Ambiguous Effects of Tax Progressivity - Theory and Danish Evidence*

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Abstract

Recent tax reforms in the OECD area have aimed at reducing the progressivity of labour income taxation by reducing marginal taxes for given average taxes. Theory has shown that this reduces employment/production when workers and firms determine wages through bargaining. This paper shows that an opposite effect arises when both wages and working hours are subject to bargaining. This may reverse the traditional result and this is especially likely if the bargaining power of workers is low and if labour supply is relatively elastic. In conclusion, the overall effect of a reduction in progressivity is ambiguous. The empirical estimates for Denmark indicate that the overall effect is negative for blue collar workers and neutral for white collar workers.

Keywords: Tax Progression, Wage Bargaining, Endogenous Working Time.

JEL Classification Numbers: H24, J42, J51.

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1 Introduction

Recent tax reforms in most OECD countries have reduced the progressivity of income taxation by lowering marginal tax rates for given average tax rates. The tax reforms are typically motivated by a desire to increase incentives to work and thereby expand activity in the economy. This view is supported by models with perfect competition in the labour market: A decrease in the marginal tax rate leads to a substitution effect towards higher labour supply, and as the average tax is fixed no income effect is present, and so the effect on activity is positive. We will name this effect the "labour supply effect".

More recent papers have challenged this view by arguing that the assumption of a perfectly competitive labour market is a bad description of most real world labour markets facing unemployment and therefore also misleading for our understanding of how the structure of the tax system influences the labour market. In fact, the opposite conclusion is obtained when introducing imperfect competition in the labour market, see Hersoug (1984), Malcomson and Sartor (1987), Lockwood and Manning (1993), and Koskela and Vilmunen (1996). These papers consider unionised labour markets where wages are set by unions or negotiated between firms and unions for an exogenously given length of the working day. In this case a union faces a trade off between employment and higher after tax wages for the employed. A decrease in the marginal tax rate of the employed workers implies that they keep a large fraction of a wage rise for themselves. This increases the incentives of unions to claim higher wages which reduce activity. We will name this effect the "union effect".[1]

One may argue that the two types of results presented above represent polar cases in the sense that the competitive labour market result is a consequence of a pure labour supply effect whereas the imperfectly competitive result is a consequence of no labour supply effect due to the assumption of

[1] This terminology is somewhat misleading as the effect is not specific to a unionized labour market. The same effect is found in an efficiency wage setting, see Hoel (1990), and in search models, see Pissarides (1983).

an exogenous length of the working day. Therefore, it seems interesting to analyse the case of an imperfectly competitive labour market with an endogenous length of the working day. We do this by assuming that firms and unions negotiate both wages and number of working hours per worker as is done in many countries, e.g. Denmark.

The result is that the effect of a decrease in the marginal tax rate becomes indeterminate since both a labour supply and a union effect appear. The sign of the overall effect depends on the bargaining power of the union, the wage elasticity of labour supply, and the progressivity of the tax system. If the initial tax system is very progressive it is less likely that the union effect dominates. On the other hand, if the union has a high bargaining power and the elasticity of labour supply is small then it is more likely that the union effect dominates. The pure union effect found in the aforementioned papers is reproduced in the special case of a perfectly inelastic labour supply.

The theoretical ambiguous effects of changes in tax progressivity motivate empirical investigation. Therefore, an empirical wage equation is derived from the model and estimated on Danish data for both blue collar workers and white collar workers. The estimations indicate that a reduction in progressivity for blue collar workers increases real wages and reduces activity, i.e. the union effect dominates, whereas the estimate for white collar workers is insignificant maybe reflecting that the union effect and the labour supply effect cancel out.

The remainder of the paper is organised as follows. The next section derives the theoretical consequences of changing tax progressivity and the wage equation used for the estimation. Section 3 estimates the wage equation on both blue collar workers and white collar workers and discusses the implications. Section 4 contains concluding remarks.

