Debt, cash flow and inflation incentives: A Swedish example*

Mats Persson, Torsten Persson, and Lars E.O. Svensson

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Can higher inflation diminish the government debt and contribute to financing the budget deficit? And how do these public finance concerns influence inflationary expectations? These have been classic questions in macroeconomics since the seminal papers by Auernheimer (1974), Calvo (1978) and Barro (1983). The same questions recently became very relevant for several European countries in the aftermath of the 1992-93 ERM crisis. In Sweden, our own country, the government deficit in 1994 stood at about 13% of GDP.[1] Increasing long bond rates and a depreciating krona —as well as higher volatility in financial markets—were often explained by a fear that "politicians would lose control of government finances and resort to higher inflation as a solution." Developments in other countries with high debts and deficits, such as Italy or Spain, were similar.

Discussions of these issues in the media and in financial markets are, however, sometimes both simplistic and somewhat confused. In this paper we take the case of Sweden in 1994 as a concrete example and try to answer four specific questions. (1) How much would government finances have improved with a higher inflation rate? (2) What would the *social* costs and benefits of such a policy have been? (3) What political incentives and power did the government have to increase the inflation rate? (4) What measures or reforms would reduce the likelihood that bad public finances promote higher inflation? Even though we study a specific country in a specific time period, the four questions we deal with are of much more general interest. Our

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[1]For a discussion of the deficit episode of the 1990s, see M. Persson (1996a).

discussions highlight the preferences of policymakers and the constraints imposed on them by the institutions in the politico-economic decision process. We thus adopt the new approach in macroeconomic research that tries to endogenize monetary and fiscal policy.[2]

Section 1 introduces some notation and provides a formal background to our calculations by separating the government's intertemporal budget constraint into those components that are sensitive to the inflation rate and those that are not. This section also makes precise some of the assumptions behind the analysis to follow.

Section 2 contains our calculations of the budgetary gains in a high-inflation scenario relative to a low-inflation scenario. To determine the effects of higher inflation we take a starting point in 1994. Specifically, we consider government expenditures and taxes according to their 1994 rules, and the government's net financial position in 1994. We express the results in two different ways. One measure is the budget improvement in a single year: 1998. The other measure is the discounted present value (in 1994) of the budgetary gains from all future years. We thus look at the effects on the government's profit-loss account for 1998 and on its balance sheet for 1994.

Our calculations in Section 2 reveal that the high inflation scenario entails substantial budgetary gains. In Section 3 we discuss the *social* costs and benefits of such a policy, relative to an alternative where government finances are instead stabilized by direct budget cuts or tax increases. We argue that the inflationary route entails the higher social costs.

In Section 4, however, we argue that the *political* costs of the inflationary route are likely to appear lower than the social costs. We also argue that the existing Swedish policymaking institutions not only give the political bodies the incentive, but also the power, to steer the Swedish Riksbank towards an accommodating monetary policy that implements a high inflation scenario.

Given these conclusions, it is not surprising if the Riksbank's 2% inflation target came to lack credibility in 1994. In Section 5, we discuss how such credibility problems affect the fiscal gains from high inflation and show that the additional costs are indeed substantial.

[2] A number of the most important contributions to this literature are collected in Persson and Tabellini (1994).

These additional costs reinforce the conclusion that the incentives in 1994 to choose a high-inflation solution to the fiscal problem seemed considerable. Since a return to the high inflation rates of the seventies and eighties would, according to our estimates, reduce net social welfare, it is of interest to discuss measures and institutional reforms that would reduce the risks for a return to high inflation. This is done in Section 6. These measures and reforms can be seen as mechanisms to bring the *political* costs of high inflation closer in line with the *social* costs.

1 PRELIMINARIES

This section clarifies the nature of our calculations in the context of an intertemporal government budget constraint. We also spell out the basic assumptions behind the analysis to follow.

Consider a one-sector model without uncertainty. The government's expenditures, receipts, and debt issue in year t must obey the budget constraint

$$\begin{aligned}&(P_t g_t + G_t) + (P_t\ {}_t b_t + \ {}_t B_t) = \\ &(M_{t+1} - M_t) + (P_t t_t + T_t(\pi_t)) + \sum_{v=t+1}^{\infty} Q_{tv}\left[P_v\left({}_{t+1}b_v - \ {}_t b_v\right) + \left({}_{t+1}B_v - \ {}_t B_v\right)\right].\end{aligned} \tag{1}$$

The first term on the left-hand-side of (1) represents total expenditures, including transfer payments, but excluding debt service. For some expenditures, g_t, the government's commitment is fixed in real terms; their nominal value is $P_t g_t$, P_t being the year t price level. For other expenditures, G_t, the government's commitment is instead fixed in nominal terms.

The second term represents government debt service. Let the vector $\{{}_t B_v\}_{v=t}^{\infty}$ denote claims on the government (possibly negative), by the private sector, to future *money*. That is, ${}_t B_v$ is the sum of interest payment and maturing principal in year v on the outstanding nominal government debt. Similarly, the vector $\{{}_t b_v\}_{v=t}^{\infty}$ denotes the private sectors claims on the government to future *goods*; i.e. the stream of future interest and amortization on indexed *cum* foreign-currency denominated debt (see further below). With this notation, $(P_t\ {}_t b_t + \ {}_t B_t)$ is total debt service, in year t, on the outstanding government debt.

The right hand side of (1) captures government revenue. Let Q_{tv} denote the year t price of

one unit of money in period v. Then, the last term is the market value of total debt issued in year t. The first term is the value of new money printed in year t. The second term, finally, represents total tax receipts at t. As expenditures and debt, it is decomposed into a real and a nominal component. Note, however, that we have written the nominal component as a function of the inflation rate $T_t(\pi_t)$. This function captures various non-neutralities, whereby effective tax rates depend on the rate of inflation.

It will be convenient to discount future expenditures and receipts back to our starting year 94 (for 1994). For this purpose, define the nominal discount factor D_t and the real discount factor d_t, by

$$\begin{aligned} D_t &\equiv \frac{1}{\Pi_{v=95}^{t}(1+i_v)} \\ d_t &\equiv \frac{1}{\Pi_{v=95}^{t}(1+r_v)}, \end{aligned} \tag{2}$$

where i_v denotes the nominal interest rate from year $v-1$ to year v, and r_v denotes the corresponding real interest rate. The latter is defined by $(1+i_t) \equiv (1+r_t)(1+\pi_t)$, where the inflation rate π_t, in turn, is defined as $(1+\pi_t) \equiv P_t/P_{t-1}$. Normalizing the initial price level, P_s, to unity, we may thus write $P_t \equiv \Pi_{v=s+1}^{t}(1+\pi_v)$. It follows from these definitions that

$$D_t P_t = d_t. \tag{3}$$

To write the government's budget constraint on present value form, multiply each of the budget constraints in (1) with the corresponding nominal discount factor D_t, and replace the market prices Q_v with D_v in each expression. Then, add the rewritten budget constraints from year 94 to ∞ together and simplify the resulting expression, to get

$$\begin{gathered} \textstyle\sum_{t=94}^{\infty} d_t \left(g_t + \frac{G_t}{P_t}\right) + \sum_{t=94}^{\infty} d_t \left({}_{94}b_t + \frac{{}_{94}B_t}{P_t}\right) + m_{94} = \\ \textstyle\sum_{t=94}^{\infty} d_t \left(t_t + \frac{T_t(\pi_t)}{P_t}\right) + \sum_{t=95}^{\infty} d_t \, i_t \, m_t, \end{gathered} \tag{4}$$

where m_t denotes real balances $m_t \equiv M_t/P_t$.[3] In words, (4) simply shows that the real present value of total government expenditures at year 94 is constrained by the real present value of total

[3] To understand how the final term on each side of the equality sign is obtained, notice that, by the definitions in the text,

tax payments including the inflation tax, less the market value of the outstanding government debt including the initial money stock.

