FISCAL SUSTAINABILITY AND STRUCTURAL REFORMS – INCORPORATING LABOUR SUPPLY RESPONSES IN LONG-TERM MODELLING

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*In general the issue of long-term sustainability of public finances is assessed given current policy and behaviour. Future demographic pressure on public expenditure must then be met by either pre-funding, reductions in public welfare systems or tax increases. In this paper we explore a fourth strategy. By incorporating endogenous labour supply responses into the modelling framework, structural reforms (*i.e. *tax cuts) may be simulated in a more realistic way than in a purely static framework. In this way demographic pressure can be dealt with through structural reforms as well as through consolidation strategies. Our simulations suggest that, at least in the Swedish case, strategic tax cuts might serve as an important path to improved fiscal sustainability. This leads us to the conclusion that policies aimed at providing incentives should also be taken into consideration when analysing the long-term sustainability of public finances.*

1 Introduction

In Sweden the proportion of older people in the population will rise appreciably in the next few decades. The growing number of people of non-working age compared to those of working age will put pressure on general government finances. The majority of developed countries have the same problem and the situation in Sweden is not more problematic than in other countries. In fact, our demographic situation is relatively favourable.[1] Nonetheless this trend is already placing demands on economic policy. In order to retain well-developed, tax-funded welfare in the future, high net lending is required in the general government sector in the next few years while demographic pressure is still low. The Government has, as a pre-funding strategy, implemented a surplus target in the general government budget of 1 per cent of GDP on average over the business cycle.

The basic idea is that high net lending today will bring about a more even distribution of the financial burden of care provision among different generations. A surplus in public finances today means that the large generations, who will need medical and health care in the future, contribute themselves to the financing of these services. Unless this occurs, either there will be a larger burden on future generations than on currently active generations or the quality and volume of medical and health care will have to be reduced.

One way of easing the financial pressure from an ageing population would be to initiate measures that enhance labour supply. Stimulating a given small population of active ages to supply a larger amount of hours worked may facilitate the demographic transition. Different types of structural reforms may impact on labour supply and fiscal sustainability in various ways, but the scope of this paper is limited to the labour supply effects of tax changes.

In this paper we present two scenarios illustrating how the demographic trend in Sweden may impact public finances. The estimates are based on alternative assumptions about the future

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[*] Swedish Ministry of Finance.

[1] European Commission (2006), United Nations (2004).

development of the labour supply. The purpose is to get some quantitative measure of how important labour enhancing measures might be compared to consolidating strategies. The idea is not to justify a loose fiscal policy in the short term by referring to future improvements in the labour market. It is rather the importance of incorporating labour supply dynamics into long-term projections that we want to emphasise. In particular, these effects should be considered when sustainability gaps are discussed. It might be unrealistic to claim that such gaps can be closed simply by raising taxes in accordance with the size of the gap. If labour supply is the least elastic, such a strategy will not be sufficient.

Our results indicate that a permanently higher labour supply appreciably benefits both future welfare and public finances. Our two scenarios, both having the same short-term fiscal implications, result in quite different pictures of long-term sustainability.

The remainder of this paper is organised as follows. Section 2 describes the factors that have been taken into consideration when choosing a method, as well as the study design. Our *reference scenario* is described in detail in Section 3, and in Section 4 it is compared to the *employment scenario.* Section 5 contains our conclusions.

2 Method, model and assumptions

In order to analyse long-term fiscal sustainability, a method of projecting public finances as well as a sustainability criterion is required. Our method of projecting public finances is related to the practice used in generational accounting.[2] The purpose of generational accounting is to determine whether general government finances, as currently designed, are financially sustainable over the long term or whether indebtedness is being passed on to future generations. The criterion for determining whether a financial burden is put on future generations, *i.e.* if the public finances are not sustainable, is whether or not the general government intertemporal budget constraint is upheld.

The advantage with our method compared to the common practice in generational accounting is that we utilise an accounting model covering the entire economy, not just the public sector. Furthermore, public expenditure and revenue are modelled in a disaggregated manner that allows non-demographic factors to affect the estimates and allows for different items to take diverse paths. On the bases of these long-term projections, we calculate the sustainability indicator derived from the intertemporal budget constraint for the public sector.

2.1 The FIMO model

Medium- and long-term forecasts and scenarios for public finances are produced in an accounting model named FIMO.[3] The model is built using a National Accounts structure and operates on annual data. It is a disaggregated sector model with a description of the public sector

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[2] See for example Auerbach, Gokhale and Kotlikoff (1992). Many countries have published generational accounts (see Auerbach, Kotlikoff and Leibfritz 1999). Generational accounts for Sweden have been published by Olsson (1995) and Lundvik (1996).

[3] The model was originally developed at the National Institute of Economic Research. The NIER still uses the model and provides the Ministry of Finance with model updates. Although the FIMO model is almost thirty years old now, the number of users is growing and today SALAR (Swedish Association of Local Authorities and Regions) and the Swedish Parliament are also using FIMO for various purposes. For a detailed description see the Ministry of Finance (1992).

(with the sub-sectors central government, local government and old-age pension system), households, the business sector and *vis-à-vis* abroad.

The model is closed in the sense that expenditure in one sector is always matched by income in another sector. Every variable with a counterpart sector in the National Accounts is treated in the same way in each sub-sector. The model system guarantees that net lending in each of the public sub-sectors adds up to net lending in the consolidated general government sector.

The equations in FIMO are based on aggregate descriptions of rules for taxes and transfers. For each revenue and expenditure variable, a relationship is specified between the nominal value of the variable and a macroeconomic base (for example, CPI, wage sum, unemployment, interest rate, etc.). The primary variables consist of close to 600 equations. Most of the equations are formulated as:

$$V_t = Z_V \times B_t$$

where:

V_t = the projected variable in current prices at year t

Z_V = calibration parameter for variable V

B_t = macroeconomic base (at year t) to which the projected variable has been calibrated.