2 Theory

For simplicity, we derive the basic theoretical results and the empirical wage equations from a simple partial model.[2] Consider a trade union organising all workers in a firm/industry. There are m members of the trade union and each member, i, has the indirect utility function

$$V\left(I_i, p, l_i\right) = \frac{I_i}{p} - \frac{\gamma}{\gamma+1} l_i^{\frac{\gamma+1}{\gamma}}, \quad \gamma > 0,$$

where the first term is utility of income and the last term disutility of working, as I_i is nominal income, p is the consumer price index, and l_i is the working time. The parameter γ influences the marginal disutility of working and in this formulation γ equals the labour supply elasticity with respect to the hourly wage. The net-income of an unemployed worker is given by an exogenous benefit level, b, whereas the net income of an employed worker is given by $wl - t\left(wl\right)$, where $t\left(\cdot\right)$ is an increasing tax function.

The quasi-linearity of the utility function simplifies the algebra by excluding income effects in the labour supply. Note though that this absence of income effects is not crucial for comparative static results involving changes in the marginal tax for a given average tax since such changes leave net income unchanged initially, making any possible income effects of second order (see also the discussion in Lockwood and Manning, 1993).

The objective of the trade union is to maximise the expected utility of a representative member given by

$$U\left(w, p, l, b, u\right) \equiv \frac{n}{m} V\left(wl - t\left(wl\right), p, l\right) + \frac{m-n}{m} \bar{U}\left(b, p, u\right),$$

where n is the number of employed member and $\bar{U}\left(b, p, u\right)$ is the expected utility of an unemployed member given by

$$\bar{U}\left(b, p, u\right) \equiv v\left(u\right) V\left(b, p, 0\right) + \left(1 - v\left(u\right)\right) V\left(\bar{I}, p, \bar{l}\right), \quad v'\left(u\right) > 0.$$

This reflects that union members that are not employed in the industry receive a weighted average of the utility of being on unemployment benefits,

[2] It is though possible to derive it all from a full macro general equilibrium framework (see Hansen *et.al.* 1995).

b, or working in other parts of the economy at working hours $\bar{l}$ and giving the income level $\bar{I}$ both beyond influence of the union and the firm. The weights depend on the (exogenous) overall unemployment in the economy, u, reflecting that it is harder to get jobs outside the particular firm if the aggregate unemployment is large.[3] Assuming that $V\left(\bar{I}, p, \bar{l}\right) > V\left(b, p, 0\right)$ then implies that the opportunity costs on employment decrease when the aggregate unemployment in the economy increases.

The firm has the production possibilities

$$y \leq f\left(L\right) \equiv zL^{\alpha}, \quad L = nl, \quad 0 < \alpha \leq 1, \tag{1}$$

where z is a productivity parameter, L is aggregate labour input equal to the number of employed persons, n, times the number of working hours per employed, l. In this formulation, it is implicitly assumed that employed persons and working hours are perfect substitutes implying that the firm is indifferent between whether a given increase in employment occurs through an increase in persons employed or through an increase in working hours of those already employed in the firm. This assumption simplifies the algebra substantially but is not crucial to the results.[4]

Let the demand for the output of the firm be given by

$$y = \left(q/p\right)^{-\varepsilon}, \quad \varepsilon > 1, \tag{2}$$

where q is the price of the good and ε is the demand elasticity. Equations (1) and (2) yield the following real profits of the firm

$$\pi\left(w, q, p, L\right) \equiv \frac{q}{p}y - \frac{w}{p}L = \left(zL^{\alpha}\right)^{1-1/\varepsilon} - \frac{w}{p}L. \tag{3}$$

Maximising profits yields the first order condition

$$\alpha\left(1 - 1/\varepsilon\right) zL^{\alpha-1} = \frac{w}{q}, \tag{4}$$

[3] A more micro founded modelling of this relationship is found in Layard, Nickell & Jackman (1991).

