

# CEPOS WORKING PAPER 49: 30 YEARS OF TAX REFORMS – HOW MUCH IMPACT ON DANISH GROWTH?

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## ABSTRACT:

*During three decades, Denmark has witnessed repeated tax reforms. The corporate tax rate and some marginal tax rates on labor have been cut by almost 30 percentage points. Economic theory as well as international empirical data point to a potential for economic growth especially by reducing high marginal tax rates. In this paper, the combined effect of 30 years of Danish tax reform is estimated to have increased GDP by approximately 10 per cent, and economic welfare by the equivalent of 6 per cent of GDP. Nevertheless, room remains for further reform, as Danish taxes are still very high, even if the prospect for expanding tax bases further has become slim.*

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The Danish tax system has undergone repeated tax reforms for three decades, affecting most aspects of it. Tax reforms have been a key element in an array of structural reforms, aimed at the labor market, the pension system, welfare programs, financial market liberalization and regulatory reforms. The main objectives of structural reforms have been to enhance economic growth, consolidate public finances, reduce unemployment and, at least initially, getting rid of huge current account deficits. At the beginning of the 1980s, the Danish economy was burdened by a build-up of imbalances and structural problems during the preceding 15 years, from the mid-1960s and onwards when the Danish welfare state was founded.

Tax reforms to enhance growth and reduce welfare economic costs from distortions from the tax system have not been a uniquely Danish phenomenon. On the contrary, most Western countries have reformed their tax systems, following the lead of the 1981 American tax reform.

Denmark has so far implemented nine reforms and other major changes to the personal income tax system, several reforms and tax rate cuts in its corporate tax system as well as a number of other tax policy initiatives concerning indirect taxation.

Thus, an interesting question is: How much impact has three decades of tax reforms had on economic growth?

It is extremely difficult to give a precise answer to this question, since a huge number of factors have influenced economic performance. These factors are impossible to disentangle. In this paper, however, an attempt is made to isolate the growth effect of key elements of tax reform, namely tax rate cuts in the income tax system, both personal and corporate. These are, judged from economic theory, the most important aspects of the tax system affecting economic growth.

The method used is a simulation of a non-tax reform. Combining a partial equilibrium tax model with empirical findings from the literature, I try to estimate the impact of bringing tax rates back to their 1986 levels. The counter-factual simulation gives an indication of the growth effect of actual tax reforms.

According to the simulations, the overall effect of growth enhancing Danish tax reforms since 1986 is equivalent to 10 per cent of GDP (since the simulated effect of non-reform would be a drop of 9.7 per cent). That accounts for almost one sixth of total GDP growth over the three decades. According to the simulations, the deadweight welfare economic cost of taxation has been reduced by the equivalent of 6 per cent of GDP. Roughly speaking, for every krone in tax rate cuts, taxpayers have earned two kroners in welfare terms.

Even if tax rates have been reduced, ample room remains for further reforms. Denmark still has high combined marginal tax rates for especially high income earners and a medium sized corporate tax rate within the OECD. Denmark tops the OECD tax revenue to GDP ratio list.

The paper is organized in the following way: First, an overview of the theoretical literature on taxation and growth. Second, I provide an overview of the empirical literature on the subject. Third, I carry out an experiment in two parts, implementing 1986 corporate and personal

income tax rates in today's economy. Fourth, I look into the implications for growth and welfare. Fifth, I make an indirect assessment of the implications of tax base reforms, and finally I briefly discuss some political economy caveats.

## TAXES AND GROWTH – THEORY

It is well understood that taxes and tax systems influence economic growth. Principles of taxation have been a major topic in economic theory since the classics, e.g. Smith (1776) and Ricardo (1817).

In neo-classical growth theory (following Solow 1956), the main focus is on the supply of factors of production, labor and capital. In standard neo-classical production functions, total production is an increasing function in labor and capital. Labor supply is determined by after-tax wages and opportunity costs in foregone leisure and transfer income. Marginal tax rates reduce labor supply through a substitution effect, while average income taxes increase labor supply and transfer income reduce it, both through the income effect. Taxes can effect both intensive and extensive margins labor supply, the first being the choice of how much labor to supply, while the second is the choice of whether to supply any labor at all. In the case of a fixed participation cost (such as not being eligible for transfer income, when working), the optimal supply might be zero for some individuals. The supply of capital is in principle influenced by the tax treatment of both investment and saving, since in a closed economy (such as the global economy), savings must equal investments. Actually, in the original Solow model, growth is determined by the savings rate. However, in a small open economy the domestic savings rate is of limited importance for growth, since ample supply of global savings is available at the international rate of interest. So, even if taxation of savings do have a welfare cost, in the case of an open economy, it doesn't have much impact on growth<sup>1</sup>.

In the Solow-model, the impact of taxes are on the levels of factors of production and thus on the level of GDP rather than on the rate of growth. Taxes lower growth in terms of the level of GDP rather than its rate of change<sup>2 3</sup>.

