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Comment on Bertil Holmlund and Ann-Sofie Kolm: Progressive Taxation, Wage Setting, and Unemployment: Theory and Swedish Evidence

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In the popular policy debate it has often been taken for granted that progressive taxes, by reducing labour supply, exert a negative effect on output. Indeed, this was one of the prime motivations for the Swedish tax reform in 1991. But recent theoretical research has also suggested an effect in the opposite direction: by making wage increases less "profitable" for wage earners, tax progressivity may promote real wage moderation with positive employment and output effects as a consequence. The paper by Holmlund and Kolm examines these issues. Their conclusion is that high tax progressivity does seem to reduce wage pressure and unemployment, at the same time as there are negative effects on the supply of hours per employee (and most likely on other dimensions of labour supply as well).

On the whole I find the Holmlund–Kolm analysis careful and balanced. The paper represents a nice mix between theory and empirical testing. Nevertheless I shall play the devil's advocate and raise a number of critical questions.

1. The theoretical analysis

A simple way of showing that tax progressivity can exert a moderating influence on real wages in the class of models used by Holmlund and Kolm is as follows. Assume that the wage in a sector is set by a monopoly union

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($\lambda = 0$ in equation A.3 in the paper), that workers are risk neutral ($\sigma = 1$ in equation A.2 in the paper) and that there is no mobility of labour between sectors, so that the utility of a laid-off worker is simply the (exogenous) unemployment benefit. It is well known that if taxes are proportional, a utility-maximising trade union will then set the real after-tax consumption wage (the nominal after-tax wage deflated by the consumer price index) as a mark-up on the real (after-tax) unemployment benefit (see e.g. Layard *et al.*, 1991). More precisely, it will hold that

$$w_c = \left(1 - \frac{1}{\varepsilon}\right)^{-1} B, \tag{1}$$

where w_c = the real after-tax consumption wage, B = the real after-tax unemployment benefit and ε = the labour-demand elasticity. The intuition is simple: the higher the elasticity, the larger the employment loss caused by a given percentage wage increase and thus the stronger the incentive for wage moderation.

With a progressive income tax, it is straightforward to show, as I do in Appendix A.1, that a utility-maximising union will instead choose the wage

$$w_c = \left(1 - \frac{v}{\varepsilon}\right)^{-1} B, \tag{2}$$

where v = (1 – the marginal tax rate)/(1 – the average tax rate) is the elasticity of the after-tax wage with respect to the before-tax wage (the Holmlund–Kolm measure of income tax progressivity). It is immediately seen that higher tax progressivity (a lower v) reduces the mark-up in the same way as a higher labour-demand elasticity. Again the intuition is simple. When a union contemplates a wage rise, it must take into account that if the after-tax wage is to increase by, say, 1 percent, the before-tax wage must increase by $1/v$ percent. This means that the accompanying employment loss will be ε/v percent. Hence, since wage increases become more costly with progressive taxes, rational unions will choose not to push wages so high as with a proportional tax schedule.

The conclusion that tax progressivity can contribute to real wage moderation and employment is quite general. As shown by Holmlund and Kolm, it carries over to a model of bargaining between employers and unions (also if unions care only about after-tax wages but not about employment). The conclusion would also hold in a model with bargaining between employers and *individual* employees (such as in Mortensen and

Pissarides, 1994). Similar results would be obtained in a search model, too, although the mechanism is different: high marginal tax rates reduce the expected return for the unemployed of turning down present job offers in order to preserve the option of receiving even better offers in the future (Ljungkvist and Sargent, 1995).

A natural question to ask is how the models discussed above go together with the notion that high marginal tax rates may cause high wage increases in order to achieve after-tax real wage targets. This idea was first formalised by Lundberg (1953) in his analysis of the "wage multiplier" and later elaborated by Calmfors and Lundberg (1974) and Calmfors (1977). It is true, as pointed out by Holmlund and Kolm, that this framework ignored the possibility of a link between tax progressivity and real wage targets. But the wage multiplier analysis also addressed another problem than the one analysed by Holmlund and Kolm: Which *nominal* wage increases are required to achieve given targets for after-tax real wages under *inflation* and *non-indexed* taxes (the Swedish situation for many years)? As I show in Appendix A.2, the conclusion from this literature that tax progressivity is likely to cause large compensating nominal wage increases in the case of, for instance, import price rises still holds. The simple explanation is that the nominal pre-tax wage increases required to reach a certain real wage target are larger than the nominal after-tax wage increases when taxes are progressive.[1]

