Automatic Fiscal Stabilizers in Sweden 1998-2009*

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SSE/EFI Working Paper Series in Economics and Finance
No. 719
April 24, 2009

Abstract

In this note, I examine how the responsiveness of the Swedish public budget to business-cycle conditions has developed between 1998 and 2009. I document substantial changes in three components behind the budget elasticity: (i) the average level of personal income taxes has fallen substantially, (ii) the progressivity of personal income taxation has increased, and (iii) spending on unemployment compensation has fallen. The first two changes have opposing effects on the budget elasticity, and I find that the higher progressivity has had a marginally larger impact on the elasticity than the tax cuts. Also allowing for the lower unemployment compensations, the three effects add up to a small and non-substantial fall in the budget elasticity. Considering that most of the components behind the budget elasticity are imprecisely estimated, there is no clear evidence that the Swedish budget elasticity has changed during the last decade.

JEL classification: E62; H30; H60
Keywords: Automatic stabilizers; budget elasticity; fiscal policy; stabilization policy

*I thank Lars Calmfors for valuable comments and suggestions.
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1 Introduction

Many components of the public budget respond automatically to changes in the business cycle. When business-cycle conditions improve, the income of firms and households tends to rise and unemployment tends to fall. As a result, tax revenue increases and spending on unemployment compensation falls. These automatic fiscal responses are mostly countercyclical, i.e. they induce contractionary fiscal responses in booms and expansionary responses in recessions, and therefore help stabilizing the business cycle.

Based on the Swedish tax code for 2003, Girouard and André estimated that automatic fiscal stabilizers in Sweden were around 0.55. That is, a one percent increase in output over the business cycle would result in an automatic improvement in the budget balance relative to output by 0.55 percent of GDP.[1] After 2003, however, Swedish taxes have fallen rather substantially. For example, the average tax rate has fallen by almost six percentage points for a typical worker between 2003 and 2009. The unemployment insurance system has also been reformed. Benefit levels have been reduced and the criteria for qualifying for insurance have been tightened. In general, we would expect that such changes would imply smaller automatic stabilizers.[2] This suspicion was for example articulated by the OECD (2008, p. 42): "recent income tax cuts and reductions in unemployment benefits may have weakened the automatic stabilisers, but this has not yet been quantified".

In this study, I follow the OECD method outlined in Girouard and André (2005) to estimate how the Swedish budget elasticity (automatic stabilizers) has developed between 1998 and 2009. I document substantial changes in three components behind the budget elasticity: (i) the average level of personal income taxes has fallen, (ii) the progressivity of personal income taxation has increased, and (iii) spending on unemployment compensation has fallen. The first two changes have opposing effects on the budget elasticity, and I find that the higher progressivity has had a marginally larger impact on the elasticity than the tax cuts.[3] When also accounting for the lower unemployment compensations, these changes add up to a small estimated fall in the budget elasticity. But considering that most of the components behind the budget elasticity are imprecisely estimated, there is no clear evidence that the Swedish budget elasticity has changed during the last decade.

Girouard and André (2005) treat expenditure on unemployment compensation as the only component of public expenditure that is part of the automatic fiscal response to business-cycle fluctuations. In my baseline estimate, I adopt the same assumption and estimate a the budget elasticity to 0.53 for year 2009, relative to their estimate 0.55 for year 2003. Previous OECD estimates by van den Noord (2000) also included spending on active labor

[1] Braconier and Holden (1999) estimated Swedish budget elasticities in the range 0.6 to 0.8 for the period 1980 to 1997. Boije (2004) summarizes other studies of the Swedish budget elasticity.

[2] We typically expect automatic fiscal responses to be larger if the public sector is large. This presumption is clearly supported by empirical estimates. For example, Griouard and André (2005) estimate budget elasticities of 0.34 and 0.33 for the United States and Japan, which have small public sectors, and 0.59 and 0.53 for Denmark and Norway, which have large public sectors.

[3] Buti et al. (2002) analyze the theoretical relationship between automatic stabilizers, the efficiency of tax systems, and the generosity of welfare systems. They argue that although a reform that reduces the progressivity of the tax system may reduce the measured budget elasticity, the reform may make the remaining automatic stabilizers more *effective*. The efficiency of the fiscal responses is not considered in the present study.

market programs in the automatic fiscal response. Van den Noord estimated the Swedish budget elasticity to 0.79 for year 1999. Using a similar method, I estimate that this broader elasticity has fallen from 0.72 to 0.63 in the last decade.

2 The Method

Let B denote the public budget balance, Y output, T_i tax revenue from source i, G primary public expenditure, and X net other revenues (non-tax revenue minus interest on public debt minus net capital outlays). The budget balance (or fiscal balance) relative to output, b, is then

$$b = \frac{B}{Y} = \frac{\sum_i T_i - G + X}{Y} \tag{1}$$

The fiscal balance can be decomposed into two components,

$$b = b^* + \widetilde{b} \tag{2}$$

where $\widetilde{b}$ denotes the impact of automatic stabilizers and b^* denotes the structural budget balance. We can state the decomposition (2) more explicitly as

$$b = b^* + \alpha \left(\frac{Y - Y^*}{Y^*} \right) \tag{3}$$

where Y^* is potential output and α denotes the magnitude of *automatic stabilizers*, i.e. the parameter I am interested in estimating. To estimate this parameter, I follow the OECD method presented in Giorno et al. (1995), van den Noord (2000), and Girouard and André (2005).[4]