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<sup>1</sup> However, capital markets can be segregated so that risky investments in e.g. entrepreneurial enterprises have to be financed locally (maybe by the entrepreneur her or himself), in which case the tax treatment of savings matters for growth too.

<sup>2</sup> The estimations of growth effects of tax reforms in Denmark are also in terms of level rather than rate of change. Any policy which would increase the permanent rate of growth would of course ultimately outstrip policies affecting the level only, but are harder to identify. That goes for empirical findings as well. Empirical findings of policies seeming to increase the rate of growth might very well affect levels instead in the long run. A measured higher growth rate could be the result of the economy changing from one growth path to another.

<sup>3</sup> In fact, as the Solow economy reaches a steady state, the rate of growth declines to zero, if population growth wane off. In steady state, gross investments equals capital depreciation, leaving the factors of production constant.

Whereas labor is a homogeneous factor of production in the Solow model, ultimately given by the size of the (working age) population, in human capital theory (following Becker 1964) a quality dimension is added to labor. Thus, investments in formal education can affect human capital, just as decisions about on the job training, mobility, choice of career and the like. Taxes can influence labor supply in these dimensions, too, since they affect after-tax earnings. A second best case can be made for subsidizing education, if incentives are distorted by taxes. A subsidy scheme will, however, still distort for instance the type of education<sup>4</sup> chosen, leaving a welfare loss compared to a first-best tax cut.

Endogenous growth theory (following Romer (1986,1990)), Lucas (1988, 1990), Mankiw et al (1992) among others) introduced human capital formation into growth theory and focus on the influence on growth of making given factors of production more productive, both the productivity of individual factors and total factor productivity. Innovations can increase total factor productivity a number of ways: More productive methods of production and more valuable products. In addition, a wider range of goods and services to choose from is valuable to consumers in itself (even if some economic progress due to more variety is difficult to measure by traditional statistical means). Thus, taxes impeding human capital formation and innovation will also effect growth, just like taxes hamper the supply of factors of production in the Solow model<sup>5</sup>.

In traditional welfare economics, (following Pigou 1920), taxation can play an import role in correcting market prices, when externalities lead private and social costs to diverge. Thus, commodity taxes should correspond to externalities. In the case of a positive externality, the corrective tax should be a subsidy instead (a theme also cultivated by endogenous growth theory, in the case of possible growth spill overs from R&D). Atkinson & Stiglitz (1976) proved that Pigou's result stands<sup>6</sup>, even in general equilibrium and if policies are aimed at redistribution. An implication is that capital income<sup>7</sup> should be untaxed, a result also following from Mirrless (1971), Judd (1985), Chamley (1986) and Lucas (1990).

An important question related to taxation is of course how the revenue is spent. Government spending can be both productive and detrimental to growth. See e.g. Niskanen (2008, 139) for a simple political economy model were taxes reduce growth, while the provision of public goods is growth enhancing (and lump sum redistribution is neutral). In a more realistic, richer setting, redistribution also hampers growth, by reducing labor supply. Furthermore, if government consumption consists of private goods rather than public goods, there is an additional welfare cost compared to lump sum transfers, if they are non-price rationed (either by restrictions on quantity and quality or by saturation). Not only does non-price rationing

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<sup>4</sup> Since there is both an investment and a consumption element to an education, a tax-subsidy scheme will distort the investment-consumption mix.

<sup>5</sup> However, endogenous growth theory doesn't rule out affecting the rate of change as well as the level of GDP.

<sup>6</sup> Provided only that labor and consumption arguments are weakly separable in the utility function.

<sup>7</sup> A capital income tax can be seen as commodity tax on future consumption goods.

imply a welfare cost; GDP as measured by the national account will overestimate the true level, since neither input nor output based government consumption takes this problem into account.

In the Niskanen model, institutions play a role in how policies are set vis-à-vis optimal policies (which in the simple model is when marginal distortionary costs equals the marginal benefit of the public good). In a democracy with a decisive median, taxes and the supply of public goods will be higher than optimal levels<sup>8</sup>. Institutions play an important role for economic growth in a wide range of economic theory. North (1990) for instance emphasizes protection of property rights, Acemoglu and Robinson (2010) competition for political power, Hayek (1945) the free operation of the price system. The choice of tax policy should not only depend on how well it supports such institutions; the institutions themselves can have implications for tax systems. Buchanan & Brennan (1980) point out that from a constitutional perspective, distortionary taxes could be a preferred choice, if it limits the ability of rulers to overtax citizens. A progressive tax system thus could be an efficient institution in an autocracy, whereas a general flat tax is efficient in a democracy.

Another implication of the Niskanen model is the existence of an optimal supply of public goods and taxation necessary to finance it. A related concept is that of a growth maximizing mix of public goods and taxes (which are not necessarily the same). Beyond the optimal level, further taxation will impede welfare or growth by more than they will be promoted by marginal increases in public goods.

