Dynamic effects of public expenditures - channels and policy implications *

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Abstract

Recent policy debates have raised concerns that current economic policy analyses are biased since they typically takes account of so-called dynamic (or behavioral) effects of taxes (distortions) on the financing side, while similar type of effects on the expenditure side (e.g. consumption and investment effects) are generally unaccounted for. We present a simple theoretical framework in which to clarify the role of behavioural or indirect effects arising from both the tax and the expenditure side of public policies. We discuss policy implications of such indirect effects on the expenditure side and we discuss possible channels and empirical evidence.

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1 Introduction

A key objective in economic policy analysis is outlining and quantifying economic benefits and costs associated with a given economic policy. This is by no means a simple task and there are many pitfalls and ongoing discussions about the best way to e.g. quantify benefits and costs associated with a given policy (see e.g. discussion about the Danish UI system etc.). Examples of discussions concern updating estimates based on new data, access to new data making it possible to shed empirical evidence previously impossible, or changes related to new policy concerns like climate related expenses.

Recent policy debates have raised concerns that policy analyses are biased since behavioural effects of taxes (distortions) are included on the financing side while those arising from the governments expenditure side (e.g. consumption and investments effects) are generally neglected[1]. Examples of often cited indirect effects from expenditure side includes public spending on goods that complement employment (e.g. daycare or healthcare), promote education, and infrastructure investments.

Overall, behavioural responses to taxes and expenditures affect income (through e.g changes in individual labor supply), consumption etc, which in turn affects taxes bases and hence the net costs of the programmes. Hence, the assessment of both the welfare implications and the net costs of various programmes may be inaccurate if such behavioural responses are neglected. In the debate, the behavioural effects are sometimes labelled "dynamic effects", but in the following they are called indirect budget effects (or in short indirect effects) to distinguish from the direct (or mechanical) budget effect (for given behaviour) of changes in taxes or expenditures[2].

To begin with, it is worth noting that behavioural responses to changes in public expenditures are not neglected in economic theory; some important examples include education (see e.g. Dhont and Heylen (2008, 2009), Eaton and Rosen (1980), Jacobs (2009), and Hanushek (2002)), child care (see e.g. Rogerson (2007) and Ragan (2013)), and growth effects (see e.g. Barro (1990) and Barro and Sala-i-Martin (1992)). The indirect effects of public expenditures can be positive or negative, depending on the specific expenditures but also their level. For example, decreasing returns to expenditures implies differences between average vs. marginal effects, and as a consequence the marginal return to expanding daycare from a given level is lower than the marginal return to introducing it in the first case. The potential for decreasing returns is important to take account of when interpreting empirical work which evaluates policy changes starting from a given level.

Secondly, comparative research on welfare states also points to and discuss

[1] For the Danish debate see e.g. Enhedslisten (2018), Arbejderbevægelsens Erhvervsråd (2017), and Økonomisk Råd (2017)

[2] In some literature termed a "fiscal externality", see e.g. Finkelstein and Hendren (2020). It is, however, not an externality in the standard definition, referring to an external effect not reflected in prices and which influences utility or production possibilities. It is standard in public economics and macroeconomics to include the full budget responses in analyses.

the potential role of the expenditure effects in accounting for the relatively favourable economic performance of the Nordic countries and the large public sectors and high tax rates; for a discussion and references see e.g. Andersen (2015b), Kleven (2014) and Mogstad et al. (2025). Related ideas are featured in the discussion of social investment models, see e.g. Giddens (2000).

Thirdly, empirical analyses of how the size and structure of the public sector affect economic growth have also pointed to the expenditure effects and the need to distinguish explicitly between the financing and the expenditure side when considering how the public sector affects economic performance, see e.g. Gemmell et al. (2011). Finally, indirect effects do not only pertain to public consumption and investments, transfers may have effects beyond the insurance and incentive effects traditionally discussed via their implications for children rearing, support for education etc. as analysed in so-called family investment models, see Durlauf and Seshadri (2018). In conclusion, behavioural responses to changes in expenditures are not generally neglected in the economics literature, and it is a key insight that the effects of taxes cannot be seen independently of what they are financing, and oppositely the effects of expenditures cannot be seen independently of how they are financed. To capture these effects, a general equilibrium approach is needed.

The challenge in a specific policy context is the availability of relevant empirical evidence on these behavioural effects of taxes and expenditure. The behavioural effects of taxes have been widely studied, in particular in relation to labour supply. A tax increase thus generally affects tax revenue by less than the direct effect due to distortions tending to reduce economic activity (and oppositely for a tax decrease), as has been discussed vividly in relation to labour supply responses to tax changes, see e.g. Keane (2011) for a survey and le Maire et al. (2013), Kleven et al. (2014), Kreiner et al. (2016), Kreiner (2023), and Sigaard (2023) for a studies for Denmark. Such indirect budget effects of tax changes are typically included in policy analyses. Empirical evidence on the expenditure side is more scant, but there is a growing empirical literature providing evidence on such effects; for recent surveys see Hendren and Sprung-Keyser (2020) and Kristensen and Vammen Lesner (2020).