The structural budget balance is

$$b^* = \frac{B^*}{Y^*} = \frac{\sum_i T_i^* - G^* + X}{Y^*} \tag{4}$$

where the * indicates that the variable is structural, i.e. that the business-cycle component of the variable has been removed. The relation between actual and structural components of government revenue and expenses is

$$T_i = \left(\frac{Y}{Y^*} \right)^{\varepsilon_i} T_i^* \tag{5}$$

and

$$G = \left(\frac{Y}{Y^*} \right)^{\gamma} G^*. \tag{6}$$

[4] The Swedish Ministry of Finance calculates the structural budget balance as $b^* = b - \alpha \left[\left(Y - Y^* \right) / Y^* \right]$, using the OECD's estimate of the budget elasticity α. OECD however calculates the structural budget balance from the disaggregated components behind α (see below). But the disaggregation makes little difference, at least for Swedish data. The correlation between $\alpha \left[\left(Y - Y^* \right) / Y^* \right]$ and $\widetilde{b}$ is 0.97 in OECD Economic Outlook 84. The National Institute of Economic Research calculates a structural balance b^* for Sweden without directly calculating a budget elasticity (see Braconier and Forsfält, 2004).

With this specification, ε_i is the elasticity of the i:th tax component with respect to output and γ is the elasticity of expenditure with respect to output. Using (5) and (6) in (3) we get

$$\widetilde{b} = \frac{\sum_i \left[1 - \left(\frac{Y}{Y^*}\right)^{1-\varepsilon_i}\right] T_i - \left[1 - \left(\frac{Y}{Y^*}\right)^{1-\gamma}\right] G + \left[1 - \left(\frac{Y}{Y^*}\right)\right] X}{Y} \tag{7}$$

Note from (2) and (3) that

$$\alpha = \frac{\partial b}{\partial Y} Y^* \approx \frac{\partial b}{\partial Y} Y, \tag{8}$$

i.e. that the magnitude of automatic stabilizers can be calculated as the semi-elasticity of the budget balance with respect to output.[5] From (7) we see that

$$\frac{\partial \widetilde{b}}{\partial Y} Y = \frac{-\sum_i (1-\varepsilon_i) \left(\frac{Y}{Y^*}\right)^{1-\varepsilon_i} T_i + (1-\gamma) \left(\frac{Y}{Y^*}\right)^{1-\gamma} G - \left(\frac{Y}{Y^*}\right) X}{Y} \tag{9}$$

Evaluated at $Y = Y^*$ and $b = 0$ we get

$$\alpha = \sum_i \varepsilon_i \frac{T_i}{Y} - \gamma \frac{G}{Y}. \tag{10}$$

Let τ, g, y, and y^* denote the logarithms of T, G, Y and Y^*, respectively. We then note that the tax elasticities can be separated into two components,

$$\varepsilon_i \equiv \frac{\partial \tau_i}{\partial (y - y^*)} = \frac{\partial \tau_i}{\partial \beta_i} \frac{\partial \beta_i}{\partial (y - y^*)} \equiv \varepsilon_{\tau_i} \varepsilon_{\beta_i}. \tag{11}$$

where β_i is the tax base for tax source i. Similarly, the expenditure elasticity can be separated as

$$\gamma = \frac{\partial g}{\partial (y - y^*)} = \frac{\partial g}{\partial (u - u^*)} \frac{\partial (u - u^*)}{\partial (y - y^*)} \equiv \gamma_g \gamma_u \tag{12}$$

where u and u^* are the logarithms of the actual and structural unemployment rates, respectively.

Girouard and André (2005) consider four sources of tax revenue: personal income taxes, social security contributions, corporate income taxes, and indirect taxes. They consider unemployment compensation to be the only cyclical component of public expenditure.[6] The following section describes how the elasticities ε and γ are estimated from Swedish data.

[5] This statement, and the formulation in (8), is somewhat sloppy since also the structural budget balance may respond to business-cycle fluctuations through discretionary measures. More precisely, α is the semi-elasticity of the cyclical component $\widetilde{b}$. Fatas and Mihov (2009) show that the structural balance in Sweden indeed is countercyclical.

[6] The previous work by van den Noord (2000) also considered expenditure on activle labor market measures as being cyclical. In the baseline calculations, I follow the former approach.

3 Estimating elasticities

3.1 The elasticity of earnings with respect to the output gap

Let w denote the logarithm of the economy's wage bill. To estimate the elasticity of the wage bill with respect to the output gap (i.e. the elasticity ε_β), I run the regression

$$\Delta\left(w_t - y_t^*\right) = a + \varepsilon_\beta \Delta\left(y_t - y_t^*\right) \tag{13}$$

on annual data from OECD Economic Outlook (No. 83, June 2008). Table 1 presents the results for the estimated elasticity ε_β based on data for different time periods. The first column shows OLS estimates with Newey-West standard errors. In the second column, I have used the Prais-Winsten and Cochrane-Orcutt method to correct the for serially correlated residuals, a method similar to the method used by the OECD. The Durbin-Watson test however indicates that serial correlation in the error terms is minor. The two methods consequently result in similar estimates.