[4] E.g., in the special case of a monopoly union model ($\lambda = 1$) it is relative simple to show that Proposition 1 is unchanged if the hourly wage (the inverse labour demand) responds differently to changes in hours and number of workers whereas the inequality in Proposition 2 is more (less) likely to be fulfilled if the hourly wage is more (less) responsive to changes in persons than to changes in hours.

determining the firm's demand for labour (measured in hours) as a function of the hourly product wage rate.

The hourly wage and working time of the workers are determined in a bargain between the union and the firm whereas the firm alone determine the number of workers to hire afterwards (i.e., the right-to-manage assumption). We assume that the bargaining outcome is characterised by the asymmetric Nash-bargaining solution, see Binmore *et.al.* (1986), giving

$$\max_{w,l} \Omega = \left(U\left(w,p,l,b,u\right) - \bar{U}\left(b,p,u\right)\right)^{\lambda} \left(\pi\left(w,q,p,L\right) - 0\right)^{1-\lambda}, \qquad (5)$$

where λ is the relative bargaining strength of the union and where the disagreement point is set equal to $\left\{\bar{U}\left(b,p,u\right),0\right\}$. Maximising (5) subject to the labour demand equation (4) yields the following first order conditions:

$$l^{*} = \left(\frac{\left(\gamma+1\right)\bar{U}\left(b,q,u\right)/\omega}{\left(\gamma+1\right)\left(\frac{1-t_a}{1-t_m}-1\right)\left(1+\lambda\mu\right)+1}\right)^{\frac{\gamma}{\gamma+1}}, \qquad (6)$$

$$\frac{w^{*}}{q} = \frac{1+\lambda\mu}{1-t_m}\left(\frac{\left(\gamma+1\right)\bar{U}\left(b,q,u\right)}{\left(\gamma+1\right)\left(\frac{1-t_a}{1-t_m}-1\right)\left(1+\lambda\mu\right)+1}\right)^{\frac{1}{\gamma+1}} \omega^{\frac{\gamma}{\gamma+1}}, \qquad (7)$$

where $t_a \equiv \frac{t(w^{*}\ell^{*})}{w^{*}\ell^{*}}$ is the average tax rate, $t_m \equiv t'\left(w^{*}\ell^{*}\right)$ is the marginal tax rate, $\mu \equiv \frac{\varepsilon-\alpha(\varepsilon-1)}{\alpha(\varepsilon-1)}$ is a measure of the steepness of the labour demand curve where zero corresponds to a horizontal curve and infinity to a unit elastic curve, and $\omega \equiv p/q$ is the so-called wedge between the real product wage and the real consumption wage which may change due to terms-of-trade shocks, changes in the indirect taxation, or shifts in preferences, which change the sectoral composition of aggregate demand. In the following, we assume that m is sufficiently large such that an equilibrium involves unemployment and is characterized by the two above equations.

Observe from (6) and (7) that if the union has zero bargaining power, $\lambda = 0$, then the marginal after tax real consumption wage is equal to the marginal disutility of working the optimal number of working hours, $\left(1-t_m\right)\frac{w^{*}}{q\omega} = \left(l^{*}\right)^{\frac{1}{\gamma}}$. If the union has a positive bargaining power then the wage is set such that the marginal benefit from employment exceeds the marginal disutility of

working the optimal number of working hours. Thus, for all positive values of λ any unemployment is involuntary in the sense that all unemployed members would prefer to work the optimal number of hours at the existing wage.