When the model database is updated from the outcomes of the National Accounts or a forecast, all the model equations are solved "backwards" to calculate the Z-parameters as a function of V and B at time T:

$$Z_V = V_T / B_T$$

This operation is done for all primary variables. The use of the calibration parameter Z is crucial in many respects. The calibration parameter can reflect a spectrum of factors, such as replacement rules, tax parameters, etc. In other cases it can be said to represent changes in behaviour. This may be a heavy burden for one parameter. Still, the technique works well in a simulation model. The choice of an appropriate macroeconomic base for each primary variable is important if simulations of different scenarios are to be reliable and constitute a useful instrument for policy making.

In long-term calculations, the parameters Z must be calibrated to an equilibrium level in order to avoid infinite replications of cyclical imbalances. This can be done in several ways. We start at the end of a medium-term projection, as they always end in equilibrium.

A simple GDP module is added to the main model. The sub-model is primarily a tool to simplify FIMO simulations. All macroeconomic variables are usually exogenous. However, by adding simple aggregated equations for exports, imports and household consumption, the sub-model can also be used to illustrate partial feedback effects from public finances. The GDP module is also used for sensitivity calculations.

When used for long-term projections, the model focuses on the effects of demographic development on economic growth and on public sector expenditure. GDP is generated from labour market assumptions, together with an exogenous assumption of productivity development. Public transfers are related to relevant age groups. Public consumption is generated from the demographic development and unit costs for age groups within different areas of activity (schooling, health and elderly care, etc.).

The development of exogenous variables sometimes takes place in pre-models. There are four pre-models to FIMO. In one demographic model, it is possible to create alternative demographic scenarios. There is one labour market model containing labour supply, employment, unemployment and hours worked on the bases of age, sex and ethnicity.

A third pre-model represents public consumption where those parts of public consumption that can be attributed to specific age groups are projected demographically. Actual utilisation of various publicly financed goods and services is observed in micro-data.[4] Consumption is averaged by age and gender groups and put into the model. In the model it is then possible to implement alternative assumptions regarding future consumption. Residual consumption that cannot be associated with specific individuals or groups (infrastructure, defence, justice system, etc.) is assumed to grow in line with aggregate population growth.

Expenditure for old-age pensions is modelled in the dynamic microsimulation model SESIM.[5] The micro model is calibrated to follow the same macroeconomic assumptions as in the public finance simulations and current rules are used to calculate future pension expenditure. The main reason for using a micro model for this purpose is that current changes in the labour market will affect future pensions in a non-trivial way. The only way to fully capture the dynamics of pension systems is through a dynamic micro-level approach.

2.2 Indicator for long-term sustainability of public finances

It is not obvious how to define fiscal sustainability.[6] The assumption that we make in this paper is that public finances are sustainable in the long run if the intertemporal budget constraint is fulfilled for the public sector. The intertemporal budget constraint states that the sum of the present value of all future primary balances should be equal to or greater than the initial net debt. An indicator can be derived from the intertemporal budget constraint that states the permanent budget strengthening that is required to fulfil the restriction.[7] This sustainability indicator is given by the following equation:[8]

$$S = \left[rD_{t_0} - PB_{t_0}\right] + \left[-r\sum_{t=t_0+1}^{t_b-1}\Delta PB_t/(1+r)^{t-t_0}\right] + \left[-\Delta PB_{t_b}/(1+r)^{t_b-t_0}\right]$$

$$S = \quad D \quad + \quad E1 \quad + \quad E2$$

where:

S = permanent budget strengthening relative to GDP

t = index for the year

t_0 = starting year

t_b = last year of the public finances projection

D_t = net debt relative to GDP

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4 The income distribution survey 1999, HEK.

5 See Flood *et al.* (2005) for a description of the pension model.

6 Blanchard *et al.* (1990) provide an exemplary discussion of the concept of fiscal sustainability.

7 This indictor is used by the EU Commission when assessing the long-term sustainability of public finances within the Stability and Growth Pact, see European Commission (2006).

8 See the Appendix for the derivation of the sustainability indicator from the intertemporal budget constraint.

PB_t = primary balance relative to GDP

ΔPB_t = change in primary balance compared to the starting year, $\Delta PB_t = PB_t - PB_{to}$

r = discounting factor, that is, the difference between the nominal interest rate and the nominal GDP growth.

The sustainability indicator can be divided into three components. Each component states the budgetary burden for the period. The first component D concerns the initial budgetary position. It is the primary balance the starting year minus the discounting factor multiplied by the debt. The second component $E1$ concerns the period with projections for public finances. $E1$ is the sum of the present value of primary balances for the period. The third component $E2$ concerns the last year of the projection to infinity. It is the present value of the primary balance the last year of the projection period minus the primary balance in the starting year. This represents the budgetary burden in infinity.

The interpretation of the indicator is that a negative value means that public finances are sustainable and that the intertemporal budget constraint is fulfilled. A positive value means the contrary: a permanent strengthening of the budget is needed, corresponding to the value of the indicator, to secure the long-term sustainability.

2.3 Macroeconomic assumptions

Employment growth after 2010 is based on the forecasted population trend. Our assumption is that men and women born in Sweden and abroad in different age groups work to the same extent as they do today. This means that we have no trend. Average working hours, the proportion of people employed and the proportion of unemployed thus remain constant in groups defined by gender, age and ethnicity. This is one of our basic assumptions of unchanged behaviour.

In the short term, the change in the age structure of the population plays a major role. The number of people aged 20 to 29, with a relatively low labour supply, will account for the entire population growth in the 20–64 age group in the next few years, while the number of people of other ages will fall. In a somewhat longer perspective, changes related to origin in the composition of the population are more important. The proportion of immigrants and particularly those born outside the EU in the 20–64 age group will grow rapidly.

Up to and including 2014, it is also assumed that some adjustment resulting from the measures to stimulate labour supply implemented during the present government's term of office and proposed in the Government Budget Bill for 2007 and 2008 will continue.[9] The major part of this is due to increased labour force participation while a smaller part is due to reduced unemployment. The increased employment is assumed to be partly offset by a small reduction in average working hours. All effects considered, hours worked are assumed to increase by 0.7 per cent between 2012 and 2014.