I have also considered specifications with linear time trends in the elasticity, but the trend is not statistically significant. OECD (2005) estimated $\varepsilon_\beta = 0.82$ for the period 1980-2003, but then chose to use $\varepsilon_\beta = 0.71$ for Sweden (based on comparisons to other similar countries, see the appendix to Girouard and André, 2005). My estimates do not indicate that the elasticity has increased in magnitude after OECD's estimations. Possibly a slightly higher value can be chosen for the Swedish elasticity, but this would not be motivated by the elasticity having changed over time, but because the OECD chose a conservative estimate for Sweden. Along that line, I set $\varepsilon_\beta = 0.8$ which is somewhat lower than my estimated values.

Table 1: Estimated elasticity of the wage bill with respect to the output gap

time period	(i)	(ii)
$1970-2007$	0.81	0.73
	(0.19)	(0.21)
$1980-2007$	1.04	0.94
	(0.26)	(0.27)
$1990-2007$	1.01	1.02
	(0.35)	(0.32)
$1970-1989$	0.60	0.52
	(0.16)	(0.21)
$1980-2003$	1.06	0.98
	(0.28)	(0.30)

Note: The table shows estimates of the elasticity ε_β for different time periods. Standard errors in parenthesis. Column (ii) corrects for serially correlated residuals.

3.2 Personal income taxes and social security contributions

The calculation of the elasticity of personal income taxes with respect to earnings follows Girouard and André (2005), in particular their paragraph 10 and equation 6,

$$\varepsilon_\tau = \frac{\sum_{i=1}^{n} m\left(W_i\right) f\left(W_i\right)}{\sum_{i=1}^{n} a\left(W_i\right) f\left(W_i\right)} \tag{14}$$

where ε_τ is the average tax elasticity per capita, $m\left(W\right)$ is the marginal tax rate for an individual with income W, $a\left(W\right)$ is the average tax rate, and $f\left(W\right)$ is the value-weighted fraction of individuals in income group i.[7] The elasticity of social security contributions, ε_s is calculated from

$$\varepsilon_s = \frac{\sum_{i=1}^{n} m^s\left(W_i\right) f\left(W_i\right)}{\sum_{i=1}^{n} a^s\left(W_i\right) f\left(W_i\right)} \tag{15}$$

where m^s and a^s are the marginal and average social security contribution rates.

The tax system for 1998-2009 (except 2001) has been implemented according to the descriptions in OECD's *Taxing Wages* (1999-2008) and information from the Swedish tax authority (*Skatteverket*) and Statistics Sweden. I calculate the marginal tax rate as the marginal tax effect of an income increase by SEK 20,000.[8,9]

To estimate the income-distribution function f, Girouard and André (2005) approximate a country's income distribution by a log-normal distribution. They calibrate the function to match two empirical moments, the $p90/p50$ and $p50/p10$ ratios under the assumption that the median ($p50$) income is equal to that of their 'average worker'. OECD defines this 'average worker' as a typical worker that is full-time employed during the entire year. In 2005, the details behind this definition were revised. As a consequence the earnings of the 'average worker' increased by more than 15 percent. After this revision, earnings of the average worker calculated by the OECD are substantially higher than median earnings in Sweden. Rather than following OECD's approach and fitting a log normal distribution around this non-representative average worker, I base my calculations on the more detailed information on individual taxable labor income available in the LINDA database.[10] To calculate the distribution function f, I use the income distribution from 2004 and assume that it has been constant between 1998 and 2009 although Table 2 indicates that income inequality may have increased slightly between 1998 and 2004.

Marginal and average taxes are evaluated for individuals with earnings $\alpha_i \hat{W}_t$ where $\alpha_i \in \{0.01, 0.02, ..., 5.00\}$ and $\hat{W}_t$ is earnings for the typical worker in year t according to OECD's calculations in *Taxing Wages* (1999-2008).[11] The marginal and average tax rates are weighted and summed as in (14). Figures 1 and 2 below show the marginal and average tax rates for individuals on different positions in the income distribution in 2003 and

[7] Tax rates (and rates for social security contributions) are calculated in relation to gross earnings, i.e. earnings including social security contributions.

[8] Matlab code with the Swedish tax codes for these years is available upon request.

[9] Many amounts in the tax system are rounded to the closest multiple of SEK 100. The tax effect of small income changes can therefore be misleading.

[10] See Domeij and Flodén (2009) for further information about the database and the income measures.

[11] For years 2008 and 2009, earnings for the average worker has been increased by the economy's forecasted nominal wage growth.

2009.[12] Table 3 shows measures of the average worker's average tax rates, and Tables 4 and 5 show the implications of equations (14) and (15) for personal income taxes and social security contributions.[13]

Table 2: The Swedish income distribution

year	$p50/p10$	$p90/p50$	year	$p50/p10$	$p90/p50$
1980	1.30	1.57	1993	1.34	1.59
1981	1.32	1.55	1994	1.36	1.61
1982	1.31	1.53	1995	1.39	1.59
1983	1.30	1.50	1996	1.40	1.63
1984	1.33	1.52	1997	1.38	1.61
1985	1.30	1.59	1998	1.37	1.62
1986	1.32	1.57	1999	1.36	1.64
1987	1.33	1.57	2000	1.39	1.69
1988	1.34	1.56	2001	1.38	1.67
1989	1.35	1.57	2002	1.38	1.65
1990	1.32	1.52	2003	1.38	1.67
1991	1.36	1.55	2004	1.38	1.67
1992	1.34	1.57			

Note: Relation between 90:th, 50:th, and 10:th percentiles in the distribution for taxable income. *Source*: LINDA database.

