

Dynamic curvature of the tax wedge

April 24 1996

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JEL H2

Summary

The tax wedge makes for a higher gross minimum wage, and a wedge comes about when tax exemption is adjusted for inflation only. Due to curvature, the wedge comes close to its limit value for already low levels of productivity growth. Thus, the negative effects of the wedge occur primarily at the onset of economic growth, and are less noticeable when stagnation has already set in.

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Introduction

OECD countries have the common policy to adjust tax exemption for inflation only, see OECD (1986). Incomes commonly rise not only with inflation but also with the real rise in productivity. This *differential indexation* appears to imply a disproportional rise in the tax burden.

A first point has already been discussed by this author elsewhere, see Cool (1992-1996), i.e.: Evidence of social psychology (see Aronson (1992)) indicates that people take relative positions. Social subsistence has a tendency to rise with the general level of income. When subsistence rises with general welfare, the tax obligation tends to be translated into rising gross wages. And indeed, gross minimum wages in OECD countries appear to rise disproportionately, and they cause increasing rates of unemployment at low levels of productivity. Thus a cause of international mass unemployment has been identified.

A second point is curvature. Due to curvature the major effect takes place in the first phase of economic growth. This second point has been indicated by Cool (1995b) but not well elaborated. This paper extends this argument, by giving formulas and plots. Especially, it are the plots that may help us to understand that the major distortionary effects took place in the 1960s and 1970s. People looking only at the events in the 1990s are less likely to see root of the problem.

In the following we first derive the formulas and then give plots for the average tax rate (ATR) and the gross to net ratio (GNR). The latter ratio may better express the effect on the gross minimum wage.

Formulas

Regard a linear tax $T(y)$ for income y , exemption x , and marginal rate τ :

$$T(y) = \tau(y - x) \quad (1)$$

The average tax rate (ATR) and the gross to net ratio (GNR) are:

$$ATR(y) = T(y)/y = \tau(1 - x/y) \quad (2)$$

$$GNR(y) = y/(y - T(y)) = y/((1 - \tau)y + \tau x) = 1/(1 - \tau + \tau x/y) \quad (3)$$

In the deductions below we will use the fact that the gross minimum wage m is defined by subsistence s and the tax system:

$$m = s + T(m) \quad \Rightarrow \quad m = s + \tau(m - x) \quad \Rightarrow \quad m = (s - \tau x)/(1 - \tau) \quad (4)$$

Examples work best. Let subsistence s be exempt from taxation so that $x = s$, and let the marginal tax rate there-after be 50%. The average tax rate (ATR) of a subsistence worker then is 0, and the gross to net ratio (GNR) is 1. Someone earning twice subsistence, pays tax 50% $(2s - s) = s/2$, and thus has an average tax of 25% and a gross to net ratio of 4/3. In the limit, i.e. when exemption has been reduced to a negligible proportion, then the average tax equals the marginal rate of 50% while the gross-to-net ratio is 2.

Next, notice two points. First, the formulas by themselves do not quite show how quickly the limit values are approached. To answer this question we can best look at some graphs. Secondly, these examples are static, i.e. at one point in time for different incomes. Thus, when we make graphs, then we can use a static index, and compare an income level 1 to an income ten times as large. In dynamics, i.e. when incomes rise, things are a bit complicated.

In dynamics, when we look at the practice of adjusting exemption for inflation, we can take exemption as constant, and look at real incomes (adjusted for inflation). In that case it seems as if we can take the formulas and graphs of the statics case, and compare real incomes regardless of the time. However, in dynamics, there is an interaction between indexation and the consistency between net subsistence, the tax parameters, and the gross minimum wage; and there appears to be an accelerator effect. Before we make the plots we have to develop on this.

Let us first regard a general formula for dynamics, and see that it seems as if there were no difference with the formula for the statics case. Let exemption x be adjusted for inflation with index p , then $x = p x_0$. Let y be adjusted for the real level of income, with index g , too; then $y = p g y_0$. Define $f = x_0 / y_0$. Then:

$$ATR(y) = \tau(1 - x/y) = \tau(1 - x_0/(y_0 g)) = \tau(1 - f/g) = ATR(g) \quad (2')$$

This seems no different from (2). However, the complication comes from subsistence. It is not sufficient to simply substitute values for gross minimum wage m and net subsistence s . It would be nice when $x = s$, for in that case $m = s$. However, we have discussed the practice that exemption is indexed on inflation, and that net subsistence follows general welfare. Thus (4) is a nontrivial equation. Let real net subsistence be adjusted for real w , so that $s = w p s_0$. Then:

$$m = (p w s_0 - \tau p x_0) / (1 - \tau) = p (w - \tau x_0/s_0) / (1 - \tau) \quad (4')$$