Going back to the Holmlund–Kolm case with indexed taxes, the main limitation of the analysis in Sections 1.1 and 1.2 of the paper is its *partial* character. It neglects the supply effects of taxes that formed the principal motivation for the Swedish tax reform. This is the reason why Holmlund and Kolm in Section 1.3 evaluate the impact of tax progressivity on the expected *welfare* of workers taking the effects on hours of work into account. Their conclusion is that the positive effect of high tax progressivity on the number of employed *persons* (which follows from the analysis above) has to be traded off against the negative welfare effects resulting from

[1] Note also the possibility in the wage-multiplier analysis that real wage targets cannot be reached through nominal wage *increases* (because nominal after-tax wage increases turn out to be smaller than the induced price increases). The way to reach the after-tax real wage targets may therefore be to *reduce* nominal wages (Calmfors and Lundberg, 1974; Calmfors, 1977). Such an outcome would, however, seem to imply an improbable degree of co-ordination between different wage setters under decentralised bargaining. In a centralised system it is theoretically possible that progressive and non-indexed taxes could contribute to wage restraint (Agell and Ysander, 1993).

fewer hours and thus lower wage income per employed worker. Although no explicit solutions can be derived, the numerical examples suggest that a certain – and perhaps quite high – degree of progressivity $(0<v<1)$ is optimal.

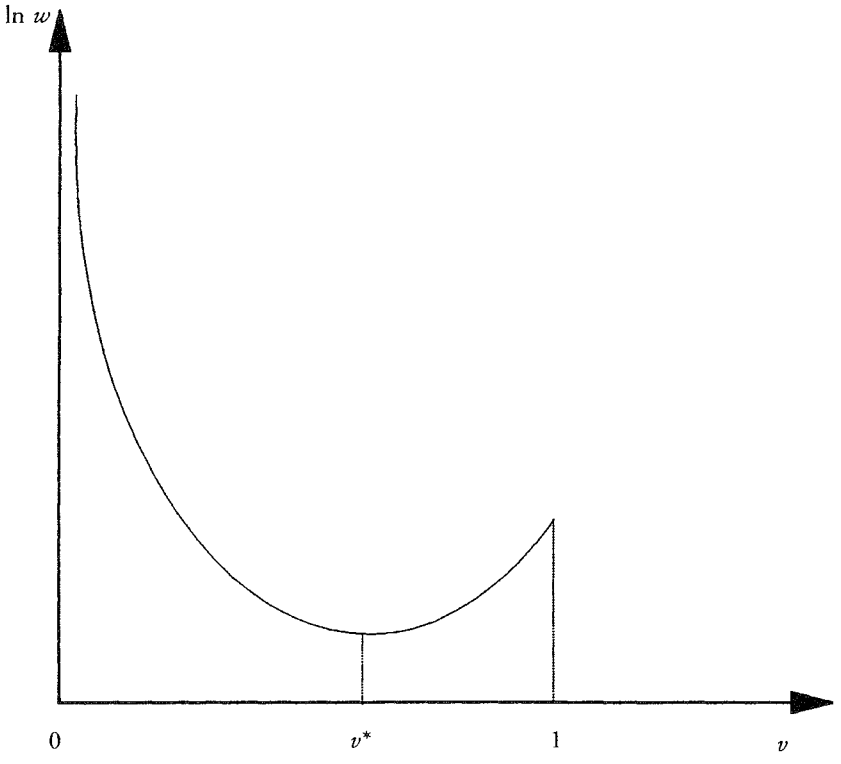
However, the Holmlund–Kolm exposition in Section 1.3 fails to bring out a few crucial points. One can get a clearer picture by simplifying the analysis somewhat. I am especially interested in how the *pre-tax wage per hour* is affected. Since hours and workers are assumed to be perfect substitutes in production, this wage rate determines the total number of hours worked in the economy and thus also output. In Appendix A.3 I again let a monopoly union (with the same utility function as in the paper) set wages in a situation with no labour mobility between sectors and an exogenous benefit level.[2]

I show in equation (A.8) that the after-tax wage *income* of an employed worker will in this case be set as a mark-up on the sum of the unemployment benefit and the perceived disutility of work (which is assumed larger the longer working time is and thus the more "leisure" that has to be given up when employed). As in the analysis above, an increase in tax progressivity reduces the mark-up. In addition an increase in progressivity lowers the number of working hours per employee. This decreases the disutility from having a job, which will make the union more anxious to avoid employment losses. Both these effects work in the direction of reducing the pre-tax wage per hour. But against this must be set that shorter working time tends to reduce wage income, so that an incentive is also created for the union to raise the pre-tax wage rate in order to compensate for this effect.