From these figures and tables, we see that average tax rates were substantially lower in 2009 than in 2003, but also that the progressivity of the tax system has increased: marginal tax rates have fallen for households with low-earnings but increased for households with high earnings. The fall in marginal tax rates for low-income households, and the fall in average taxes across the distribution is mostly accounted for by the introduction of earned income tax credits in 2007 and further expansions of these credits in 2008 and 2009.

The tables show that the elasticity for social security contributions has been stable at 0.97. Girouard and André (2005) estimated this elasticity to 1.0 while van den Noord (2000) estimated the elasticity to 0.9. The tables further show that average personal income taxes have fallen more rapidly than marginal taxes in the last years. Consequently, the Swedish tax system has become more progressive, and the elasticity of income taxes has risen from 1.3 to 1.7 during the last decade.[14]

[12] These figures show taxes (including the individual's social security contributions) relative to earnings, whereas the elasticity calculations are based on taxes (excluding social security contributions) relative to firms' total wage costs (i.e. earnings plus social security contributions).

[13] The tax rates in Table 3 deviate from those reported in early editions of OECD's *Taxing Wages*. The main reason is that OECD has changed the definition of the 'average worker' (the average worker has substantially higher earnings under the new definition). I get tax rates similar to those in *Taxing Wages* when I use the same definition of the average worker.

[14] Girouard and André (2005) estimated the elasticity to 1.3 in year 2003 rather than 1.4 according to my calculations.

Table 3: Average tax rates for the average worker

	$\frac{\text{income tax}}{\text{earnings}}$	$\frac{\text{income tax and soc. sec. contrib.}}{\text{earnings and soc. sec. contrib.}}$
1998	35.3	51.4
1999	35.0	51.2
2000	33.7	50.1
2002	30.6	47.8
2003	31.2	48.2
2004	31.5	48.4
2005	31.2	48.1
2006	30.9	47.8
2007	27.6	45.4
2008	26.8	44.7
2009	25.4	43.3

Note: Ratios in percent. *Source*: OECD Taxing Wages, National Institute of Economic Research, and own calculations.

Table 4: Elasticity of personal income taxes

	marginal tax rate $\sum m(W_i) f(W_i)$	average tax rate $\sum a(W_i) f(W_i)$	elasticity ε_τ
1998	29.3	21.9	1.34
1999	28.5	21.1	1.35
2000	27.8	20.3	1.37
2002	26.0	18.5	1.41
2003	26.3	18.8	1.40
2004	26.8	19.1	1.40
2005	26.9	18.7	1.44
2006	26.9	18.3	1.47
2007	25.6	15.8	1.62
2008	25.2	15.1	1.67
2009	24.0	14.3	1.68

Note: The marginal and average tax rates are population averages weighted by earnings. The elasticity is the ratio between the marginal and average rate.

Table 5: Elasticity of social security contributions

	marginal contribution rate $\sum m^s(W_i) f(W_i)$	average contribution rate $\sum^s a(W_i) f(W_i)$	elasticity ε_s
1998	28.7	29.6	0.97
1999	28.8	29.7	0.97
2000	28.7	29.6	0.97
2002	28.5	29.5	0.97
2003	28.6	29.5	0.97
2004	28.5	29.5	0.97
2005	28.4	29.3	0.97
2006	28.3	29.2	0.97
2007	28.3	29.3	0.97
2008	28.3	29.3	0.97
2009	27.9	28.8	0.97

Note: See Table 4.