The purpose of this paper is to clarify the role of behavioural or indirect budget effects arising from both the tax and the expenditure side of public policies. To this end, a stylized (static) reduced form model is used as a work horse framework, skipping the microeconomic foundation for expositional clarity. This is used both to clarify the mechanisms and to discuss the policy implications of such indirect effects. The paper also includes a brief overview of the possible channels through which behavioural expenditure effects can arise.

2 The basic effects of taxes and public expenditures - A stylized model

Consider a reduced form model where income $y(\tau, g)$ depends on both the income tax rate (τ) and public expenditures (g). Both the tax rate and public consumption are used as generic terms, referring to a long list of specific taxes and expenditures, and the effects discussed below are in general instrument-specific, see section 3 below. To focus on the importance of public expenditures, we impose the standard assumption that a higher tax decreases output, $y_\tau(\tau, g) < 0$, and the following considers cases where public consumption also releases behavioural responses, $y_g(\tau, g) \neq 0$, which in general is ambiguously signed (see discussion below), $y_g(\tau, g) \lesseqgtr 0$. To simplify, we disregard transfers.

The primary budget balance for the public sector (b) is given as the difference between tax revenue and expenditures,

$$b = \tau y(\tau, g) - g$$

Considering first how a tax change affects the budget,

$$\begin{aligned} \frac{\partial b}{\partial \tau} &= \frac{\partial \tau y(\tau, g)}{\partial \tau} = \underbrace{y(\tau, g)}_{\text{direct effect } \tau} + \underbrace{\tau \frac{\partial y(\tau, g)}{\partial \tau}}_{\text{indirect effect } \tau} \\ &< \underbrace{y(\tau, g)}_{\text{direct effect } \tau} \quad \text{for } \frac{\partial y(\tau, g)}{\partial \tau} < 0 \end{aligned} \tag{1}$$

The direct revenue effect of the tax change is proportional to the tax base, while the indirect effect captures possible behavioural responses to the change in the tax rate. The total revenue effect[3] of the tax change is thus smaller than the direct effect in the standard case, where a higher tax rate reduces income via incentive effects/distortions ($\frac{\partial y(\tau)}{\partial \tau} < 0$)[4].

In parallel, for a change in public expenditures the net budget effect of an increase in expenditures is

$$\frac{\partial b}{\partial g} = \frac{\partial \left[\tau y(\tau, g) - g\right]}{\partial g} = \underbrace{-1}_{\text{direct effect } g} + \underbrace{\tau \frac{\partial y(\tau, g)}{\partial g}}_{\text{indirect effect } g} \tag{2}$$

Hence, as for a tax change, an expenditure change has both a direct and an indirect effect. In general, the sign of the indirect effect is ambiguous. Two

[3] Tax revenue is non-decreasing in the tax rate under the "Laffer-curve" assumption $\frac{\partial y(\tau, g)}{\partial \tau} \frac{\tau}{y(\tau, g)} > -1$.

[4] The standard textbook case focuses on labour supply and the counteracting income and substitution effects. If the latter dominates, as generally confirmed by empirical evidence, a tax increase reduces labour supply. In richer environments, additional effects may arise. As an example, in a risky environment income taxes provide implicit insurance, which, for risk averse individuals, may imply that labour supply over some range is increasing in the tax rate, see Sinn (1995) and Andersen (2015a).

examples illustrate this. Expenditures financing leisure activities may reduce labour supply and thus the tax base (in this case: $\frac{\partial y(\tau,g)}{\partial g} < 0$), while expenditures on education may increase employment/wages and thus the tax base (in this case: $\frac{\partial y(\tau,g)}{\partial g} > 0$). This is further discussed below.

2.1 Policy trade-offs

To clarify how the direct and indirect effects of changes in taxes and expenditures impact policy trade-offs, consider the balanced budget effects of policy changes implying that expenditures and taxes are related via (3)

$$g = \tau y(\tau, g) \tag{3}$$

Hence, the tax rate (τ) and public consumption (g) cannot both be treated independently, stressing the general point that the effects of tax changes cannot be assessed independently of what the tax is financing.

Assume without loss of generality that public consumption (g) is the choice variable, and hence the tax rate follows from the budget constraint. For a given level of expenditures, the tax rate can be specified by the implicit function

$$\tau = \phi(g)$$

Total differentiation of (3) implies

$$1 = \frac{\partial \tau}{\partial g} y(\tau, g) + \tau \left[\frac{\partial y(\tau, g)}{\partial \tau} \frac{\partial \tau}{\partial g} + \frac{\partial y(\tau, g)}{\partial g} \right]$$

Hence, the response of the tax rate to a change in public consumption is

$$\frac{\partial \tau}{\partial g} = \phi_g(g) = \frac{1 - \tau \frac{\partial y(\tau,g)}{\partial g}}{y(\tau, g) + \tau \frac{\partial y(\tau,g)}{\partial \tau}} \lessgtr 0 \tag{4}$$

where the numerator is the total expenditure effect (2), and the denominator the total tax effect (1). This shows that both the indirect expenditure and tax effects should be taken into account when assessing the budget (tax) effects of a change in public expenditures. In other words, the net effect depends on the indirect effects arising from behavioural responses to both the expenditure change ($\frac{\partial y(\tau,g)}{\partial g}$) and the tax change ($\frac{\partial y(\tau,g)}{\partial \tau}$) here running via output.

