Tax Effects on Education

Annette Alstadsæter[*]

Statistics Norway[†]

January 4, 2005

Discussion Paper 01/2005

Abstract

Taxes affect the individual's educational choice through many channels, and they have both direct and indirect effects on human capital accumulation. The structure of the tax system creates different incentive effects that distorts the individual's educational choice. Some of these tax effects discourage higher education, while others encourage it. I give an overview over the existing literature on taxes and education and also provide the intuition for many of these partial effects in a simple model. The total effect of taxes on education is ambiguous.

JEL codes: H24; I21; J24.

1   Introduction

Education is both investment and consumption. The return to the educational investment is a higher wage later in life, and this wage return is reduces by income taxes. This affects the relative attractiveness of education compared with other investment alternatives. Therefore income taxes affect the duration of the individual's education. Different types of education yield different rates of wage return, such that taxes might also affect the individual's educational portfolio. The price on education as a consumption good consists both of foregone wages during the educational process and of future foregone earnings by not choosing a profession that yields higher wages. In addition, income taxes reduce the after-tax price on education and might affect the level of educational consumption. The after-tax price on educational consumption varies across educational types, since different

---

types of education yield different rates of wage return. Thus income taxes might also affect the individual's portfolio of educational consumption.

Taxes affect the individual's educational choice through many channels, and I present a simple model to illustrate different partial tax effects on education. A proportional tax on wage income has by itself no effect on the human capital accumulation, while it in presence of other effects create distortions. Educational attainment is increased by a tax on capital income and by non-pecuniary returns to education. On the opposite, direct and non-pecuniary costs of education, and a progressive wage tax reduce educational attainment. The conclusion is that these effects go in different directions, such that the total effect of taxes on education depends on the individual's preferences.

Not only the wage return to education is important to determine the level of educational investments. I present Norwegian data that indicate that the optimal educational level may change if the full after-tax lifetime income is used to assess the return to different educational levels..

## 1.1   The structure of taxation.

Which is the best tax structure, and how should tax revenue be spent? The answers to these questions depend strongly on the preferences towards inequality. Egalitarian countries, such as the Nordic countries, traditionally put strong emphasis on equality and on having a large welfare state. These countries have a progressive tax structure to ensure redistribution, and they have a high level of overall taxation to finance a high level of publicly financed welfare goods. Other countries such, as the U.S., put stronger emphasis on individual freedom and on minimizing the role of the state. Such countries have less progressive income taxation, a lower overall tax level, and a lower level and range of publicly provided goods.

As we see in figure 1, countries differ also in how tax revenue is generated, and in whether individuals or firms carry the larger tax burden. Assume that revenue is spent on public consumption and transfers to individuals. Then a high level of taxation indicates a large public sector and broad welfare system.

1.2   The structure of education.

Prior to the human capital revolution in the 1960ies education was considered to be a cultural good that made individuals better citizens. Schultz (1960) and Becker (1964) introduced the idea that human capital investments increase productivity. The basic intuition is that the effect of one hour of labor is not the same across individuals, but that

Figure 1: *Total tax revenue as % of GDP, 2000.* Source: OECD.
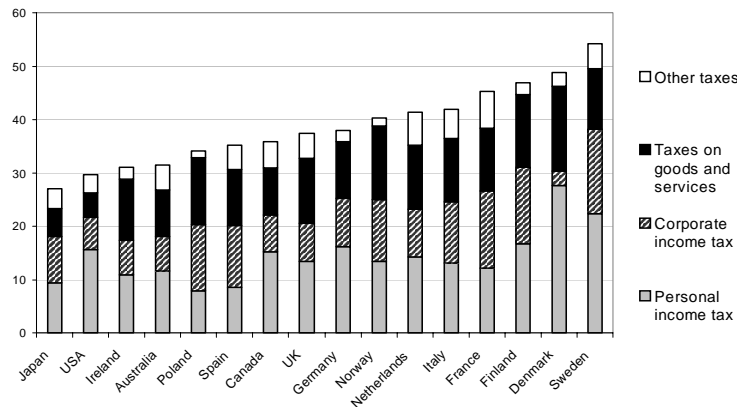
the effective hour of labor might increase through making investments in the worker. Different activities increase the individual's human capital, such as health service, migration, on-the-job training, and education.

The educational structure varies greatly across countries, both regarding who supplies education and who attends it. For instance, in 2001 only 6% of the adult population in Mexico had higher education, while 42% had higher education in Canada[1]. At the same time the overall spending on higher education varies greatly across countries. Canada and the US by far have the largest spending on higher education. In 2001, 2.7% of GDP was spent on higher education in the US, and only one third of this was public spending. In contrast, the Nordic countries spent 1.3% - 1.8 % of GDP on higher education, and nearly all of this are public spending.

The wage return to education varies considerably across countries. While one additional year of higher education yields a wage return of 8-10 % in the U.S. (Card 1999), it only yields a wage return of 4-6% in Norway (Hægeland et al. 1999).

Education is a wide concept. In this paper education means higher education, that is post-high school education. There is a variety of different types of higher education to choose from, and they differ in content, requirements regarding ability and effort, as well as in return. In the greater part of this paper, though, education is assumed to be homogenous. Let us now discuss what determines the individual's educational choice in the first place.

---

[1] The corresponding numbers for the Scandinavian countries are 31% in Norway, 33% in Sweden, and 27% in Denmark. Source: OECD Education at a glance.

