in the short term. That is, the short-term effects greatly overshoot the long-term steady state effects.

6. Labor Taxes and Economic Performance: A further look

In the previous section we considered the effects of labor taxes in the economy when taxes levied on both employers and workers were considered together under a narrow definition of labor taxes. We consider now the results of similar exercises using other definitions of the labor tax rate.

6.1 On the differential effects of labor taxes levied upon workers and employers

We first consider the effects of labor taxes levied on workers and levied on employers under a narrow definition, that is, we are now considering two sets of exercises in which the labor tax rates, if combined, would add up to the tax rate used in section 5. The results are reported in Table 8, which includes also the central case elasticities from the previous section.

Table 8: Long-term accumulated effects of a one percentage point decrease in labor taxes: total and by legal incidence

Variable	Elasticities wrt		
	total labor taxes	labor taxes levied on employers	labor taxes levied on workers
GDP	0.337	0.344	0.317
PCD	-1.889	-2.222	-3.826
UNR	-4.035	-3.426	-1.610

The long-term elasticities estimated from the long-term accumulated impulse response functions using the two disaggregated tax rate variables completely confirm the general direction of results that we discussed previously. In both cases the effects of reducing labor taxes would reduce the unemployment rate and the private consumption deflator. A reduction in the labor taxes levied on workers, however, would lead to more substantial gains in terms of the private consumption deflator - in fact 75% greater than a reduction in the labor tax levied on employers. A reduction in the taxes levied upon employers would lead, in turn, to a much greater benefit in terms of reducing unemployment than an equivalent reduction in the labor tax levied upon workers. In fact, it would double the gain from a one percentage point reduction in the labor tax. Finally, in both cases a reduction in labor taxes would increase the GDP in the long term. The effects of reducing the labor taxes on employers have marginally better results reflecting greater gains in terms of unemployment.

These results have clear policy implications. The unemployment rate could be substantially improved and the GDP marginally improved by a simultaneous reduction in the labor tax levied on employers and a corresponding increase in the taxes levied on workers. Aside from the potential negative social and political aspects of this strategy, it may also be unwise since it would lead to an increase, albeit temporary, in the inflation rate. Accordingly, the most desirable alternative would be to simply reduce one or both of these two labor taxes and finance this reduction with reduced public spending.

6.2 On the effects of labor taxes under a broad definition of these taxes

Until now we have considered a narrow definition of labor taxes which has the advantage of considering only labor taxes with the disadvantage of not considering all the labor taxes. We now consider a broad definition in which all the labor taxes are included. Nevertheless, this definition is contaminated in the sense that some taxes on other sources of income are also considered. We perform the same experiments as reported above for the narrow definition for the total tax, tax on workers, and tax on employers. The results of these experiments are reported in Table 9.

Table 9: Long-term accumulated effects of a one percentage point decrease in labor taxes using a broad definition of labor taxes

Variable	Elasticities wrt		
	total labor taxes	labor taxes levied on employers	labor taxes levied on workers
GDP	0.467	0.344	0.301
PCD	-4.438	-2.222	-4.899
UNR	-3.369	-3.426	-0.070

The general nature of the results is the same as with the narrow definition. First, reducing the labor tax rates has the long-run effects of decreasing unemployment and the private consumption deflator, while increasing GDP. Second, the specialization, as it were, of the effects of the two labor taxes is also present. The labor taxes levied on workers tend to have a greater effect on the private consumption deflator while the taxes levied on employers tend to have a greater effect on unemployment. The only difference now is that this specialization is much more pronounced. The effects on the private consumption deflator are more than doubled with the labor taxes levied on workers, which, however, have an essentially zero long-term effect on unemployment.

Again the policy implications of these results are very important. Recall that the broad definition of the labor tax levied on workers is contaminated in that it includes taxes on other sources of income. It is, in a way, a broader based tax than a labor tax. What we observe is that with this broader base labor tax the effects on unemployment are very small and certainly much smaller than the effects under a narrow definition of labor taxes on workers or employers. This finding suggests that replacing the labor tax, preferably the one levied on employers, but also the

one levied on workers, with a broader based tax would clearly improve the unemployment rate. Thus, the recent move to finance social security with a 1% transfer from the general VAT seems to be a wise policy. Again, the downside of moving from labor taxes to broader based taxes resides in the inflationary effects of such a move: the increase in a broader base tax would lead to a temporary increase in inflation by more than the offsetting decrease in labor taxes.