Private consumption (c) is given as

$$c = [1 - \tau] y(\tau, g) \tag{5}$$

and it can (taking into account how taxes depend on public consumption) in implicit form be written as

$$c = \chi(g) \equiv [1 - \tau(g)] y(\tau(g), g)$$

and the effect on private consumption of a change in public consumption is

$$\begin{aligned}\frac{\partial c}{\partial g} &= \chi_g(g) \\ &= \underbrace{-y(\tau,g)\frac{\partial \tau}{\partial g}}_{\text{direct effect } \tau} + [1-\tau]\left[\underbrace{\frac{\partial y(\tau,g)}{\partial \tau}\frac{\partial \tau}{\partial g}}_{\text{indirect effect } \tau} + \underbrace{\frac{\partial y(\tau,g)}{\partial g}}_{\text{indirect effect } g}\right] \qquad (6)\end{aligned}$$

There are also direct and indirect effects on private consumption. The first term captures the direct effect of a tax rate increase; disposable income decreases one-to-one with an increase in the tax rate, and this reduces private consumption. Next comes the indirect tax and expenditure effects. Under the standard assumption that the tax effect is negative ($\frac{\partial y(\tau,g)}{\partial \tau}\frac{\partial \tau}{\partial g} < 0$), the indirect tax effect further decreases private consumption. The indirect expenditure effect may strengthen or weaken this effect ($\frac{\partial y(\tau,g)}{\partial g} \lesseqgtr 0$). This reiterates the point of considering both the indirect tax and expenditure effects.

The effect on private consumption of changes in public consumption can be rewritten

$$\begin{aligned}\frac{\partial c}{\partial g} &= -y(\phi(g),g)\frac{\partial \tau}{\partial g} + [1-\tau]\left[\frac{\partial y(\tau,g)}{\partial \tau}\frac{\partial \tau}{\partial g} + \frac{\partial y(\tau,g)}{\partial g}\right] \\ &= -1 + \left[\frac{\partial y(\tau,g)}{\partial \tau}\frac{\partial \tau}{\partial g} + \frac{\partial y(\tau,g)}{\partial g}\right]\end{aligned}$$

where the first term is the direct effect that for given income, higher public consumption reduces private consumption one-to-one, and the second term in brackets includes the indirect tax and expenditure effects. Inserting (4), the latter two effects can be written

$$\frac{\partial y(\tau,g)}{\partial \tau}\frac{\partial \tau}{\partial g} + \frac{\partial y(\tau,g)}{\partial g} = \frac{\partial y(\tau,g)}{\partial \tau}\frac{1-\tau\frac{\partial y(\tau,g)}{\partial g}}{y(\tau,g)+\tau\frac{\partial y(\tau,g)}{\partial \tau}} + \frac{\partial y(\tau,g)}{\partial g}$$

implying

$$\frac{\partial c}{\partial g} = \frac{\frac{\partial y(\tau,g)}{\partial g}y(\tau,g) + \frac{\partial y(\tau,g)}{\partial \tau}}{y(\tau,g)+\tau\frac{\partial y(\tau,g)}{\partial \tau}} - 1$$

or in terms of elasticities (using (3))

$$\frac{\partial c}{\partial g} = \frac{\varepsilon_{y,g}+\varepsilon_{y,\tau}}{1+\varepsilon_{y,\tau}}\frac{y(\tau,g)}{g} - 1 \lesseqgtr 0$$

where $\varepsilon_{x,z} \equiv \frac{\partial x}{\partial z}\frac{z}{x}$.

Even in the standard case where higher taxes reduce income, $\frac{\partial y(\tau,g)}{\partial \tau} < 0$, it cannot be ruled out that private consumption increases, $\frac{\partial c}{\partial g} > 0$, but this requires a sufficiently positive indirect expenditure effect ($\frac{\partial y(\tau,g)}{\partial g} > 0$). The

standard textbook case ($\frac{\partial y(\tau,g)}{\partial \tau} < 0$, $\frac{\partial y(\tau,g)}{\partial g} = 0$) implies that private consumption decreases by more than public consumption increases due to the indirect tax effect,

$$\frac{\partial c}{\partial g} = \frac{\frac{\partial y(\tau,g)}{\partial \tau}}{y(\tau,g) + \tau \frac{\partial y(\tau,g)}{\partial \tau}} - 1 < -1 \text{ for } \frac{\partial y(\tau,g)}{\partial g} = 0$$