1.3 Determinants for the educational choice.

The individual's educational choice is mainly determined by his preferences and abilities. When making his educational choice, the individual makes a trade-off between the expected costs and expected returns to education. The costs of the educational investment consists of the effort and time he has to put in to complete the education, as well as foregone labor income and direct costs such as tuition fees. The returns to education consists both of pecuniary and non-pecuniary returns. Pecuniary returns are wage, fringe benefits, and other types of compensation that could instead have been paid directly as wages. Non-pecuniary returns are types of return that cannot be replaced directly by higher wages, such as status, job-satisfaction, good job environments, and the direct utility gain, which I call the consumption value of education[2].

The individual's abilities determine the level of effort and time required to complete the education. The higher his abilities, the lower the costs, and the higher the wage return. His preferences determine which factors he values higher in this trade-off between costs and returns, and which types of returns to education he values higher, pecuniary or non-pecuniary returns.

1.4 Risk.

Education is an investment and a means to shift income between periods, in the same way as financial capital and real capital investments. One fact that is often ignored is that human capital investments are in some sense more risky than financial or real capital investments.

Human capital is inseparable from its owner and cannot be traded in the market, and thus the investment cannot be capitalized. The possibilities to diversify human capital investments are limited compared with the diversification possibilities of financial capital investments. When making his educational choice, the individual has full freedom and may choose from a large range of alternatives. But after the completion of the education, he has invested in a particular type of skills, such that there exists a potential lock-in effect her.

In contrast to financial capital investments, which generate a future return independent of the individual's actions once the investment has been made, human capital investments require labor effort in order to generate any return. Human capital investments generate no return if the individual is unemployed or disabled and cannot work.

---

[2] See Alstadsæter (2004) for a thorough discussion of the consumption value of education.

Since there is a long lag from the educational investment decision is made to any returns may be generated, the individual makes his educational choice based on the expected wage return and the expected situation in the future labor market. Many factors can change the actual outcome of the investment, in that they alter the demand for skilled labor, change the wage level, or affect the individual's health. All factors affect the individual's unemployment probability and thus also the utilization of the human capital investment and its rate of return. The larger the uncertainty, the greater the risk of human capital investments, and the higher must the expected rate of return be in order to induce the individual to acquire higher education.

But one might also argue that higher education makes the individual more flexible and able to fill different types of positions, such that education actually reduces the future systematic income risk.

1.5   Distortions to the educational choice

The individual acquires the level of education that maximizes his utility. In the absence of a consumption value of education, this means that he chooses the educational level that maximizes the present value of his income stream. This is also the optimal educational level for the society, and the level of education that maximizes productivity. Which factors can then distort his educational choice and generate an inefficient level of human capital in the society?

If there are imperfect capital markets, the liquidity constrained individual cannot borrow to finance his living expenses and other costs of education, and thus he acquires a level of human capital below the optimal. In the presence of income risk the risk averse individual under-invests in education if he cannot insure himself against the future income risk.

Supply-side effects also distort the individual's educational choice. If the supply of education is rationed, this restricts the individual from acquiring his optimal level of education. A distorted wage setting process might reduce the wage return to education and thus also the incentives to acquire higher education. An example of this is monopsony power of the employer, such that he can set the wage artificially low. This can be seen in the labor market for nurses in Norway, where the public sector basically is the only employer and thus pushes down the wage. A centralized wage setting process can have a similar effect, where strong labor unions prioritize wage increases for the low-skilled at the expense of wage increases for the high-skilled. This reduces the wage dispersion in the economy and thus also the wage return to higher education.

The last distortive element in the individual's educational decision process is income taxes, which reduce the individual's wage return to education and introduce a tax wedge between the social and private return to education. Let us now take a closer look at how the structure of income taxation affects the individual's educational choice.

2 Tax distortions to the individual's educational choice

The overall structure and level of the tax system governs the level of public revenue and thus also public expenditure. In turn this determines the level of public transfers to the individual in case of unemployment, sickness or disablement. The larger the welfare state, and the higher these transfers, the lower the future income risk, and the greater are the incentives to acquire higher education. Also, the overall structure of the tax system and the organization of public expenditures determine the level of public versus private financing of higher education, which affects the liquidity constrained individual's possibilities to invest in higher education.

The structure of the income tax system might also affect the level of the before-tax market wage. There is considerable empirical evidence that a progressive wage tax might in fact reduce before-tax inequality. A survey of this literature is given by Røed and Strøm (2002). But the opposite may also be the case, as Persson and Sandmo (2002) show.

In the following I will concentrate on the third channel for tax effects on education, namely how the income tax determines the after-tax wage when the before-tax wage is given. There is a disagreement in the tax literature on whether or not one ought to tax the return to human capital investments, and on how taxes affect the incentives to acquire higher education. For instance, Heckman (1976) argues that taxes encourage human capital accumulation, while Trostel (1993) argues the opposite. Income taxes alter the after-tax wage return to education through different channels. The reason why authors conclude differently on whether taxes encourage or discourage education is that they study different partial effects. I will now provide the intuition for these partial effects in a simple model.

2.1 A simple model.

Apply an extended version of the simple two-period representative agent model of Jacobs (2002) in a small open economy. The real interest rate, r, is given, as is the real wage that is normalized to 1. The individual can increase his second period income by either investing in the financial market, where the return is given by the real interest rate, or by investing in education, which yields a wage return in the second period.

Let the return to educational investments E be given by the function $g(E)$, which here has the functional form E^β. The larger β is, the higher is the wage return to educational investments. Note that $0 < \beta < 1$. The duration of each period is normalized to 1, such that $0 < E < 1$ is the fraction of first period that is spent acquiring education. The remaining time is spent working as an unskilled worker.