2.1 Changes in the Marginal or Average Tax Rate

The consequences of a change in the average tax rate are

Proposition 1 *A reduction in the average tax rate, t_a, for a given marginal tax rate, t_m, reduces wages and increases aggregate employment, L, and production, y.*

Proof. Equation (7) yields the elasticity

$$\zeta_{1-t_a} = \frac{\partial\left(\frac{w}{q}\right)}{\partial\left(1-t_a\right)}\frac{\left(1-t_a\right)}{\left(\frac{w}{q}\right)} = -\frac{\left(1+\lambda\mu\right)\frac{1-t_a}{1-t_m}}{1+\left(\frac{1-t_a}{1-t_m}-1\right)\left(\gamma+1\right)\left(1+\lambda\mu\right)} < 0,$$

implying that $\partial\left(w/q\right)/\partial t_a > 0$. The impact on L and y follows directly from (1) and (4). ■

A decrease in the average tax rate reduces the product wage. This effect is due to the non-competitiveness of the labour market. There would be no effect present if the labour market had been competitive, since no income effect is present in the labour supply in the present model. The effect appears here, because the (opportunity) costs of being employed depend upon the benefits per hour net of tax adjusted to the allowed tax deduction in labour income for employed workers. Observe that even if the bargaining power of the union converges to zero the result remains different from the competitive case. This is due to decomposition of the bargaining problem, where the union sets the optimal number of working hours no matter how small its bargaining power is.

The consequences of a change in the marginal tax rate are

Proposition 2 *A reduction in the marginal tax rate, t_m, for a given average tax rate, t_a, increases wages and reduces aggregate employment, L, and production, y, if $\frac{\lambda\mu}{(1+\lambda\mu)\gamma} > \frac{1-t_a}{1-t_m} - 1$.*

Proof. Equation (7) yields the elasticity

$$\zeta_{1-t_m} \equiv \frac{\partial\left(\frac{w}{q}\right)}{\partial\left(1-t_m\right)}\frac{\left(1-t_m\right)}{\left(\frac{w}{q}\right)} = \frac{\lambda\mu - \left(\frac{1-t_a}{1-t_m}-1\right)\gamma\left(1+\lambda\mu\right)}{1+\left(\frac{1-t_a}{1-t_m}-1\right)\left(\gamma+1\right)\left(1+\lambda\mu\right)} \begin{matrix} > \\ = \\ < \end{matrix} 0,$$

implying that $\partial\left(w/q\right)/\partial t_m < 0$ if $\zeta_{1-t_m} > 0 \Leftrightarrow \frac{\lambda\mu}{(1+\lambda\mu)\gamma} > \frac{1-t_a}{1-t_m} - 1$. The impact on L and y follows directly from (1) and (4). ■

The partial effect of a decrease in the marginal tax rate for a given level of the average tax rate may be both positive or negative. This is in contrast to the results of e.g. Lockwood and Manning (1993), who show under quite general conditions that if the wage is given by an interior solution to the Nash-bargaining problem of the right-to-manage type then a decrease in the marginal tax rate increases the wage. The feature that distinguishes our result from the previous ones is that the number of working hours is endogenous. This feature re-introduces a variant of the labour supply effect known from the competitive models of the labour market. Now, the wage is decreasing in the marginal tax rate if and only if $\frac{\lambda\mu}{(1+\lambda\mu)\gamma} > \frac{1-t_a}{1-t_m} - 1$. For a progressive tax system the left hand side of this inequality is positive. γ approaching 0 implies that the individual labour supply becomes perfectly inelastic giving the pure union effect obtained by the papers mentioned in the introduction. However, if the labour supply is sufficiently elastic then the labour supply effect may dominate and the result becomes a variant of the competitive case, where a reduction in the marginal tax rate reduces the real product wage. The likelihood for this to happen is large when the bargaining power of the union is low (λ small) or when μ is low implying that a wage rise claimed by the union has a large adverse effect on employment.

