Application of the Swiss Fiscal Rule to Artificial Data A Monte Carlo Simulation

Alain Geier[a]

JEL Classification: H61, E62
Keywords: Balanced Budget, Debt, Deficit, Budgeting, Business Cycle

1. Introduction

The Swiss fiscal rule at the Federal level, also known as the "debt brake" is an interesting representative of its kind in many aspects. The mechanism of the fiscal rule aims at financing expenditures through current revenues instead of new debt. This budget rule is applied in concert with a constitutional upper limit on the main tax rates that limits the usefulness of taxes in order to micro-manage the budget. Designed as a structurally balanced budget rule, the rule thus combines the stabilising properties of an expenditure rule (because of the country's specific budget institutions) with the effective debt-controlling properties of a budget rule, thereby predating recent works[1] about fiscal rules that suggest a design with similar properties as a guideline and replacing the previous preference for pure expenditure rules[2]. The debt brake rule was first applied with the Federal budget of 2003.

The debt brake is a constitutional rule that aims at correcting a perceived dysfunction of the budget process, and can be understood in a sense that has been outlined by Brennan and Buchanan (1985): the rule is a constitutional principle regarding debt and deficits. Having been accepted by a large majority in a popular vote (in 1999) the constitutional amendment represents a broad consensus regarding the abstract goals of budget policy. At the same time the discussion about the measures required to meet the requirements of the rule is left to the daily political business. The institutions of the budget process therefore do no longer need to address the question of the overall deficit and can focus on the

a University of Neuchâtel and Federal Finance Administration.
1 notably Debrun et al. (2008), Kumar et al. (2009) or also Geier (2011).
2 e.g. Dabàn et al. (2003).

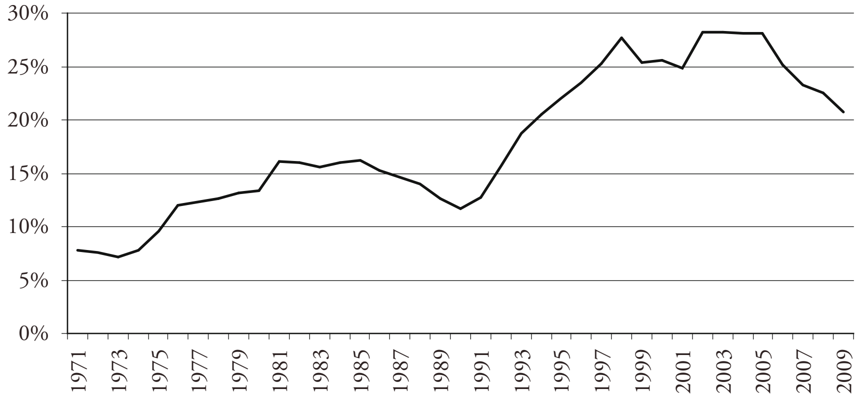
politically debated question of the allocation of available resources. The rule – the details of which are defined in the budget law (FHG) – is therefore more likely to eliminate previously observed incentives of decision makers towards accepting large deficits in economic downturns while failing to achieve corresponding budget surpluses when economic conditions improve. While a variety of theoretical approaches exist to explain a bias towards (excessive) deficits[3], the rule addresses mainly institutionally embedded incentives leading towards deficit bias such as they have been described mainly by von Hagen (1992). In addition, the effectiveness of fiscal rules with respect to the limitation of budget deficits seems generally to be confirmed by a number of empirical analyses[4], a number of which have been summarised by Poterba (1997).

In the case of Switzerland, fiscal policy was perceived to have a deficit bias during the 1990s[5] (see Fig. 1) as well as being pro-cyclical[6]. A recent study of Schaltegger and Weder (2010) found that federal fiscal policy has become less pro-cyclical since the implementation of the fiscal rule, which means that the stabilisation feature of the fiscal rule seems to be successful so far. A close analysis[7] shows that the rise of the debt ratio in the nineties had several causes, notably pure balance sheet transactions (acknowledgment of implicit debt items, e.g. toward pension funds). The economic downturn was certainly another important cause and led to the view that these deficits would never be matched by corresponding surpluses in the future. As demographic prospects are likely to further increase fiscal pressures, it seemed particularly important to find new ways to ensure sound public finances.