The net of taxes first period wage income is invested in the capital market. The costs of acquiring higher education is foregone labor income, as well as direct monetary outlays for tuition fees, books, etc. as a fixed proportion k of first period income per unit of education. Total non-deductible direct costs of education are given by $k \cdot E$. Capital markets are assumed to be perfect, such that the individual can borrow to finance the direct costs of education. Leisure in the first period is given. In the second period, however, leisure L_2 is endogenously determined, and it is measured as a fraction of available time. Time spent working in the second period is given by $(1 - L_2)$.

Let the income tax system be dual[3], such that the tax rate on capital income, τ, and the tax rate on labor income, t, can differ. Allow for the possibility of progressive labor income taxation, such that a two-tariff rate is required. Let t_1 be the basic tax rate, and let t_2 be the top tax rate that applies if labor income is above a given threshold I. First period labor income is always below I, such that only the basic tax rate applies. The educated individual always generates a labor income above the threshold, such that the top tax rate applies to part of his labor income. If $t_1 = t_2$ labor income taxation is proportional, and if $t_1 < t_2$ labor income taxation is progressive.

Now consider the individual's budget constraints. First period consumption is zero, and thus first period saving S in the financial market is given by labor income net of taxes and educational expenditures:

$$S = (1 - t_1) \cdot (1 - E) - k \cdot E \qquad (1)$$

Second period consumption, C_2, is given by net of taxes labor income and savings:

$$C_2 = (1 - t_1) \cdot I + (1 - t_2) \cdot \left\{ (1 - L_2) \cdot E^\beta - I \right\} + \left\{ 1 + (1 - \tau) \cdot r \right\} \cdot S \qquad (2)$$

The more education he acquires in the first period, the higher is his wage return to education and the higher share of his wage income is taxed according to the top tax. On the other hand, the higher his educational level, the lower are his savings in the financial market.

---

[3] See Sørensen (1998) for more on the dual income tax.

The individual enjoys both second period consumption and leisure. The non-pecuniary return to education is represented through the taste parameter γ. If $\gamma > 0$, the individual has a positive consumption value of education, and if $\gamma < 0$, the consumption value of education is negative. In the case that $\gamma = 0$, then education is a pure investment and yields no non-pecuniary returns. In order to isolate the various tax effects on the individual's educational choice, let his utility function have the following specific functional form[4]:

$$U(C_2, L_2, E) = C_2 + \gamma \cdot E - \frac{(1 - L_2)^{1 + \frac{1}{\varepsilon}}}{1 + \frac{1}{\varepsilon}} \tag{3}$$

Remember that $(1 - L_2)$ is the second period labor supply, and as utility depends positively on the amount of leisure, it depends negatively on the amount of time spent working. The wage elasticity of the labor supply is represented by the parameter ε. The greater this elasticity, the larger is the effect on the individual's labor supply by a change in the after tax wage.

The individual's discount rate is the after tax real interest rate. When he at the beginning of the first period decides how much education to acquire, he maximizes his utility function (3) subject to the present value of the life-time consumption (1) and (2). It can be shown that the individual's level of educational attainment then is given by E, which is a function of taxes, the rates of return to the two investment alternatives, as well as the wage elasticity of labor supply:

$$E = \left\{ \frac{\beta \cdot (1 - t_2)^{1 + \varepsilon}}{[1 + (1 - \tau) \cdot r] \cdot [1 - t_1 + k] - \gamma} \right\}^{\frac{1}{1 - (1 + \varepsilon) \cdot \beta}} \tag{4}$$

The different tax rates have different effects which go in opposite directions. Let us now take a closer look at each of these tax induced distortions to the educational choice.

Proportional wage tax. Now consider the effect of a proportional income tax. Isolate this effect by assuming no tuition fees, $k = 0$, no non-pecuniary returns to education, $\gamma = 0$, exogenously given labor supply in the second period, $\varepsilon = 0$, and no tax on capital income, $\tau = 0$. Labor income taxation is proportional, such that $t_1 = t_2 = t$. The individual's demand function for education (4) then reduces to:

---

[4]I could instead have analyzed this on a general utility function. That would nevertheless not have provided the immediate intuitive tax effects on the individual's demand for higher education. Thus I choose to use this very specific functional form in order to immediately illustrate the various effects that have been derived from general utility functions in the reference papers.

$$E = \left\{ \frac{\beta}{1+r} \right\}^{\frac{1}{1-\beta}} \tag{5}$$

The amount of education that the individual chooses to acquire depends on the present value of the return to the investments, and there are no tax-induced distortions to his educational choice. The higher the return factor β to education is, the more education he acquires. A high return to financial investments, r, makes financial investments relatively more attractive and reduces education.

But why doesn't the wage tax affect the individual's investment decision? A proportional tax on labor income taxes the cost of the educational investment, which here is foregone labor income, at the same rate as the return to the investment, which is second period labor income. As is shown by Sandmo (1979), a neutral cash flow tax of this kind levies zero marginal tax on the return to educational investments. Thus, a proportional tax on labor income induces no distortions to the individual's choice of educational investments. This was first shown by Boskin (1975).

But the neutrality of the proportional wage tax brakes down if other effects are present.