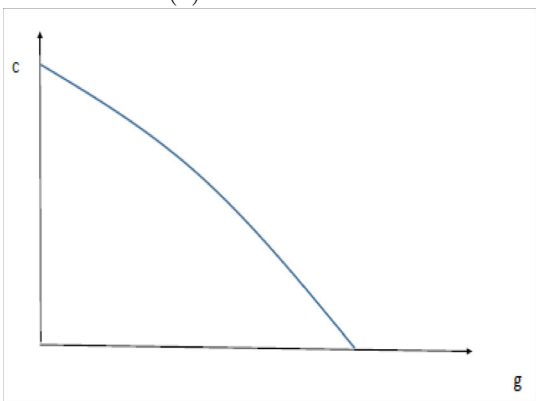
In the general case, including potential indirect expenditure effects, it is ambiguous whether private consumption decreases more or less (or possibly even increasing) than the increase in public consumption

$$\frac{\partial c}{\partial g} = \frac{\frac{\partial y(\tau,g)}{\partial g} + \frac{\partial y(\tau,g)}{\partial \tau}}{y(\tau,g) + \tau \frac{\partial y(\tau,g)}{\partial \tau}} - 1 \lessgtr -1$$

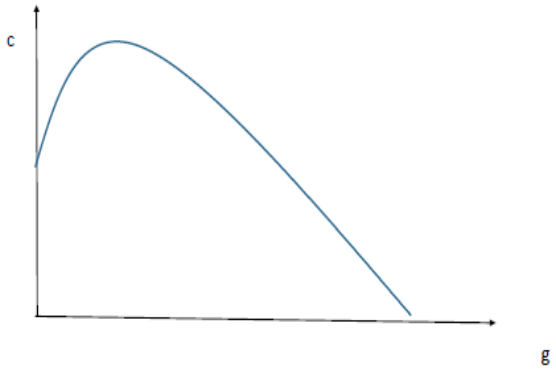
Figure 1.a illustrates the equilibrium locus between private and public consumption for a case where private consumption is unambiguously decreasing in public consumption (the standard assumptions, $\frac{\partial y(\tau,g)}{\partial \tau} < 0$, $\frac{\partial y(\tau,g)}{\partial g} = 0$ produces this case), and Figure 1.b shows a case where the indirect expenditure effect is so strong that private consumption initially increases (necessary condition: $\frac{\partial y(\tau,g)}{\partial g}\Big|_{g=0} > 0$), but for high levels of public consumption further increases reduce private consumption (the indirect tax effect comes to dominate the indirect expenditure effect), producing a hump-shaped relation between public and private consumption [5].

Figure 1: Equilibrium relation between private and public consumption

(a) Standard case



(b) Hump-shaped



[5] Even if $\frac{\partial y(\tau,g)}{\partial g}\Big|_{g=0} > 0$, a hump-shaped relation generally arises because tax distortions are increasing in the tax rate ($\frac{\partial^2 y(\tau,g)}{\partial \tau^2} < 0$) and the marginal product of expenditures is declining ($\frac{\partial^2 y(\tau,g)}{\partial g^2} < 0$) in the level of expenditures.

2.2 Optimal policies

To analyse how the indirect tax and expenditure effects influence optimal policies, assume that the social welfare function or political decision function is given as

$$\Omega(c, g) \tag{7}$$

and it is assumed to be increasing and concave in both private consumption and public expenditures , $\Omega_c(c, g) > 0, \Omega_{cc}(c, g) < 0, \Omega_g(c, g) > 0$, and $\Omega_{gg}(c, g) < 0$. This formulation is rather general and agnostic as to whether policies are determined by a social planner or a political process.

Inserting (5) into the "policy objective" function yields

$$\Omega([1 - \phi(g)]\, y\left(\phi(g), g\right), g)$$

and hence the optimal level of public expenditure is determined by the first-order condition[6]

$$\Omega_c\left(\cdot\right)\left[\frac{\partial \tau}{\partial g} y\left(\phi(g), g\right) - [1 - \tau]\left[\frac{\partial y\left(\tau, g\right)}{\partial \tau}\frac{\partial \tau}{\partial g} + \frac{\partial y\left(\tau, g\right)}{\partial g}\right]\right] = \Omega_g(\cdot)$$

or

$$\Omega_c\left(\cdot\right)\left[-\frac{\partial c}{\partial g}\right] = \Omega_g(\cdot) \tag{8}$$

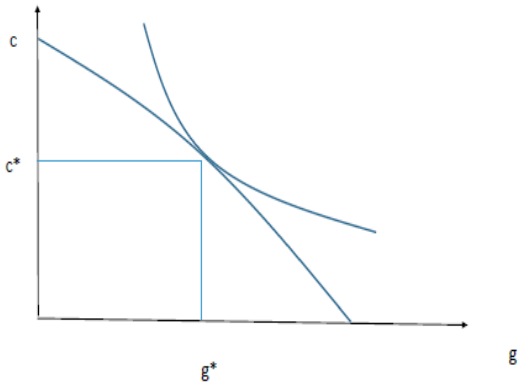
This is a version of the classical Samuelson condition; the optimal level of the public expenditure is determined such that the marginal benefit of the public expenditure ($\Omega_g(\cdot)$) equals the marginal cost given as the decline in private consumption ($-\frac{\partial c}{\partial g}$) multiplied by the marginal utility of private consumption ($\Omega_c\left(\cdot\right)$). Note that the objective function defines indifference curves in the (c, g)-space[7], and Figure 2 illustrates the optimum policies for the opportunity sets illustrated in Figure 1.

