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Prof. Dr. Klaus Beckmann

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Author's adress and affiliation:

Prof. Dr. Klaus Beckmann
Andrássy-Universität Budapest
Pollack Mihály tér 3
H-1088 Budapest
E-Mail: Klaus.beckmann@andrassyuni.hu

Tax Progression and Evasion: a Simple Graphical Approach

Klaus Beckmann, Andrássy-Universität Budapest*

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Abstract

I present a simple graphic that is quite useful to demonstrate standard results from the neoclassical theory of tax evasion in a simple way. The technique is then applied to the effects of an increase in tax progressivity on evasion.

Keywords: tax evasion, tax progression

JEL classification: H2

*Reader in Economics, Andrássy University, Pf. 1422, H-1464 Budapest, Hungary. Email: klaus.beckmann@andrassyuni.hu.

1 A different view on an old problem

In the standard "portfolio" model of tax evasion (Allingham and Sandmo, 1972), a rational risk-averse taxpayer must allocate an exogenous income y to risky evasion h and risk-free declaration $y - h$. Let the probability of detection be fixed at p. With a constant tax rate t and a fine s levied as a surcharge on the evaded tax (th, see Yitzhaki 1974), the taxpayer will have net income $y^g = (1-t)y + ht$ if the evasion succeeds, and $y^b = (1-t)y - sht$ if it doesn't.

In this framework, one can apply standard portfolio theoretic reasoning to show that

1. no risk-averse or risk-neutral taxpayer will engage in any evasion if the expected return to evading an additional dollar of tax, $1-p$, falls short of the expected return ps,
2. and *every* risk-averse taxpayer will evade some – possibly small – amount of tax if $1 - p > ps$.

We are interested in describing an interior solution that can (but may not) obtain in the latter case, using an approach that differs slightly from the standard one. Note that as long as a taxpayer hides a positive amount h that falls short of his total income y, tax evasion is a means of transferring net income from the "bad" state of the world to the "good" one. In an optimal solution, the taxpayer will use this instrument up to the point where the expected benefit of doing so, $(1-p)\,u'(y^g)$, equals her expected cost, $p\,s\,u'(y^b)$.

FIGURE 1 ABOUT HERE

Figure 1 depicts this situation graphically. While the solid falling curve represents the taxpayer's marginal utility of income schedule, the "rule" below the abscissa extends from the net income in the case of discovery y^b on the left to the net income with successful evasion y^g. It is of length $(1+s)\,t\,h^*$, and includes the net income with full honesty. Choosing the optimal h^* implies extending the left and right "whiskers" at a fixed rate from $y(1-t)$ until the marginal utility of income at the left end of our rule is $\frac{1-p}{ps}$ times as large as its right end counterpart.

2 Some well-known applications

Most of the standard comparative statics of the Allingham-Sandmo model can be derived quite easily from figure 1. I will focus on two examples and leave the remainder to the reader.

2.1 Comparative statics: variation of y

Let us assume the exogenous income y to increase, *ceteris paribus*. Graphically, this implies sliding our rule to the right. The income change will have no effect on evasion h^* iff the rate of change of the marginal utility of income $-\frac{u''}{u'}$ – remains the same at both ends of a constant-length rule as this rule shifts to the right. In other words, changes in gross income do not impinge on evasion iff there is constant absolute risk aversion.

2.2 Beyond *homo œconomicus simplex*: fairness and equivalence taxation

Suppose that utility depends on some factor other than own income, for instance a fairness parameter f, which we take to be positively related to perceived fairness in exchange, that is to the relation between the individual's tax burden and the *quid pro quo* she receives from the state. Given standard assumptions, an increase in f will shift the marginal utility of income schedule upwards (as depicted by the dashed curve in fig. 1). Under which circumstances will such a shift leave the optimal h^* unaffected?

Obviously, a necessary condition for this is that the slopes of the marginal utility schedule at both ends of the original rule vary in proportion. If we want the result to hold for all incomes, we have the sufficient condition that the shift in the marginal utility schedule leaves us with the same slope everywhere, *viz.* that $\frac{u_{yf}}{u_y} = \partial\left(\frac{u_{yy}}{u_y}\right)/\partial f$ is a constant (Falkinger, 1995: 66). In this case, a move towards equivalence taxation would have no effect on evasion. On the other hand, we see immediately that such a move would reduce evasion unambigously if $\frac{u_{yf}}{u_y}$ fell throughout.

3 Tax progression

Having introduced our graphical device and (hopefully) demonstrated its power, we now proceed to applying it to the analysis of tax progression and evasion. For simplicity, let us focus on an indirect progressive tax on income with a constant marginal tax rate t and a basic exemption T. In our graphic analysis, the "anchor" of the sliding rule will now be found at $y(1-t)+tT$.

3.1 The effects of stiffening progression if fines depend on the amount of tax evaded

Now consider what happens if we increase both t and T in such a way as to leave the statutory tax liability of the individual in consideration unaffected (see Wrede 1993: 57–62 for a mathematical exposition). It is clear that the "anchor" of the sliding rule will stay put, while the larger marginal tax rate t, considered in isolation, has the effect of extending the "whiskers" outwards. On the other hand, the taxpayer can counter this effect by reducing h. In this situation, it remains optimal to evade the same *amount of tax* as before, which can now be achieved by hiding *less income*.