Proportional income tax   Next, consider the case where a positive proportional tax on capital income exists along with the wage tax, such that $\tau > 0$ and $t_1 = t_2 = t$. We still disregard other complicating effects and assume that there are no tuition fees, $k = 0$, no non-pecuniary returns to education, $\gamma = 0$, and that labor supply in the second period is exogenously given, $\varepsilon = 0$. The demand for education is then given by

$$E = \left\{ \frac{\beta}{1+(1-\tau) \cdot r} \right\}^{\frac{1}{1-\beta}} \tag{6}$$

As we see, the tax on capital income creates distortions in the individual's investment decision and induces him to spend more of his time in the first period on education than he would have done in the absence of tax on capital income. There are three reasons for this. First, tax on capital income reduces the return to financial capital investments and increases the relative return to human capital investments. Second, a tax on capital income reduces the discount factor and increases the present value of the return to education. And third, a tax on capital income reduces the costs of borrowing, provided that the tax system is symmetric. Thus the conclusion here is that a tax on capital income distorts the individual's investment decision in favor of human capital investments. This is shown by Driffill and Rosen (1983), and Nielsen and Sørensen (1997).

A proportional wage tax is a neutral tax on the return to human capital investments as long as there is no tax on capital income. A proportional tax on all income induces the individual to over-invest in human capital from a social point of view, which is the result of Heckman (1976).

Direct costs of education. Now consider the effect of taxes on the educational level in the presence of direct costs of education, $k > 0$. To simplify, let there be no tax on capital income, $\tau = 0$, a proportional wage tax, $t_1 = t_2 = t$, exogenously given labor supply, $\varepsilon = 0$, and no non-pecuniary returns to education, $\gamma = 0$. We see from the demand function for education below that a proportional wage tax no longer is neutral since the direct costs of acquiring education in the first period are non-deductible:

$$E = \left\{ \frac{\beta}{[1+r] \cdot \left[1 + \frac{k}{1-t}\right]} \right\}^{\frac{1}{1-\beta}} \tag{7}$$

Tax on labor income reduces total costs of the educational investments, which is the sum of foregone labor income and direct monetary outlays, at a lower rate than the return to the investments. The proportional tax on labor income thus discourages human capital investments and leads to under-invest in education in the presence of non-deductible direct costs of education. This conclusion is drawn by among others Trostel (1993), Nerlove et al. (1993), and Jacobs (2003).

Another direct cost of educational investments is the non-deductible depreciation of human capital. As Nerlove et al. argue, human capital is inseparable from its owner, and it thus depreciates to zero at death. They consider the choice of investing in human capital or in real capital, where the depreciation of real capital is tax deductible. Including human capital depreciation as a cost of acquiring education, they conclude that even a proportional income tax on both labor and capital income discriminates against human capital investments and lowers productivity in the society.

If direct costs of educational investments are tax deductible, this tax induced distortion disappears. Alternatively, the government can eliminate the distortion through direct educational subsidies. Heckman (1976) assumes that direct costs are in fact deductible, so the tax induced distortion of non-deductible direct costs does not appear in his analysis.

Non-pecuniary returns to education. Higher wage in the future is not the only motivation for acquiring higher education. As we now will show, the presence of non-pecuniary returns or costs to education, $\gamma \neq 0$, destroys the neutrality of the proportional

wage tax. Consider the simple case of a proportional wage tax, $t_1 = t_2 = t$, no tax on capital income, $\tau = 0$, no tuition fees, $k = 0$, and exogenously given labor supply in the second period , $\varepsilon = 0$. The individual's demand function for education (4) then reduces to:

$$E = \left\{ \frac{\beta}{1 + r - \frac{\gamma}{1-t}} \right\}^{\frac{1}{1-\beta}} \tag{8}$$

The presence of a proportional tax on wage income exaggerates the importance of the non-pecuniary returns or costs of education. First, consider the case where there are non-pecuniary costs of education, $\gamma < 0$, such that the individual considers education to be a consumption bad. These costs are non-deductible. As in the above case with non-deductible direct costs of education, the wage tax reduces the return to education at a higher rate than the costs, inducing the individual to choose less education than in the absence of taxes.

On the other hand, if the consumption value of education is positive, $\gamma > 0$, the result is the opposite. The proportional wage tax now increases demand for education, since the non-pecuniary returns to education are tax-exempt. The cost of education, which is the foregone labor income, is taxed at a higher rate than the total return to education, which is the sum of the taxed wage return and the untaxed consumption value. The proportional wage tax serves as a tax subsidy on the consumption value of education and induces the individual to over-invest in education. This is shown by Alstadsæter (2003a).

Proportional wage tax when labor supply is endogenous . Let us now find the effect of taxes on educational attainment when labor supply and second period leisure are endogenously determined, such that $\varepsilon > 0$. Assume no direct costs of education, $k = 0$, no tax on capital income, $\tau = 0$, proportional wage tax, $t_1 = t_2 = t$, and no non-pecuniary returns, $\gamma = 0$. Also in this case the neutrality of the proportional wage tax breaks down:

$$E = \left\{ \frac{\beta}{1 + r} \cdot (1 - t)^{\varepsilon} \right\}^{\frac{1}{1-(1+\varepsilon)\cdot\beta}} \tag{9}$$

A tax on labor income reduces the price on second period leisure, measured in foregone labor income, and it thus reduces the second period labor supply. Thus, as the hours worked decreases, the utilization of the educational investment decreases, as does the

return to education. This reduces investments in education[5]. The effect is even stronger in if the labor income tax is progressive. This effect from labor supply is highlighted by Lucas (1990), Lin (1998), and Jacobs (2003). Nielsen and Sørensen (1997) show in a special case that the neutrality of the proportional wage tax can still hold even when labor supply is endogenous.