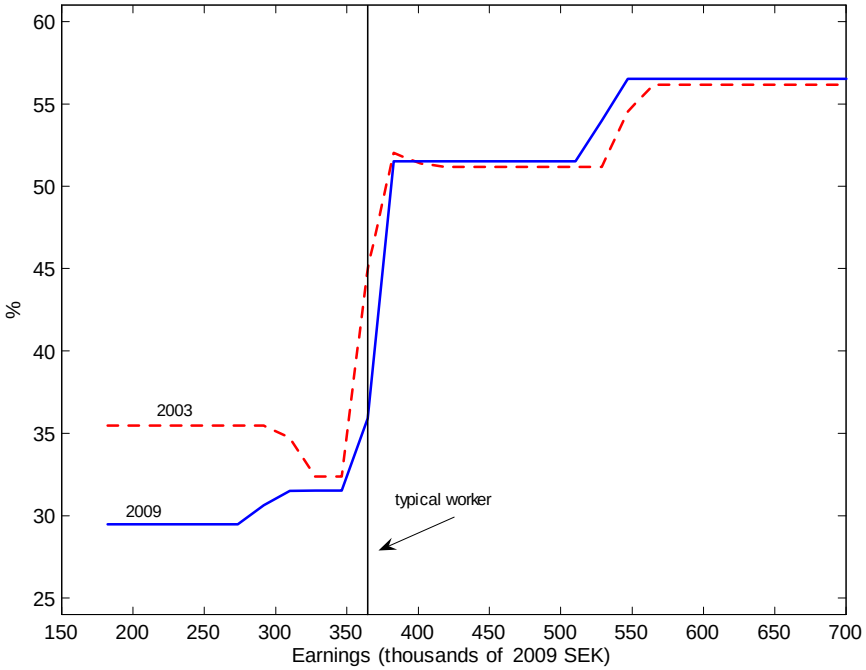

Figure 1: Marginal tax rates in 2003 and 2009

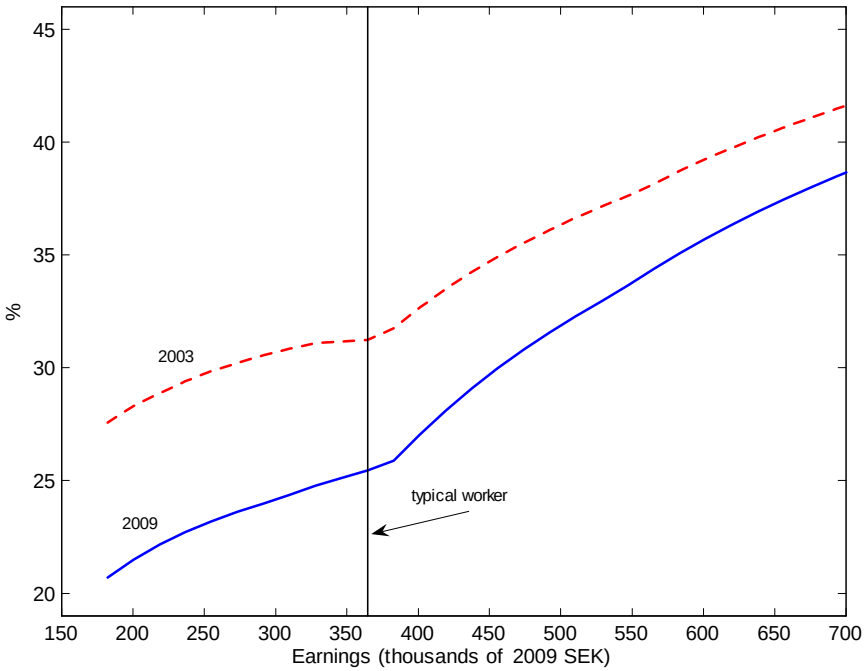

Figure 2: Average tax rates in 2003 and 2009

3.3 Corporate income taxes

The elasticity of corporate income taxes with respect to the output gap depends on the profit share in GDP and the elasticity of the wage sum with respect to the output gap. The OECD estimated the profit share to $\theta = 27.7$ percent. There is too little data (the profit share is too volatile) to revise this estimate or to identify time trends. Previously, I also concluded (see Table 1) that there is no evidence indicating that the elasticity of the wage sum has changed. There is thus no evidence indicating that the elasticity of corporate income taxes has changed over time.

The elasticity of corporate income taxes with respect to the output gap is calculated as[15]

$$\varepsilon_c = \frac{1-(1-\theta)\,\varepsilon_\beta}{\theta}. \tag{16}$$

With $\varepsilon_\beta = 0.8$ and $\theta = 0.277$, the elasticity of corporate income taxes is then $\varepsilon_c = 1.52$.

3.4 Indirect taxes

The elasticity of indirect taxes (mostly consumption taxes) to the output gap, ε_v, is set to unity for all countries in the most recent versions of the OECD method. I follow this approach.

3.5 Public expenditure

The elasticity of public expenditure with respect to the output gap depends on the elasticity of the unemployment rate with respect to the output gap in combination with the share of unemployment-related expenditure in public expenditure. To find the elasticity of the unemployment rate with respect to the output gap, I estimate

$$\Delta\left(u_t - u_t^*\right) = a + \gamma_u \Delta\left(y_t - y_t^*\right). \tag{17}$$

on annual data from OECD's Economic Outlook. The results are presented in Table 6.

[15] In (13) we implicitly have assumed that

$$\frac{\beta_w}{Y^*} = (1-\theta)\left(\frac{Y}{Y^*}\right)^{\varepsilon_\beta}$$

where β_w is the wage bill. By definition the compensation to capital owners is $\beta_r = Y - \beta_w$. It then follows that

$$\frac{\beta_r}{Y^*} = \frac{Y}{Y^*} - (1-\theta)\left(\frac{Y}{Y^*}\right)^{\varepsilon_\beta}.$$

To get (16), we evaluate

$$\frac{\partial\left(\beta_r/Y^*\right)}{\partial\left(Y/Y^*\right)}\frac{Y/Y^*}{\beta_r/Y^*}$$

at $Y = Y^*$ and note that

$$\frac{\partial T_c}{\partial\left(\beta_r/Y^*\right)}\frac{\beta_r/Y^*}{T_c} = 1$$

where T_c denotes corporate income taxes, and assuming that corporate income is taxed at a flat rate.

Table 6: Estimated elasticity of unemployment with respect to the output gap

time period	(i)	(ii)
$1970-2007$	-7.11	-5.96
	(1.76)	(1.31)
$1980-2007$	-7.95	-6.00
	(1.96)	(1.42)
$1990-2007$	-7.86	-5.66
	(2.27)	(1.80)
$1970-1989$	-6.28	-5.91
	(2.38)	(2.00)
$1980-2003$	-8.35	-6.61
	(2.05)	(1.54)

Note: The table shows estimates of the elasticity γ_u for different time periods. Standard errors in parenthesis.