An alternative and useful way to express the government's intertemporal budget constraint is to follow Persson, Persson and Svensson (1987) and define "real" and "nominal cash flows" as

$$\begin{aligned} {}_s z_t &\equiv t_t - g_t - {}_s b_t \\ {}_s Z_t &\equiv T_t(\pi_t) + (M_{t+1} - M_t) - G_t - {}_s B_t \end{aligned} \tag{5}$$

The real cash flow in year t is the excess of tax payments defined in real terms over expenditure defined in real terms less debt service on the indexed part of government debt. The nominal cash flow in year t thus summarizes those parts of the budget that are sensitive to the realized path for prices, either because they are defined in nominal terms or because they depend on the inflation rate in some other fashion. Expressions (4) and (5) imply:

$$\sum_{t=94}^{\infty} d_t \left({}_s z_t + \frac{{}_s Z_t}{P_t} \right) = \sum_{t=94}^{\infty} \left(d_t \, {}_s z_t + D_t \, {}_s Z_t \right) = 0, \tag{6}$$

where the first equality follows from (3). The present value of total government cash flow is thus constrained to be zero.

1.1 BASIC ASSUMPTIONS

The effect on government finances of two different paths for the price level will be considered in our calculations. In the *low-inflation* scenario we have

$$\pi_t = \pi^L = 2\%, \qquad\qquad t = 95, ..., \infty; \tag{7}$$

$$D_t \left(M_{t+1} - M_t \right) =$$

$$d_t \left(\frac{M_{t+1}}{P_t} - \frac{M_t}{P_t} \right) = d_t \left(\left(1 + \pi_t \right) m_{t+1} - m_t \right) =$$

$$d_{t+1} \left(1 + i_{t+1} \right) m_{t+1} - d_t m_t.$$

in accordance with the Riksbank's explicitly stated inflation target, a 2% inflation rate from 1994 and onwards. In the *high-inflation* scenario, the inflation rate is instead 10 percentage points higher indefinitely:[4]

$$\pi_t = \pi^H = 12\%, \qquad t = 95, ..., \infty. \tag{8}$$

We assume that Sweden is a small open economy so that we can take the *ex ante* real interest rate (gross of tax) as given from the world market. Furthermore, the same real interest rate will apply to indexed and foreign-currency denominated debt. We assume that

$$r_t = r = 5\%, \qquad t = 95, ..., \infty; \tag{9}$$

the real interest rate stays constant at 5%.

We must account for growth in some of our calculations Denote the growth rate between year $t-1$ and t by n_t . Then we assume that

$$n_t = n = 2\%, \qquad t = 95, ..., \infty. \tag{10}$$

A final simplifying assumption is that money is neutral: the real path of the economy is basically unaffected by the higher inflation rate.[5] Specifically, we assume that relative prices and real wages in all sectors are unaffected, so that real government consumption does not change. This is obviously a strong assumption, given various non-neutralities in the economy. One way to look upon our calculations is that they measure the "impact effect" of a higher inflation rate and thus the immediate "temptation" to solve the fiscal problem with higher inflation.

[4] Of course, a jump in the inflation rate of 10 percentage points within a given year is unlikely; in reality higher inflation would come about more gradually. But our calculations in the high-inflation scenario can be interpreted as a 12% *average* inflation for the period 1994-98 and a stable 12% inflation rate thereafter.

[5] We allow for two exceptions: we will assume that real balances adapt to the inflation rate. When discussing the effects of lacking credibility (Section 5), the *ex post* real interest rate will also vary with the realized inflation rate during a transition period.

Our calculations try to gauge the improvement of the fiscal position due to the higher inflation rate. From (5)-(6), a straightforward summary measure of the inflationary gains is

$$X = \sum_{t=95}^{\infty} d_t \left(\frac{{}_{94}Z_t^H}{P_t^H} - \frac{{}_{94}Z_t^L}{P_t^L} \right), \tag{11}$$

the present value gains (in 1994 prices) in the real value of nominal cash-flow due to higher inflation. An alternative way of expressing the gains follows from (3), namely

$$X = \sum_{t=95}^{\infty} (D_t^H \ {}_{94}Z_t^H - D_t^L \ {}_{94}Z_t^L). \tag{11'}$$

The latter measure is useful when calculating how much a permanently higher inflation rate affects the market value of government debt: (11') suggests calculating the effect on market value of a parallel shift in the nominal yield curve, which is easily done once we know the *duration* of the outstanding debt.

When calculating the fiscal gains from higher inflation, we assume that the government will stabilize the debt ratio at the end of the current election period, i.e. in 1998. To set the horizon at 1998 is natural; it marks the end of the current (four-year) election period, and the incumbent social democratic government has indeed formulated a goal to stabilize the debt ratio in precisely this year. A horizon of four years is also relevant in an international context; those European countries that have succeeded in stabilizing a serious fiscal situation have achieved this in about four years time (see Giavazzi and Pagano (1990b)). To make this assumption concrete, we assume that the real budget deficit falls from around 200 bn kronor in 1994 to about 20 bn kronor in 1998. We also assume that this improvement occurs in *both* scenarios. The low-inflation scenario thus entails a tougher fiscal policy with additional discretionary measures in the budget. We will assume that these budget measures apply to the spending and taxation components of the real cash flow.

To find out what these additional budget cuts should amount to in 1998, we calculate a second measure of the gains from a higher inflation rate: the improvement of the real budget deficit in 1998, the final year of the election period. We can calculate the gain in this single year

(in 1994 prices) as

$$X_{98} = \left(\frac{\left(T_{98}(\pi^H) - G_{98}\right)}{P_{98}^H} - \frac{(T_{98}(\pi^L) - G_{98})}{P_{98}^L} \right) + \tag{12}$$
$$(i_{98}^H m_{98}^H - i_{98}^L m_{98}^L) - r \sum_{t=98}^{\infty} \frac{d_t}{d_{98}} {}_{94}B_t \, (\frac{1}{P_t^H} - \frac{1}{P_t^L}),$$

where the final term captures the lower interest payments in 1998 of a lower market value of the debt outstanding in 1994.

2 BUDGETARY GAINS FROM INFLATION

2.1 GAINS FROM DEPRECIATING THE GOVERNMENT DEBT

The market value of the Swedish government debt by June 30, 1994, was 1224 bn Swedish kronor,[6] corresponding to 80% of that year's GDP, 1517 bn. From this gross figure, we first have to deduct what cannot be inflated away, i.e., the debt denominated in foreign currencies (382 bn) and in index bonds (3 bn). Second, the 76 bn in kronor-denominated debt held by the central bank should be deducted from the government's gross position.

Should the government debt held by the government pension (social security) system also be deducted? In a funded pension system a higher or a lower yield on these funds would directly affect the benefits; in this case the funds belong to the insured and are not part of government wealth. In Sweden's pay-as-you-go system, where the pension benefits have no immediate relations to fund performance,[7] however, the funds can be regarded as government wealth. Thus the krona-denominated debt held by the social security sector should indeed be deducted. Note that the same applies to all nominal assets of that sector — about 497 bn — even if they are not government securities; corporate bonds or mortgage bonds will equally fall in value if inflation increases and causes a real loss to the government.

[6] At an exchange rate of about 7 kr per US dollar, this is equal to about $175 bn.

[7] Pensions were basically defined as the real value of 60 percent of the average earnings during the individual's best fifteen years before retirement. Note that even for a pay-as-you-go system, there could be reasons for building up funds (although these would generally be smaller than those of a fully funded system).

Summing up, we had by mid-1994 a net nominal government debt amounting to (1224-382-3–76-497=) 265 bn kronor, or 17.5 percent of GDP, that could be depreciated in real value by higher inflation. How much could have been gained by such a policy? As in Section 1, we represent the net nominal debt in 1994 by a nominal cash flow, $\{{}_{94}B_t\}_{t=95}^{\infty}$. By (11), the change in the present value of the net nominal debt is given by

$$\sum_{t=95}^{\infty} \left(D_t^L - D_t^H\right) {}_{94}B_t.$$

By our assumption that the real interest rate r remains constant as inflation increases from 2% to 12%, the gross nominal interest rate, $1 + i = (1 + r)(1 + \pi)$, increases by about 10%. As the elasticity of the present value of a sequence of nominal payments with respect to the gross nominal interest rate is given by its duration, we can use the duration of the net nominal government debt to estimate the change in its present value from an increase in inflation.

The duration of the *gross* debt, denominated in domestic currency, was 3.0 years in June 1994. The securities held by the Riksbank had approximately the same duration at that time. Finally, the duration of the assets in the social security sector is not public information, but it can be assessed to roughly 2.5 years. The duration of the *net* debt is a weighted average of the durations of the components:

$$\frac{839}{265} \cdot 3.0 - \frac{76}{265} \cdot 3.0 - \frac{497}{265} \cdot 2.5 = 3.9 \text{ years}.$$

At first sight, it may seem strange that the average duration of the net debt (3.9 years) is higher than the duration of the gross debt (3.0 years) and the assets (3.0 and 2.5 years). But this is quite natural; the relatively short asset portfolio is matched by the shorter instruments in the debt portfolio. It is the longer debt instruments that remain.