Progressive wage tax. Finally, consider the effect of progressive wage tax, $t_1 < t_2$. To separate this effect from all the other effects, consider this in the absence of any capital income tax, such that $\tau = 0$. Also, let there be no direct costs of education, $k = 0$, no labor supply effects of taxation, $\varepsilon = 0$, and no non-pecuniary returns to education, $\gamma = 0$. The individual's demand for education is then determined by the present value of the return to education, as well as by the degree of progressivity in the tax system:

$$E = \left\{ \frac{\beta}{1+r} \cdot \frac{1-t_2}{1-t_1} \right\}^{\frac{1}{1-\beta}} . \tag{10}$$

A progressive wage tax reduces the return to educational investments more than the cost of the investment, which is foregone labor income in the first period. This reduces the return to human capital investments and increases the relative return to financial capital investments. Thus, a progressive labor income tax discriminates against human capital investments and induces the individual to under-invest in human capital. This investment disincentive is stronger the more progressive the labor income tax is. The more progressive the tax system is, the smaller is the fraction $\frac{1-t_2}{1-t_1}$, and the lower is the demand for educational investment. This effect is shown by among others Nielsen and Sørensen (1997), and Heckman, Lochner and Taber (1998)

A tax on capital income induces the individual to invest more in human capital, such that the effect of progressive labor income taxes on the educational level is ambiguous in the presence of capital income taxation, as shown by Sgontz (1982).

Summary We have shown that the tax system induces several distortions to the individual's educational choice, and that these distortions go in different directions. The different partial effects are as follows:

---

[5] Only substitution effects of taxes on labor supply are present in this simple model, no income effects. The presence of the income effect makes the conclusion here ambiguous.

	Effect on education
Proportional wage tax	0
Proportional capital income tax	+
Proportional income tax	+
Proportional wage tax and direct costs of education	−
Proportional wage tax and non-pecuniary returns to education	+
Proportional wage tax and non-pecuniary costs of education	−
Proportional wage tax when labor supply is endogenous	−
Progressive wage tax	−

Progressive tax on labor income discourages educational investments, while tax on capital income encourage them. A proportional tax on labor income is in itself neutral, but in the presence of other effects, such as direct costs of education, non-pecuniary returns to education, capital income taxation, and endogenous labor supply the proportional wage tax still introduces distortions.

All these effects partly neutralize each other. Whether or not this tax system induces the individual to acquire more or less education than in the absence of taxes depends on the relative sizes of the tax rates and on the individual's preferences.

But there are other effects of taxes on the individual's educational choice that we have not captured in this simple model. Let us now take a look at them.

2.2 Other effects of taxes on education.

Risk. One important extension is the inclusion of risk. Human capital is inseparable from its owner and cannot be traded in the market. The return to education depends on the labor supply of the individual, and if unemployed, he receives no return to human capital investments. There are limited possibilities for diversification in the human capital investments in order to reduce this risk. The only option for diversification is to acquire a combination of general and sector specific human capital. Rosen (1980) shows that in the presence of uncertain future wage return to education, taxes might actually increase educational attainment. The intuition for this is that income taxes reduce the future income variance. Thus taxes reduce the income uncertainty and encourage human capital investments.

This model is extended by Kreider (2003) to consider the effect of tax on human capital investments when labor supply is endogenous and there are social security payments to unemployed. He finds that young individuals under-invest in education, since they, if

educated, would have to pay income-based transfers to non-workers, and these transfers are not adjusted for the cost of the educational investment. In addition to all these effects, labor income taxes generate a negative income effect that could reduce the individual's willingness to take risk, and thus reduce the individual's educational investments. This effect depends on the assumption that the individual has decreasing risk aversion in income.

Social security. Unemployment benefits through the social security system reduce the future income loss in case of unemployment. Brown and Kaufold (1988) show that if unemployment insurance is financed as a proportional pay-roll tax and unemployment benefits are link to paid contributions, the presence of the unemployment insurance might increase educational attainment. The intuition is that the unemployment insurance shifts income from the good state, where the individual is employed, to the bad state, where he is unemployed, thus reducing the income risk. Similarly, Lau and Poutvaara (2001) find that in the absence of risk, the structure of old age pension benefits from the social security system affect the individual's educational investment. A system where pension benefits are linked to age as well as paid social security contributions might actually increase educational attainment.

Tax evasion. Tax evasion is a well-studied topic in the tax literature, but only Kolm and Larsen (2004) include evasion motives when analyzing the effects of taxes on the individual's educational attainment. They analyze the effects of taxes on educational attainment when higher taxes encourage participation in the informal economy and tax evasion. Only unskilled individuals can work in the informal sector. The higher the wage taxes, the stronger the incentives to participate in the informal sector, and the lower is the return to education. In this context, even a proportional wage tax reduces educational attainment. They also show that a higher punishment for tax evasion can increase educational attainment.

Heterogenous education. Until now, we have assumed that education is homogenous, which obviously is a very simplifying assumption. Alstadsæter (2003b) shows that if the individual can choose between educational types that differ in wage return and in consumption value, then a progressive wage tax might induce the individual to choose more of the educational type with the higher consumption value. The tax reduces the price on the consumption value of education, measured in foregone labor income by not choosing the educational type that generates the higher wage return. Malchow-Møller and Skaksen (2003) reach the same conclusion in an general equilibrium expansion of this model.