Productivity in the business sector rises by an average of 2.3 per cent a year until 2015. This is in line with the relatively rapid productivity growth of the past few years, but it is considerably higher than the rate of growth in the 1970s and 1980s. After 2015, productivity growth in the business sector is assumed to fall gradually to an average of 2.2 per cent a year. Productivity

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[9] These reforms are described in detail in Ministry of Finance (2006 and 2007).

Table 1

Macroeconomic Assumptions

	2007	2015	2020	2030	2040	2050	2070	2099
Percentage change[1]								
Population aged 16–64	0.7	–0.2	0.0	0.1	0.1	0.2	0.2	0.1
Employed	2.4	0.0	0.0	0.0	0.1	0.3	0.2	0.1
Number of hours worked	3.0	0.1	0.0	–0.1	0.1	0.3	0.2	0.2
Productivity in the business sector	–0.3	2.4	2.3	2.2	2.2	2.2	2.2	2.2
GDP, fixed prices	2.6	2.4	2.0	1.7	2.0	2.2	2.1	2.2
GDP per capita	2.0	2.0	1.5	1.3	1.8	1.9	1.9	2.0
GDP productivity	–0.1	1.9	1.8	1.7	1.8	1.9	2.0	2.0
GDP deflator	3.2	2.5	2.4	2.4	2.3	2.0	2.0	2.0
CPI	2.2	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Hourly wages	3.6	4.6	4.4	4.3	4.2	4.0	4.0	4.1
Percent								
Real rate of interest	2.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Labour force participation	79.1	81.5	81.2	80.0	79.9	80.1	80.0	80.2
Employment	75.4	78.2	77.9	76.7	76.6	76.9	76.8	77.0
Open unemployment[2]	4.6	4.1	4.0	4.1	4.1	4.1	4.0	4.0

[1] For the period 2020–99, the average percentage change from the previously presented year is stated in the table.
[2] National definition.
Sources: Statistics Sweden and the Ministry of Finance.

growth in the general government sector is assumed to be zero.[10] Combined with employment shifts between the private and the general government sectors, this leads to a productivity increase in the whole economy, which varies around 1.9 per cent a year during the period 2016-99.

The increases in productivity and in the labour force result in an average GDP growth of 2.1 per cent a year during the period 2008-99. GDP per capita grows on average by 1.8 per cent a year.

Wage growth in the private sector is guided by productivity growth. This means that corporate profit levels are assumed to remain unchanged. Wages in the general government sector are assumed to follow wages in the business sector. Since productivity growth in the general government sector is assumed to be zero, productivity in the total economy grows more slowly than wages.

The most important macroeconomic assumptions are summarised in Table 1.

[10] This used to be the customary practice in the National Accounts. From 2008 onwards, the National Accounts have been revised and public sector productivity is no longer zero by definition. In practice it is, however, difficult to measure this productivity in any meaningful way.

2.4 Public finances

Long-term projections for public finances start after the medium-term forecasts for public finances as stated in the Budget Bills. From the last year of the medium-term forecast onwards, policies and behaviour are assumed to be unchanged, unless otherwise stated. By unchanged policies, we mean an unchanged level of ambition within different policy areas, as explained below. We construct unchanged behaviour by letting the population work, study, become sick, demand public consumption, etc. to the same extent as it did in the last year of the medium-term forecast. However, the full impact of demographic changes is incorporated. The unchanged behaviour is kept constant within each group, based on age and sex. When groups' relative size changes over time, it affects aggregate behaviour.

2.5 General government revenue

Stating taxes and charges as a constant percentage of GDP is a simple method for making projections of general government revenues. The European Commission uses this method in its long-term projections of Member States' public finances.[11] Instead of keeping the aggregate tax level as a constant share of GDP, we assume that all tax rates are kept constant relative to the respective tax base. This method is used to reflect unchanged tax regulations. The total tax ratio will vary if tax bases develop in a different way than GDP does. Such variations occur in our two scenarios, as can be seen in Figure 7.

A small proportion of the costs of providing welfare services is financed through user fees. These fees are assumed to rise in pace with production costs. Consequently, fee revenues rise at a considerably higher rate than they would if today's maximum charges remained in force, but at a slower rate than household disposable income rises.

2.6 General government expenditure

In the calculations it is generally assumed that current legislation – such as tax and transfer payment regulations – remains consistent for all future years. However, certain departures are made from that assumption. With the exception of some components of the old-age pension system, most transfer payments – such as the ceiling on sick pay and parents' allowance – currently track prices by means of the price base amount. In long-term calculations, which assume rising productivity and wages, the result is that benefits and allowances lose value year after year. Thus, unchanged indexation in accordance with the price base amount or nominal values implicitly assumes a smaller welfare state in the future in real terms. In order to avoid this, we assume a standard guarantee in general government transfer payment systems. For a large portion of transfer payments, there are rules and regulations that automatically increase benefits in line with the wage trend. Transfer payments lacking this type of automatic standard guarantee, e.g. the child benefit and the study allowance, are assumed to increase in line with the nominal wage trend. Such a standard guarantee offsets the erosion that would take place in the longer term if the estimate were based strictly on unchanged regulations. This implies that we assume that certain reforms are implemented in pace with economic growth.

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[11] European Commission (2006).

2.7 Health care and elderly care

We assume that general government services output is carried out with the same staff density that exists today. This assumption can be seen as an unchanged level of ambition in public services. There is some evidence of a tendency for care needs to move up to older age categories as life expectancies increase (Batljan & Lagergren, 2005). This suggests that a purely demographic projection might exaggerate future expenditure. On the other hand there is also evidence that health care expenditure has historically grown more rapidly than demographic needs would suggest. CBO (2007) states: *"The rate at which health care costs grow relative to national income – rather than the ageing of the population – will be the most important determinant of future federal spending"*. The tendency for the relative price of services to increase as real wages grow (Baumol, 1967 and Baumol *et al.*, 1985) is also a potential driver of future government spending, as a large share of public consumption consists of labour intensive services. In this paper we disregard most of these issues and all projections on health care consumption are, in volume terms, driven by demographic factors. We do, however, allow for Baumol effects on the cost of services provided by the public sector.