2.2 Empirical Wage Equations

The theoretical ambiguous effects of changing tax progressivity motivate empirical investigation. To test how the tax system influence the wage level the wage equation (7) is log linearised giving a structural equation for the real

product wage as a function of the exogenous variables. This yields

$$\begin{aligned}\log(w/q) &= \zeta_c + \underset{(?)}{\zeta_{1-t_m}} \log(1-t_m) + \underset{(-)}{\zeta_{1-t_a}} \log(1-t_a) + \underset{(+)}{\zeta_{\omega}} \log\omega \\ &\quad + \underset{(+)}{\zeta_{b/q}} \log(b/q) + \underset{(-)}{\zeta_u} \log u + \varepsilon, \end{aligned} \tag{8}$$

where ε is an error term and ζ_c the intercept. The signs below the parameters are the expected signs from the theoretical model. The parameters ζ_{1-t_m} and ζ_{1-t_a} have been discussed. The parameter ζ_u is expected to be negative as an increase in total unemployment reduces the expected utility of unemployed which reduces the wage claims of the union. The parameter ζ_ω is expected to be positive as an increase in the wedge increases wage pressure. Increases in unemployment benefits increase the opportunity costs of the union and so $\zeta_{b/q}$ should be positive. Furthermore, both ζ_ω and $\zeta_{b/q}$ are expected to be between zero and one where the latter corresponds to a completely inelastic labour supply. Note, that productivity, z, does not enter the wage equation which arises because the wage is determined in a bargaining between workers and firms.[5] The real wage will though depend indirectly on productivity in the model as an increase in productivity reduces unemployment which increases wage pressure. There may also be an indirect effect through unemployment benefits if they are raised when GNP increases. However, productivity should not in itself enter as an explanatory variable.

3 Evidence

The approach of the empirical analysis follows previous studies by estimating (8) using time-series data on wages for two types of workers; blue collar workers and white collar workers. For example, Holmlund and Kolm (1995) estimate a similar wage equation for different groups in the Swedish labour market and Lockwood and Manning (1993) use the same approach on data for male manual workers in the United Kingdom.

[5] The wage would of course be rising in productivity if labour demand became more elastic when productivity increased.

3.1 Data Description

The wage equation (8) is estimated for blue collar workers and white collar workers on Danish data from 1970 till 1992. The starting year is the first year with a tax system based on present (as opposed to past) income. Data for nominal wages are from the statistics of the Confederation of Danish Employers Associations. The category "blue collar workers" is defined as "unskilled workers", whereas the category "white collar workers" is defined as the upper quartile of the wage distribution for white collar workers.

For each year the Danish tax system is modelled and marginal and average taxes are calculated for the two annual wages. Local tax rates are set to the average value. Taxes are based on wage income; capital income and thus capital income taxes are ignored. The tax system allows deduction of union membership fees and fees to the unemployment benefit system. These fees are set to the levels paid by members of the union organising office clerks and shop assistants (in Danish called HK). The wages after tax measured per hour are constructed by dividing by the negotiated number of hours.

In this period in Denmark unemployment benefits were equal to 90% of the workers previous wage level but no more than a maximum daily benefit level. This implies that the level of unemployment benefits in the model, b, is set equal to the annual value of the maximum daily benefit level, as this is below 90% of both wage series in the entire period. The tax on unemployment benefits is calculated along the same lines as the tax of wage income. Unemployment is defined as the number of unemployed as a percentage of the total labour supply and we follow Holmlund and Kolm (1995) by using lagged unemployment in the regression. The domestic price, q, is the producer price index of the manufacturing sector, while the wedge, ω, is calculated by dividing the consumer price index, p, with the producer price index of the manufacturing sector.

3.2 Regression Results

The estimation procedure used is Instrument Variable estimation since average and marginal tax rates are endogenous variables; that is, they are calculated from the annual wage on the left hand side of the estimated equation. Instruments are: The lagged value of the endogenous variables, the rest of the right hand side variables and trend and quadratic trend. The results of the estimations when all right hand side variables are included are given in Table 1 whereas Table 2 contains variables that enter significantly after elimination of insignificant variables one by one (at the usual 5% level). We also provide some diagnostic tests which provide no evidence of misspecification.