Figure 2: *Number of students enrolled at universities and colleges in Norway in the period 1985-2001.*
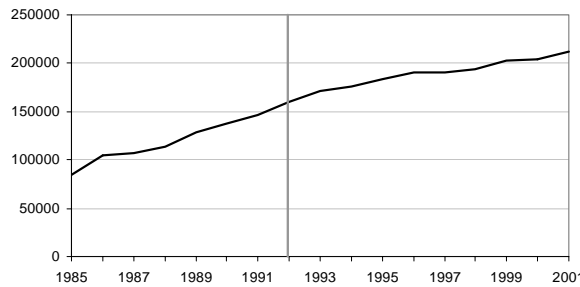
3 Empirical tax effects on education.

Already 25 years ago, Sgontz (1989) pointed out that there the lack of empirical analysis of tax effects on human capital accumulation, and many authors of theoretical papers have joined in his call for empirical facts on this issue. In spite of this, the empirical literature of tax effects on education is basically non-existing. Fredriksson (1997) finds that the educational attainment of young Swedish individuals to a large extent seems to respond to economic incentives, such as the after-tax wage of educated individuals. But the only major attempt to find empirical effects of income taxes on the educational attainment is done by Heckman, Lochner, and Taber (1998, 1999) and Taber (2002) in a series of general equilibrium models. They estimate individual parameters such as ability and level of human capital based on micro panel data, and simulate the effects of a tax reform on educational attainment. They find that progressive labor income taxes in combination with a proportional capital income tax[6] have a small negative effect on human capital accumulation in the long run, while the short-lived short run effect is larger.

Let me illustrate with an example why it is so difficult to identify any effects of taxes on education. The Norwegian 1992 tax reform broadened the tax base and reduced marginal tax rates. It also represented a shift from global progressive income tax to a dual income tax[7]. The Nordic dual income tax combines a low proportional capital income tax with a progressive labor income tax. Can we find any effect of this tax reform on the educational attainment? As we see from figure 2, the number of students enrolled at Norwegian colleges and universities increased steadily with 150% from 1985 to 2001. At first glance the 1992

---

[6] As in the Nordic dual income tax.

[7] While a global income tax applies one tax schedule on the sum of income from all soucres, the dual income tax taxes income from capital and labor separately. See Sørensen (1998) for more on the dual income tax.

tax reform does not appear to have any effect on the aggregate educational attainment beyond the positive trend that already existed. The supply of higher education is limited and governed by public policy. The increase in educational attainment during the early 1990ies was to a large extent caused by an expansion of the educational sector and the following relaxation of the rationing. Around 1990 Norway experienced a recession, and many of the young individuals who previously would have started working directly after high school now acquired education in order to improve their skills and their competitiveness on a tightening labor market. Also, there has been an upward shift in the minimum educational requirements to be considered for different types of jobs. The requirements for education to function as a signal of good skills has increased over time, pushing the educational level up. Another factor that complicate the identification of the tax effect is the long lag from when the educational decision is made to when the return to education is collected. So even if we cannot immediately see any effect of the 1992 tax reform on the educational attainment, it does not mean that it had no effect.

4   Tax effects on the return to different education levels.

The educational choice is often not a continuos choice of how many years of higher education to acquire, rather than a discrete choice between different levels of education. In most cases, the individual has to complete a degree in order to get any return to the educational investment. So which educational level should the young individual choose? As we have already discussed, many factors affect the individual's educational choice. Assume for now that there are no non-pecuniary returns to education, and that all individuals have the same innate ability level. Then the answer would be to choose the educational level that yields the highest return. But as is shown below, the optimal educational level might depend on how the return to education is measured. Let us consider this in the two-period framework of section 2. During the first period the individual either works or acquires education, and during the second period he works. Assume that the first period lasts from the age 19 to age 29, and that second period lasts from age 30 to age 55[8].

Figure 3 shows the 2002 average wage of all Norwegian employees[9] aged 30-55 who at least have completed high school. This is a total of 785 728 individuals, and their distribution of highest completed education is as follows: 372 152 have high school, 319

---

[8]In order to avoid the problems introduces by the retirement decision, only prime aged individuals are consideres in the second period.

[9]An individual is defined as employee if he works at least two months during the year, which here corresponds to a wage income of NOK 50.000, and who is not self-employed.

Figure 3: *Average annual wage at different educational levels. All Norwegian employees aged 30-55, 2002.*
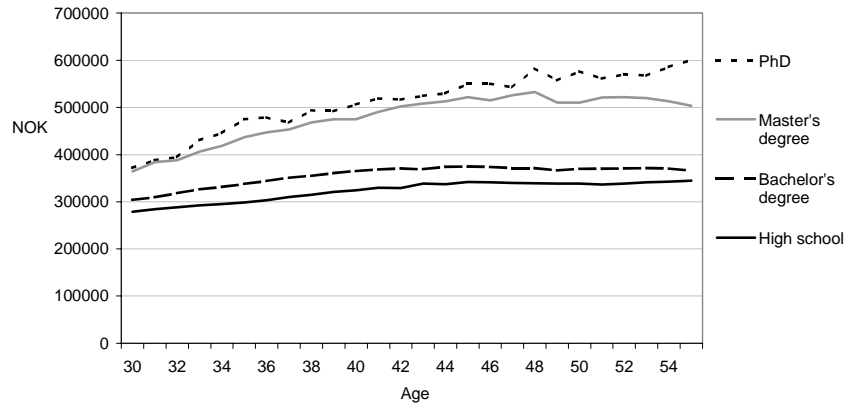
893 have a Bachelor's degree, 84 800 have a master's degree, and 7 883 have a Ph.D. These wage profiles can be considered as the expected lifetime wage profiles for the young individual who in 2002 makes his choice of educational level. Disregard all complicating factors and assume homogenous innate abilities and no liquidity constraints[10] The advice to the young individual is clear: A Ph.D. generates the highest wage return during the second period, and thus you should choose this educational level.