3 Reference scenario for public finances

In this section, a reference scenario for the development of public finances is presented, given the demographic forecast,[12] the macroeconomic assumptions and the methodology stated in this paper. The starting point for the long-term scenario is 2012. Hence, the last year of the medium-term forecast is 2011. That year public finances are expected to show a surplus that is higher than the Swedish surplus target of 1 per cent of GDP. For that reason the surplus is gradually adjusted after 2011 so that the target is met in 2015.[13] This is technically done in the model by increased transfer payments to the household sector. This is assumed not to affect the performance of the economy in other respects. Tax rates are kept constant at 2011 levels through the entire simulation period.

The development of public finances is mainly driven by changes in demography. Sweden's population is expected to grow in the coming century, mainly because of an increase in the number of elderly. The demographic trend can be summarised in dependency ratios, which are the number of persons of non-working age relative to the number of persons of working age. The dependency ratio for older persons, aged 65 and older, compared to the number of persons aged 20 to 64, is estimated to increase rapidly over the next 30 years. Thereafter the increase slows down. For the last year of the projection, the ratio is almost 49 per cent, compared with 30 per cent in 2008. The dependency ratio for young people, measured as the number of persons under the age of 20 relative to the number of persons aged 20 to 64, is more stable and fluctuates around 41 per cent (see Figure 1).

With an ageing population the expenditures for pensions, health and elderly care can be expected to increase. According to the scenario, these age-related expenditures are projected to peak in the mid-2030s at 2.5 percentage points of GDP higher than in 2008. Thereafter they decrease a bit (see Figure 2). The level in 2099 is however almost 2 percentage points higher than

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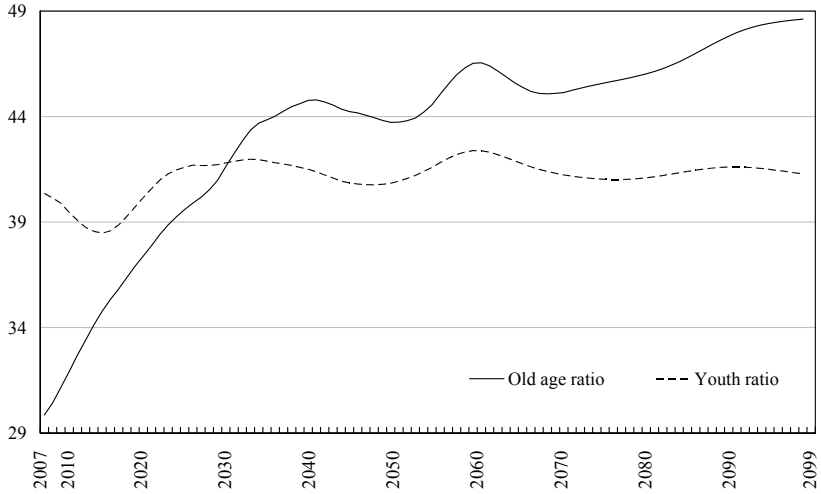
[12] Statistics Sweden's population forecast of May 2007.

[13] In Ministry of Finance (2007) the Government has stated that it intends to maintain this fiscal policy target during the current term of office and as long as it is necessary to ensure the long-term sustainable development of public finances.

in 2008.[14] It is the increase in elderly care that drives the increase in age-related expenditure. Health care spending is relatively constant, while pension expenditure falls after the beginning of the 2030s. The reformed Swedish pension system,[15] which is being phased in, is a notional defined contribution system. When pensions are defined by contributions and life expectancy increases, together with an assumption of an unchanged retirement age, pension expenditure will decrease as a share of GDP.

Figure 1

Demographic Dependency Ratios
(percent)



The development of primary expenditure in the long-term roughly follows the development of age-related expenditure (see Figure 3). According to the 2008 Budget Bill, primary expenditure as well as primary income is expected to decrease as a share of GDP until 2010.

Adding interest expenditure and capital income to primary revenue and expenditure gives total revenue and expenditure for the

Figure 2

Public Sector Expenditures for Pensions, Health and Elderly Care
(percent of GDP)

[14] Age-related expenditures, especially for elderly care, are affected by more factors than just the age structure of the population. Income development, the health status of elderly people, technological development, etc. exert considerable influence on demand and consumption. The expenditure path presented should therefore not be seen as a forecast but as an illustration of the purely demographic pressure.

[15] For a presentation of the Swedish old-age pension system, see the European Commission (2007).

public sector. Their path follows the same pattern as primary revenue and expenditure until the beginning of the 2040s. Thereafter the effect of expenditure exceeding revenue since 2015 becomes evident, in the form of the higher interest expenditure resulting from the increasing debt. Consequently expenditure remains higher than revenue for the rest of the calculation period even though primary expenditure decreases to the same level as primary revenue in the last years in the scenario.

Public sector revenue and expenditure lead us to net lending, which is expected to be positive until the mid-2020s. Thereafter deficits are projected for the rest of the period (see Figure 5). The development of public sector primary net lending is similar to the development of net lending until the beginning of the 2030s. Thereafter primary net lending improves and is zero at the end of the calculation period.