[6] In applied welfare analyses there is a discussion of whether simple decision criteria can be used, including the Marginal Value of Public Funds (MVPF) approach used in Hendren and Sprung-Keyser (2020). The idea in the latter is to assess the ratio of the willingness to pay the net public costs of a given public activity. For two activities with the same revenue requirement, the one with the highest MVPF should be chosen; for a discussion see also Finkelstein and Hendren (2020), Garcia and Heckman (2022) and Hendren and Sprung-Kaiser (2022). However, while this the MVPF-criteria provide the correct ranking when deciding on marginal changes in net spending, it is not generally the case when marginal changes in up front spending , see Almlund and Andersen (2025). Related is the discussion on the marginal costs of public funds, see e.g. Bastani (2023).

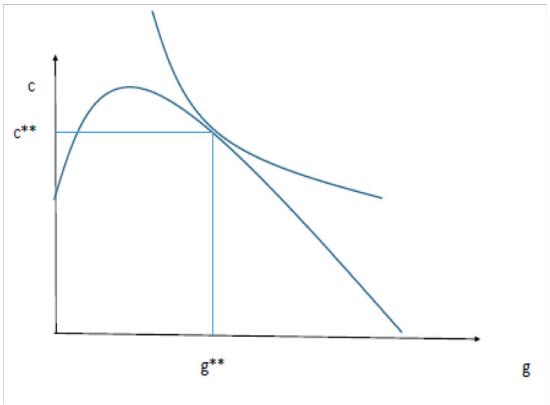
[7] The objective function implies that the slope of the indifference curve is $\frac{\partial c}{\partial g} = -\frac{\Omega_g(c,g)}{\Omega_c(c,g)} < 0$.

Figure 2: Optimal policies

(a) Standard case



(b) Hump-shaped



Importantly, assessed at the optimal level of public expenditure (g^*), a marginal increase in public expenditure unambiguously decreases private consumption ($\frac{\partial c}{\partial g} < 0$ follows from (8) given that $\Omega_c(\cdot) > 0$ and $\Omega_g(\cdot) > 0$). This is also the case when the locus is hump-shaped (Figure 2.b). The optimality condition says that the optimum is on the downward sloping part of the opportunity set; that is, a marginal increase in public expenditures is inevitably associated with a decrease in private consumption. This is so despite the fact that the indirect effect of public consumption is initially positive, and private consumption thus rises. The intuition is straightforward; the optimum can never be at the upward sloping part of the opportunity set, since at such positions it is possible to increase both public activities and private consumption, and hence it cannot be an optimum. The optimality condition basically says that in the case of a hump-shaped relation, public expenditures should at least be expanded to the point where a trade-off arises.

The case illustrated in Figure 2b stresses the importance of distinguishing between the average and marginal effects of public consumption. In the case illustrated, both private and public consumption is higher at the optimum compared to the Laissez-faire situation with zero public consumption. Hence, on average public expenditures and private consumption are positively related, but at the optimum a trade-off arises, and a marginal increase in public expenditures is inevitably associated with a decline in private consumption. It is implied that for applied policy analysis it is critical whether the initial situation is optimal given the social/political objective function.

Importantly, the optimal policy considered above based on the objective function (7) is not equivalent to maximizing income, but the income responses influence the optimal policy. The income effect of a marginal change in public expenditures is

$$\frac{\partial y\left(\phi(g),g\right)}{\partial g} = \frac{\partial y\left(\phi(g),g\right)}{\partial \tau}\frac{\partial \tau}{\partial g} + \frac{\partial y\left(\phi(g),g\right)}{\partial g} \lesseqgtr 0$$

and for private consumption to be increasing in public consumption ($\frac{\partial c}{\partial g} > 0$) it is a necessary condition that income increases, $\frac{\partial y(\tau,g)}{\partial g} > 0$ (this follows from (6).

Finally, note that the "first" principle[8] in "Finansministeriets regneregler" (Finansministeriet (2018)) says: "It is to be expected that the marginal effect on income of an increase in public expenditures is smaller than the loss from a marginal increase in taxes. A general reduction of taxes and expenditures is therefore expected to increase GDP. Such a decline should be weighted against other consequences (including distributional)." This statement does not have general support. It is true that assessed for the optimal level of public expenditures private consumption is declining in public consumption ($\frac{\partial c}{\partial g} < 0$), as discussed above, but this does not rule out that the marginal effect of expenditures on income is positive ($\frac{\partial y(\tau,g)}{\partial g} > 0$). Moreover, the statement assumes that the level of public activities is optimally determined. The principle does not take into account the implications of policies being planned without including the dynamic expenditure effect, and therefore by definition being inoptimal, see discussion below.