Thus, if $(1 + i)$ increases by about 10%, and the duration is 3.9 years, as a first approximation, the present value of the net nominal debt falls by about 39%.

For a non-infinitesimal change, however, this linear approximation overestimates the fall in real value, since the bond price is a convex function of the interest rate. The exact fall in the market value of the Swedish government debt could be computed using detailed data on actual

future cash flows. Such a detailed analysis is, however, outside the scope of the present paper. To get a rough estimate of the right order of magnitude we treat the debt as a single discount bond with a duration of 3.9 years. By mid 1994, the net debt had a market value of 265 bn. At that time, however, neither of the two inflation rates was fully credible, as the nominal interest rate on four-year government bonds was neither 7 nor 17 percent, but approximately 9.5 percent. We postpone the treatment of this *credibility problem* to Section 5, however. At present, we only compare two credible steady states, one with $\pi = 2\%$ and one with $\pi = 12\%$.

If i had been equal to 7% (rather than 9.5%) and the government debt had been a discount bond with 3.9 years to maturity, the market value of government debt by mid-1994 would have been 290 bn. If on the other hand i had been equal to 17%, the market value of the net debt would have been 205 bn. The difference of 85 bn is the government capital gain of choosing a credible high-inflation policy rather than a credible low-inflation policy.[8]

As for the gain in the 1998 budget, the last term in equation (12), one could again make a detailed computation based on the actual maturity structure. But in this paper, we treat the capital gain of 85 bn as occurring at a single point in time, corresponding to the average duration of the outstanding debt, that is just before the middle of 1998. With $r = 5\%$, the effect on interest payments in 1998 is then 4.3 bn.

2.2 INCREASED SEIGNORAGE

The gain from increased seignorage for a particular year 1998, at a higher rate of inflation, is given by the second term in equation (12). In Sweden, like in most developed countries, the base for the inflation tax is small. In 1994 the private sector's holdings of coins and banknotes were approximately 70 bn kronor, about 5% of GDP. There are no reserve requirements for banks and voluntary reserves held at the Riksbank pay a market interest rate. Higher inflation and higher nominal interest rates lead to lower real balances. Estimates of the sensitivity of money

[8] Thus the market value would be 29 percent lower for the high-inflation scenario than for the low-inflation scenario. This figure should be compared to the 39 percent obtained in the linear approximation above.

demand to the interest rate vary; let us assume that an increase in i by one percentage point reduces m by 0.5 percent (probably an underestimate). Using $m^H = 66.5$ and $m^L = 70$, the seignorage gain in 1995 is [9]

$$0.17 \cdot 66.5 - 0.07 \cdot 70.0 = 6.4 \text{ bn.}$$

At constant 2% real growth, it is reasonable to assume that real balances will grow at a similar rate. Thus the gain from seignorage in 1998, our reference year, will be $1.02^4 \cdot 6.4 = 6.9$ bn. With $r = 5\%$, the discounted value in 1994 of a perpetual flow, starting by 6.4 bn and growing at 2 percent, is 213 bn.

2.3 INCOMPLETE INDEXATION OF THE TRANSFER SYSTEM

The analogy between interest payments and certain government expenditures is emphasized in the government budget constraints of Section 1. Most public expenditures would be classified under the terms G_t and g_t. But the cash flows ${}_{94}B_t$ and ${}_{94}b_t$ could equivalently include any claims of the private sector on the government that are due at time t, be that debt service, social security payments, or some other kind of transfer. It goes without saying that the legal status of such claims could vary, as could the claimants' possibilities to enforce the claim — but economically speaking, they are equivalent. In this section we will deal with the most important element of government's transfer liabilities, namely the pension system. The total pension payments from the public sector in 1994 amounted to 194 bn kronor before tax and roughly 135 bn after tax.[10] We simplify and regard the 135 bn as a steady-state figure, i.e., we disregard long-run trends towards an ageing population and the possible effects of future changes in the pension system. As public pensions are tied to the consumer price index, we can consider

[9] Here, too, we disregard the fact that the actual interest rate by mid 1994 was neither 7 nor 17 percent, confining our analysis to credible policies only.

[10] In this aggregate, the supplementary ATP pensions are most heavily taxed, the basic pensions being taxed at a lower rate, on average, while some payments — like housing allowances to elderly persons with low pensions — are not taxed at all.

these 135 bn as the yield on a stock of "indexed pension bonds" with a constant coupon, g^p_{94}, and infinite maturity. The present value of these consols, discounted at a growth-adjusted real rate of 3 percent, is thus: $g^p_{94}/0.03 = 135/0.03 = 4500$ bn. This is almost four times the value of the (gross) outstanding government debt. Now, the pension claims are not entirely real; in practice they form a mixture of nominal claims ${}_{94}B_t$ and real claims ${}_{94}b_t$. Below, we discuss two deviations from perfect indexation, where the real value of the pension claims depend on the inflation rate.[11]

2.3.1 DELAYED INDEXATION

According to current legislation, indexation of pensions is made with a delay: the pensions of 1995, e.g., are determined by the change in the CPI between October 1993 and October 1994. For the average pension payment in 1995, the delay is thus about eight months. At a higher inflation rate, the real value of the 1995 pensions will be correspondingly lower. The government's gain can be computed as

$$\begin{aligned} g^p_{94} \cdot \left[P^L_{95-8/12}/P^L_{95} - P^H_{95-8/12}/P^H_{95}\right] &= 135 \cdot \left[1/(1.02)^{0.67} - 1/(1.12)^{0.67}\right] = \\ 135 \cdot [0.987 - 0.927] &= 8.1 \text{ bn kronor,} \end{aligned}$$

Since this gain remains for all future, 2% real growth implies a gain in 1998 of $1.02^4 \cdot 8.1 = 8.8$ bn. The present value of this perpetual stream in 1994 is $8.1/0.03 = 270$ bn.

2.3.2 PARTIAL INDEXATION

In the fall of 1994, the parliament ruled — as part of its stabilization programme — that pensions will be compensated for only 60% of inflation during the election period 1995-1998.

[11] There are a few other kinds of transfers that are related to the CPI in one way or another (e.g., student loans, various forms of social security schemes, foreign aid). Since these are relatively insignificant in comparison to the pensions, we disregard them in this context. Unemployment insurance is quantitatively important, but the sectoral unemployment insurance benefits are indexed to *wages,* not to prices. Unemployment benefits are thus unchanged in real terms, given our assumption that real wages are independent of the inflation rate.

This temporary de-indexation is equivalent to 40% of the stock of pension bonds being replaced by nominal bonds during a four-year period— an open market operation where the private sector is obliged to buy the nominal bonds [12] at a pre-determined price equal to unity.[13] In the notation of Section 1, part of the real cash flow ${}_{94}z_t$ is turned into a nominal cash flow ${}_{94}Z_t$. Pension payments as of 1999 are assumed to be fully indexed again. The value of those 40 percent of the pension payments that are de-indexed in 1995 and re-indexed in 1999 from 1998 and onwards will amount to $1.02^{(t-94)}0.4 \cdot 135 \cdot P_{94}/P_{98}$ bn per year (in 1994 prices). The value, in 1994 prices, of the payments during 1995-1998 is instead given by $0.4 \cdot 135$ bn discounted by $1.02 \cdot (P_{94}/P_{95})$ for 1995, by $1.02^2 \cdot (P_{94}/P_{96})$ for 1996, etc.

Working out these computations for 2% and for 12% inflation, we find that the 1998 real value of the de-indexed pension payments is 54.0 bn in the low-inflation scenario against 37.2 bn in the high-inflation scenario. The gain from inflation in the 1998 budget is thus considerable: 16.8 bn.

The capitalized real value of the de-indexed payments, with $n = 2\%$ is 1672.3 bn with low inflation, and 1171.8 bn with high inflation. The present value in 1994 of the gain from the high inflation is thus a staggering 500.5 bn.