The growing deficits in public sector net lending lead to a growing gross debt (the Maastricht definition) from its lowest level of 7 per cent of GDP in year

Figure 3

Public Sector Primary Income and Expenditure
(percent of GDP)

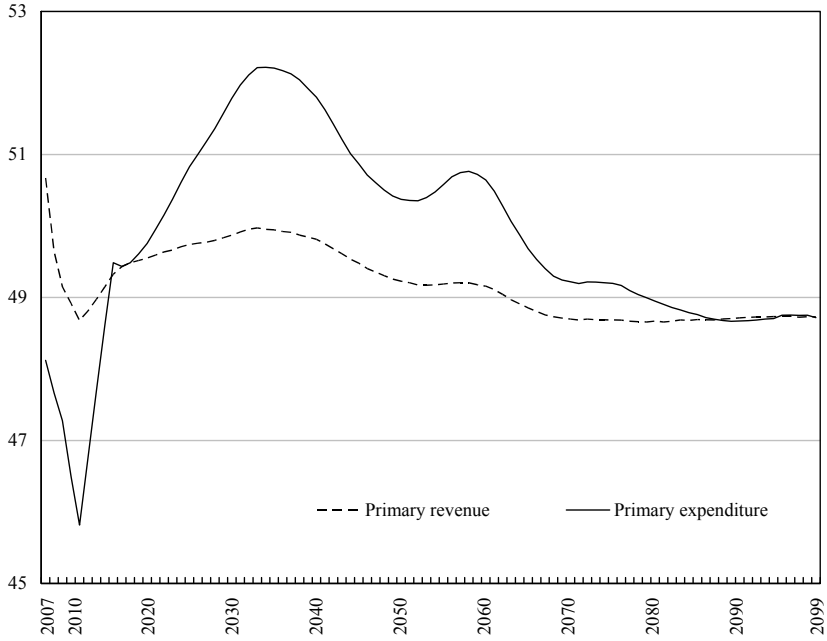
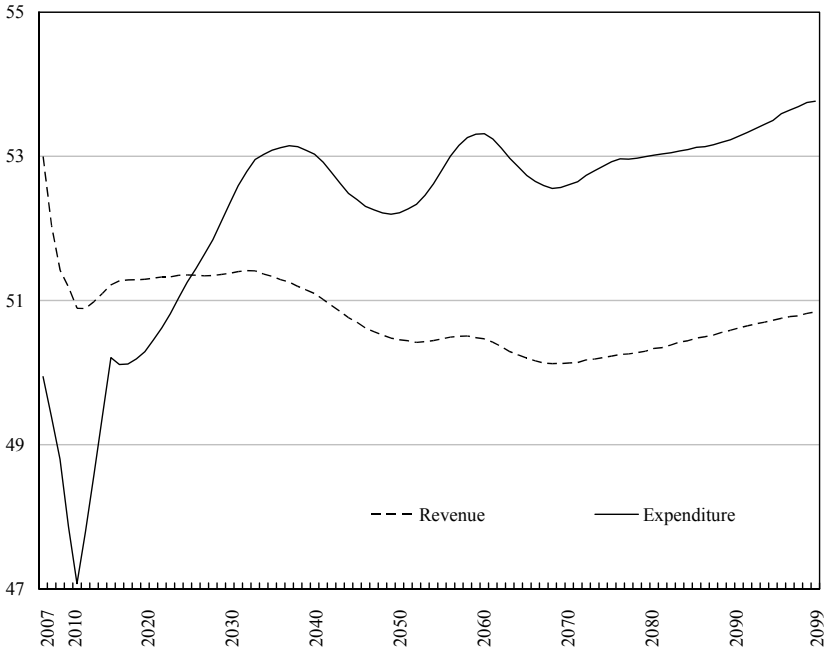


Figure 4

Public Sector Revenue and Expenditure
(percent of GDP)



2023 to over 100 per cent of GDP by the end of the projection period (see Figure 6). This violates the Maastricht requirement that debt is not to exceed 60 per cent of GDP. But this, in a strict sense, does not necessarily have to imply that public finances are not sustainable in the long run.

Public assets gradually decrease until the beginning of the 2060s. Thereafter there is a small increase in assets. The development of public sector net debt will therefore turn from being negative (that is, from a net asset) to a net debt by the beginning of 2040s. The net debt in the last year of the projection period is projected to be almost 50 per cent of GDP. Public sector assets are mainly assets in the old-age pension system. This system is autonomous, which means that its assets cannot be used to reduce central government debt.

3.1 Sustainability calculations

To determine whether or not public finances are sustainable in the long run, the sustainability indicator is calculated, as shown in Section 2. The debt

Figure 5

Public Sector Net Lending
(percent of GDP)

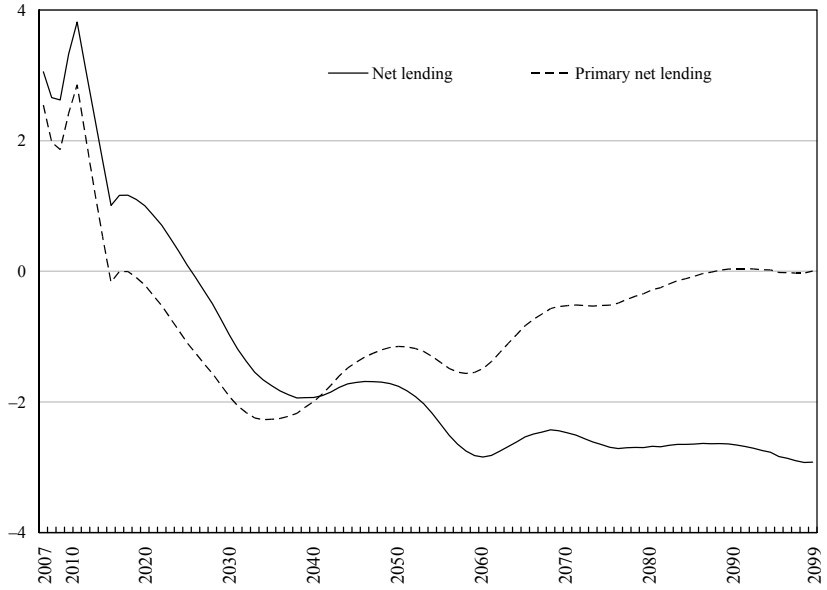
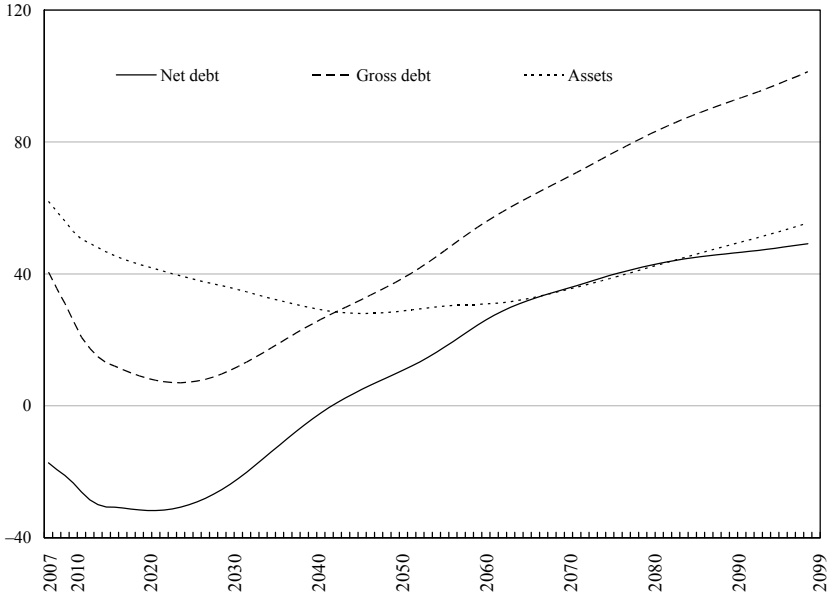