We can apply the same reasoning to individuals whose overall statutory tax liability changes as a result of the stiffening of tax progression, provided that the net income with unsuccessful evasion y^b does not fall short of the basic exemption T. For poorer individuals, the rule will shift to the right, reflecting an increase in statutory net income, while the opposite movement applies to richer ones. The rule will also grow longer due to the increase in the marginal tax rate unless the taxpayer adapts h to compensate for this effect. From our preceding analysis, however, we know precisely under which condition it is optimal to keep the rule at a constant length, to wit: if the utility function exhibits constant absolute risk aversion. It follows that under this condition, all individuals with $y^b > T$ want *to evade the same tax as before, concealing less income as a consequence.*

But what happens under the customary assumption of *decreasing* absolute risk aversion? In this case, shifting our rule to the right involves a smaller rate of change at its right end than at the left end; in order to preserve the first order condition $\frac{1-p}{p\,s} = \frac{u'(y^b}{u'(y^g)}$, that is to ensure that the ratio of the marginal utilities at both ends of the rule stays the same, the rule has to grow longer. In other words, richer individuals evade more tax, *ceteris paribus*, if their utility functions exhibit decreasing absolute risk aversion – a standard result of the tax evasion literature since Yitzhaki (1974). We can combine this result with our preceding discussion to find that "the rich", whose tax burden increases due to the tax change, will evade less tax and consequently conceal less income. By the same token, "the poor" will tend to evade more tax. We cannot say, however, whether this involves a greater or smaller h. Finally, note that it follows from these results that the pre-tax distribution of *reported* income will become more unequal as a result of the boost in tax progression, even though the true distribution of income is exogenous in our basic setup (see also Koskela 1983).

3.2 The Allingham-Sandmo fine

In their original model, Allingham and Sandmo (1972) specified a different type of fine that depends only on h, such that net income in the "bad" state becomes $y^b = y\,(1-t) - s\,h$. The main difference, graphically speaking, is that an increase in tax progression now only makes the right-hand whisker grow (while shifting the rule as before unless the average statutory tax rate for the individual in question remains the same). The obvious interpretation is that the tax hike increases the expected return to tax evasion, while leaving the expected cost unaffected. In the benchmark case of constant absolute risk aversion, it is clear that all taxpayers will react by evading more tax, although the effect on h is ambiguous. Also note that for a given h, increasing tax progression will lower the effective tax rate for the taxpayer. In a model with endogenous income (or other margins of choice), this may lead to the counter-intuitive result that effort increases as a result of stiffening progression. Such effects, however, can no longer be illustrated using our graphical device alone.

4 Caveat and conclusion

The chief purpose of the present note was to point out that a simple graphical approach suffices to demonstrate most standard results from the standard neoclassical theory of tax evasion, and some lesser known ones as well. In particular, the approach is very helpful in developing a sound intuition about the effects of tax progression on evasion. Of course, quite a lot has been left out: We specified that net income with unsuccessful evasion must not fall short of the basic exemption, and we restricted our attention to indirect tax progression. In the more general case of direct progression, the left and right "whiskers" would no longer grow or shrink in proportion, and much of our reasoning would no longer apply.

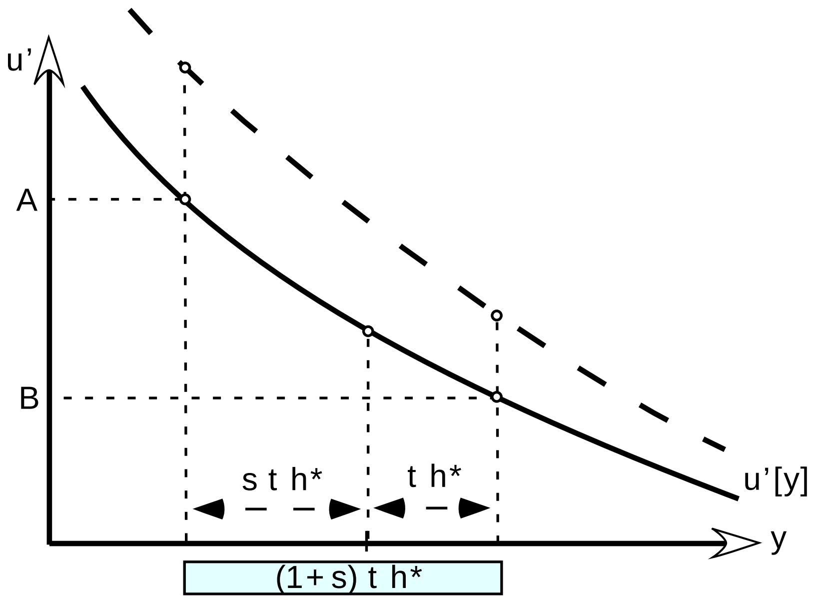

Figure 1: A graphical representation of the interior solution

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