Generally, it is not possible to conclude anything on the relation between the optimal policy (g^*) and the policy maximizing income ($\widehat{g}$), $\frac{\partial y(\phi(\widehat{g}),\widehat{g})}{\partial g} = 0$,

$$g^* \lesseqgtr \widehat{g}$$

The intuition is that welfare depends on private and public consumption, and even in the case where an increase in g may increase income, it does not necessarily increase disposable income. Finansministeriet (2018) argues that since there are other concerns for the choice of public activities than total income, it must follow that the level of g is at a higher level than the one maximizing income. Therefore, it is inferred that the income gain from a further increase in expenditures is smaller than the income loss from an increase in the tax rate. This cannot in general be concluded.

2.3 Neglecting indirect public expenditure effects

In policy debates it is being discussed how neglection of indirect effects of public expenditures affects policies. Such a neglection may be due to lack of empirical evidence, or biases in the decision process. To discuss the implications, let $\frac{\partial \widetilde{c}}{\partial g}$ denote the perceived effect of public expenditures on private consumption assuming that the indirect effect is zero ($\frac{\partial y(\tau,g)}{\partial g} = 0$) when it is not,

$$\frac{\partial \widetilde{c}}{\partial g} = \frac{\frac{\partial y(\tau,g)}{\partial \tau}}{y(\tau,g) + \tau \frac{\partial y(\tau,g)}{\partial \tau}} \neq \frac{\frac{\partial y(\tau,g)}{\partial g} + \frac{\partial y(\tau,g)}{\partial \tau}}{y(\tau,g) + \tau \frac{\partial y(\tau,g)}{\partial \tau}} = \frac{\partial c}{\partial g}$$

[8] The second principle says: "It is in general not possible to say whether a marginal change in expenditures has a positive or negative effect on income. This ambiguous sign is consistent with public expenditures having a significant positive effect on income (compared to a situation without such expenditures)," and it is supported by the analysis above.

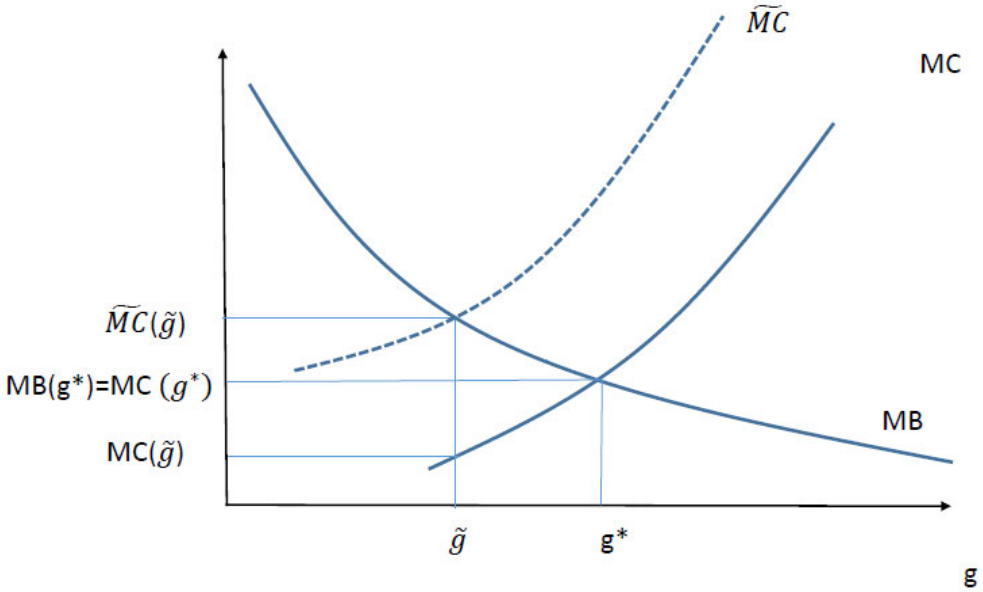
Denote the optimal policy when indirect expenditure effects are neglected by $\widetilde{g}$, and the optimal policy taking into account the effect by g^*, then it follows that

$$\begin{aligned} \widetilde{g} &< g^* \text{ for } \frac{\partial y(\tau, g)}{\partial g} > 0 \\ \widetilde{g} &> g^* \text{ for } \frac{\partial y(\tau, g)}{\partial g} < 0 \end{aligned}$$

It is an obvious implication that if positive indirect public expenditure effects ($\frac{\partial y(\tau,g)}{\partial g} > 0$) are neglected, the level of public consumption is set too low, and vice versa for negative effects, $\frac{\partial y(\tau,g)}{\partial g} < 0$. In general, it cannot be concluded whether the neglect of indirect effects of public consumption leads to a downward or upward bias of public consumption levels.

It is worth stressing that this is not a point about different political views on public sector activities (captured by the objective function (7)), but a question of the information on which policy decisions are made. If, say, the marginal costs are overestimated due to neglect of a positive indirect budget effect such that policy is based on the $\widetilde{MC}$ -curve rather the MC-curve in Figure 3, the actually chosen level of public expenditures is suboptimally low $\widetilde{g} < g^*$. At the chosen level of expenditures, the marginal benefits of a further increase outweighs the marginal costs. An assessment based on $\widetilde{MC}$ will conclude that a marginal change in public expenditures (around the level $\widetilde{g}$) has no effect on welfare. But if the true marginal costs are MC, a marginal increase in g (starting at $\widetilde{g}$) has a first-order welfare effect. Importantly, neglecting the positive expenditure effect of public consumption does not imply that it is always beneficial to cut public consumption (as claimed by Arbejderbevægelsens Erhvervsråd (2017, p 3) since the sign of the bias in general is ambiguous (indirect effects can be both positive and negative)). Evaluated under the curve MC, a reduction in g from the level $\widetilde{g}$ reduces welfare since $MB > MC$.