If 40% of the pension payments are de-indexed, we need to modify the earlier computation of the effects of delayed indexation. First, the delayed indexation is applicable to 60% of the earlier amount only, i.e. a present value of 162 bn or a budget improvement in 1998 of 5.3 bn. For the remaining 40% of the pension liabilities, the value will instead be modified by delayed indexation after 1998. The government can thus again appropriate a further part of the real cash flow, corresponding to eight months of high inflation. The 1994 value of this budget

[12] We assume that such a de-indexation of the pensions is implemented in simultaneity with a de-indexation of the tax schedules and the other parts of the social security system. In that case, the ratio between gross and net transfers will be approximately constant and determined by the average tax rate on pensions, i.e., roughly 30%.

[13] This illustrates the problem of defining government liabilities in practice. Obviously, there is some room for the government to affect and/or to redefine some liabilities ${}_{94}B_t$ and ${}_{94}b_t$ without actually defaulting.

improvement is approximately

$$0.4 \cdot 135 \cdot 1.02^4 \cdot (P_{94}^H/P_{98}^H) \cdot \left[P_{99-8/12}^L/P_{99}^L - P_{99}^4 - \frac{8}{12}P_{99}^H\right] =$$
$$37.2 \cdot \left[1/(1.02)^{0.67} - 1/(1.12)^{0.67}\right] = 2.2 \text{ bn}$$

for each year from 1999 on. The present value of this real cash flow is 57.5 bn kronor.

To sum up: with simultaneous partial and delayed indexation, the inflation gains due to partial indexation amount to a present value in 1994 of 500.5 bn, and 16.8 bn in the 1998 budget, whereas the inflation gains due to delayed indexation, amount to 162 + 57.5 = 219.5 bn, and 5.3 + 2.2 = 7.5 bn, respectively.

2.4 NOMINALISTIC FEATURES OF THE TAX SYSTEM

The tax system defines a flow of future payments from the private to the public sector, the present value of which can be regarded as a net asset of the public sector. As emphasized in Section 1, the real value of this asset depends on the nominalistic features of the tax system, which make effective tax rates or tax bases sensitive to the inflation rate.

2.4.1 THE INCOME TAX

The present tax schedules are in principle indexed, brackets being adjusted according to the CPI. In the fall of 1994, however, a partial return to the nominalistic tax schedules was introduced by the decision that tax brackets will be adjusted for 60 percent only of the inflation during the period 1994-1998. For every 2.5 percent of inflation, the real value of each bracket will thus be eroded by 1 percent. The effects on government revenue depend in a complicated way on the distribution of pre-tax income and might very well be non-linear in the inflation rate. According to the Treasury's detailed computer model for simulating budget effects of different policy experiments, real tax revenue is, however, approximately linear in the inflation rate over the relevant interval. Specifically, the model indicates that a lowering of brackets by one percentage point raises tax revenue by 0.75 bn. An inflation rate of 12 percent, rather than

2 percent, thus raises 1995 tax revenue by $0.4 \cdot 100 \cdot [1.12 - 1.02] \cdot 0.75 = 3$ bn. The effect grows larger over time, through 1998, as the price level increases. In 1998, the budget improvement is $0.4 \cdot 100 \cdot \left[(1.12)^4 - (1.02)^4\right] \cdot 0.75 \cdot 1.02^3 = 15.6$ bn, where we have also included 2% growth in the tax base. In 1999, the tax schedules are assumed to be re-indexed, but the budget improvement created by the de-indexation during 1994-1998 remains indefinitely and increases at the real growth rate of the economy. The present real value in 1994 of this partial indexation of the income tax schedule is equal to 427.8 bn.

A further non-neutrality can be attributed either to the (labour) income tax or to the capital income tax discussed in the next section. On the one hand, private pension savings are deductible against the income tax; on the other hand, once paid out, private pensions are taxed as ordinary income. Private pension funds, amounting to 700 bn kronor in 1994, thus partly constitute an implicit tax claim by the government (in this context, we do not distinguish between local and central governments; in practice, most of this tax claim is held by local municipalities).

Of the 1994 private pension funds, 435 bn were invested in nominal securities with an average duration of approximately 2.5 years. A ten percent higher inflation rate will reduce the real value of these nominal assets by approximately 20 percent (cf. the reasoning in Section 2.1 above), i.e., by 87 bn. The real value of the private pension funds will thus be 613 bn in the high-inflation case.

In the high inflation case, the pension funds will give rise to a perpetual flow of real pension payments equal to: $613 \cdot [0.17 \cdot (1 - \tau^p) - 0.12]$, where τ^p is the tax rate paid by the insurance companies on fund returns (cf. Section 2.4.2 below). Of these pension payments, 30 percent will be paid to the local and central government as income tax.

In the low-inflation case, the flow of real pension payments will instead be:
$700\,[0.17 \cdot (1 - \tau^p) - 0.02]$. Setting $\tau^p = 0.15$, we get an annual tax flow of 4.5 bn in the high-inflation case and of 8.3 bn in the low-inflation case. Thus there is a yearly *loss* to the government from inflationary policy, equal to 3.8 bn, or a capitalized value (using the growth-adjusted real rate of 3 percent) equal to 126.7 bn.

2.4.2 THE TAXATION OF CAPITAL

Since Sweden has a nominal capital income tax, the effective tax rate on capital is $\tau^c(r+\pi)$, where the nominal tax rate is denoted by τ^c. With $r = 0.05$, the yearly difference in tax revenue under the high-inflation and the low-inflation scenario is

$$\Delta T^r = \tau^c(0.05 + 0.12) \cdot K^H - \tau^c(0.05 + 0.02) \cdot K^L,$$

where K^H and K^L denote the tax base (i.e., the real value of the nominal, taxable assets of the private sector) under the high-inflation and low-inflation scenario, respectively. The tax bases K include government bonds as well as other securities issued by private agents. The tax rate τ^c and the tax base K differ over investors. Broadly speaking, the following kinds of investors are active on the Swedish capital market:

Investor category	**Tax rate, %**
Households	30
Life insurance companies	17
Banks	0
Non-financial companies	0
Foreigners	0
Others (foundations, labor market organizations, etc.)	0

The tax base K has been negative for households in the past, due to various forms of tax arbitrage. One of the objectives of the 1990-91 tax reform was to make such tax arbitrage less profitable. In 1994, however, the net financial position of the households was still negative. In this context, we cannot make any reliable forecast of the households taxable financial net position for the next few years. In Section 4 below, however, we study the gains from inflation in a credibility context, where the magnitude of new debt issue plays an important role. We construct a numerical example based on explicit assumptions of the government's borrowing requirement for the years 1994-1998. For consistency, we will use the same assumptions for now,

and assume that the new debt issue will be distributed over investor categories in the same way as the stock of gross debt was distributed in 1994, i.e., with 10% of the debt held by households and 30% held by insurance companies.

In that example, we assume a real borrowing requirement of 632 bn over the period.[14] We assume that the net position of the households will be 10% of that amount, or 63.2 bn, in 1998, thus the income tax in that year will be $0.30 \cdot 0.17 \cdot 63.2 = 3.2$ bn under the high-inflation scenario, and $0.30 \cdot 0.07 \cdot 63.2 = 1.3$ bn under the low-inflation scenario[15]. The gain from inflation in 1998 is thus 1.9 bn, and if treated as an annuity (which is not entirely correct, since the government's borrowing requirement varies over the years, cf. *Table 4* below) it gives us a capital amount of 31.3 bn in 1994.[16]

Banks and non-financial companies are subject to ordinary corporate income tax. This tax is based on the company profit, which is a net concept, and not on the yield of the company's financial assets, which is a gross concept. It is difficult to estimate the effect of an increase in the inflation rate on taxable profits in the corporate sector . For simplicity, we therefore assign this sector an effective tax rate equal to zero.

Life insurance companies[17] pay a capital income tax of 17 percent on average. Total assets within the life insurance industry (mainly government and mortgage institute bonds) in mid-1994 amounted to 700 bn. The duration of these assets is around 2.5 years.[18] Inflation will thus erode the real value for 2.5 years, i.e., till December 31, 1996, on average. In the middle of 1994, the interest rate on 2.5-year bonds was approximately 9.5 percent, which means that by the end of 1996, these funds will have grown to 848 bn. Then, the money will be reinvested at the

[14] This is a numerical example only, and not a forecast of actual borrowing requirements.

[15] For simplicity, we have abstracted from the fact that the net position of the households will depend on the inflation policy actually chosen. Thus we probably overestimate the budgetary gains from high inflation.