Table 1: Estimation using all right hand side variables

	Blue collar workers	White collar workers
constant	-0.56 (0.42)	-3.06 (2.00)
$\log(u(-1))$	-0.01 (0.40)	-0.16 (5.35)
$\log(1-t_m)$	1.34 (1.90)	-0.22 (0.65)
$\log(1-t_a)$	-3.41 (4.68)	-2.20 (3.04)
$\log(\omega)$	0.63 (1.54)	0.40 (0.36)
$\log(b/q)$	1.17 (4.14)	0.39 (4.18)
Specification	6.84 (0.08)	5.09 (0.17)
R^2	0.97	0.97
DW	1.81	2.00
Std. Err.	0.0307	0.0315
AR(1)	0.06 (0.81)	0.00 (0.95)
AR(2)	0.24 (0.89)	0.05 (0.98)
Normality	1.97 (0.37)	3.55 (0.17)
ARCH 1	0.06 (0.81)	0.51 (0.49)

Note: Parentheses after estimated parameters are t-values. AR(1) and AR(2) are χ^2-tests for autocorrelated residuals. Normality is a $\chi^2(2)$-test for normally distributed residuals, and ARCH is a F-test for autoregressive conditional heteroscedasticity. Specification test is a standard Sargan χ^2-test for validity of instruments. Parentheses after dianostics are p-values.

3.2.1 The Wage Equation for Blue Collar Workers

Table 1 reveals that the estimated coefficient of the marginal tax rate is negative (i.e., the opposite sign of ζ_{1-t_m}) and that all other coefficients have the expected signs derived from the theoretical analysis. The coefficients of both the marginal and the average tax rate are significant, along with the coefficient of unemployment benefits. But the coefficients of the wedge and of unemployment are not significant. After elimination of the unemployment variable the coefficient of the wedge becomes significant and the rest of the coefficients change only slightly, cf. Table 2.

The negative coefficient of the marginal tax rate indicates that the "union effect" dominates the "labour supply effect" suggesting that a lower marginal tax rate implies an increase in the wage for blue collar workers. Similar results are found in studies for other countries: Lockwood and Manning (1993) find a negative coefficient for male manual workers in the United Kingdom. Holmlund and Kolm (1995) offer a disaggregated analysis on Swedish data which shows negative coefficients of the marginal tax rate for almost all groups in the Swedish labour market.

Table 2: Estimation after elimination of insignificant variables

	Blue collar workers	White collar workers
constant	-0.13 (0.17)	-3.73 (6.31)
$\log(u(-1))$		-0.15 (6.83)
$\log(1-t_m)$	1.51 (2.83)	
$\log(1-t_a)$	-3.43 (4.94)	-2.60 (15.36)
$\log(\omega)$	0.73 (2.41)	
$\log(b/q)$	1.08 (6.39)	1.84 (13.43)
Specification	7.25 (0.12)	0.81 (0.85)
R^2	0.97	0.97
DW	1.88	1.97
Std. Err.	0.0293	0.0344
AR(1)	0.01 (0.92)	0.00 (0.98)
AR(2)	0.38 (0.83)	0.03 (0.98)
Normality	2.40 (0.30)	3.33 (0.19)
ARCH 1	0.29 (0.60)	0.27 (0.61)

Note: Parentheses after estimated parameters are t-values. AR(1) and AR(2) are χ^2-tests for autocorrelated residuals. Normality is a $\chi^2(2)$-test for normally distributed residuals, and ARCH is a F-test for autoregressive conditional heteroscedasticity. Specification test is a standard Sargan χ^2-test for validity of instruments. Parentheses after dianostics are p-values.

It is worth noting that the relative large coefficients of ω and b/q indicate that the labour supply is relatively inelastic.[6] This is in accordance with the estimated coefficient to the marginal tax rate which becomes negative even for a low value of the bargaining power of the union if the labour supply is very inelastic.