## TAXATION AND GROWTH – THE EMPIRICAL LITERATURE.

A large empirical literature on the impact of taxes on economic growth has accumulated over the last decades. Basically, there are two strands. One is focused on trying to measure the size of the various mechanisms involved in transmitting taxes to growth. For instance, an estimated production function is a standard ingredient in almost any macroeconomic model. The estimated impact of user cost of capital can be utilized to model the effect of taxes on capital on the supply of capital, and via the production function on growth. Obtaining similar estimates for other relevant mechanisms makes it possible to model the interaction between all of them. The other strand tries to estimate the growth outcome directly, usually by regression growth on tax related variables.

There are different pros and cons to both strands, and they are not mutually exclusive. Regressing directly will in principle capture all the channels by which a tax influences growth. It is, however, difficult to sort out which are the more important ones. Furthermore, it is usually only possible to regress on very crude measures of taxes. Modelling the ultimate growth effect by way of each individual mechanism can tell you which are more important, but obviously only

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<sup>8</sup> Where as in an authoritarian regime, taxes will be much higher, but the level of public good lower than the social optimum.

if they are included. And this is true only in the case, where the modelling results are tractable. In more complex models, important interactions can be lost to the naked eye.

The second strand was pioneered by Barro (1990), and is often referred to as Barro-regressions. In his original study and in many subsequent ones, growth (measured by GDP per capita) was regressed against public consumption as a percentage of GDP (as well as other variables and controls). This is indeed a crude measure, as it not only captures the possible distortionary costs of taxes raised to finance government consumption. In the end, the distortionary cost will depend not only on the size of government consumption, but also on other spending and on the overall efficiency of the tax system (since distortions as a rule of thumb grows by the square of the tax rate, e.g. see Li and Sarte (2004) on consequences of not taking account of tax progressivity). The estimated effect of government spending on growth usually has a negative sign, but in recent studies (including Barro 2015) it is insignificant.

Bergh & Henrekson (2011), in a survey of recent studies of the growth rate effect of government consumption in rich countries, find a significant, and negative relationship between the size of government and the rate of growth (on average an increase of government size of 10 percent is associated with  $\frac{1}{2}$ -1 percentage point lower growth rate).

A number of growth regression studies have added tax variables to government spending variables and have found negative relationships between taxation and growth. Bassini & Scarpetta (2001) find that if they include the government revenue to GDP ratio (and in some regressions, the indirect to direct tax revenue ratio), it has a significant negative sign, while government consumption gets a positive sign, which is however not robust to different specifications. Over all, the negative effect of taxes dominates the positive impact of government consumption, which could account for the negative sign in regressions including government consumption only. However, there are serious issues regarding causality and endogeneity when both taxes and spending are included at the same time.

A number of studies have explored the relationship between growth and actual tax rates rather than macro tax rates. Gemmel et al (2013) find that marginal income tax rates for persons and corporations have robust and significant negative effects on growth in OECD-countries, whereas macro tax rates perform less well explaining growth. Interestingly, they also find the impact on factor productivity to be a more important channel to growth than factor accumulation is. Dackehag & Hansson (2012) find a negative relationship between initial statutory tax rates and subsequent 4 year growth rates in a panel of 25 rich OECD-countries from 1975-2010. The results are significant, but (as often the case) corporate tax rate results are more robust.

The first strand of research – estimating single mechanisms – is represented by a host of studies in the literature. As mentioned, estimated production functions, linking cost of capital to fixed capital formation are standard issue in most macroeconomic models. So are labor supply functions in more recent general equilibrium models of the macro economy. Until recently, however, empirical studies of the elasticity of labor supply to after tax income have come up with quite varying estimates. In a survey of the literature, Keane (2010) found a large group of

relative small quantitative elasticities for males (around 0.1), but also a “sizable minority” with large values. The average supply elasticity was 0.3. In most OECD countries, an elasticity of that magnitude will imply a large welfare cost of taxation (e.g. even at a flat tax of 50 per cent, the marginal distortionary cost would equal one third of revenue raised).

In a number of important contributions, Chetty (2011, 2012) has showed that the varying estimates in labor supply elasticities can be accounted for by sluggish adjustments to changes in after tax wage income. In fact, taking sluggish adjustment into account, it cannot be rejected that all labor supply elasticities from a survey of international studies were drawn from identical samples. Thus, he recommends using a conservative estimate of 0.3 per cent of the elasticity of taxable labor income in macroeconomic models. A number of recent Danish studies find elasticities in line with Chetty’s recommendation (Brøns-Petersen, 2016b)<sup>9</sup>.

As far as corporate taxes are concerned, there is a large number of studies of real capital formation. Corporate taxes affect growth also by other channels, which are being explored to an increasing extent. Mooij and Ederveen (2008) have surveyed the literature on five different such channels: organizational form, debt versus equity financing, investments distortion on the intensive and extensive margin and international profit shifting. Semi-elasticities relating to the statutory tax rate range from -1.2 to -0.15, with profit shifting being <sup>10</sup>most sensitive.