I have also allowed for a linear time trend in the elasticity, but the trend is not statistically significant. OECD (2005) found $\gamma_u = -6.12$ for the period 1980-2003, but chose to use $\gamma_u = -7.9$ based on comparisons to other similar countries. There is thus no indication that the elasticity has changed in recent years. Following OECD, I use $\gamma_u = -7.9$.

In my baseline calculations, I follow Girouard and André (2005) and consider unemployment compensation to be the sole cyclical automatic component in public expenditure. As an alternative, I follow van den Noord (2000) and also include active labor market policies in the automatic expenditures.

Recall from (12) that

$$\gamma_g = \frac{\partial g}{\partial (u - u^*)}. \tag{18}$$

I separate primary public expenditure into two components,

$$G = \hat{G} + \Psi \tag{19}$$

where $\hat{G}$ denotes primary expenditure net of unemployment compensation and Ψ denotes unemployment compensations. Assuming that unemployment compensation is proportional to unemployment,

$$\Psi = \frac{U}{U^*}\Psi^* \tag{20}$$

we get

$$\frac{\partial g}{\partial (u - u^*)} = \frac{\Psi^*}{G^*}. \tag{21}$$

Table 7 reports information on unemployment compensation, primary public expenditure and unemployment for the period $1998-2009$. I calculate structural unemployment as the average of the reported actual unemployment levels for these years, i.e. $U^* = 5.2$ percent.

I then approximate $G \approx G^*$ and calculate the structural component of unemployment compensation from (20) as

$$\gamma_g = \frac{\Psi^*}{G^*} = \frac{\Psi}{G}\frac{U^*}{U} \tag{22}$$

Table 7: Labor-market expenditure

	$\frac{\Psi}{Y}$	$\frac{\widetilde{\Psi}}{Y}$	$\frac{G}{Y}$	$\frac{\Psi}{G}$	$\frac{\widetilde{\Psi}}{G}$	U	$\gamma_g = \frac{\Psi^*}{G^*}$	$\widetilde{\gamma}_g = \frac{\widetilde{\Psi}^*}{G^*}$
1998	1.91	3.9	51.7	3.7	7.6	6.5	3.0	6.1
1999	1.53	3.4	52.0	2.9	6.5	5.6	2.7	6.1
2000	1.31	2.8	49.6	2.6	5.5	4.7	2.9	6.1
2001	1.04	2.5	50.0	2.1	4.9	4.5	2.4	5.7
2002	1.02	2.7	50.9	2.0	5.2	4.5	2.3	6.0
2003	1.21	2.5	51.9	2.3	4.8	5.5	2.2	4.6
2004	1.29	2.5	50.9	2.5	4.9	6.3	2.1	4.1
2005	1.17	2.5	50.6	2.3	4.9	6.0	2.0	4.3
2006	0.96	2.3	49.8	1.9	4.7	5.4	1.8	4.5
2007	*0.80*	*1.7*	48.2	1.7	3.5	4.6	1.9	4.0
2008	*0.60*	*1.5*	48.0	1.2	3.1	4.4	1.4	3.7
2009	*0.60*	*1.6*	48.8	1.2	3.3	4.7	1.3	3.7

Note: Unemployment is according to the old Swedish definition. $\widetilde{\Psi}$ denotes expenditure on unemployment compensation and active labor market measures.
Source: OECD Employment Outlook (1998-2006/2008), and the National Institute of Institute of Economic Research. Unemployment compensation for $2007-2009$ is estimated based on the Budget Bill for 2009.

According to Girouard and André (2005), unemployment compensation accounted for 1.9 percent of primary public expenditure. My calculations indicate that unemployment compensation was slightly higher in the years they considered. Table 7 also documents a clear and rather substantial fall in spending on unemployment compensation. In particular after a right-wing government was elected to replace the ruling social democratic government in the Fall of 2006, a series of reforms of the unemployment insurance system has resulted in lower benefit rates and stricter criteria to qualify for insurance.

3.6 The total elasticity

Table 8 summarizes the implications of the elasticities calculated above.

Table 8: Summary of elasticities

	Pers. inc. taxes	Soc. sec. contr.	Corp. inc.	Indirect	Expenditure	
	$\varepsilon_\tau \varepsilon_\beta$	$\varepsilon_s \varepsilon_\beta$	taxes, ε_c	taxes, ε_v	$\gamma = \gamma_g \gamma_u$	$\widetilde{\gamma} = \widetilde{\gamma}_g \gamma_u$
1998	1.07	0.78	1.52	1.00	−0.23	−0.48
1999	1.08	0.78	1.52	1.00	−0.21	−0.48
2000	1.10	0.78	1.52	1.00	−0.23	−0.48
2002	1.13	0.78	1.52	1.00	−0.18	−0.48
2003	1.12	0.78	1.52	1.00	−0.17	−0.36
2004	1.12	0.78	1.52	1.00	−0.16	−0.32
2005	1.15	0.78	1.52	1.00	−0.16	−0.34
2006	1.18	0.78	1.52	1.00	−0.15	−0.36
2007	1.30	0.78	1.52	1.00	−0.15	−0.31
2008	1.34	0.78	1.52	1.00	−0.11	−0.29
2009	1.34	0.78	1.52	1.00	−0.11	−0.29

To calculate the budget elasticity α from equation (10) we also need information on the size of the respective tax and spending programs relative to GDP. This information is summarized in Table 9.