There will thus be forces working in opposite directions on the pre-tax wage per hour. It is shown in the Appendix that the wage-reducing effects of higher progressivity (lower v) dominate at low levels of progressivity (high v), whereas the wage-increasing effects dominate at high levels of progressivity (low v). The relationship between tax progressivity and the pre-tax real wage rate will look as in Figure 1. The sign of the effect of a change in tax progressivity thus depends on the initial position of the economy. It also follows that there is a certain degree of tax progressivity

[2] Holmlund and Kolm assume bargaining, an exogenous replacement rate and that laid-off workers can move to other sectors. My modifications leave all the important mechanisms in the model intact.

Figure 1. Tax progressivity and hourly real wages



w = the hourly real wage
v = tax progressivity (the elasticity of the after-tax wage with respect to the pre-tax wage)

$(0 < v^* < 1)$, which *minimises* the hourly wage. This degree of progressivity maximises the total number of hours worked in the economy and thus also output.

2. The empirical analysis

In an empirical section Holmlund and Kolm test the hypothesis that higher tax progressivity leads to lower real wages. Two sets of wage equations are estimated. The first set exploits time-series data for different *quintiles* of the income distribution for the period 1975–1992. The second set of estimations instead aims at explaining cross-section wage changes between 1989 and 1992 in a sample of *individuals*. Both types of

regressions seem to support the hypothesis that high tax progressivity is conducive to real wage moderation. There are, however, a few issues that could be raised in this context.

There is a certain lack of consistency in the paper between the theoretical formulations and the empirical applications. The former assume a constant replacement rate (i.e., that unemployment benefits make up a certain fraction of wages), whereas exogenous benefit levels are assumed in the estimations. Another problem is whether the observational units in the estimations can be taken to correspond to the trade unions of the theoretical analysis. It may perhaps be reasonable to approximate unions with the different quintiles of the income distribution. But it is more problematic to use the model of bargaining between unions and employers as the theoretical basis for explaining cross-section differences in wage changes among *individuals.* This may in fact be quite inappropriate. One might instead base the empirical analysis here on a model of bargaining between individual employees and firms of the Mortensen-Pissarides (1994) type. But it is not clear to me how relevant such an approach is in the Swedish context with its emphasis on collective bargaining. So the question remains as to how much the empirical cross-section analysis of differences in wage changes says about the effect of tax progressivity on the *aggregate* wage level. It may very well be, as the authors themselves note, that the negative relationship between tax progressivity and wage changes in the cross-section analysis instead reflects that effort (and thus earnings) are negatively related to tax progressivity.

There is also the econometric problem of non-stationarity of at least real wages and unemployment benefits in the time-series regressions. Even though the time series are short, an attempt could have been made to examine the co-integration properties of the variables and to make the estimations in error-correction form.

I also see a risk that omitted-variable bias may have affected the results in the time-series regressions. The results are likely to be governed mainly by the coincidence of real wage cuts and high tax progressivity in the late 1970s and early 1980s. But we know that there are a number of other possible explanations for these real wage reductions: oil-price shocks, lower productivity growth, the world recession in general, and pay-roll tax rises. The exclusion of such variables from the regressions may have exaggerated the role of variations in income tax progressivity for the explanation of wages.

Finally, the earnings measures used as dependent variables in the re-

gressions have been derived by help of very crude assumptions on working time. The estimated wage equations are therefore not well suited to analyse the issue discussed above of how *pre-tax wage rates* (and hence output) is likely to respond to tax progressivity, once the endogenous response of hours supplied is taken into account. An extension in this direction would seem worthwhile.

3. Conclusions

So what is my overall judgement on the evidence presented in the paper? I have – perhaps somewhat inappropriately – focused my comments on factors that weaken the claim that tax progressivity may contribute to wage restraint. Still, once labour supply responses are taken into account, I find the theoretical basis for this hypothesis weaker than Holmlund and Kolm seem to do. The sign of the effect on pre-tax wage rates is likely to depend upon the initial degree of progressivity: a moderating wage effect is more probable if progressivity is raised from a low than from a high level. As for the empirical analysis, the paper does present interesting evidence in favour of wage-moderating effects of progressive taxes, but I would be more convinced if my objections above could be addressed in further work.