In the context of discussions about the Swiss Confederation's fiscal rule some concerns were raised about its ability to balance the budget over the medium term. The method used to measure the output gap consists of a statistical filter (a modified HP filter) and yields perfectly symmetrical results when applied ex post to any GDP series. This does not mean, however, that this result is generally valid, i.e. that can also be obtained in real time (ex ante). Müller (2003) for instance questions the ability of the rule to balance the budget when business cycles are non-stationary. The present paper is one possible approach to answer the question. It uses long series of artificial data to illustrate the behaviour of the

3 e.g. Alesina and Perotti (1995).
4 e.g. Poterba (1994; 1997), Bohn and Inman (1996), Fatás and Mihov (2003), Schaltegger (2002), Feld and Kirchgässner (2008), Auerbach (2008) or Badinger (2009).
5 Swiss Federal Council (2000) – *Botschaft zur Schuldenbremse.*
6 e.g. Lampart (2005).
7 Swiss Federal Council (2006) – *Schuldenbericht.*

Figure 1: Swiss Federal Debt as a % of GDP



Source: Swiss Federal Council (2006) – *Schuldenbericht*

fiscal rule in the long term and test whether the objective of a balanced budget can be achieved. In order to contribute to a clarification the present paper focuses on a technical design property of the debt brake, namely the implications of the measurement of the output gap that is applied by Swiss fiscal policy authorities when implementing the fiscal rule. Other approaches might consist in a simulation on actual historical data[8] or in a formal derivation of the rule's properties[9].

Given the presence of various uncertainties that are inherent in every budget process, and the fact that planned revenues and expenditures can change throughout the budgeted fiscal year, it seems plausible to imagine that the fiscal rule can only approximately balance a budget. Hence the relevant question should be whether a balanced budget can be attained within an acceptable range or if there are some systematic biases toward either deficits or surpluses. To answer this question, the adjustment account, which is an important feature of the debt brake that allows ex post corrections, should be given proper attention[10]. Moderate

8 Bodmer (2006) and Geier (2011).

9 Bruchez (2003a).

10 A detailed analysis of the debt brake mechanism and the adjustment account can be found in Geier (2010); another analysis, reflecting works within the Finance department, is found in Colombier (2004). The official descriptions of the concept and the budget law are found in Swiss Federal Council (2000; 2001) and regarding recent modifications to its design in Swiss Federal Council (2003; 2008).

deviations from a structurally balanced budget can be eliminated this way. The problem therefore can be reduced to determining whether remaining biases and deviations from a perfectly balanced budget are small enough to be eliminated through the adjustment account (without triggering a stop and go policy, disrupting the budgetary process).

The present paper simulates the behaviour of the debt brake applied to a modelled output series using a Monte Carlo approach and tests whether budget balance is achieved in the medium term and whether debt remains within fixed limits. After describing the Swiss debt brake in Section 2, the simulation method as well as the different processes used to generate an output (GDP) series are explained in Section 3. That section analyses the effect of simulated data based on (a) sinusoidal business cycles, (b) business cycles of variable length and (c) a random walk (with drift). The cases (b) and (c) add a complication for the statistical filter, which is designed to smooth out specific periodicities (frequencies) and may show different features for different periodicities. It is therefore interesting to simulate the impact of a change in the length of business cycles. The results of the simulation are presented in Section 4. Section 5 will propose concluding remarks.

2. Debt Brake Mechanism

The rule limits, for each year, the amount of central government expenditures, as a function of current revenues and the position of the economy in the business cycle. It therefore aims at keeping total central government expenditures relatively independent of cyclical variations, whereas tax revenues are supposed to act as automatic stabilisers[11]. Actual deviations from the limit set by the rule, result in a credit or debit to a so called adjustment account or *Ausgleichskonto*[12] and must be taken into account when setting the new expenditure ceilings for the following years. It should be noted that the rule is applied to budget forecasts before being applied again to effective values. The second calculation allows to determine the deviations that must be credited or debited on the adjustment account.

The characteristic "debt brake formula" (equation 1) states that at any calculation period (t) the maximum allowed expenditures ($\bar{G}$) must equal revenues

11 Important expenditure-side automatic stabilisers, such as the unemployment insurance and other social insurances do have accounts that are kept separately from Federal accounts and are therefore not subject to the debt brake rule.