Figure 3: Policy bias - net marginal costs of public expenditures are overestimated



The above-mentioned bias may arise due to incomplete information, for instance if there is no empirical evidence documenting the indirect budget effect from a specific public expenditure item. As discussed above, there is some macro evidence, but it is typically based on a reduced form approach where some measure of economic performance is estimated on either an (aggregate) expenditure or financing (tax) variable, implying that the estimated coefficient to any such fiscal variable would be a mixture of the expenditure and the financing effect (e.g. if estimating y on g where $y(\tau, g) = y(\phi(g), g) \equiv \widehat{y}(g)$) and seldom allows an identification of the separate tax and expenditure effects[9]. Hence, such information is useful for discussions of how the public sector affects the overall economic performance and for cross-country comparisons, but it is not sufficiently granular to be used on an analysis of a specific expenditure item[10]. Micro evidence is challenged by the difficulty of separating effects

[9] An important exception is the work reported in e.g. Gemmell et al. (2011).

[10] The presence of behavioural or indirect expenditure effects also has implications for assessing the effects of tax changes. Estimated tax elasticities may be biased since the policy setting in the sample period is not well defined (what are the taxes financing?). At best, such estimates identify the partial effects, but they are not informative on the general equilibrium effects (simultaneous changes in taxes and expenditures for a balanced budget). Labour supply elasticities estimated on historical data may be interpreted to apply to historical averages of other taxes and expenditures. Neglecting dynamic expenditure effects would in general tend to give a downward bias in estimated labour supply elasticities if expenditures have "positive" indirect effects (employment did not fall as much due to the tax increase, since the expenditures financed had a positive effect on employment), and vice versa.

(including general equilibrium effects) and finding causal evidence, although a growing microeconometric literature is providing insights on the indirect expenditure effects, see Hendren and Sprung-Keyser (2020) and Kristensen and Vammen Lesner (2020). The next section briefly discusses the channels through which indirect expenditure effects may arise, and why specific expenditure items work through different mechanisms.

3 Sources of indirect expenditure effects

The preceding discussion is cast in very general terms, leaving open the precise mechanisms through which behavioural or indirect expenditure effects may arise. The following goes one step further in trying to list possible sources of such indirect effects arising from changes in public expenditures. This listing is also a guide for empirical research aiming at identifying and quantifying indirect public expenditure effects.

The following does not consider

- Transfers
- Heterogeneity and thus distributional aspects
- Dynamics (implicitly steady-state effects are considered).
- General equilibrium effects, including effects running via factor prices. Likewise, effects on the budget and thus tax rates are not considered (the tax rate is thus kept constant below). As already pointed out above, a proper general equilibrium analysis is required to work out the net equilibrium effects of given policies.

The preceding used g as a generic measure for public expenditures (consumption or investment). To be more precise, it is necessary to make a distinction between expenditures and services actually produced and received by households, firms etc. In the following, g is interpreted as the expenditure, and s as a generic expression for the publicly provided/produced activity or service received by households, firms etc. In general there is a vast number of different activities, and s and the corresponding g could be interpreted as vectors including the full set of instruments. To simplify the exposition, the following focuses on a specific expenditure (g) financing the provision of a specific service (s).

Let the public sector production function for these services be[11]

$$s = A\chi(g) \tag{9}$$

where A is a productivity parameter, and $\chi_g(\cdot) > 0$, $\chi_{gg}(\cdot) < 0$, and hence the effect of a change in expenditure on the service received by households or firms is

$$ds = A\chi_g(g)dg \tag{10}$$

[11] An explicit dynamic analysis should include the capital stock needed for the production.

The expenditure g may be interpreted as acquisition of inputs in the form of goods produced by private firms, or as labour input $g = l_g$, where l_g is public employment. In the latter case, $s = A\chi(l_g)$, and $l_g = A^{-1}\chi^{-1}(s) = h(s)$, gives the labour needed to produce s, where $h_s(s) > 0, h_{ss}(s) > 0$. The relation (9) can be interpreted as a standard production function giving output depending on inputs. It can also be interpreted to capture rent-seeking activities, bureaucracy, implying that not all expenditures are used to produce services of general social value.

The two most important tax bases are income and consumption. The following does not specify different types of income or consumption explicitly, but takes a broader approach to identify potential channels which then may have specific effects on particular types of income or private consumption. To discuss the effects running via income, it is useful to take a production function approach. Let private production be

$$y^p = f(e(s)l^p, k, s)$$

where e is the efficiency factor for labour, l^p employment in the private sector, total labour input in efficiency units is $e(s)l^p$, and k real capital. The production function f has standard properties, and the efficiency function is non-decreasing in the service, $e_s(s) \geq 0$. The direct effect of s captures other factors that may affect the production possibilities, which here is called infrastructure.