The marginal and average tax rates for blue collar workers seem correlated. Thus, to check the robustness of the results we have also tried to use the Musgrave progressivity parameter $v \equiv \frac{1-t_m}{1-t_a}$ instead of the separate tax rates.[7] The coefficient restriction implied by this parameter was clearly accepted and the estimation using this parameter showed a significant positive relationship confirming the previous results. Finally, we have tried to include productivity in the regression. The theory did not support this variable but it is commonly used in wage equations. In the analysis it became insignificant; but correlated with unemployment benefits and the wedge reflecting that the trend in real wages is captured by these variables as the theory prescribes.

3.2.2 The Wage Equation for White Collar Workers

Table 1 reveals that the estimated coefficient of the marginal tax rate is positive but insignificant for this group. Again, all other coefficients have the expected signs but the wedge is not significant. After removing the wedge the coefficient on the marginal tax rate is still insignificant and therefore also removed, finally giving the results in Table 2.

[6] Note, that although the coefficient of b/q is larger than one it cannot be rejected that it is equal to or below one.

[7] This coefficient restriction is supported by the theory in Lockwood and Manning (1993). However, our model does not in general support the restriction; it requires that after tax benefits are indexed to after tax wages and that the labour supply is perfectly inelastic.

The small but insignificant coefficient on the marginal tax rate may indicate that the overall effect of changing the tax progressivity of white collar workers is zero suggesting that the "union effect" and the "labour supply effect" cancel out. However, it may also just reflect that the data is insufficient to identify the underlying relationship.

In Table 1 the smaller coefficients of ω and b/q compared to blue collar workers may reflect that the labour supply is more elastic for this group. Theoretically this implies a stronger "labour supply effect" which supports that the overall effect of reducing progressivity for white collar workers is a smaller wage rise than for blue collar workers or even a wage reduction.

Like in the case for blue collar workers, the marginal and average tax rates for white collar workers are correlated which may be the reason that it is difficult to identify a pure progressivity effect. We have also tried to use the Musgrave progressivity parameter, $v \equiv \frac{1-t_m}{1-t_a}$, instead of the separate tax rates. The coefficient restriction implied by the parameter is accepted and in the regression it becomes negative and also significant but there is now a clear indication of misspecification from the diagnostic tests. This may reflect that ζ_{1-t_m} really has the opposite sign than implied by the Musgrave progressivity parameter which is also indicated by the fact that ζ_{1-t_a} in the restricted regression is half as large as in the unrestricted regression. Thus, the overall conclusion is that it is difficult to disentangle any effect of progressivity on white collar workers.

Finally, we have also tried to include productivity in the regression and as for blue collar workers it became insignificant.

4 Conclusion

The conventional view on the effects of tax progression in non-competitive labour markets is reflected by the title of Koskela and Vilmunen (1996): "Tax progression is good for employment in popular models of trade union behaviour". The main point of our paper is that this view may be wrong when working hours are endogenous since this may introduce a labour supply

effect known from competitive models of the labour market. More specifically, we show that tax progression may be bad for employment when both wages and working hours are subject to bargaining.[8] This is especially likely if the bargaining power of workers is low and if labour supply is relatively elastic.

The ambiguous effects of changing tax progressivity motivate empirical investigation. Therefore, we derive an empirical wage equation from the theoretical model and estimate it on Danish data for blue collar workers and white collar workers. For blue collar workers the results show that the pre-tax wage is decreasing in the marginal tax rate implying that the conventional effect is stronger than the labour supply effect. The results for white collar workers show an opposite but insignificant relationship. This may indicate that the conventional effect and the labour supply effect balance. However, it may also just reflect that data is insufficient to identify the underlying relationship. Finally, it is worth mentioning that even though tax progression may be good for employment it is not necessarily good for aggregate welfare since it reduces working hours.

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