Figure 6

Public Sector Debt and Assets
(percent of GDP)



Note: Gross debt is in accordance with the Maastricht definition. Net debt and assets are as stated in the Swedish National Accounts.

Table 2

Sustainability Indicator and Its Components
(percent of GDP)

	D	E1	E2	S
Reference scenario	–2.8	1.6	1.3	0.1

definition used will be the net debt according to the Swedish National Accounts. The primary balance used will be public sector net lending according to the Swedish National Accounts, adjusted for capital revenues affecting the net debt but not the primary net lending.

The sustainability indicator S for the reference scenario is 0.1 per cent of GDP. This implies that public finances are slightly unsustainable in the long run. The initial surplus in net lending is very strong, which can be seen in component D, which is –2.8 per cent of GDP (see Table 2). Budgetary pressures under the period for the scenario 2008-98 imply a strain on the sustainability indicator corresponding to 1.6 per cent of GDP (component *E*1). The budgetary pressures from 2099 to infinity imply further pressures corresponding to 1.3 per cent of GDP (component *E*2).

4 Scenario for public finances with structural reforms

In this section an alternative scenario for the public finances, the *employment scenario*, is presented and compared to the reference scenario. General government net lending is assumed to decline on a straight-line basis between 2011 and 2015 from 3.8 per cent of GDP to 1 per cent of GDP in both scenarios. In the reference scenario, presented in Section 3, the balance deteriorates through increased household transfers, which are assumed not to affect the performance of the economy in other respects. In the employment scenario, the budget balance is reduced through tax cuts designed to stimulate the labour supply.

4.1 Incorporating labour supply responses

Labour supply in the reference scenario is projected by demographic factors. Employment, average working hours, etc. are held constant within cells defined by age, gender and ethnicity. Hours worked are thus unambiguously determined by population growth and composition. Combined with an exogenous productivity growth, future production is derived.

In the employment scenario, endogenous adaption of labour supply as well as productivity is applied. The tax cut conveyed in the scenario is assumed to influence labour supply and employment through an elasticity. A reduction in the income tax wedge corresponding to one percentage point will increase the employment ratio by 0.25 percentage points.[16] The relative impact on employment and hours worked is assumed to be of equal size. The adaption is implemented over a four-year period.

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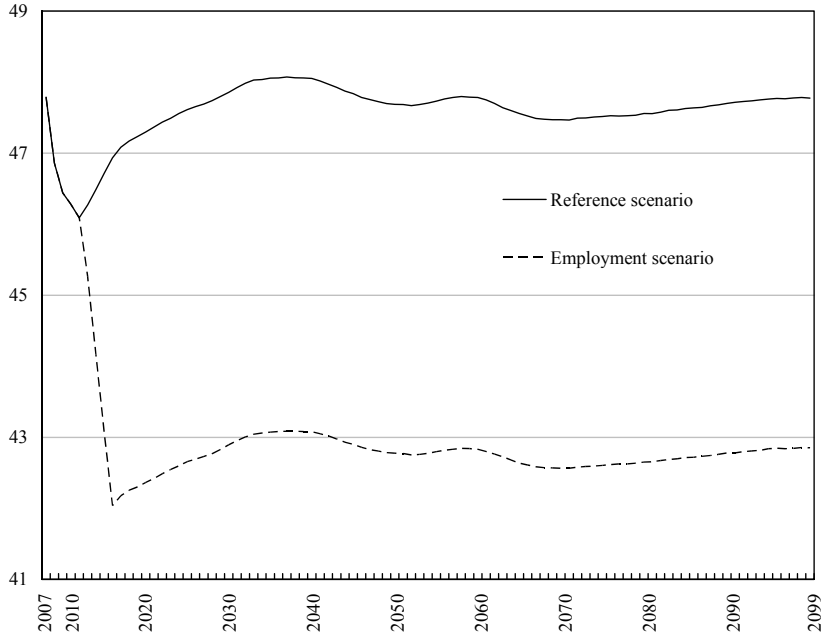
[16] This elasticity is in line with (or below) those reported in, for example, Bassanini & Duval (2006), Nicoletti & Scarpetta (2005), Nickell *et al.* (2003) and Nickel & Layard (1999).

Figure 7

Public Sector Taxes
(percent of GDP)



However, increased labour force participation s assumed to cause a slowdown in productivity growth.[17] This slowdown will wear off in a few years but the level of productivity will be permanently lower. We assume that those who enter the labour market owing to the tax cut have an average productivity equal to 75 per cent of the average productivity in the current labour force.