[16] Here we have used a discount rate of 5 percent, since there is no reason to assume any real growth in these figures above what is assumed in *Table 4.*

[17] Property and liability insurance companies are subject to the regular corporate income tax.

[18] This figure is not public, but is based on an informed estimate by the authors.

current interest rate, and will in the middle of 1998 have a nominal value of 1,034 bn[19] under the high-inflation scenario (interest rate 17 percent) and 923 bn under the low-inflation scenario (interest rate 7 percent). The real values of these amounts in 1994 prices, are 657 and 853 bn, respectively. Tax revenue for these two cases is $0.17 \cdot 0.17 \cdot 657 = 19.0$ bn with high inflation, and $0.17 \cdot 0.07 \cdot 853 = 10.2$ bn with low inflation. The difference is 8.8 bn. Treating this as an annuity, and assuming that long-run pension savings grow at the same rate as real GDP, gives us a capital value of 241.3 bn in 1994.

The flow of new savings due to the government's budget deficits should also be added. Treating this in the same way as the households, we assume that the insurance company share of government debt remains 30 percent of the new debt issue of 632 bn; thus 190 bn will be placed in these companies by 1998. The tax on this is $0.17 \cdot 0.17 \cdot 190 = 5.5$ bn for the high-inflation case, and $0.17 \cdot 0.07 \cdot 190 = 2.3$ bn for the low-inflation case, i.e., an inflation gain for the government of 3.2 bn in 1998. Treating this, for simplicity, as an annuity, it corresponds to a capital of 52.6 bn in 1994. [20]

2.4.3 TAX COLLECTION

Since taxes are paid to the government with a lag after the taxable income has been earned, the real tax revenue is sensitive to inflation; this is the so called "Olivera-Tanzi effect." Although the method of collection varies over different taxes, we find it is sufficiently realistic to assume an overall lag length of one month.

The income tax revenue (central and local government) in 1994 was around 300 bn, payroll taxes and social insurance fees collected 200 bn, and indirect taxes yielded 185 bn. Assuming the collection of these 685 bn to be evenly distributed over the year, the government thus collected $685/12 = 57$ bn per month. Since these 57 bn were paid with one month's delay, it can be

[19] Here we have taken into account the increase in the average tax rate of the insurance companies, from 12% to 17%, on January 1, 1995.

[20] As for the households, we have not assumed any real growth in this amount, i.e., the annuity has been calculated for a 5 pecent real interest rate.

said that the government had a continuous, non-interest bearing claim on the private sector amounting to 57 bn. With a low inflation, the loss in real value would be 1.14 bn per year; with high inflation, it would be 6.84 bn. The difference, i.e. the government's real loss from high inflation, is 5.7 bn.

With a two percent real growth rate, the high-inflation policy would thus cause a 6.2 bn loss in the budget of 1998. The capitalized value of all future losses due to lags in tax collection is 190 bn.[21]

2.5 SUMMARY

Table 1 summarizes the gains and losses when the inflation rate goes from 2% to 12%. We indicate the gains and losses both in absolute terms (in mid-1994 prices) and as percentages of 1994 GDP. The total net gain is rather impressive: a flow value in the 1998 budget amounting to 3.6%, and a present value amounting to 95.8%, of 1994 GDP. It is noteworthy, however, that the major gains do not, as many economists might think, accrue from the traditional sources of inflationary finance, i.e., from increased seignorage and a real depreciation of government debt. Instead, the major gains accrue from the nominalistic features of tax and transfer systems. It is worth emphasizing that these gains are so substantial that the appropriateness of de-indexation as a means for restoring budget balance might be questioned. Such a de-indexation may create an immediate real budget gain, but it also creates such strong incentives for inflation that the overall effects on the budget are not obvious, once we add the prospective effects on credibility, and thus also on nominal interest rates. These issues will be discussed further in Section 4 below.

[21] Here we disregard possible redistribution, due to inflation, between central and local government.

Table 1. Gains from increasing the rate of inflation from 2 to 12 percent

	1988 budget	1994 present value
Real value of government debt	4.3 bn (0.3 %)	85 bn (5.6 %)
Seignorage	6.9 bn (0.5 %)	213 bn (14.0 %)
Transfers		
delayed indexation	7.5 bn (0.5 %)	219.5 bn (14.5 %)
incomplete indexation	16.8 bn (1.1 %)	500.5 bn (33.0 %)
Taxes		
income tax schedules	15.6 bn (1.0 %)	427.8 bn (28.2 %)
pension funds	-3.8 bn (-0.3 %)	-126.7 bn (-8.4%)
capital income tax	13.9 bn (0.9 %)	325.2 bn (21.4 %)
tax collection	-6.2 bn (-0.4 %)	-190 bn (-12.5 %)
Total:	55 bn (3.6 %)	1454.3 bn (95.8 %)

3 SOCIAL COSTS AND BENEFITS OF INFLATION VS. EXPENDITURE CUTS AND TAX INCREASES

The budgetary gains from higher inflation are sizeable. To find the net social welfare effect of higher inflation they have to be translated into social benefits, and then compared to the social costs of inflation, which is done in this section.

3.1 SOCIAL BENEFITS OF THE BUDGETARY GAINS FROM HIGH INFLATION

The present value budgetary gains from inflation reported above are 1454 bn, which corresponds to about 95% of GDP. The social benefit of these budget gains equals the social loss of the corresponding expenditure cuts and tax increases that must be done in the low inflation scenario. First consider a case when the tradeoff between expenditure cuts and tax increases is socially optimal: the marginal social cost of public funds is not only equalized over different sources of

revenue, but is also equal to the social marginal benefits of public expenditure, which in turn are assumed to be equalized over different types of expenditure. In this hypothetical case the welfare effect is simply given by the marginal deadweight loss caused by increased taxes of the same present value as the budgetary gains from inflation.

Obviously, the assumption of a socially optimal tradeoff between taxes and government spending is not realistic. In the next section, we argue that features of the Swedish political system imply that politicians had relatively strong incentives to choose the inflationary route despite its costs. These political distortions also suggest that the starting point in 1994 was distorted, in that the social costs were not equalized across taxes and social benefits not equalized across expenditures. Moreover, it is likely that there was overspending, in the sense that the average marginal cost of taxes were higher than the average marginal benefit of expenditures. For some types of public expenditures, the marginal benefit may even have been below unity. Thus, private consumption was more valuable at the margin so that a cut in those types of spending would in fact increase social welfare. In that situation, the actual social gain from the high inflation alternative would depend on exactly which taxes were increased and which expenditures were cut in the low inflation alternative.

Estimates of the marginal social cost of public funds are controversial, especially after the 1990-91 tax reform. We assume, in line with Agell, Englund and Södersten (1995), that the marginal cost in the benchmark case is 1.5, expressed in terms of private consumption, which implies a deadweight loss of 0.5 (the marginal cost of public funds less one). We also consider an upper bound for the marginal social benefit of 2 (a deadweight loss of 1). Thus, the present value of social welfare gain of high inflation—the reduced deadweight loss, or excess value of government over private spending—in the benchmark case is 727 bn, that is about 48% of GDP. The upper bound for the social welfare gain is 1454 bn, or 95% of GDP.

3.2 THE SOCIAL COSTS OF INFLATION

From the social gain in the previous section, we have to deduct the social costs of inflation to assess the net social welfare effect of the high-inflation alternative. High inflation has large and well-known social costs, confirmed by the experience from the last few decades. High inflation, even when anticipated, combined with seemingly unavoidable nominal tax systems, adds to other distortions and makes resource allocation less efficient. Consumption, savings and investment decisions are distorted. Empirically, high inflation is strongly correlated with high variability and low predictability of inflation. The resulting uncertainty in itself contributes to making resource allocation less efficient. In addition, high and variable inflation results in huge redistributions of wealth, for instance between families in rented apartments and those in owner-occupied houses, and generally between creditors and debtors. The high-inflation alternative would result in arbitrary losses for investors who have lent money to the Swedish government. Eventually, the social costs of inflation would most likely cause a lowering of inflation to more reasonable levels. A return to lower inflation would, however, have dismal credibility, after another sad page of Sweden's inflation history, and therefore be correspondingly costly in terms of recession, lost income and unemployment.