Tax competition in statutory corporate tax rates is sometimes seen as a harmful “race to the bottom”, driven by inadequate control over international profit shifting by tax authorities. The other channels affecting growth are large enough, however, to merit reducing corporate tax rates even to the point of extinction. As Fehr et al (2013) has calculated in a simulation, abolishing the corporate tax globally would be beneficial to all<sup>11</sup> countries, even if tax revenues are collected by personal income taxes and consumption taxes instead.

Finally, a number of studies have tried to estimate optimal level of government spending. The welfare or growth maximizing levels are generally much lower than actual spending, especially the very high Danish level in excess of 50 per cent of GDP. Vedder and Gallaway (1998) estimated an optimal level of federal spending of 17 per cent of GDP in the US, while Niskanen (2008) found an optimum at 18 per cent of GDP. Chobanova & Mladenova (2009) estimated an optimal level of 25 per cent of GDP in OECD countries. Pevcin (2004) found that actual spending in eight EU countries is on average 19 percentage points above the optimal level

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<sup>9</sup> The estimated elasticities are elasticities of taxable (labor) income. As pointed out by Feldstein (1995), all margins should be included when estimating the welfare cost of taxation, implying that taxable income rather than mere quantitative labor supply is the relevant measure.

<sup>10</sup> Formally, all profit shifting will affect GDP as measured by statistical authorities. In reality, only the cost of profit shifting has an effect on growth, since profit shifting is mainly just transfers. In the estimate of the growth effect of corporate tax reform in Denmark, only the cost of profit shifting is included.

<sup>11</sup> Except China, who benefits from leading tax competition today.

(with only one country, Ireland, below growth optimizing spending, while the two Scandinavian countries included, Finland and Sweden, were 34 and 29 percentage points above<sup>12</sup>).

It should be noted, however, that these estimates refer to optimal levels, given actual tax instruments<sup>13</sup> and expenditures rather than efficient ones. If optimal government spending were instead to refer to optimal instruments too (excluding e.g. highly distorting taxes, growth reducing transfer payments, and provision of private goods), optimal levels would presumably be different, even if the direction is in principle uncertain. The elimination of growth retarding spending would reduce the optimal level, while less distortionary taxation could work in the opposite direction.

No doubt, the literature suggests that present spending levels and compositions in high tax countries such as Denmark are still far from optimal. Some of the negative effect on growth might be counteracted by an otherwise liberal market economy (see Bergh and Henrekson 2011) as well a low level of corruption etc. (see Fournier and Johansson 2016).

## THE GROWTH EFFECT OF DANISH TAX REFORMS.

Like many other OECD countries, Denmark embarked on a path of tax reforms in the mid-1980s. They have been part of a larger set of structural policies aimed at improving growth and labor market conditions, reforming the welfare state and consolidating public finances. Personal income taxes have undergone nine major reforms etc. beginning with the 1987 reform. Corporate taxation has also been subject to major reforms. Furthermore, indirect taxation has seen numerous changes, including more extensive use of “green taxes”.

Nevertheless, Denmark remains one of the countries with the highest tax burdens in the Western world, topping the list of tax revenue to GDP in OECD countries. Currently, tax revenue is 46.4 per cent of GDP, almost the same as before the first tax reform (46.1 per cent of GDP in 1986). The top marginal tax rate is still high by international comparison; tax rates on capital income are higher than in Norway and Sweden, who have embraced the “Scandinavian dual tax system” to a much larger extent, and indirect taxes deviate from true external costs. Thus, there is still scope for further reform. In Brøns-Petersen et al (2015) is a blueprint for a tax reform, which would reduce the tax to GDP ratio by 3 per cent and increase GDP by 3 per cent, according to standard calculation methods used by Danish economic ministries.

The further scope for reform notwithstanding, the extensive reform activity during the last 30 years has not only transformed the Danish tax system, but must also be expected to have had a sizeable impact on economic growth. The changes to the tax bases have been so comprehensive, it would be difficult to disentangle their effects. At the same time the

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<sup>12</sup> No significant result was obtained for Denmark.

<sup>13</sup> Niskanen (2008) is an exception on the revenue side.

composition of the economy has changed substantially. In order to assess the impact of tax reforms, I am instead going to make a more limited experiment.

The experiment is to simulate the GDP effect of reintroducing the personal income tax rate structure and the corporate tax rate of 1986 in the economy of today.

It is important to stress that such an experiment will only give a partial picture of growth effects, as I am disregarding growth effects of changes in tax bases and other rates than income tax rates. However, rate cuts have been a major part of reforms. And by comparing simulated and actual tax revenues, it is possible to get an idea about changes in tax bases (as well as in other economic conditions). The growth effects are ambiguous and probably small compared to tax rate cut effect.

The simulation is done in four steps. First, the “reversed tax reform” is simulated for personal income taxes on income from labor, self-employed and income transfers. In order to do so, a model has been constructed similar to the STØV model used by the Danish Ministry of Taxation (2008). This model is a partial structural model, suitable for estimating labor supply and human capital as well as tax revenues from these sources. Next, a capital stock response is modelled by a simple constant return aggregate Cobb-Douglas function in aggregate labor and capital.

$$Y = AK^\alpha L^{1-\alpha}$$

where L is aggregate labor supply (quality adjusted), and K is capital stocks, and Y is GDP.