In the employment scenario, the adjustment to the 1 per cent budget target is made through tax reforms (tax cuts), which permanently increase the labour supply and employment.

The tax ratio remains constant after 2015 whereas in the reference scenario it remains constant after 2011. The method for projecting both expenditure and revenue are the same in both scenarios. Figure 7 above shows how the aggregate tax burden develops in the two scenarios. The explanation for the slight increase in the tax ratio in the reference scenario after 2011 is that the tax base for VAT, that is, private consumption, rises as a share of GDP. Private consumption increases because of the technical assumption that transfer payments to households will increase in order to decrease public sector net lending.

The decreasing tax levels that occur in the employment scenario will have lasting effects on labour supply. The initial reduction in net lending equals 2.8 (3.8-1.0) per cent of GDP. As the labour supply starts to increase when the tax cuts are initiated in 2012, scope for additional tax reductions is created. When the labour supply adjustment that occurs between 2012 and 2015 is taken into consideration, the overall scope for tax reductions amounts to 4.9 per cent of GDP. The reduction in the income tax wedge that this leads to equals 8.2 percentage points. Using an elasticity of 0.25 yields an increase in the employment ratio by 2.05 (8.2 * 0.25) percentage points. The labour supply adjustment is assumed to have full effect in 4 years. As the last year of tax reductions is 2015, the adjustment is complete by 2018. In the reference scenario 4,581,100 persons are employed in 2018 and 5,861,620 individuals are of working age (16 to 64 years). The employment ratio is thus 78.15 per cent. An increase in the ratio by 2.05 percentage points to 80.2 per cent brings about an employment growth of 120,160 (5,861,620 * 2.05) persons. Throughout

[17] The mechanisms are described in McGuckin & van Ark (2005).

the rest of the simulation period, the difference in the employment ratio between the scenarios is kept constant. However, variations in the population of working age will cause the absolute difference in employed persons to vary between 120,000 and 130,000 persons (see Figure 8).

The GDP effect (as well as the employment effect) will occur during a short transition period. The difference is greatest, about 2 per cent, around year 2020. Beyond this adjustment period, GDP growth will be parallel. As GDP continues to grow, the difference will shrink in relative terms and hence the decreasing differences in Figure 9.

In addition to the generally increased welfare that a continuation of the structurally focused policy is likely to lead to, it also provides scope for future reforms in the form of additional tax cuts or initiatives in, for example, the care sector. Primary net lending will be around 0.35 per cent of GDP higher in the employment scenario. The difference in net lending between the two scenarios increases over time, because of decreasing interest expenditures owing to a lower debt level in the employment scenario. In the last year of the projection, net lending is 2.5 percentage points of GDP higher than in the reference scenario. Over the projection period this results in the Maastricht

Figure 8

Employment
(thousands)

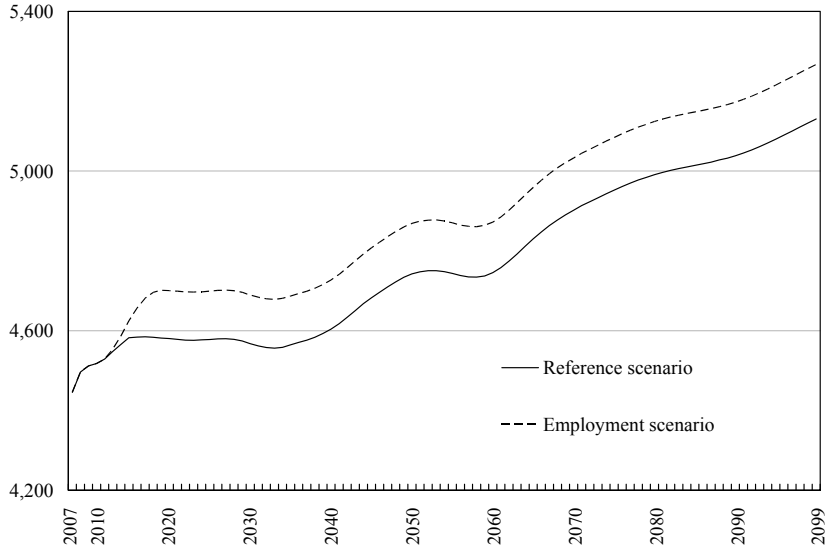


Figure 9

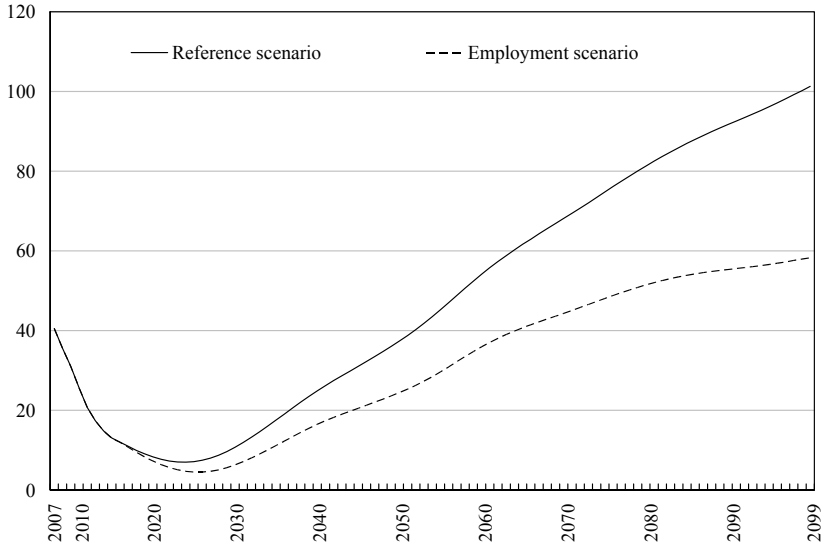
GDP in the Employment Scenario
Relative to the Reference Scenario

debt being 43 percentage points lower in the employment scenario compared to the reference scenario in 2099 (see Figure 10). This of course affects long-term sustainability.