Hence, a change in the provision of the public service potentially affects private sector production as follows

$$dy^p = \left\{ f_L(\cdot)l^p e_s(s) + f_L(\cdot)e(s)\frac{\partial l^p}{\partial s} + f_k(\cdot)\frac{\partial k}{\partial s} + f_s(\cdot) \right\} ds$$

where the service change is given by (10). The indirect expenditure effects may thus in general arise through the following four channels:

- Labour efficiency/productivity (qualitative dimension) ($e_s(s)$)
- Labour inputs (quantitative dimension) ($\frac{\partial l^p}{\partial s}$)
- Capital accumulation ($\frac{\partial k}{\partial s}$)
- Direct production effect "Infrastructure" ($f_s(\cdot)$)

Considering the labour input channel in more detail, let l^s denote labour supply by households, where

$$l^s = l^s(w, \tau, s)$$

Standard assumptions imply $l_w(\cdot) > 0$, and $l_\tau(\cdot) < 0$. The labour supply effect of public services is generally ambiguous, $l_s(\cdot) \gtreqless 0$, due to the different ways public activities can affect households (day care supporting labour supply or other activities reducing labour supply).

To capture labour market frictions and a role for active labour market policies, let effective labour supply be

$$l^a = l(l^s, s)$$

where $l^a_{l^s}(\cdot) \geq 0$, and $l^a_s(\cdot) \lesseqgtr 0$.

The labour market "clearing" condition is thus

$$l^a = l^p + l^g$$

which given the equations above implies that private employment is given (implicit an equilibrium relation)

$$l^p = l^e(l^s(w, \tau, s), s) - h(s)$$

The labour input effect can thus be decomposed (recall that the tax rate is here kept fixed) in the following way

$$dl^p = \left\{ l_{l^s}(\cdot) \frac{\partial l^s}{\partial s} \left[l^s_w(\cdot) \frac{\partial w}{\partial s} + l^s_s(\cdot) \right] + l_s(\cdot) - h_s(s) \right\} ds$$

identifying the following channels underlying the labour input channel identified above:

- Wage effect: a standard effect depending on how labour supply and demand respond to a change in the wage rate ($\frac{\partial w}{\partial s}$)
- Labour supply effect: the direct effect of the service on labour supply ($l^s_s(\cdot)$)
- Labour matching effect: how public activities affect labour market matching ($l_s(\cdot)$)
- Crowding out effect: public activities require labour which - other things being equal - affects the amount of labour available to the private sector ($h_s(s)$)

Finally, some instruments may affect private consumption (c) through other channels than income. In general, private consumption can be specified as $c((1-t_y)y + T, t_c, s)$, where t_y is the income tax rate, t_c consumption taxes, and T transfers. Public services may affect the marginal disutility of work (the effect captured above), but also the marginal utility of private consumption. The effect is negative for public services being substitutes to private consumption and positive for services being complements to private consumption. Hence, the list also includes specific consumption effects,

- Consumption effect

The listing of the possible transmission mechanisms for public expenditures underlines the empirical challenge of quantifying indirect expenditure effects since different specific expenditure types release their particular mechanisms. Hence, it is not possible to make unconditional statements on the effects of public expenditure changes, since the effects depend on the specific expenditure type and the initial expenditure level.

4 Conclusion

The purpose of this paper has been to clarify some basic insights on the indirect effect of public expenditure programmes. Like tax changes releasing behavioural responses affecting tax bases and hence revenue, so does public expenditures. The presence of such indirect budget effects on both the financing and expenditure side implies that the effects of tax and expenditures cannot be analysed separately, and it is important to include both in economic policy analyses. The indirect effects arising from taxation are well known, while those arising from the expenditure side arguably have attracted less attention. Empirical evidence on these effects is also more scant, although recent empirical work on the effects is expanding. Theoretically, the sign of the indirect budget effects of public expenditures is ambiguous, and they may be positive or negative depending on both the specific instrument and the initial spending level.

The average and marginal indirect effects generally differ, and may be oppositely signed. Hence, it is theoretically consistent that positive expenditure effects help account for the fact that the economic performance in the Nordic countries is comparatively strong despite a large public sector and a correspondingly high tax share (which is a paradox if only focussing on distortions arising from the financing side), and yet have that a marginal expenditure increase has a cost in terms of e.g. a decline in private consumption and thus involving a trade-off. If there are positive expenditure effects implying that over some interval it is possible to increase public expenditure and private consumption, then this opportunity should be exploited and that optimal policies are at a point where a trade-off arises (which arises under the plausible assumption that the marginal benefits are declining when the public expenditure reaches some level).

Policy biases may arise if indirect expenditure effects are not included in policy analyses, but the sign of the bias is inambiguous since the sign of the indirect expenditure effects is in general ambiguous and therefore also depending on the specific expenditure item. Indirect expenditure effects may arise through many channels, which both points to the potential importance of assessing them carefully and poses an empirical challenge in assessing their quantitative importance.

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