Several recent papers have discussed the potential deterioration of investment and long term growth that inflation may cause (Fischer (1993), Pindyck and Solimano (1993), Barro (1995)). The cross-country estimates in these papers are controversial and vary between sizeable and small; the jury is still out. One result seems clear, though: inflation does not improve long-term growth. At best it is neutral, at worst it can cause a sizeable deterioration, particularly at high inflation rates.

The exact costs of high inflation depend on details in the institutional framework, especially the tax system, and can hence vary from country to country. A precise estimate has, to our knowledge, never been done for Sweden. Fischer (1994) — when surveying the cost of inflation — reports that a 10% inflation rate may imply a cost of 2-5% of GDP, excluding any growth

effects. Feldstein (1996) examines the social benefits of reducing anticipated inflation from 2% to zero in the US, taking into account reduced distortion of household saving, housing demand and money demand, as well as resulting public revenue changes. Public revenue effects are indeed the subject of our previous calculations, so in order to assess the relevant US number, we should look at the estimates of social cost gross of revenue effects. Feldstein's favoured estimate of the annual social benefits of going from 2% to zero inflation amounts to about 1.1% of GDP. As a more conservative estimate, he suggests the number 0.85%. Under the assumption of linearity—which most likely underestimates the social cost—a 10% increase in inflation would thus entail an annual social cost of 5.5% of GDP, with a lower bound of 4.25% of GDP. These estimates still exclude quite a few of the above mentioned costs.

In general, Swedish taxes are much higher than US taxes. But the inflation distortions mainly derive from capital taxation, where the relevant marginal tax rates are more comparable: since the 1990-91 tax reform basically all capital income, including capital gains, is taxed at the same proportional 30% tax rate for all households and firms. The Swedish and US tax systems differ in a number of other ways, and a more detailed assessment is necessary for a precise comparison. Here we shall, however, accept Feldstein's favourite case and use it as a benchmark for social cost in Sweden. With a 5% real interest rate and a 2% annual GDP growth rate, the present value of this social cost is about 180% of GDP. If we instead use Feldstein's lower bound, we get a social cost of 140% of GDP.[22]

The pieces can now be put together. Deducting social costs of inflation from the social gains calculated in the previous section, we get the net social effect of the high inflation alternative.

[22] As a very rough consistency case, we can compare our budgetary gains with those of Feldstein's (where Feldstein's original estimates are multiplied by -5 to make them correspond to a 10 percentage point increase in inflation instead of a 2 percentage point decrease). Feldstein's transformed budgetary gains from seignorage are then 0.58% of GDP (ours are 0.5%), and from capital income (including implicit subsidies to housing) $1.3 - 1.5 = -0.2\%$ of GDP (ours are 0.9%). Thus, our budgetary gains from capital income (including mortgage deductions) are higher. If we have exaggerated the budgetary gains from capital income taxes, our result concerning the social net undesirability of inflation is strengthened.

In the benchmark case, the result is a social loss, the present value of which is about 85% of GDP. If we instead use the upper bound for the social gain and the lower bound for social cost, we still end up with a loss, with a present value of about 45% of GDP.

4 POLITICAL INCENTIVES AND POWER TO CHOOSE THE INFLATION ROUTE

In order to evaluate the likelihood for a return to high inflation, we must consider the alternative to the inflation route; as we stated initially, a fiscal consolidation within the parliament period with maintained low inflation requires that the budgetary gains from high inflation are compensated by other means: expenditure cuts and tax increases. In this section we will therefore briefly review the political costs and benefits of achieving fiscal consolidation through inflation or by other means.

4.1 POLITICAL INCENTIVES

International experience shows that, among democratic industrial countries, it is primarily those with proportional election systems—rather than those with majority election or mixed parliamentary-presidential systems—that have had problems with their fiscal situations during the last decades (Roubini and Sachs (1989), Grilli, Masciandaro and Tabellini (1991)). The reason seems to be that these countries often have minority or coalition governments. Countries where governments are short-lived also have fiscal problems more often.

Experience from the European countries also indicate that fiscal policy is systematically related to the institutions in the budget process, i.e. the process in which budget decisions are prepared by the government, finalized by the parliament, and executed by the public administration. A weak budget process seems to be a great hindrance for attempts to fiscal consolidation (von Hagen (1992), von Hagen and Harden (1995)). This can be understood along the lines of the theoretical political economy literature on "universalism" (see, for instance, Weingast, Shepsle, and Johnson (1981)). When the benefits of a particular type of public spending are

concentrated to a particular region or a particular sector, but the cost dispersed over all tax payers, and each special interest fails to internalize the overall budget constraint, the end result may be individually rational—but collectively irrational—overspending in all areas.

Swedish experience does not contradict the international picture. Sweden again has a minority government, something which has been the rule during the last 20 years of mostly too expansionary fiscal policy. The Swedish budget process is one of the weakest in Europe (Molander (1992)). That the existing institutions have not withstood the pressure and thereby contributed to the overly expansionary fiscal policy was one of the main points in the analysis of the Economics Commission (Lindbeck et al. (1993)).

When it came to solving the fiscal problems, the institutional conditions were hence far from good. Chances were that it would be exceedingly difficult to push a sufficiently ambitious consolidation programme through the government and the parliament. Given the outlook in 1994, most commentators were convinced that the *concrete* budget improvements suggested by the government were insufficient. Estimates of the necessary budget improvements to stabilize the debt ratio in the election period ranged from 50 to 80 bn kr (3-5% of GDP). What is relevant for the argument in this paper is the *marginal* consolidation, the last part of the consolidation programme. Our point is that party politics and the power of special interests could make the last, say, 50 bn appear very costly for the government in political terms. The sum of 50 bn equals e.g. the (net) saving of completely eliminating the child allowance, the sickness benefit and the (12 month) parental benefit to stay home after childbirth. Politicians might very well consider inflation a politically cheaper way to get the last 50 bn. Instead of explicitly having to announce precisely which expenses to cut, benefit to slash, and taxes to increase, it might be attractive to have inflation cause more anonymous expenditure cuts and tax increases.

Note that the above does not imply that the government and parliament must necessarily argue explicitly for inflation as a way to reduce the budget deficit. But everything else equal, the government and the parliament might be much less inclined to resist inflationary impulses and support the Riksbank's low inflation policy if the budget deficit is large than if it is small.

Thus, given the constant pressure from various special interests on the Riksbank to conduct a more accommodating and expansionary monetary policy, the substantial budgetary gains from inflation, and the resulting weaker support of the Riksbank from the government and parliament, might tip the balance towards more inflation.

4.2 THE POWER TO CHOOSE INFLATION

It is thus far from inconceivable that politicians in the government and the parliament might have had strong incentives to accept or even support an inflationary policy. What are the possibilities to induce the Riksbank to conduct an expansionary policy? This is related to the institutional setup of monetary policy and the degree of independence of the Riksbank. International experience not only shows that countries with more independent central banks have generally had lower inflation. It also shows that a rapid increase of the national debt in European countries has been associated with higher inflation in countries with less independent central banks, but not in countries with independent central banks (Grilli, Masciandaro and Tabellini (1991), Jonsson (1995)).

The modern theoretical literature (Rogoff (1985), Cukierman (1992), Persson and Tabellini (1993), Walsh (1995), Svensson (1995a)) emphasizes three aspects of the institutional setup that combined can improve monetary stability: (1) delegation of monetary policy to the central bank, with a clear mandate to the central bank to focus on price stability, with a larger emphasis on inflation stabilization relative to employment stabilization, incentive contracts that increase the central bank's cost of inflation, or an extra low inflation target, (2) instrument-independence of the central bank so that it can best pursue the goal of monetary policy without giving in to short-run political pressure, and (3) accountability of the central bank to achieve the goal, for instance with sanctions for the Governor or the Board if the goal is not achieved.

The status of the Riksbank is ambiguous in this context, as is clear for instance in the report of the Riksbank Commission (SOU 1993:20) or in Svensson (1995b). On the one hand, the delegation of monetary policy is far-reaching, even in an international perspective. For

instance, exchange rate policy is decided upon by the Riksbank and not the government.[23] The Riksbank has also announced an explicit inflation target of 2%. On the other hand, the inflation target lacks formal or legal backing from the parliament, the principal of the Riksbank. Some social democrat politicians have expressed a desire to add a growth or employment target to the inflation target, something which would increase the demands for an inflationary monetary policy. Moreover, the Governing Board is politically appointed by the parliament for each parliament period, and it has a composition that gives the Board members of the ruling party or coalition in the parliament a majority of the votes in the Board. Hence these Board members can pursue the monetary policy they wish without the consent of the Governor. They can also, at any time, without giving a reason, fire the Governor. Thus, the result may be a Riksbank that is very obedient to the short-run interests of the ruling party or coalition in the parliament.

