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How to Finance Military Spending: Tax or Debt?

1. Introduction

The security environment in Sweden has deteriorated during recent years, which has led to a political prioritization of defense spending. In 2019 the Defence Commission proposed an increase in the budget for military defense by roughly 5 billion SEK annually over the period 2022-2025.[1] There is little consensus, however, on how to best finance the proposed increase. Some debaters have argued that the government should finance the defense buildup via government debt, while others argue that it is better to raise taxes (see Calmfors 2017; Hamilton 2017; and Hökmark 2016). Meanwhile, the Swedish government has proposed that a tax on the financial sector, at least partly, will be used to finance the larger budget for military defense.[2]

Should the increase in public spending on defense be financed by means of public debt or taxation? Does it matter from an economic point of view? The aim of this short paper is to investigate the related issues of defense spending, public debt management and distortionary taxation using a simple model of tax smoothing, first suggested by Barro (1979). As such, this paper adds to the ongoing discussion by formally analyzing the economic arguments made.

2. A simple model of public debt creation

A central assumption in the theoretical analysis is that the policy maker can only raise revenue by means of a distorting tax system. Following Heijdra and van der Ploeg (2002), assume that the welfare loss associated with taxation is given by the equation:

$$L_G = \frac{1}{2} t_1^2 Y_1 + \frac{1}{2} \frac{t_2^2 Y_2}{1 + \rho_G} \qquad (1)$$

Where Y_1 and Y_2 represent (exogenous) income in the present (period 1) and the future (period 2); t_1 and t_2 are proportional tax rates on income in the present and in the future; and ρ_G is the policy maker's time preference.

There are two types of government spending in the model: consumption and investment, denoted by G_t^C and G_t^I, respectively. Further, the government can borrow or lend freely at the interest rate r. The government budget restriction is then given by the equations:

$$(D_1 \equiv)\ rB_0 + G_1^C + G_1^I - t_1 Y_1 = B_1 - B_0 \qquad (2)$$

$$(D_2 \equiv)\ rB_1 + G_2^C - R_2^I - t_2 Y_2 = B_2 - B_1 = -B_1 \qquad (3)$$

[1] See press release: https://www.government.se/articles/2019/05/the-swedish-defence-commission-presents-its-white-book-on-swedens-security-policy-and-the-development-of-its-military-defence/

[2] See press release: https://www.government.se/press-releases/2019/09/long-term-financing-of-military-defence/

Where D_1 and D_2 denote the deficit in the two periods; B_1 and B_2 denote the government debt in the two periods; and R_2^I is the gross return on public investment obtained in the second period. The rate of return r_G on public investment can therefore be written as:

$$R_2^I = (1 + r_G)G_1^I \tag{4}$$

Using equations (2), (3) and (4), the consolidated government budget restriction can be written:

$$(1 + r)B_0 + G_1^C + G_1^I - t_1Y_1 = \frac{t_2Y_2 + (1 + r_G)G_1^I - G_2^C}{1 + r} \rightarrow \tag{5}$$

$$(1 + r)B_0 + G_1^C + \frac{G_2^C}{1 + r} + \frac{(r - r_G)G_1^I}{1 + r} = t_1Y_1 + \frac{t_2Y_2}{1 + r} \tag{6}$$

Where equation (6) is the present value of the net liabilities of the government, denoted Ξ_1.

2.1 Tax smoothing

Once the level of defense spending has been chosen, there are only two ways for the government to finance it in this model. It can tax the public today, or it can borrow money and pay it off (with interest) in the future, taxing the public just enough in the second period to meet their obligations.[3] Does it matter which method the government decides to use?

Following Heijdra and van der Ploeg (2002), suppose the growth rate of income in the economy, denoted γ, is defined as:

$$\gamma = \frac{Y_2 - Y_1}{Y_1} \tag{7}$$

Using that $Y_2 = (1 + \gamma)Y_1$, the government budget constraint can be re-written:

$$\xi_1 \equiv \frac{\Xi_1}{Y_1} = t_1 + \left(\frac{1 + \gamma}{1 + r}\right)t_2 \tag{8}$$

Where ξ_1 is net government liabilities expressed as a share of income in the first period.