The relative increase in employment is 2.6 per cent but owing to reduced productivity, the impact on GDP will be somewhat smaller (see Figure 9).

Figure 10

Maastricht Debt
(percent of GDP)



4.2 Sustainability calculations

The sustainability indicator *S* for the employment scenario is –0.2 per cent of GDP, which implies that public finances are sustainable in the long run. The initial position is the same as in the reference scenario, with *D* being –2.8 per cent of GDP (see Table 3). Budgetary pressures for the employment scenario under the period 2008-98 are somewhat lower than in the reference scenario at 1.4 per cent of GDP (component *E*1). The budgetary pressures from 2099 to infinity are also slightly less than in the reference scenario, at 1.2 per cent of GDP (component *E*2).

Table 3

Sustainability Indicator and Its Components
(percent of GDP)

	D	E1	E2	S
Structural reforms scenario	–2.8	1.4	1.2	–0.2

5 Conclusion

Swedish public finances are slightly unsustainable in the long run when standard assumptions are used. This result includes some measure of pre-funding through the budget surplus target. What we analyse is a shift in the policy mix in which reduced taxes are financed by reduced household transfers. We model-changed labour supply responses to changes in aggregate household tax rates. This in turn leads to public finances being sustainable in the long run. Our conclusion is that policies aimed at providing incentives should also be taken into consideration when analysing the long-term sustainability of public finances. Conversely, in consolidation strategies including higher taxes, a reduction in labour supply and working hours should probably be expected and thus be incorporated into projections and evaluations.

APPENDIX
DERIVING THE SUSTAINABILITY INDICATOR FROM THE INTERTEMPORAL BUDGET CONSTRAINT

One definition of long-term fiscal sustainability is that the intertemporal budget constraint for the public sector is fulfilled. It states that the sum of the present value of all future primary balances should be equal to or greater than the initial net debt. A sufficient condition to fulfil the constraint is that the sum of the present value of all future primary balances is equal to the initial net debt. See equation 1.

$$\sum_{t=t0+1}^{\infty} PB_t / (1+r)^{t-t0} = D_{t0} \tag{1}$$

where:
t = index for the year
t_0 = starting year
D_{t0} = initial net debt in relation to GDP
PB_t = primary balance in relation to GDP
r = discounting factor, that is, the difference between the nominal interest rate (R) and the nominal GDP growth (G), in other words $1+r = (1+R)/(1+G)$

To derive the permanent budget strengthening needed to fulfil the intertemporal budget constraint infinitely, the variable S can be added to the primary balance in equation 1. S then states the permanent budget improvement as a share of GDP that fulfils the constraint:

$$\sum_{t=t0+1}^{\infty} (PBt + S)/(1+r)\ t - t0 = Dt0 \tag{2}$$

If the discounting factor r is strictly positive, equation 3 is valid:

$$\sum_{t=t0+1}^{\infty} 1/(1+r)^{t-t0} = 1/r \tag{3}$$

The primary balance can be split into the primary balance in the starting year and the change in relation to the starting year:

$$PB_t = PB_{t0} + \Delta PB_t \tag{4}$$

The initial primary balance and S (which is constant over time) can now be factored out from the summation in equation 2:

$$PB_{t0}/r + S/r + \sum_{t=t0+1}^{\infty} \Delta PB_t /(1+r)^{t-t0} = D_{t0} \tag{5}$$

Multiply both sides of the equation with the discounting factor r:

$$PB_{t0} + S + r\sum_{t=t0+1}^{\infty} \Delta PB_t/(1+r)^{t-t0} = r\,D_{t0} \tag{6}$$

Finally, S can be derived:

$$S = r\,D_{t0} - PB_{t0} - r\sum_{t=t0+1}^{\infty} \Delta PB_t/(1+r)^{t-t0} \tag{7}$$

S in equation 7 is an indicator of the size of the permanent tax increase or expenditure reduction needed for the sum of the present value of all future primary balances to be equal to the initial net debt. This indicator is the EU Commission's main indicator when assessing Member States' long-term fiscal sustainability.[18]

The sustainability indicator S can be divided into three parts. The first component D concerns the initial budgetary position. The second component $E1$ concerns the period with underlying projections for public finances. The third component $E2$ concerns the last year of the underlying projection to infinity.

The first component D is:

$$D = r\,D_{t0} - PB_{t0} \tag{8}$$

The second component $E1$ is:

$$E1 = -r\sum_{t=t0+1}^{tb-1} \Delta PB_t/(1+r)^{t-t0} \tag{9}$$

where:
t_b = the last year of the projection.

The third component $E2$ is:

$$E2 = -r\sum_{t=tb}^{\infty} \Delta PB_{tb}/(1+r)^{t-t0} \tag{10}$$

Change in the primary balance is assumed to be constant from the last year of the projection to infinity, which implies that we can put it outside of the summation. In the next step the condition in equation 3 is used. $E2$ can then be written as below. This implies that $E2$ is the present value of the primary balance in the last year of the projection minus the primary balance for the starting year.

$$E2 = -r * \Delta PB_{tb}/(1+r)^{tb-t0} * \sum_{t=tb}^{\infty} 1/(1+r)^{t-t0} = -r * \Delta PB_{tb}/(1+r)^{tb-t0} * 1/r = -\Delta PB_{tb}/(1+r)^{tb-t0} \tag{11}$$

S can now be expressed in a way that allows sustainability calculations on projections that are finite in time, according to equation 12:

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[18] See p. 177, equation 2 in *Long-term Sustainability of Public Finances in the European Union,* European Economy, No. 4/2006.

$$S = [r\,D_{t0} - PB_{t0}] + [-r \sum_{t=t0+1}^{tb-1} \Delta PB_t/(1+r)^{t-t0}] + [-\Delta PB_{tb}/(1+r)^{tb-t0}] \quad (12)$$

$$S = \quad D \quad + \quad E1 \quad + \quad E2 \quad (12')$$

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