Appendix

A.1. Income tax progressivity and the monopoly-union model

Let the utility of an employed worker be equal to the after-tax real wage w_c and the utility of a laid-off worker be equal to the unemployment benefit B. Furthermore let $w_c = \alpha w^v$, where v is the income-tax progressivity parameter discussed above, α is another tax parameter and w is the pre-tax real wage (= the real wage cost to employers). Employment is given by $N = N(w)$. Assume that a monopoly union sets the wage by maximising the expected utility of a representative member

$$EV = \frac{N}{M} w_c + \left(1 - \frac{N}{M}\right) B, \qquad \text{(A.1)}$$

where M is the number of union members. Equation (2) in my text can be derived from the first-order condition for utility maximisation. Note that

$$\frac{\varepsilon}{v} = -\left(\frac{\partial N}{\partial w}\cdot\frac{w}{N}\right)\Big/\left(\frac{\partial w_c}{\partial w}\cdot\frac{w}{w_c}\right) = -\frac{dN}{dw_c}\cdot\frac{w_c}{N}, \qquad \text{(A.2)}$$

i.e., ε/v is the elasticity of employment with respect to the after-tax real wage. Note also that $v = 1$ (a proportional income tax) in my equation (2) gives my equation (1).

A.2 Tax progressivity in a non-indexed tax system

Let in this case $w_c = \alpha W^v/P$, where w_c, α and v denote the same variables as before, W is the nominal pre-tax wage and P is the (exogenous) price level (think in terms of traded goods, the prices of which are determined by world market prices and exchange rates that are not explained in the model). If W is set so as to maximise (A.1) given $N = N(w) = N(W/P)$ and the exogenous real benefit level B, equation (2) in my comment can again be derived. But from the definition of w_c in this case, we obtain

$$\ln W = \frac{1}{v}\left[\ln P + \ln B - \ln\left(1 - \frac{v}{\varepsilon}\right) - \ln\alpha\right] \qquad \text{(A.3)}$$

Hence it follows that a price increase will induce a larger *nominal* pre-tax wage increase, the higher tax progressivity is (the lower v is). This is required in order to achieve the after-tax real wage target, which according to equation (2) is independent of the price level. It also holds that the real product wage ($\ln W - \ln P$) must increase (and thus employment fall) if the price level increases.

A.3. Income tax progressivity and supply of hours

Assume the same utility function for an employed worker as in Section 1.3 of the Holmlund–Kolm paper, i.e.

$$U = \ln\left(\alpha(wh)^v\right) - \frac{h^{1+\delta}}{1+\delta} \qquad \text{(A.4)}$$

where w is now the pre-tax wage per *hour*, h is hours worked, α and v are tax parameters as above and $\delta > 0$ is a parameter reflecting the evalua-

tion of leisure. As discussed in the paper, utility maximisation on the part of the individual worker gives rise to the hours supply function

$$h = v^{1/(1+\delta)}. \tag{A.5}$$

I again assume that a monopoly union sets the wage so as to maximise the expected utility of a representative worker

$$EV = \frac{N}{M} U + \left(1 - \frac{N}{M}\right) B, \tag{A.6}$$

where now

$$N = \frac{L(w)}{h}, \tag{A.7}$$

by way of an assumption that hours and workers are perfect substitutes in production. Maximisation of (A.6) subject to (A.4), (A.5) and (A.7) gives the wage equation

$$\ln \bar{w}_c = \ln B + \frac{h^{1+\delta}}{1+\delta} + \frac{v}{\bar{\varepsilon}} = \ln B + \left[\frac{1}{1+\delta} + \frac{1}{\bar{\varepsilon}}\right] v, \tag{A.8}$$

where $\bar{w}_c = \alpha(wh)^v$ is the after-tax real wage *income* of an employed worker and $\bar{\varepsilon} = -(\partial L/\partial w) \cdot (w/L)$ is the elasticity of labour demand.

To make things simple, I assume that *net* taxes for the employed are zero, i.e. that

$$N\left[wh - \alpha(wh)^v\right] = 0. \tag{A.9}$$

After substituting (A.9) into (A.8) and rearranging terms, one obtains

$$\ln w = \ln B + v\left(\frac{1}{\bar{\varepsilon}} + \frac{1}{1+\delta}\right) - \frac{1}{1+\delta} \ln v. \tag{A.10}$$

Differentiation with respect to v gives

$$\frac{d \ln w}{dw} = \left(\frac{1}{\bar{\varepsilon}} + \frac{1}{1+\delta}\right) - \frac{1}{(1+\delta)} \gtreqless 0. \tag{A.11}$$

The degree of progressivity v^* that minimises the wage (and thus maximises the total number of hours worked $hN = L$) is obtained by setting, $d\ln w/dv = 0$, which gives

$$v^* = \frac{\bar{\varepsilon}}{1+\bar{\varepsilon}+\delta} . \qquad (A.12)$$

This is obviously a minimum since $d^2 \ln w/dv^2 = 1/(1+\delta)v^2 > 0$. It follows immediately from (A.12) that $0 < v^* < 1$, i.e., a certain degree of progressivity is always optimal.

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