Now, what does w stand for? A common approach is that net subsistence is adjusted so that it stays in line with other net incomes. Thus w is 'real net average income'. Here we take the 'average' to be the median gross income a with index g . Let $h = x_0 / a_0$, and derive:

$$net(a) = a - T(a) = (1 - \tau) p g a_0 + \tau p x_0 \quad (5)$$

$$\begin{aligned} w &= net(a) / net(a_0) / p = ((1 - \tau) g a_0 + \tau x_0) / ((1 - \tau) a_0 + \tau x_0) = \\ &= ((1 - \tau) g + \tau h) / ((1 - \tau) + \tau h) \end{aligned} \quad (6)$$

For example, if we take median income at $a_0 = 2 s_0$ and $x_0 = s_0$ then $h = .5$. When we also take $\tau = .5$ then $w(g) = .33 + .67 g$.

The average tax rate and the gross to net ratio for the minimum appear to be special cases of the definitions above; i.e. special since the index w is special. We use the symbol "°" to signify the dynamic point of view.² Using $q = x_0 / s_0$:

$$GNR^\circ(m) = m/s = (1 - \tau/w x_0/s_0) / (1 - \tau) = (1 - q \tau/w) / (1 - \tau) \quad (7)$$

$$ATR^\circ(m) = T(m)/m = 1 - 1/GNR^\circ(m) = \tau(1 - q/w) / (1 - q \tau/w) \quad (8)$$

Note that (7) and (8) depend on $w(g)$ where g is the 'general' index for all incomes. Over time, w will rise to infinity, and limit values will be $GNR^* = 1/(1 - \tau)$ and $ATR^* = \tau$ as for all incomes. The point however is that the average tax at subsistence, $ATR^\circ(m)$ (see (8)), will rise

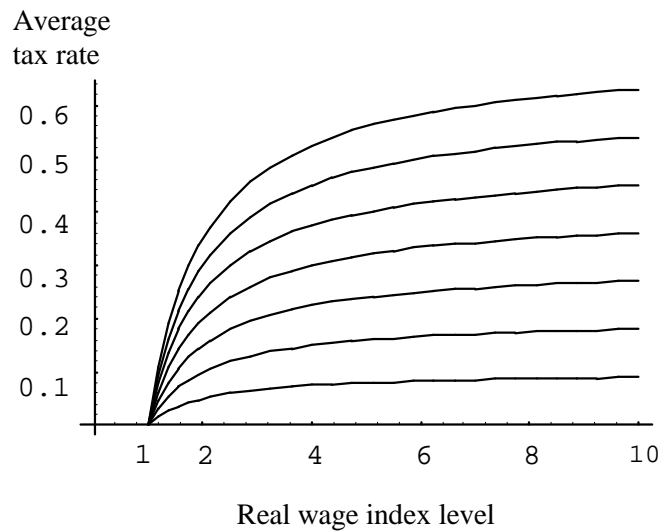
² Note that the 'dynamic average' concept differs from the 'dynamic marginal' concept in Cool (1995a).

faster than $ATR(g)$ (see (2')). One cannot regard m as a normal case of $y = p g y_0$, since gross income m will have to rise faster than median a to make up for the rise in the tax.

Graphs

First we plot the static ATR and GNR for values of a real net wage index from 1 till 10. We plot the paths for various marginal tax rates: 10%, 20%, ..., and (even) 70%, all assuming $x = s = 1$. These plots show the point made earlier, that the ATR is close to the marginal rate at already low income values, e.g. 2 (our estimate of the median).

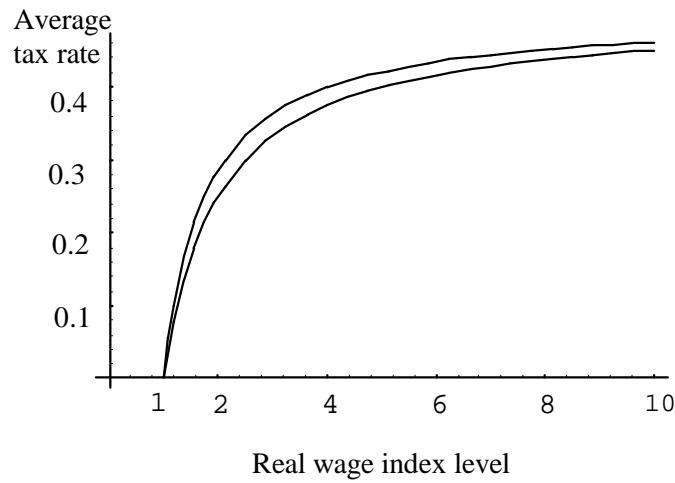
Figure A: Average tax, in statics, dependent on the real net wage index, for various marginal tax rates