Table 9: Tax and spending shares (%)

	Pers. inc. taxes	Soc. sec. contr.	Corp. inc. taxes	Indirect taxes	Expenditure
	T_τ/Y	T_s/Y	T_c/Y	T_v/Y	G/Y
1998	16.8	16.4	2.3	12.0	51.7
1999	16.4	16.7	2.5	12.8	52.0
2000	15.6	16.8	3.2	12.7	49.6
2002	14.6	17.1	1.8	12.9	50.9
2003	15.1	16.1	1.9	13.0	51.9
2004	15.0	15.8	2.7	12.9	50.9
2005	14.7	15.6	3.4	13.1	50.6
2006	14.2	15.3	3.4	12.9	49.6
2007	13.1	15.4	3.3	13.0	48.1
2008	13.1	15.6	3.0	13.5	48.2
2009	13.0	15.6	3.2	13.3	50.8

Source: Budget Bills and National Institute for Economic Research.

Table 10 shows the elasticities weighted by the tax and spending shares. The final column shows the budget elasticity α for different years. We confirm OECD's estimate of α around 0.55 in year 2003. According to these estimates, the elasticity has fallen marginally to 0.53 in recent years. Note that the recent reforms of the Swedish tax system (in particular the introduction of earned income tax credits in $2007 - 2009$) has had minor impact on the estimated budget elasticity. These tax changes have had two offsetting effects. Since the tax system has become more progressive, personal income taxes have become more elastic with respect to the business cycle. But since average taxes have fallen, this elasticity gets a lower weight when summing up for the total budget elasticity. A small fall in the elasticity is instead explained by changes in the unemployment insurance system.

The final column of Table 10 reports the total budget elasticity when also expenditure on active labor market policies are included in the automatic fiscal response. Spending

on active labor market policies has fallen during the last decade, and this contributes to reducing the responsiveness of fiscal policy to the business cycle. I therefore find a clearer fall over time for this broader measure of the budget elasticity.

Table 10: The budget elasticity (%)

	Pers. inc. taxes	Soc. sec. contr.	Corp. taxes	Indir. taxes	Expend.		**Total**	
	$\varepsilon_\tau\varepsilon_\beta T_\tau/Y$	$\varepsilon_s\varepsilon_\beta T_s/Y$	$\varepsilon_c T_c/Y$	$\varepsilon_v T_v/Y$	$\gamma G/Y$	$\widetilde{\gamma} G/Y$	$\boldsymbol{\alpha}$	$\widetilde{\alpha}$
1998	18.0	12.8	3.5	12.0	−12.1	−25.0	**58.4**	71.3
1999	17.7	13.0	3.8	12.8	−11.1	−24.9	**58.4**	72.2
2000	17.2	13.1	4.9	12.7	−11.3	−24.0	**59.2**	71.9
2002	16.5	13.3	2.7	12.9	−9.3	−24.3	**54.7**	69.7
2003	16.9	12.6	2.9	13.0	−9.0	−18.7	**54.4**	64.1
2004	16.8	12.3	4.1	12.9	−8.3	−16.3	**54.4**	62.4
2005	16.9	12.2	5.2	13.1	−8.0	−17.1	**55.4**	64.5
2006	16.8	11.9	5.2	12.9	−7.2	−17.8	**54.0**	64.6
2007	17.0	12.0	5.0	13.0	−7.3	−15.1	**54.3**	62.1
2008	17.6	12.2	4.6	13.5	−5.4	−14.0	**53.3**	61.9
2009	17.4	12.2	4.9	13.3	−5.4	−14.7	**53.2**	62.5

Note: α is the budget elasticity for the baseline specification (with unemployment compensation as the only automatic expenditure), $\widetilde{\alpha}$ is the broad estimate of the budget elasticity (also including active labor market measures).

4 Effects of the earned income tax system

In year 2007 an earned income tax credit (EITC) system was introduced in Sweden. The system was extended in a second step in 2008 and a third step in 2009. The Swedish EITC system can be summarized as implying a larger tax credit for all workers, and this credit is the main explanation for the fall in average taxes between 2003 and 2009 shown in Figure 2. The full implications of the EITC reform on the budget elasticity are however not captured by the OECD method considered above. This method considers how marginal changes in the households' labor income affect tax revenue. The implicit assumption is then that all households are affected equally by the business cycle. In reality many households are not directly affected by the business cycle fluctuations, but some households are severely affected by moving in or out of unemployment. Unemployment insurance compensation is taxable in Sweden, but the compensation does not generate earned income tax credits. The EITC system therefore mitigates the automatic stabilizers by raising average taxes as unemployment increases in an economic downturn.[16]

To assess the importance of the EITC system for the budget elasticity, let us again consider the elasticity of personal income taxes with respect to the business cycle. In (11) we separated this elasticity, ε, as

$$\varepsilon \equiv \frac{\partial \tau}{\partial (y - y^*)} = \frac{\partial \tau}{\partial \beta} \frac{\partial \beta}{\partial (y - y^*)} \equiv \varepsilon_\tau \varepsilon_\beta. \tag{23}$$

[16] More precisely, fewer workers benefit from the EITC system in a downturn. Average taxes need not increase, but the tax for unemployed relative to employed is higher under the EITC system.