In figure 3, progressive wage taxes would affect the relative return to the different educational levels, but the ranking of the different educational levels would still be the same, with Ph.D. generating the highest after-tax wage return. Thus a progressive wage tax would in this context not affect his educational choice. But if he acquires a Ph.D., he has to spend at least nine more years at school than if he starts working directly after high school. During this time he borrows to finance living expenses and direct costs of education[11], a debt that has to be repaid during the second period. At the same time, the high school graduate may work during these nine years and invest part of his income in the financial market, an investment that generates returns during the second period. If the return to financial investments is taken into account, a Ph.D. not necessarily generates the highest lifetime income. This might affect the ranking of the different investment alternatives. As different income types are taxed differently, the tax system could actually affect not only the relative after-tax income at the different educational levels, but also the

---

[10] The young Norwegian individual experiences no or only very weak liquidity constraints when making his educaitonal chocie. This is due to the absence of tuition fees (most higher education is publicly financed) and the presence of a highly subsidiezed student loan available to all students.

[11] Here assume that there are no bequests and financial transfers from family.

Figure 4: *Average total after-tax income from all sources at different educational levels. All Norwegian employees aged 30-55, 2002.*
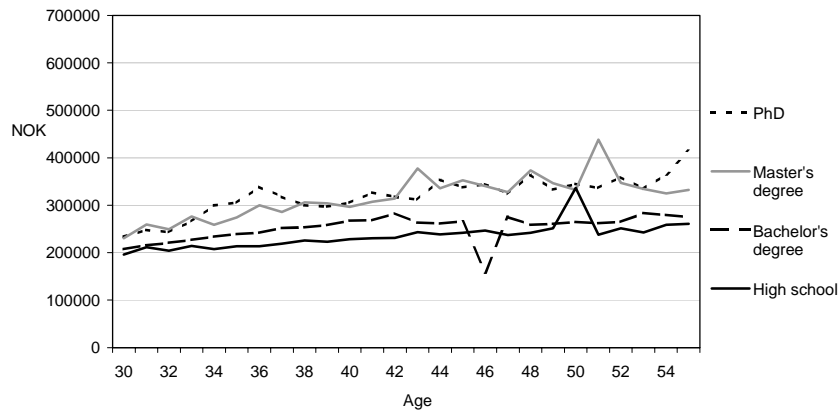

Figure 5: *Percentage increase in present value of second period income (age 30-55) at age 19 by acquiring a higher educational level compared with only having high school. Calculated at 5 % discount rate, based on average incomes at different educational levels by age group in Norway, 2002.*

Educational level	Wage income	Net of tax total income
Bachelor's	10,9 %	8 %
Master's	49,4 %	33,1 %
PhD	58,3 %	35 %

ranking among them. As we see in figure 4[12], when total after-tax income is considered, a Ph.D. not necessarily generates the highest lifetime income. A master's degree generates nearly the same lifetime income. It nevertheless seems like higher education still pays off. A Master's degree is the educational level that contributes to the largest positive increase in after-tax income.

As we see in the table in figure 5, the present value of the lifetime income at different educational levels decreases substantially when the after-tax income from all sources is

---

[12] The different spikes in the wage profiles is due to outliers in capital income. In particular, remember that the 2000-2001 dividend tax was removed January 1st 2002, prompting a timing effect and an increase in dividend payments. These are only averages, and no attempt has been made to remove these spikes.

18

considered instead of only before-tax wage income. The return to the different educational levels are measured in increased present value of the second period income stream compared with having only high school. The individual makes all choices in order to maximize his utility, where education is only one choice among others, and where the wage return to education is one among many decision variables behind the educational choice. Thus, only considering the wage return when analyzing the tax effects on education only gives part of the total picture.

5   Summary

Income taxes have several different partial effects on the individual's educational choice that go in different directions. We have shown that a proportional wage tax is a neutral tax on the return to higher education, but that this effect breaks down in the presence of other taxes. A tax on capital income increases educational attainment, as does the presence of non-pecuniary returns to education. A social security system where benefits are linked to paid contributions also encourage education. Both pecuniary and non-pecuniary non-deductible costs of education discourage education, as do tax evading possibilities for the low-skilled. Progressive wage taxes might affect the individual's choice of educational type when education is heterogenous, such that he chooses more of the education with the higher non-pecuniary return. The total effect of the tax system on educational attainment in the society is ambiguous.

Finally, consider the question: Does the real-world 19-year old *really* consider the tax system when making his educational decision? No. But he has a notion of the before and after-tax overall wage levels in the society, as well as of the wage levels in different professions. This gives him an impression of which lifetime income he can expect by acquiring higher education. He holds this against the impression of what he will earn from other sources should he not acquire education, both before and after tax. He also has an idea of the future income risk. How much weight he puts on this future income risk depends among other things on the level of welfare in the society. If there are good unemployment insurance, health insurance, as well as disability insurance provided by the government, this reduces the importance of the future income risk. Whether or not higher education is publicly provided affect the liquidity-constrained individual's possibility to attend higher education, as do the extent of subsidized student loans. The supply of educational institutions to some degree depends on the level of public financing, which in turn governs the individual's possibilities for education. So even though it is not likely that the young individual includes the structure of the income tax as an important decision variable when

making his educational choice, the tax system has a rather large indirect effect on his choice of education.