5 THE CREDIBILITY PROBLEM

The calculations in Section 2 above compare two alternatives: a credible policy of low inflation (with $i = 0.07$), and a credible policy of high inflation (with $i = 0.17$). Our discussion in Section 4 of the government's and parliament's incentives indicate that the temptation is strong to follow the latter alternative; it leads to a permanent, real budget improvement of 55 bn kronor (or between 3 and 4 percent of GDP) per year. In order to achieve an improvement of a similar magnitude with a low-inflation policy, the government would have to perform very large, and politically painful, spending cuts and/or tax increases.

To get a clear picture of the temptations facing the government and parliament in financial distress, we cannot, however, simply compare a hypothetical high-inflation policy to a hypo-

[23] This is a very rational setup, as many monetary policy commentators have observed, since exchange rate policy and monetary policy cannot be separated. Nevertheless several, but not all, countries with otherwise independent central banks, are plagued by the contradiction that the government is responsible for the exchange rate policy and the central bank is responsible for monetary policy. Recently, however, both the Governing Board of the Riksbank and the Swedish Treasury have surprised monetary policy commentators by declaring that the responsibility of exchange rate policy should be transferred to the government.

thetical low-inflation policy. We also have to take the actual situation into account. In Section 2 we answered the question, "What are the budgetary gains from a credible 12% inflation as compared to a credible 2% inflation?" The question to be dealt with in the present section is instead: "What were the budgetary gains from a 12% inflation in 1994, when the actual value of i was around 10 percent?

This change of focus has implications for our calculations of inflation gains from the tax and transfer systems. These effects are, however, relatively small and will be disregarded here. As to government borrowing, there is a large extra cost associated with the lack of credibility for the low-inflation policy.

5.1 A NUMERICAL EXAMPLE

The credibility problem is mainly associated with the issue of new debt. In section 2.1 above, dealing with the possibility of reducing the real value of existing debt, the *net debt*, which had an average duration of 3.9 years, was the most relevant concept. For simplicity, we will assume that the new debt has a duration of 4 years.

The four-year interest rate was 9.5% in the middle of 1994. Thus, neither the low-inflation nor the high-inflation policy was credible at that time. We assume that the market—like ourselves—considered two scenarios only. The probabilities associated to the low-inflation and high-inflation scenarios are denoted by p and $(1-p)$, respectively. For an expected real yield equal to 5% and a nominal market rate of 9.5%, we can compute the implied value of the probability of a low inflation: $p = 0.75$.

At each point in time, the market will revise its p value based on actual inflation. This could be modelled theoretically in a Bayesian framework, assuming that the government has complete control over monetary policy, that there could be two types of governments, one with preferences for high inflation, and one with preferences for low, and that the agents do not know which type is in power at the moment. By observing actual inflation, the agents can revise their prior probabilities, and base their demand and supply of bonds on these. If the inflation rate is

subject to exogenous shocks, the first year's performance will not immediately reveal the type of government in power; a low inflation rate could be the consequence of either an inflation-averse government, an inflation-prone government and a negative random shock to the inflation rate, or an inflation-prone government that mimics an inflation-averse government.[24]

The rate at which the probability p will be revised in the light of actual inflation data depends on the distribution of random shocks. A thorough investigation of this problem of Bayesian learning is beyond the scope of the present paper. We will present a simple numerical example, just to indicate the order of magnitude.

Assume that the government chooses a low inflation policy. In the beginning, agents' subjective probability of this event is 75%. We now assume that the agents revise their probability linearly over four years. Let us denote the probability of a low-inflation government, conditional on a low inflation rate being observed, by p^L. This variable will develop according to the p^L column in *Table 2*.

With regard to p^H, the subjective probability assigned to a low inflation rate conditional on a high inflation rate being observed, we assume that learning is faster. We assume that the probability goes linearly to zero in two years (column p^H in *Table 2*). The asymmetric assumption has support in the theory in which an inflation-prone government may temporarily mimic the behaviour of an inflation-averse government. Observing low inflation does therefore not necessarily signal that the government is inflation averse. However, the inflation-averse government would never mimic the inflation-prone government and temporarily pursue high inflation. Therefore, observing high inflation is a strong indication that the government is actually inflation-prone.

[24]The first analysis of this type is in Backus and Driffill (1985). Cukierman and Meltzer (1986) analyze an alternative case, where the preferences of the central bank is changing over time but cannot be directly observed. Instead the public estimates the central bank preferences from the observed outcome with a Kalman filter. See T. Persson and G. Tabellini (1990, ch.4) for a survey of the relevant literature.

Table 2. Subjective probabilities of a low inflation

Year	p^L, %	p^H, %
1994	75,00	75,00
1995	81,25	37,50
1996	87,50	0
1997	93,75	0
1998	100,00	0

If we assume that the market, given this uncertainty regarding the actual intentions of the government, demands an expected real interest rate *ex ante* at 5%, we can compute the cost for the government of performing a non-credible low-inflation policy. Inserting the probabilities of *Table 2* into the Fisher equation yields the nominal interest rates i_t^j, $j = L, H$,

$$i_t^j = 5 + (1 - p_t^j) \cdot 2 + p_t^j \cdot 12 = 7 + p_t^j \cdot 10,$$

and the ex post real interest rates r_t^j, $j = L, H$,

$$r_t^j = i_t^j - \pi^j.$$

These ex post rates, and the difference between ex post real interest rates in the low and high inflation alternatives, are reported in *Table 3* for the period 1994-1998.

Table 3. Nominal Interest Rates and

Real Ex Post Interest Rates, %

Year	i^L	i^H	r^L	r^H	$r^L - r^H$
1994	9.5	9.5	7.5	−2.5	10.0
1995	8.875	13.25	6.875	1.25	5.65
1996	8.25	17.0	6.25	5.0	1.25
1997	7.625	17.0	5.625	5.0	0.625
1998	7.0	17.0	5.0	5.0	0

The ex post real rate that is relevant for new debt issue is thus highly dependent on inflation. To see the actual difference in cost of borrowing, we need estimates of the governments borrowing requirements during this period. *Table 4* shows the hypothetical numbers underlying our calculations; we have assumed that the borrowing requirement, which amounted to 200 bn during the calendar year of 1994, falls by 45 bn per year in real terms. This is in no way a forecast of the budget deficits during the period, but is intended to serve as a numerical example only.[25] The example is however consistent with the precondition spelled out in Section 1 above, namely that government debt be stabilized as a fraction of GDP by 1998.[26] Since all our computations refer to the situation in the middle of the year, we assume for simplicity that each year's borrowing takes place on July 1.

In addition to the net borrowing, the existing stock has to be rolled over. In Section 2 above, we saw that the net debt, amounting to 265 billion, had an average duration of 3.9 years. Here we will assume that 1/8 of the debt matures each year and has to be rolled over which means that on top of the linearly falling budget deficits, another 66 billion has to be borrowed each year. Of this gross borrowing requirement, we assume that 2/3 will be borrowed against bonds denominated in domestic currency, for which the real ex post interest rates of Table 3 are relevant. For simplicity, we assume the issued debt to have an average duration of 4 years.

[25] In fact, the borrowing requirement fell faster during 1995. Having chosen 1994 as the point of departure for our exercise, we have however disregarded the availability of recent data for 1995 and tried to work out our computations conditional on the information available in 1994.

[26] Note that the numbers refer to the entire, and not only the primary, budget deficit.

Table 4. The Government's Borrowing Requirement (1994 prices), bn kr

Calendar year	New debt issue	Turnover of net debt	Total	Total in domestic currency
1994	200	66	266	177
1995	155	66	221	147
1996	110	66	176	117
1997	65	66	131	87
1998	20	66	86	57

All this will result in a higher cost for the low-inflation alternative, in the form of higher ex post real interest payments. The higher cost is distributed over the years in the way shown in *Table 5*. A total of 177 bn in domestic currency is borrowed in 1994. This leads to an increased ex post real interest cost for the low-inflation alternative of 17.7 bn in 1995 and each of the three following years, since the ex post real interest rate difference for loans in 1994 is 10 percentage points. A total of 147 bn has to be borrowed in domestic currency in 1995. The increased ex post real interest cost will be 8.3 bn in 1996-1999. The total interest cost for the low-inflation alternative is hence 26.0 bn, etc.