6.3 Sensitivity analysis

To establish the robustness of our results we now consider the long-term elasticities that are obtained under the opposite orthogonalizing assumption. While in the previous discussion we assumed that innovations in the labor tax rate affect all the other variables contemporaneously without being affected by them, here we assume that the labor tax rate is affected by all other variables without affecting any of them. The long-term elasticities for all tax variables are reported in Table 10.

Table 10: Long-term accumulated effects of a one percentage point decrease in labor taxes under an alternative orthogonalization assumption

Variable	Elasticities wrt		
	total labor taxes	labor taxes levied on employers	labor taxes levied on workers
Under a narrow definition of labor taxes			
GDP	0.470	0.355	0.433
PCD	-5.709	-3.321	-6.281
UNR	-1.127	-1.293	-0.358
Under a broad definition of labor taxes			
GDP	0.198	0.355	0.164
PCD	-3.036	-3.321	-3.838
UNR	-0.917	-1.293	-0.012

These results confirm both the sign and the general magnitude of the effects as uncovered previously. They also confirm the specialization pattern of the effects of labor taxes levied on workers and employers. The results, however, tend to be larger in terms of the effects on the private consumption deflator and somewhat smaller in terms of effects of unemployment and the GDP: Furthermore, they suggest that a change from labor taxes to broader-based taxation may be beneficial not only in terms of reducing unemployment but also of reducing inflation in the short term.

7. Summary and Policy Implications

This paper analyzes the effects of changes in the effective labor tax rates on economic performance in Portugal. The empirical results are based on VAR estimates using output, the inflation rate, the unemployment rate, as well as different effective labor tax rate variables. This approach follows the conceptual argument that the analysis of the effects of changes in the effective labor tax rate requires the consideration of dynamic feedbacks effects among the different variables.

The impulse response function results indicate that a decrease in the effective labor tax rate, under any definition, would positively affect the performance of the Portuguese economy in the long term. In fact, a decrease in the effective labor tax rate would decrease both the private consumption deflator and the unemployment rate and it would increase the GDP. Furthermore, improvements in the unemployment rate are more substantial with a reduction of the labor taxes levied on employers, while greater reduction in the private consumption deflator would be achieved with a reduction in the labor taxes levied on workers.

These results also motivate the question of whether or not a reduction in the effective labor taxes would be a desirable policy change. Clearly, a pure reduction in labor taxes is not politically feasible because of its budgetary implications. Accordingly, a reduction in labor taxes would have to be matched either by a reduction in spending or by an increase in other taxes, namely indirect taxes, like the VAT.

Our results suggest that a simultaneous reduction of the labor taxes on employers together with an offsetting increase of the labor tax on workers would improve the unemployment situation, but would also increase short-term inflationary pressure. Moreover, our results suggest that replacing labor taxes, both those levied on employers and on workers, with broader-based taxes would still further improve the unemployment situation. There is a question in this case, however, of whether or not such change would generate negative effects on inflation in the short term.

It would be particularly interesting to consider the possibility of reducing the labor taxes at the cost of increasing other taxes, say the VAT. This is, in fact, a policy experiment that is already in place albeit in an embryonic form. Indeed, part of the social security spending is

financed by a 1% VAT surcharge and part of its deficit is being financed by funds from the general budget which come, in good part, from indirect taxes, in particular the VAT. Assuming that inflation is under control or that the effects on inflation from such a change are small, our results hint at the possibility that this is a very desirable alternative because of its positive effects on unemployment.

Now, is the replacement of the labor tax revenues with VAT tax revenues a desirable policy change in general? Clearly, we do not provide enough empirical evidence in this paper on this issue, and one would be wise to be rather careful with such a change. First, the VAT itself is not neutral in terms of its inefficiencies. In fact, given the already relatively high VAT tax rates, any further increases have the potential for being highly distortionary. Second, the reliance on indirect taxation always generates concerns of political transparency.

From this discussion it is clear that a reduction in labor taxes financed by a reduction in general spending remains as interesting alternative. To understand the desirability of such changes, however, one would have to realize that labor taxes, at least in their narrow definition, are earmarked social security taxes. Accordingly, in the case of a reduction in labor taxes matched by reduced spending, a reduction in the social security benefits would be necessary. Again, but for very different reasons, this seem to be an alternative which is not politically viable.

A possible policy alternative, although not politically easy, could provide the best results. A redesign of the social security system into a capitalization or fully-funded regime would transform labor taxes, at least in their narrow definition, into genuine savings and would avoid, or at least minimize, the labor market distortions and the negative effects on inflation and on the GDP.

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