6   References

Alstadsæter, Annette (2003a): Does the tax system encourage too much education? *FinanzArchiv 59(1)*, 27-48.

Alstadsæter, Annette (2003b): Income Tax, Consumption Value of Education, and the Choice of Educational Type. *CESifo Working Paper no. 1055.*

Alstadsæter, Annette (2004): Measuring the Consumption Value of Education. *NHH Discussion Paper SAM 04/2004.*

Becker, Gary S. (1964): *Human Capital. A Theoretical and Empirical Analysis with Special Reference to Education.* University of Chicago Press, 3rd edition 1993.

Boskin, Michael J. (1975): Notes on the Tax Treatment of Human Capital. *NBER Working Paper no. 116.*

Brown, Eleanor and Howard Kaufold (1988): Human Capital Accumulation and the Optimal Level of Unemployment nsurance Provision. *Journal of Labor Economics 6(4)*, 493-514.

Card, David (1999): The Causal Effect of Education on Earnings. *Handbook of Labor Economics (3). Edt. Orley Ashenfelter and David Card.* 1801-1863.

Diamond, Peter A. and James A. Mirrlees (1971): Optimal Taxation and Public Production. *American Economic Review 61*, 8-27 and 261-278.

Driffil, E. John and Harvey S. Rosen (1983): Taxation and Excess Burden: A Life Cycle Perspective. *International Economic Review 24(3)*, 671-683.

Fredriksson, Peter (1997): Economic Incentives and the Demand for Higher Education. *Scandinavian Journal of Economics 99(1)*, 129-142.

Heckman, James J. (1976): A Life-Cycle Model of Earnings, Learning, and Consumption. *Journal of Political Economy 84*, S11-S44.

Heckman, James J., Lance Lochner, and Christopher Taber (1998): Tax Policy and Human-Capital Formation. *American Economic Review 88(2)*, 293-297.

Hægeland, Torbjørn, Tor J. Klette and Kjell G. Salvanes (1999): Declining Returns to Education in Norway? Comparing Estimates across Cohorts, Sectors and over Time. *Scandinavian Journal of Economics 101(4)*, 555-576.

Jacobs, Bas (2002): *Public Finance and Human Capital.* Book no. 280 Tinbergen Institute Research Series, Amsterdam.

Jacobs, Bas (2003): Optimal Income Taxation with Endogenous Human Capital. *Manuscript, forthcoming in Journal of Public Economic Theory.*

Kolm, Ann-Sofie and Birthe Larsen (2004): Does Tax Evasion Affect Unemployment and Educational Choice? *IFAU Working Paper 2004:4.*

Kreider, Brent (2003): Optimal Tax Policy when Human Capital and Labor Force Participation Decisions are Endogenous. *Iowa State University, Department of Economics Working Paper no. 03009.*

Lau, Morten I. and Panu Poutvaara (2001): Social Security Incentives and Human Capital Investment. *CESifo Working Paper no. 438.*

Levhari, David and Yoram Weiss (1974): The Effect of Risk on the Investment in Human Capital. *American Economic Review 64*, 950-963.

Lin, Shuanglin (1998): Labor Income Taxation and Human Capital Accumulation. *Journal of Public Economics 68*, 291-302.

Lucas, Robert E. (1990): Supply-Side Economics: An Analytical Review. *Oxford Economic Papers 42*, 293-316.

Malchow-Møller, Nikolaj and Jan Rose Skaksen (2003): How to Finance Education - Taxes of Tuition Fees? *CEBR Discussion Paper 28*-2003.

Mincer, J. (1974): *Schooling, Experience and Earnings.* Columbia University Press, New York.

Nerlove, Marc, Assaf Razin, Efraim Sadka, and Robert K. von Weizsäcker (1993): Comprehensive Income Taxation, Investments in Human and Physical Capital, and Productivity. *Journal of Public Economics 50*, 397-406.

Nielsen, Søren B. and Peter B. Sørensen (1997): On the Optimality of the Nordic System of Dual Income Taxation. J*ournal of Public Economics 63*, 311-329.

Persson, Mats and Agnar Sandmo (2002): Taxation and Tournaments. *NHH Discussion Paper SAM 10/2002.*

Røed, Knut and Steinar Strøm (2002): Progressive Taxes and the Labour Market: Is the Trade-off between Equality and Efficiency Inevitable? *Journal of Economic Surveys 16(1)*, 77-110.

Sandmo, Agnar (1979): A Note on the Neutrality of the Cash Flow Corporation Tax. *Economic Letters 4*, 173-176.

Schultz, T.D. (1960): Capital Formation by Education. *Journal of Political Economy 64*, 571-582.

Sgontz, L.G. (1982): Does the Income Tax Favor Human Capital? *National Tax Journal 35(1)*, 99-114.

Sørensen, Søren Bo (1998), Edt: *Tax Policy in the Nordic Countries.* Macmillian Press London.

Taber, Christopher (2002): Tax Reform and Human Capital Accumulation: Evidence from an Empirical General Equilibrium Model of Skill Formation. *Advances in Economic Analysis & Policy 2(1)*, article 3.

Trostel, Philip A. (1993): The Effect of Taxation on Human Capital. J*ournal of Political Economy 101(2)*, 327-350.

Trostel, Philip, Ian Walker, and Paul Woolley (2002): Estimates of the Economic Return to Schooling for 28 Countries. *Labor Economics 9*, 1-16.