Table 5. Gains from the High-Inflation Scenario (1994 prices), bn kr

Year	
1995	17.7
1996	26.0
1997	27.5
1998	28.1
1999–2001	12.1

The present value in 1994 of these costs, at $r = 0.05$, is about 97 bn, or 6.4% of GDP. Note also that the budget effect is maximized in 1998, when it is about 2% of GDP. This gain should be added to the budgetary gains from high inflation estimated in section 2. Thus, a lack of credibility for the low inflation alternative has sizeable budgetary costs. This increases the relative attraction of the high-inflation alternative[27], but also points to the importance of remedies of reforms that increase the credibility of the low-inflation alternative. We also note that there is a simple way of avoiding these ex post real interest costs, namely to borrow against indexed bonds or against bonds denominated in foreign currency.

6 MEASURES AND INSTITUTIONAL REFORMS

Our discussion in Section 4 emphasized that an inflationary route looked politically cheaper than the alternative route of transparent budget measures. Yet, in Section 3, we argued that the social costs of the inflationary route were higher. The measures and institutional reforms that we discuss in this section either bring about weaker incentives for the government and the parliament to choose high inflation, or else makes it harder for these political bodies to steer the central bank towards a more inflationary monetary policy. Another way to describe the reforms is that they bring the political costs of high inflation better in line with the social costs.[28]

[27] Calvo (1988) has observed that multiple equilbria may arise in this kind of situation: a large perceived probability of high inflation drives up the cost of borrowing at low inflation to such an extent that high inflation is triggered. With a low perceived probability of high inflation, the cost of borrowing at low inflation is lower, so that high inflation can be avoided.

[28] This section is written from the perspective of late 1994, the time that we authored our original paper in Swedish. Since then, some of the proposed measures have in fact been decided upon, or are very actively debated. See the concluding section for an update.

6.1 REFORM OF POLITICAL INSTITUTIONS

A first set of measures changes the political institutions in a direction that makes it easier to decide on a strict budget. If the conditions for a more disciplined budget policy are better, it appears less tempting to let part of the stabilization be carried out by higher inflation.[29] One route would be to strengthen the part of the budget process that takes place in parliament. The possibilities to push through a sufficient programme of budget cuts would be enhanced if the budget process were "turned around", so that a binding decision on the overall budget were taken in one initial vote, instead of the current practice of deciding on individual components one by one to arrive at a final overall outcome. Also, a stronger role for the standing finance committee—with responsibility for the overall budget—vis-a-vis the standing spending committees would contribute to this.

Similar measures in other parts of the budget process, for example, to strengthen the Treasury and the Prime Minister's Office in the budget preparation stage, would serve an analogous purpose. Empirical work by von Hagen (1992) and by von Hagen and Harden (1995) shows that the budget discipline in European countries is indeed significantly correlated with central features of the national budget process.

6.2 MEASURES TO LOWER THE BUDGETARY GAINS FROM HIGH INFLATION

Another set of measures would instead lessen the effect of inflation on government finances and hence make it less tempting to take the inflationary route, given the overall budget stance. Our discussion in Sections 2 and 5 clearly indicates a number of possibilities to substitute real cash flow for nominal cash flow. One would be restructuring the public debt, in connection with replacing maturing loans and with new debt issue. If the debt were restructured towards indexed debt and foreign-currency denominated debt, the net gains for higher inflation would gradually decrease. A shorter average duration of the public debt would also lower the inflationary gains

[29] See Lindbeck et al. (1993, ch 5) for a discussion of a number of such changes.

from higher inflation. Shorter maturities would, however, also increase the amount to be refinanced each year and could hence contribute to volatility in financial markets. As previously pointed out, the insight that the maturity structure and the composition of the public debt affects the government's incentives has been around for some time in the theoretical literature.[30] Proposals to restructure the public debt in the direction discussed here, have also been put forward in the Swedish policy debate.[31]

Another measure is to not allow transfer programmes with nominalistic features at the margin. One may argue that partial indexation could be exploited as a means to make real budget cuts when other forms of budgetary consolidation are not viable. In fact, there are ways of constructing such partial indexation without creating incentives for high inflation. Consider for instance a transfer scheme with a nominally fixed part which is capped at some low level of inflation. With full indexation at inflation rates above, say, 2% there is a lump-sum gain, but no additional gain at inflation rates above 2%. But such an arrangement is equivalent with an annual 2% real cut in transfers with maintained indexation. The same reasoning applies to the indexation of the basic allowance and the boundaries for higher tax brackets in the income tax system.

When it comes to capital income taxation, economists have argued for quite some time that, to avoid a number of unwanted distortions (recall the discussion in Section 3), the system ought to be based on real rather than nominal returns. Our results in section 2 reinforce these arguments. Binding its hands not to cash in additional revenue through high inflation by nominalistic capital taxation, the government contributes to greater credibility for a low inflation policy.

[30] The classical paper is Lucas and Stokey (1983). Persson, Persson and Svensson (1987) show how the government's incentive to inflate can be eliminated if its net nominal position towards the private sector is zero. Calvo and Guidotti (1990) portray the choice between indexed and nominal debt as a choice between credibility and flexibility. Giavazzi and Pagano (1990a) and Alesina, Prati and Tabellini (1990) study at the interaction of the maturity structure and the likelihood of financial crises

[31] See Lindgren (1993) and Lindbeck et al. (1993). For a discussion of the Swedish experiences of issuing index bonds during 1995, see M. Persson (1996b).

6.3 CENTRAL BANK REFORM

A third set of proposals concerns measures to diminish the possibilities for pressuring the Riksbank in the direction of an accommodating inflationary monetary policy. The theme of this paper—that fiscal incentives in the presence of large public deficits may trigger inflationary pressure—has its theoretical underpinnings in the literature starting with Calvo (1978), even though that literature tends to stress a less comprehensive set of mechanisms, focusing on seignorage and the real value of outstanding debt. Strengthening the independence of the central bank has also been a common method to reach monetary stability in countries plagued by high inflation or hyperinflation: in Europe in the inter-war period and in Latin America in the last decade.

Concrete proposals about the ingredients in a credibility-enhancing Swedish central bank reform have been given in the White Paper for the Central Bank Commission, in Hörngren (1994) and in Svensson (1995b). Much of the popular discussion in Sweden has focused on the credibility problems that arise form the short-run temptation to boost the economy with an ambitious employment goal, taking its theoretical underpinnings in the academic literature emanating from Kydland and Prescott (1977) and Barro and Gordon (1983). Concern for the public finance questions to some extent underlines other aspects of central banking reform than those emphasized in the Swedish debate. For instance, the public finance perspective suggests that it would be of particular importance to close all doors for direct and indirect financing of government deficits by borrowing in the Riksbank.

7 CONCLUSION

We have studied the consequences of higher inflation from the Swedish perspective in 1994. The budgetary gains appeared considerable, even though they did not primarily emanate from those channels that are traditionally emphasized in the literature, i.e., from increased seignorage and from erosion of government debt. As we have shown, the largest budgetary gains instead

emanate from nominalistic features in the tax-transfer system. We have argued that a *social* cost-benefit calculus clearly shows higher inflation to be a more costly way to stabilize the Swedish public debt than the alternative of discretionary tax increases or spending cuts. Still, a *political* cost-benefit calculus may make the inflationary route look more attractive. We have also shown that the cost of lacking credibility is considerable: this makes the inflationary route seem even more tempting. Finally, we have pointed out a number of measures and reforms that bring political costs closer in line with political costs.

What has happened in the almost two years since the starting point for our calculations? The development so far is not inconsistent with the low-inflation scenario. The Swedish inflation rate is now a bit less than 2% and medium-term nominal interest rates are about 2 percentage points lower than in mid-1994. The real budget deficit, as we have defined it, has been shrinking drastically and is approaching zero, as a result of a better economy as well as of considerable discretionary measures. A number of the measures and reforms that we put forward in Section 6 have now been decided upon: the National Debt Office is issuing increasing amounts of indexed debt, some of the reforms of the budget process have been pursued, and a central bank reform is again being considered. The risk of a return to high inflation is not eliminated, but the outlook for low inflation appears much brighter than a few years ago.

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