The policy maker wishes to minimize welfare loss that is caused by distortionary taxation given by equation (1), subject to the budget constraint given by equation (8). The Lagrangean for the policy maker's problem is:

$$\mathcal{L} = \frac{1}{2}t_1^2Y_1 + \frac{1}{2}t_2^2\frac{1 + \gamma}{1 + \rho_G}Y_1 + \lambda\left[\xi_1 - t_1 - \left(\frac{1 + \gamma}{1 + r}\right)t_2\right] \tag{9}$$

The first-order conditions are written:

[3] A third option for the government would be to borrow money and roll over debt forever, periodically taxing the public enough to meet the interest payments. This option, however, is not possible in this two period model: all debt is re-payed at the end of the second period.

$$\frac{\partial \mathcal{L}}{\partial t_1} = t_1 Y_1 - \lambda = 0 \quad (10)$$

$$\frac{\partial \mathcal{L}}{\partial t_2} = t_2 \frac{1+\gamma}{1+\rho_G} Y_1 - \lambda \left(\frac{1+\gamma}{1+r}\right) = 0 \quad (11)$$

By combining equations (10) and (11), we obtain a tax smoothing line, much like an Euler equation for tax rates:

$$\lambda = t_1 Y_1 = \left(\frac{1+r}{1+\rho_G}\right) t_2 Y_1 \rightarrow t_1 = \left(\frac{1+r}{1+\rho_G}\right) t_2 \quad (12)$$

Using equation (12) in equation (8) and solving for t_1 and t_2 respectively we obtain the levels of the tax rates in both periods:

$$t_1 = \frac{(1+r)^2 \xi_1}{(1+r)^2 + (1+\gamma)(1+\rho_G)} \quad (13)$$

$$t_2 = \frac{(1+\rho_G)(1+r)\xi_1}{(1+r)^2 + (1+\gamma)(1+\rho_G)} \quad (14)$$

Equations (12)-(14) leaves us with a key result of the analysis: if $r = \rho_G$ then optimal taxation implies that tax rates are equalized across the two periods:

$$t_1 = t_2 = \left(\frac{1+r}{2+r+\gamma}\right) \xi_1 \quad (15)$$

Equation (15) shows that in order for losses to be minimized, taxes should not vary across time. Instead, the policy maker should try to *smooth* taxes over both periods, rather than rising taxes in some periods and lowering them in others. By spreading taxes over time, the policy maker can minimize welfare losses due to tax distortions.

3. Tax or debt?

The basic idea of tax smoothing is that the policy maker should try to minimize the welfare losses created by taxation by spreading the tax distortions over time. Hence, equation (15) states that the tax rates should be equal across the two periods in order to minimize the welfare loss due to taxation. That is,

$$t_1 = t_2 = t^* \quad (16)$$

From equation (15), we know that,

$$t^* = \left(\frac{1+r}{2+r+\gamma}\right) \xi_1 \quad (17)$$

Which means that t^* is equated to the annuity value of net government liabilities, expressed as shares of income in the first period. Expressing the right-hand side of equation (17) in terms of shares of first period incomes, we have that:

$$t^* = \left(\frac{1+r}{2+r+\gamma}\right)\left((1+r)\frac{B_0}{Y_1} + \frac{G_1^C}{Y_1} + \left(\frac{1}{1+r}\right)\frac{G_2^C}{Y_1} + \frac{(r-r_G)}{1+r}\frac{G_1^I}{Y_1}\right) \qquad (18)$$

Suppose that government consumption is the same in both time periods, so that $G_1^C = G_2^C = \bar{G}$. For simplicity, also assume that $B_0 = 0$; $G_1^I = 0$; and that $\gamma = 0$. Equation (18) now reduces to:

$$t^* = \left(\frac{1+r}{2+r}\right)\left(\frac{\bar{G}}{Y_1} + \left(\frac{1}{1+r}\right)\frac{\bar{G}}{Y_1}\right) \qquad (19)$$

After some simplification of this expression, we obtain the government budget restriction:

$$t^*Y_1 + \frac{t^*Y_1}{1+r} = \bar{G} + \frac{\bar{G}}{1+r} \qquad (20)$$

Which implies that $t^*Y_1 = t^*Y_2 = \bar{G}$ and the government runs a balanced budget in each period.

We are now ready to analyze the question stated in the beginning of this paper: should an increase in government spending be financed by means of public debt or taxation? Assume that equation (20) summarizes the starting point when the government is faced with a decision on how to finance a proposed increase in government spending. As will be demonstrated below, the outcome of this decision crucially depends on the time profile of the increase in public expenditure.

In the simplest case there are two possible scenarios regarding the time profile: either there is a permanent increase in government spending or there is a temporary increase. Starting with the first scenario, we assume that the increase is permanent, so that:

$$G_1^C + \Delta G = G_2^C + \Delta G = \bar{G} + \Delta G \qquad (21)$$

Inserting this into equation (20) gives that:

$$t^{**}Y_1 + \frac{t^{**}Y_1}{1+r} = \bar{G} + \Delta G + \frac{\bar{G} + \Delta G}{1+r} \qquad (22)$$

Which means that $t^{**}Y_1 = \bar{G} + \Delta G$ and taxes are shifted up permanently and by the amount ΔG, so that the government runs a balanced budget once again. The implication is that permanent increases in government spending should be financed by taxation, rather than debt. In other words, if there is a permanent shock to government spending, instead of adjusting the level of public debt, tax rates should be increased *immediately* in order to keep tax rates stable over time.[4]