Such a model is generally considered useful for purposes such as this. As capital taxation is unaltered at this stage, profit maximization will entail a constant capital labor ratio. Thus the stock of capital will move in tandem with labor supply, such that

$$\frac{\Delta L}{L} = \frac{\Delta K}{K} = \frac{\Delta Y}{Y}$$

The third step is simulating changes in capital stocks in the corporate sector, corporate income, and reported corporate taxes. This is done by estimating tax responses to corporate tax rate changes, using semi-elasticities from a comprehensive study of the literature (Mooij & Ederveen 2008). Finally, estimated tax base and revenue changes are translated into growth effects partly by utilizing

$$\frac{\Delta Y}{Y} = \alpha \frac{\Delta K}{K}$$

(assuming negligible feedback from labor supply).

Impact on tax revenues is modelled in terms of individual items. As they are measured relative to GDP, the denominator effect of impact on GDP is included too. The tax revenue impact consists of a “mechanical” component, disregarding behavioral effects, and a behavioral component. In addition to changes by tax rates on “their own” tax bases and revenues, other

tax bases will be affected too. For instance, an increase in the corporate tax rate will reduce not only earnings by capital, but also by labor, and consequently taxes on labor, consumption etc. will also fall. It is assumed, however, that such derived revenue changes are equal to the overall impact on GDP, in percentage terms, leaving the tax revenue to GDP ratios unchanged. Since revenues are calculated relative to GDP, the net effect is zero.

## SIMULATING A CORPORATE TAX RATE INCREASE TO THE 1986-LEVEL

Corporate taxation has undergone major changes since 1986. The tax base has been broadened in a number of ways, including reduced depreciation rates, stricter rules for joint taxation with foreign subsidiaries, limited tax liquidity and caps on interest payment deductions (see Box 1). The corporate tax rate has been cut from 50 per cent in 1986 to 22 per cent in 2016.

### Box 1. Major changes to the Danish income tax base 1986-2016

#### Personal income taxation

- Semi-dual income taxation: Separate tax bases for personal income (i.e. wages, transfer income etc.) and capital income. Capital income is taxed a lower rates, especially negative capital income.
- Deductions no longer in marginal income, but at lower, uniform rates.
- Special tax regime for personally owned businesses
- 8 per cent tax on gross wage income
- Taxation of fringe benefits

#### Corporate income taxation

- Reduced rates for depreciation allowances
- Repeal of investments funds and indexing of inventory depreciations
- Repeal of exemption for income from foreign subsidiaries
- All-in or out joint international taxation
- Ceilings to interest deductions
- Transfer pricing regulation and documentation
- Increased rent taxes on North Sea Oil income
- Taxation of foundations

Table 1 summarizes the main results of a simulated increase of the tax rate from present to the 1986 level of 50 per cent.

Table 1. Growth effects of non-tax reform	
	GDP-effects
Experiment 1:	
<b>Corporate tax increase from 22 to 50 per cent</b>	<b>-3,8</b>
Of which:	
<i>higher debt/assets ratio</i>	-0,2
<i>Real investments, intensive margin</i>	-1,9
<i>real investments, extensive margin</i>	-1,4
<i>income transformation</i>	-0,4
Experiment 2:	
<b>1986 personal income tax structure</b>	<b>-5,9</b>
Of which:	
<i>labor supply, extensive margin</i>	-0,2
<i>labor supply, intensive margin</i>	-3,5
of which:	
<i>income effect</i>	0,8
<i>substitution effect</i>	-4,3
<i>human capital and productivity (labor quality)</i>	-2,3
<b>Total tax reform experiment</b>	<b>-9,7</b>
<i>memo:</i>	
<i>Actual total GDP growth 1986-2016</i>	<i>64,2</i>

The net effect is estimated as a drop in GDP of 3.8 per cent. The main driver of this result is a decline in real investments, leading to a drop in GDP of 3.2 per cent, stemming from both the intensive and extensive margins of real investments<sup>14</sup>. The intensive margin refers to the scale of investments by existing firms, while the extensive margin refers to the location of investments by international firms. Decisions on the intensive margin are guided by real marginal effective tax rates, while they are guided by real average effective tax rates on the extensive margin. Real marginal tax rates especially are highly sensitive to assumptions about interest rates, inflation, true economic depreciation rates as well as the equity to debt mix and the mix of assets in investments. Typically, small changes in assumption can lead to large change in tax rates, often ranging from positive to negative values for different types of investments (equity being more heavily taxed than debt financed investments). In the simulation, the combined change on both margins are calculated as a change on the intensive margin<sup>15</sup>. As a robustness check, the estimated overall GDP effect can be compared to recent

<sup>14</sup> In the experiment, the marginal effective tax rate (METR) is increased by 7.3 percentage points in the experiment, while the average effective tax rate (AETR) is increased by 6.5 percentage points. The debt to assets ratio is increased by 4.2 points, while the Danish CIT rate relative to the OECD average (the difference being relevant for income transformation) is increased by 5.4 points.