We might interpret figure 1 in a dynamic way. In that case $s_0 = x_0 = 1$, $q = 1$. We may take a theoretical example. If you have a period of 35 years, then a real growth of 2% per annum would suffice to double real subsistence from s_0 to $2 s_0$. When productivity for subsistence groups has doubled, then this group meets with average taxes rather close to the marginal rate, and the gross minimum wage would be almost twice as high. Holland provides an empirical example. The gross real wage index rose from 1 in 1950 to 3.7 in 1980, and has been stagnant since then.

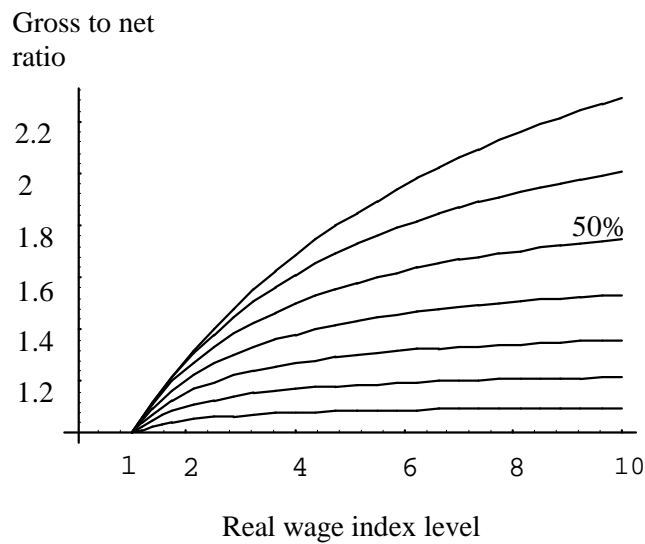
In figure 2 we consider the differentiability effect at the bottom, and compare the static ATR and the dynamic ATR° at the minimum level. We regard only one marginal rate (a 50% tariff), and assume that the 'peg average' is $2 s_0$. It appears that the dynamic ATR° is steeper and higher than the static ATR. However, the difference is not that big.

Figure B: Average tax rate, dependent on the real net wage index, static and dynamic, for $\tau = 50\%$



In figure 3 we regard the dynamic GNR°'s. The GNR is an index for the gross minimum wage. We can see that the rise is largest in the lower reaches of the graph. For example the 50% rate already reaches the level 1.6 around the index value of 4, and 1.6 does not differ much from the limit value of 2.

Figure C: Gross-to-net ratio, in dynamics, dependent on the real net wage index, for various marginal tax rates



Conclusion

Many people see the cause of mass unemployment in technology and 'globalisation', which are factors on the demand side. Others see the cause in high benefit levels or in low levels of education or educationability, which are factors on the supply side. These explanations allow little room for policy making, especially when the benefit level is regarded as social subsistence.

However, there is a third alternative. In this alternative approach the cause lies with the tax exemption level that is too low. The low exemption causes that the lowly productive must pay taxes, and thus that their gross labour costs rise towards prohibitive levels. Here policy can do much. In this alternative approach, technology and 'globalisation' have actually reduced the problem of unemployment. Technology raises productivity, even of the lowly productive. 'Globalisation' is a scare word for trade, and trade has boosted economic growth and welfare since the dawn of mankind. Since the problem lies with labour costs and the demand for labour, supply factors like the benefit level are less relevant. Occam's razor leads to the adoption of the third approach.

Adjusting tax exemption for only inflation causes a curvature in the growth of the tax wedge too. The major imbalance was caused in the period up to the 1970s. People studying current events may not be looking where the evidence can be found.

The present fix could be avoided by adjusting exemption for the rise in economic welfare too. With this alternative policy the share of collective spending in national income could remain stable - and policy could remain sound.

References

Note: econwpa references are the locations of the papers on the Economics Working Papers Archive of the Washington University of St. Louis, Missouri, USA, [Http://econwpa.wustl.edu](http://econwpa.wustl.edu)

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