12 see footnote 10.

(R), after multiplication with a "business cycle adjustment factor" (k). This business cycle adjustment factor aims at stabilising expenditures around the level of cyclically adjusted revenues, and consists of the ratio of trend real output (Y^*) and actual (real) output (Y). Therefore, if the factor k is larger than one a deficit is allowed (cyclical deficit) and if the factor k is smaller than one a (cyclical) budgetary surplus is required. This represents a simple cyclical adjustment on the lines of Giorno et al., Hagemann (1999), Gramlich (1990) and the European Commission (1995). The usefulness of the cyclically adjusted budget balance as a fiscal policy indicator has notably been discussed by Blanchard (1990).

$$\bar{G}_t = k_t R_t \text{ with } k_t = \frac{Y_t^*}{Y_t} \tag{1}$$

Whether this formula will lead to a balanced budget depends notably on the assumption that the expected value of the right hand side of equation (1) (kR) is equal to the expected value of revenues (R) over the long run. If k and R were independent random variables the proof of this would be easy to establish. However, k and R are clearly negatively correlated as both depend in opposite ways on the real output of the economy. An automatically balanced budget is therefore not an intuitively necessary outcome.

A further complication is introduced by a positive trend in economic growth. The consequence of this is that two consecutive business cycles do not have the same amplitude. On the other hand, economic growth tends to reduce past errors over time, since past deviations become more and more insignificant relative to more recent ones. For this reason the budget balance and debt are considered as a percentage of output throughout this paper.

The way that revenues are forecasted is central to the effectiveness of the rule. However, detecting possible biases in the forecasting methods is not the purpose of these simulations. The reader will find a discussion in Bodmer (2003) and Bodmer and Geier (2004).

3. Simulation

The simulations are based on output series calculated with three different processes, all including stochastic variables. These simulations shall allow conclusions about the achievement of a structurally balanced budget, which is supposed to be achieved if the debt ratio fluctuates within a limited band. A deficit ratio which remains close to nil on average is assimilated to a balanced budget. As mentioned earlier, smaller differences will be eliminated thanks to the adjustment account of the fiscal rule.

The question of the policy stance (pro-cyclical vs. anti-cyclical) is also analysed. An anti-cyclical fiscal policy is considered to be a desirable outcome.

The analysis of the business cycle adjustment factor must take into account Government revenues as these two variables are closely linked (they both depend on output). It is therefore not sufficient to establish that *k* is centered around 1. The deficit as such must therefore be simulated. By rearranging equation (1) and taking expectations (equation 2) it is possible, however, to test whether the ratio of expenditures over revenues is centered around one, which gives some (non-concluding) indication about the stabilisation properties of *k*.

$$E[k_t] = E\left[\frac{\bar{G}_t}{R_t}\right] \tag{2}$$

In the remainder of this section, the simulation parameters are explained in detail. Sections 3.1. to 3.3. describe the three processes described to generate different output series. First, a "sinusoidal" output series is constructed, then a "random length cycle" output before using a random walk with drift. The latter two methods represent challenges for the statistical filter used to calculate the output gap, because the filter can not be calibrated to fit a stable cycle anymore.

The sample has a length of 10,000 periods. The fiscal revenue series (*R*) has an additional overlay of a random or "irregular" variable, which should simulate its imperfect relation to GDP as is observed in the real world. The extent of this random component corresponds roughly to the observed magnitude of the irregular component of the Confederation's revenues as it is described by BODMER and GEIER (2004).

Fiscal revenues are modelled the following way according to the identity equation (3):

$$R_t \equiv RS_t + RC_t + RI_t \tag{3}$$

The operational definition of R (equation 4) is expressed by stating that the structural and cyclical parts of revenue (RS and RC) depend on output by a linear factor (this implies a revenue elasticity of one)[13]. The term RI corresponds to irregular revenues that can not be captured by movements of the economic cycle.

$$R_t = \beta_1 Y_t + RI_t \tag{4}$$

Equation (3) can alternatively be expressed by assuming that structural revenues (RS) depend on a trend output (Y^*), while the cyclical part of revenues (RC) depends on the difference of output with its trend.

$$R_t = \beta_1 Y_t + RI_t = \beta_1 Y_t^* + \beta_1 (Y_t - Y_t^*) + RI_t \tag{5}$$

The irregular component (RI) is a modelled random value, centered around zero, but with a variability that is proportional to total revenues (equation 6). It is constructed as a fraction of revenues (β_2) times a normally distributed variable (j_1).

$$RI_t = R_t \beta_2 \tilde{\phi}_{1t} \text{ with } \tilde{\phi}_{1t} \sim \text{std. normal distribution } N(0;1) \tag{6}$$

It is assumed that R_t is perfectly known at time t. A modelling of revenue forecasts is not the purpose of this paper.