<sup>15</sup> This is consistent with the assumption of constant returns to scale in the aggregate production function.

calculations by the Danish Ministry of Finance (2017) of the GDP impact of a change in the CIT. Even if modelled differently, the two calculations are roughly in line; in the MoF calculation, the GDP to net tax revenue change is just above 2, whereas it marginally lower (1½) in the present simulation<sup>16</sup>. The corporate tax rate has a major impact on international income transformation. However, in the experiment the CIT rate has only been raised by 5.4 percentage points, corresponding to the change in *difference* between the Danish and the OECD average from 2016 to 1986 (implicitly assuming that the OECD average increases by 22.6 percentage points in experiment 1). This is a relevant benchmark, since income transformation is driven by differences in international CIT rates. Furthermore, the GDP effect does not include the income transformation itself, even if statistical measured GDP would be reduced by it, but only in a formal statistical sense. On the other hand, the revenue effect stemming from behavioral responses would affect GDP and is therefore included. At the margin, costs and tax savings from behavioral responses are assumed to be equal. The net effect of behavioral responses in terms of income transformation is estimated to be 0.4 per cent of GDP.

Finally, an increase in the CIT rate would affect financial decisions by companies, leading to a higher debt to assets ratio, and a reduction in tax revenue from higher interest payments, which are deductible (as opposed to profits allocated to equity). The estimated effect is minor: 0.2 per cent of GDP<sup>17</sup>.

In the literature, it is recognized that corporate tax rates can also affect the level of incorporation. This effect has been ignored in the experiment, however. The reason is a peculiarity of the Danish tax system, whereby the incentive to incorporate has traditionally been neutralized by keeping marginal wage income tax rates roughly equal to the combined corporate and share earnings tax rate. This neutrality is assumed to be upheld in the experiment.

## **SIMULATING A RETURN TO THE PERSONAL INCOME TAX RATE STRUCTURE OF 1986.**

In figure 1, 2016 personal income tax rates on labor income etc. is reported as well as the 1986 rate structure. Tax brackets have been recalculated to fit 2016 income levels. Even if tax base definitions have changed, it is evident that rates have been reduced significantly over the 30 year period. Middle-income earners have seen their marginal income tax rates cut by as much as 32.6 percentage points, while the top marginal tax rate has been reduced by 16.7 percentage points.

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<sup>16</sup> However, the MoF does not include additional GDP effects from income transformation nor debt to equity ratio.

<sup>17</sup> The literature study does not take into account subsequent studies of the growth effect of banking crises. Since corporate taxes reduce the solidity of the banking sector, and since the solidity affect the risk of a banking crises, this channel could be quite important. According to Brøns-Petersen (2014), the corporate tax implies an expected cost of ½ per cent of GDP from banking crises alone.