[4] This conclusion rests on the assumption that defense spending does not increase government revenue in the future, and leaves aside the contra factual argument that defense spending in itself prevents war and destruction, which may prevent a fall in future government revenues. Also, the argument assumes that increased spending on defense cannot be financed by means of lowering other forms of public spending in the government's budget. Moreover, there are some special cases when it´s optimal *not* to finance increased government expenditure by means of taxation, even if it´s permanent. If government spending earns future revenue, i.e. takes the form

The policy recommendation is quite different, however, if the increase in government spending turns out to be only temporary. Suppose that the increase in government spending only takes place during the first time period, so that $G_1^C = \bar{G} + \Delta G$ and $G_2^C = \bar{G}$. Inserting this into equation (20), we have:

$$t^{***}Y_1 + \frac{t^{***}Y_1}{1+r} = \bar{G} + \Delta G + \frac{\bar{G}}{1+r} \tag{23}$$

Which implies that:

$$t^{***}Y_1 = \bar{G} + \frac{1}{\left(1 + \frac{1}{1+r}\right)}\Delta G \tag{24}$$

Since $\frac{1}{\left(1+\frac{1}{1+r}\right)}$ is always less or equal to one, equation (24) implies that part of the increase in government spending in the first time period is financed with a budget deficit in the first time period. For example, if the interest rate is set to zero, half of ΔG is financed by means of taxation and half is financed by means of public debt. In this way, by running a budget deficit in the first time period, the government uses public debt in order to keep tax rates constant over time. This leaves us with a key insight: when there are temporary shocks to government spending, public debt has an important role to play in order to minimize welfare losses due to distortionary taxation.

Summing up, the theoretical analysis suggests that tax smoothing has important policy implications when welfare losses due to taxation are expected to rise more that proportional with the marginal tax rate. The basic idea is that the policy maker should try to minimize the welfare losses created by taxation by spreading the tax distortions over time. The policy implication is that tax rates should be determined by the level of permanent government expenditure, whereas temporary shocks to government spending should be financed by means of debt in order to keep tax rates stable over time.

4. Conclusion

The question asked in this short paper was whether increases in public spending should be financed by means of public debt or taxation. The theoretical analysis show that when taxes are distortionary, tax rates should be determined by the level of permanent government expenditure. In contrast, temporary shocks to government spending should be financed by means of debt in order to keep tax rates stable over time.

Since the proposed increase in Swedish defense spending is the result of a security environment that appear to have deteriorated permanently, the demand for government spending on national defense can also be assumed to have increased permanently. This observation supports the conclusion that taxes should be raised immediately in order to finance the defense buildup in Sweden. On the other hand, the proposed buildup of the Swedish military

of public investment, then the increase can partially, or fully, be de-budgeted. For example, if spending earns the market rate of return, then it would not form a part of the net liabilities of the government, and it would be safe to finance the increase by public debt.

defense is likely to have an uneven time profile: in the near future there are large one-time investments to be made in infrastructure and equipment with a long technical life cycle. Such one-time costs should be financed by means of public debt. Hence, there is probably a case for *both* increased taxation *and* increased levels of public debt.

It is important to note, however, that the simple model examined here is concerned only with a world without uncertainty. In the real world, governments are always faced with the risk that some future unforeseen event may happen that involves higher public expenditure; for expenditures related to defense the level of uncertainty can be assumed to be especially high. Indeed, history has shown that things can change dramatically on the world stage, and that it is impossible to foresee events that affects the security environment: the fall of the Berlin wall and the chain of events that led up to the First World War are only two examples with a huge impact on the perceived security environment and consequently the demand for defense.

As demonstrated in this short paper, in order to minimize the welfare loss due to taxation, the government should equalize the marginal welfare loss per unit of tax revenue, across the two time periods. In a world without uncertainty, this implies that tax rates are fully smoothed. In a world that is uncertain, however, the marginal welfare loss per unit of tax revenue today should be equalized with the *expected* marginal welfare loss per unit of tax revenue tomorrow. Since welfare losses due to taxation can be assumed to rise more than proportional with the marginal tax rate, this means that the costs to society of a negative shock to government spending are larger than the benefits of a positive shock. This leaves us with an argument for declining (expected) tax rates over time: the government should *plan* to have a lower tax rate tomorrow than today. To see this, note that the welfare losses associated with taxation given by equation (1) is convex and increasing in *t*, which together with *Jensen's inequality* (see Jensen 1906), gives that:

$$E[L_G(t_2)] \geq L_G[E(t_2)] \tag{25}$$

Where $E(.)$ is the expected value operator. If the marginal welfare loss of taxation is to be equalized across time periods, this in turn implies that:

$$t_1 > E(t_2) \tag{26}$$

In essence, this is an argument for precautionary saving on the part of the government, much like in the case of risk-averse households facing an uncertain future (Leland 1968). However, uncertainty about the future does not change the conclusions made regarding how to finance the current demand for defense; from where we stand now the increased demand for defense is real and well-motivated.

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