The business cycle adjustment factors k are calculated on effective structural values (theoretical value k^*) as well as on calculated trend values using a modified Hodrick Prescott-filter[14] applied recursively (calculated value k^{HP}). Recursively here means that each trend value is a value at the end of a rolling sample. The length of the rolling sample is 24 periods, the same as the value used by the Federal Finance Administration for the actual calculation of the factor k. The filter is applied to logarithms of output (GDP). The factor k is therefore calculated according to both true values and estimated values of the trend output. This allows getting an indication of its accuracy in representing the position in the business cycle. The analysis of the difference of the two values gives an

13 When looking at the relevance of elasticities for the Debt brake it appears that long term elasticity is not relevant, as long as revenue estimates use the correct long-term elasticity, while annual elasticity is relevant and assumed to be one within the framework of the debt brake. A different elasticity would likely result in a less stable measure for cyclically adjusted revenues, but still centered around the correct (long term) trend (cf. Geier, 2011).

14 The modified version aims at reducing the end of sample bias and is described by Bruchez (2003).

indication about whether the true business cycle position is met by the cyclical adjustment factor. In the case of the random walk, the structural value of output is unknown. This structural value is then estimated by an "ex post"-calculation with a lag of 13 periods[15] (or years). The "true" factor *k* is calculated on the basis of this ex post value of trend output.

The impact on the adjustment account is calculated by using a factor *k* which has been re-calculated in the following year (as in reality), and therefore using some new information on effective output growth instead of forecasts. Unlike the calculation of the structural value (or the lagged value in the case of the random walk scenario), trend output is still an estimate at that time. A consecutive ex post calculation, several periods later would result in (sometimes substantially) revised figures.

The present work simulates the behaviour of the debt brake applied to a modelled output series and test whether a balanced budget is achieved in the medium term and whether debt remains within fixed limits. The relevant measure for both shall – as already indicated with equation 2 – not be absolute values of budget deficits and debt, but the ratio of these figures with respect to output. As economic output is subject to a growth trend, all related variables will grow at the same pace. Therefore these values are not stationary. Taking the ratio with respect to output also makes values comparable for different time periods. It is considered that the budget is balanced if on average this ratio is close to zero.

Some attention is also given to the factor *k*. If the expected value of *k* equals one, this means, according to equation (2) that the expected value of expenditures in terms of revenues is also one. This statement does not necessarily imply a precisely balanced budget, which would be the sum of the differences between expenditures and revenues, but it is a strong indication that the balanced budget requirement can be met.

3.1 Sinusoidal Cycles

This case represents a continuously growing (structural) output to which a perfectly cyclical component is added. The structural component Y^* is growing with the annual growth rate g, according to equation (7).

$$Y_t^* = Y_{t-1}^* e^g \tag{7}$$

15 This arbitrary value (in the middle of the recursive sample) just has to be at a distant enough past, so as to avoid end of sample problems with the HP filter.

The cyclical component Y^C is a fraction (α_1) of the structural component Y^* multiplied with the sinus of time (*t*) as stated in equation (8):

$$Y_t^c = \sin t \frac{Y_t^*}{\alpha_1} = Y_{t-1}^* e^g \frac{\sin t}{\alpha_1} \tag{8}$$

Total output is the addition of both components (equation 9).

$$Y_t = Y_t^* + Y_t^c \tag{9}$$

Equation (10) then follows from the equations (8) and (9).

$$Y_t = Y_{t-1}^* e^g \left(1 + \frac{\sin t}{\alpha_1}\right) \tag{10}$$

The parameters of this model are calibrated to meet the Swiss GDP's estimated trend growth of around 2%, its standard deviation of also around 2%, the typical length of a business cycle (6–7 years) and the typical standard deviation of the output gap which amounts to around 2%[16]. This yields: $\alpha_1 = 35$ and $g = 0.02$.