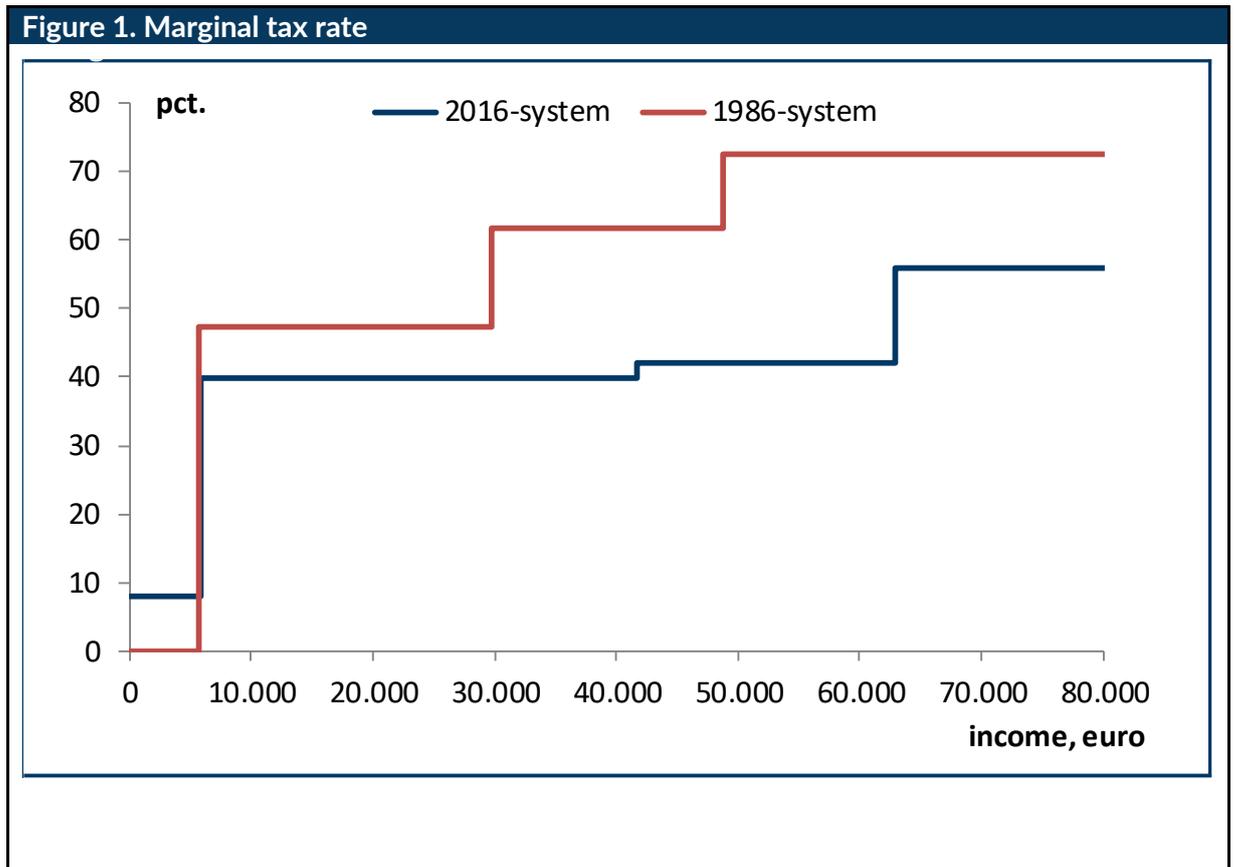


Table 1 also summarizes the GDP effects of simulating a reintroduction of 1986 personal income tax rates and brackets into the Danish tax system. All in all, GDP is estimated to decline by 5.9 per cent.

The main impact is from the quantitative substitution effect on the intensive margin of labor supply, which account for to thirds of the combined GDP effect in experiment 2. The income effect is of minor consequence, reflecting a small estimated income elasticity in Denmark, while the quantitative elasticity of substitution is on average 1.0 in the STØV model<sup>18</sup>. Furthermore, labor supply on the extensive margin is reduced very little. This is quite convenient, since the extensive margin response must be assumed to be more affected by tax base changes, too, which would have made a larger effect less reliable.

Finally, the effect of lower labor quality on GDP is estimated to -2.3 per cent. The model includes two separate channels. First, higher marginal tax rates will reduce the incentive to be productive on the job, e.g. accepting promotions, working harder and increasing mobility. Secondly, average tax rates will influence the education incentive, affecting long run human capital formation. The latter changes takes time; most formal educational choices are made at

<sup>18</sup> The qualitative labor supply is subject to an elasticity of similar average size. However, because of the composition of the tax rate cuts in the experiment, quantitative effects are larger than qualitative ones. Overall, the behavioral responses in the STØV model are relatively conservative compared to the empirical literature cited in Brøns-Petersen (2016b).

young ages. The present experiment is long run, however, spanning 30 years, allowing time for sluggish adjustments to take place (even if long run equilibrium probably hasn't been fully reached yet).

All in all, the full tax reform experiment would reduce GDP by almost 10 per cent. By the same token, the isolated effect of combined corporate and personal income tax rate reductions has been a growth effect of almost 10 per cent over the last 30 years. The total growth of Danish GDP since 1986 has been 64 per cent, so tax (rate) reforms account for almost one sixth of total growth over the period.

## SELF-FINANCING AND WELFARE

Table 2 reports the estimated tax revenue effects of the two experiments. As can be seen, tax revenue would increase by 1.8 per cent of GDP from increasing the corporate tax rate (experiment 1), whereas personal income tax rate increases (experiment 2) would bring an extra 3.5 per cent of GDP into the public coffers, making total additional revenue 5.3 per cent of GDP. The 'mechanical' revenue effect would have been 11.4 per cent of GDP.

Table 2. Revenue effect of non-tax reform	
	Revenue-change (% of GDP)
Eksperiment 1	
<b>Corporate tax increase from 22 to 50 per cent</b>	<b>1,8</b>
Of which:	
<i>mechanical tax change</i>	3,2
<i>higher debt/assets ratio</i>	-0,2
<i>Real investments, intensive margin</i>	-0,4
<i>real investments, extensive margin</i>	-0,4
<i>income transformation</i>	-0,4
Experiment 2	
<b>1986 personal income tax structure</b>	<b>3,5</b>
Of which:	
<i>mechanical income tax change</i>	8,1
<i>impact on indirect taxes</i>	-2,0
<i>labor supply, extensive margin</i>	-0,1
<i>labor supply, intensive margin</i>	-1,5
<i>human capital and productivity (labor quality)</i>	-1,0
<b>Total tax reform experiment</b>	<b>5,3</b>
<i>memo:</i>	
<i>Actual change in structural corporate tax revenue (percentage of GDP) 1986-2016</i>	0,0
<i>Actual change in personal income tax revenue</i>	-2,1

The so-called degree of self-financing is defined by

$$S = 1 - \frac{\Delta T_a}{\Delta T_b}$$

$\Delta T_a$  and  $\Delta T_b$  refers to the change in tax revenue after and before behavioral responses, respectively.