Suppose now that fluctuations in tax revenue over the business cycle are driven only by some individuals moving in or out of unemployment, and separate the elasticity as

$$\hat{\varepsilon} = \frac{\partial \tau}{\partial (y - y^*)} = \frac{\partial \tau}{\partial (u - u^*)} \frac{\partial (u - u^*)}{\partial (y - y^*)} \equiv \hat{\varepsilon}_\tau \gamma_u \tag{24}$$

where $\hat{\varepsilon}_\tau$ is the elasticity of tax income with respect to unemployment.

Total income from taxation of labor income is then given by

$$T_\tau = (1 - U) \bar{W} \sum_{i=1}^{n} a(W_i) f(W_i) + U W_u a_u(W_u) \tag{25}$$

where $\bar{W}$ is the average labor income in the employed population, W_u is the taxable income of a typical unemployed person and $a_u(W_u)$ is the average tax rate that applies to this income.[17] Consider now a business cycle fluctuation that changes the level of unemployment but that does not change income for those who remain employed. The elasticity of tax income with respect to this change in unemployment is

$$\hat{\varepsilon}_\tau = \frac{\partial T_\tau}{\partial U} \frac{U}{T} = 1 - \frac{\sum_{i=1}^{n} a(W_i) f(W_i)}{T/\bar{W}}. \tag{26}$$

To estimate the elasticity $\hat{\varepsilon}_\tau$ I use (25) and (26), and evaluate the expression at $U = U^* =$ 5.2 percent as before. In addition to the information previously used, we need information about unemployment insurance compensation. Although the level of compensations has varied over time, I fix the compensation to 50 percent of the average level of labor income for all years. By fixing the level of compensation, I am not confounding the effect of changes in the generosity of the unemployment insurance system – that have already been analyzed – with the introduction of the EITC system. According to my calculations, the maximum compensation a worker can get from the unemployment insurance system has varied between 53 and 59 percent of average labor income in the period 1998–2006 and between 46 and 50 percent in the most recent years.[18] I use the same tax system for unemployed and employed for the period 1998-2006. For 2007-2009, the earned income tax credit is not included for the unemployed. As before, the elasticity of unemployment with respect to the output gap is set to $\gamma_u = -7.9$.

Table 11 present the calculations of $\hat{\varepsilon}_\tau$ and the implied $\hat{\varepsilon}$, i.e. the contribution of personal income taxation to the total budget elasticity under the assumption that all fluctuations in this tax income is generated by movements in and out of unemployment.[19] The contribution to the total budget elasticity reported in the final column is much smaller than what we found with the OECD approach (reported in the first column in Table 10). This difference reflects several problems with the unemployment approach in this section. First, we have

[17] The function f should now be the value-weighted distribution of labor income conditional on that a person is employed. In practise this distinction however is of little importance and I use the same function as previously.

[18] The maximum compensation increased from SEK 580 per day in year 1998 to SEK 730 in the first 100 days in 2002 and has then fallen to SEK 680 in 2009. When comparing to average labor income, I multiply the compensation by 240 days in a year.

[19] These calculations also build on the assumption all unemployed are eligible for unemployment compensation and that they are unemployed for a full calendar year. These assumptions are extreme and will tend to exaggerate the importance of the EITC system.

assumed that labor income for those who remain employed is unaffected by the business cycle. In reality labor income is of course procyclical. Second, we have assumed that all unemployed are eligible for maximum unemployment insurance compensation. In reality some unemployed get lower compensation and some are not at all eligible for compensation. Both these shortcomings with this approach tend to result in an underestimation of the actual elasticity. But by making the unemployed receive as much compensation as possible – and hence also to face as high taxes as possible – this approach exaggerates the effects of the EITC system on the elasticity. The fall from 3.6 percent in year 2006 to 2.6 percent is explained by that mechanism. That is, a transition from employment to unemployment implies a loss of the tax credit in year 2009 but not in year 2006 or earlier. This loss of the tax credit mostly happens in recessions and hence make the tax system less countercyclical.

The first column in Table 10 indicated that changes in the taxation of labor income contributed to an increase in the budget elasticity between 2006 and 2009.[20] The calculations here indicate that those calculations abstract from offsetting effects of up to one percentage point from the EITC system. These calculations do however not overturn the previous conclusion that the magnitude of automatic stabilizers have been relatively unaffected by recent reforms of the tax and unemployment insurance systems.

Table 11: Elasticity of personal income taxes, unemployment approach

	average tax rate conditional on working $\sum a(W_i) f(W_i)$	average tax rate, all individuals $T_\tau/\bar{W}$	elasticity $\hat{\varepsilon}_\tau$	elasticity $\hat{\varepsilon} = \hat{\varepsilon}_\tau \gamma_u$	contribution to budget elasticity $\hat{\varepsilon} T_\tau / Y$
1998	21.9	21.3	−0.031	0.25	4.1
1999	21.1	20.4	−0.031	0.25	4.1
2000	20.3	19.7	−0.032	0.25	3.9
2002	18.5	17.9	−0.032	0.25	3.7
2003	18.8	18.2	−0.032	0.25	3.8
2004	19.1	18.5	−0.032	0.25	3.8
2005	18.7	18.2	−0.032	0.25	3.7
2006	18.3	17.7	−0.032	0.26	3.6
2007	15.8	15.3	−0.029	0.23	3.0
2008	15.1	14.7	−0.028	0.22	2.8
2009	14.3	14.0	−0.026	0.20	2.6

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[20] The important changes contributing to a higher elasticity were tax increases in many municipalities.

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