That implies a so-called degree of self-financing by 53.5 per cent. Roughly one in every two kroner tax increase would have been lost to behavioral responses.

Under certain conditions<sup>19</sup>, the degree of self-financing corresponds to the impact on economic welfare. Hence the deadweight loss connected to the experiment can be estimated to the equivalent of 6.1 per cent of GDP. The Marginal Cost of Public Funds is defined by

$$MCF = \frac{1}{1 - S}$$

implying a cost of roughly 2 kroner for every additional additional krone of revenue.

## TAX BASE CHANGES – AN INDIRECT ASSESSMENT

The two experiments do not capture the substantial changes to the tax base, which have also occurred over the three decades. But it is possible to get a broad picture by comparing estimated to actual revenue changes. The residual reflects changes to the tax base, but also a host of other factors characterizing the economic evolution over the time span, including a substantial nominal interest rates.

Table 3 compares actual revenue changes from 1986-2016 to estimated revenue gains from experiment 1 & 2. Actual revenues are calculated at a structural level to weed out temporary influence from the business cycle stance; corporate tax revenues in particular are very sensitive to business cycle developments.

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<sup>19</sup> Tax changes are marginal, and the elasticities of substitution are compensated. Neither is fully fulfilled. However, income effects in the STØV model are small (reflecting empirical findings), making compensated and uncompensated elasticities numerically close. The latter implies a small downward bias in the estimated welfare effect, while the changes not being marginal implies an upwards bias.

<b>Table 3. Revenue effects of non-tax reforms – base changes</b>		Change (% of GDP)
<b>Implicit change in tax bases etc.</b>		
Corporate tax		
Actual		0,0
Experiment 1		1,8
<b>Implicit revenue from tax base changes etc.</b>		<b>-1,7</b>
Personale income tax		
Actual		-2,1
Experiment 2		5,5
<b>Implicit revenue from tax base changes etc.</b>		<b>-3,3</b>

Interestingly, actual revenue from corporate taxation comprises almost exactly the same fraction of GDP, 2.4 per cent, in 2016 as it did in 1986. Since the tax rate is less than half now compared to then, the tax base as a percentage of GDP has more than doubled.

The estimated revenue effect of the experiment is 1.8 per cent of GDP. That implies a combined tax base broadening of the same magnitude (or that behavioral responses might have been underestimated).

Looking at personal income tax revenues, the simulated loss of revenue from experiment two is 5.5 per cent of GDP (ignoring the derived revenue from indirect taxation, as a consequence of increased disposable incomes), while the actual decline from 1986 to 2016 was only 2.1 per cent. That leaves a residual of 3.3 per cent of GDP.

Using this indirect method, there appears to have been base broadening etc. of approximately 5.0 per cent of GDP.

The growth effects of base broadening are presumably ambiguous. In some case, base broadening has increased neutrality – for instance in the case of taxation of North Sea oil, the repeal of tax exemption of corporate income from foreign subsidiaries (on top of standard DBO deductions), the introduction of a special tax scheme for personally owned businesses, semi-dual taxation with a separate taxation of capital income and taxing fringe benefits – with a positive effect on growth. In other cases base broadening have been special provisions in order to protect the tax base – such as the ceiling on deductions of corporate interest payments – or simply to finance tax reforms and government spending, which have reduced growth. In a few cases – such as lowering depreciation rates for fixed investments, narrowing the gap to true economic depreciation – the impact on growth has been negative, while enhancing economic welfare.

Overall, in the Danish case the growth and welfare economic effects of three decades of tax reform have undoubtedly been positive, with tax rate cuts dominating any growth reducing impact from tax base broadening. The scope for further base broadening is probably very limited. The most promising candidate seems to be the introduction of a flat rate on all household capital income, which at 20-25 per cent seems to be revenue neutral after

behavioral responses (financing the rate cut for positive capital income by reducing the rate on negative capital income) (Brøns-Petersen 2016a).

## **POLITICAL ECONOMY OF TAX REFORM**

Assessing the growth effect of tax reform, two important questions remain. First, what was the impact on government spending and did that influence growth? And secondly, what were the political economy implications of tax reforms?

Taken together, tax reforms has had very limited influence on government spending directly, since revenue from base broadening has roughly matched the net loss revenue from rate cuts.

The political economy implications have probably been substantial. As pointed out by Becker & Mulligan (1998), more efficient tax systems are correlated with higher government spending. In the hypothetical situation where Denmark hadn't undertaken comprehensive tax reforms, the pressures to limit spending growth would likely have been higher. And as pointed out earlier, most government spending is reducing growth. That is especially the case in Denmark with a high overall level of government spending, generous welfare state programs and a high level of government provision of subsidized private goods.

The Danish experience suggests that emphasis in tax reforms to enhance growth should be on cutting high marginal tax rates, while spending cuts should be considered a first best alternative, when it comes to financing them.

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