3.2 Variable Length Cycles

This case follows an idea similar to the previous one. The essential difference is that the cyclical component is not sinusoidal, but its length and its amplitude are random. Equations (11) and (12) are therefore identical with equations (7) and (9).

$$Y_t^s = Y_{t-1}^* e^g \tag{11}$$

$$Y_t = Y_t^* + Y_t^c \tag{12}$$

The cyclical component (equation 12) is less straightforward than in the previous case, but the numerical simulation resulting from it can be achieved quite easily. The cyclical component varies according to a random variable q_t and can

16 It comes as no surprise that this value is close to the standard deviation of growth.

exhibit negative or positive values depending on the state (0 or 1) of a dummy variable (δ_t):

$$Y_t^c = \begin{cases} Y_t^* \tilde{q}_t & \text{for } \delta_t = 0 \\ -Y_t^* \tilde{q}_t & \text{for } \delta_t = 1 \end{cases} \tag{13}$$

The variable q_t corresponds to a uniform distribution (θ) weighted by a calibration parameter α_3.

$$\tilde{q}_t = \alpha_3 \tilde{\theta}_t \text{ with } \tilde{\theta}_t \sim \text{uni. distribution } [0;1] \tag{14}$$

The state of the dummy variable (0 or 1) in turn depends (partly) on a random variable p (equation 15). This process determines the "variable" length of the cycle, because this length depends on the time period that the dummy remains in a given state. The duration of the state is constructed in a way as to keep it constant for some time. The parameter *r* is a counter of the number of years during which the dummy variable remained unchanged (equation 16). A higher value of r increases the probability that the dummy switches its state. This happens when the product of r and the uniform random variable p exceeds a value $\alpha_{2.}$

$$\delta_t = \begin{cases} \delta_{t-1} & \text{for } r_t \tilde{p}_t < \alpha_2 \\ \delta_{t-1} - 1 & \text{for } r_t \tilde{p}_t \geq \alpha_2 \end{cases} \tag{15}$$

where $\delta_t \in \{0,1\}$ and $\tilde{p}_t \sim$ uni. distribution [0,1].

There are "positive" and "negative" periods, depending on the state of the dummy, with two adjacent periods forming a business cycle.

$$r_t = \begin{cases} r_{t-1} + 1 & \text{for } \delta_{t-1} = \delta_{t-2} \\ 1 & \text{for } \delta_{t-1} \neq \delta_{t-2} \end{cases} \tag{16}$$

Again, the calibration of the parameters α_1, α_2 and α_3 reflects the properties of Swiss GDP. A business cycle induced by two adjacent periods of a constant dummy (*d*) lasts 6.8 years on average with a standard deviation of 2.3 years. The values of the parameters are the following: $\alpha_1 = 0.02$, $\alpha_2 = 1.5$, $\alpha_3 = 30$, $g = 0.02$. *p* and θ follow a uniform distribution: $\tilde{p}_t, \tilde{\theta}_t \sim$ uni. distribution [0;1].

3.3 Random Walk with Drift

In this case, there is no stationary trend output to which the output series tends to return. The Process is defined by the equations (17) to (19).

$$y_t = \ln Y_t \tag{17}$$

$$y_t = y_{t-1} + \tilde{u}_t \tag{18}$$

$$\tilde{u}_t = g + \sigma \tilde{z}_t \text{ where } \tilde{z}_t \sim \text{std. norm. distr. } N(0;1) \tag{19}$$

There is no need to define specific structural and cyclical components and the parameters are calibrated to meet Swiss GDP properties: $g = 0.02$ and $\sigma = 0.02$.

4. Results

4.1. Results with Respect to the Budget Balance

In all three cases, the budget remains balanced over the medium to long term. The average budget outcome is always almost identical to zero (Table 1, column [1]).

a The debt ratio remains centered around zero and does fluctuate by a few points of output (cf. column [2]). The fluctuations are more pronounced in the case of the random walk. This outcome is compatible with the target value of the Swiss federal fiscal rule, which requires a nominally balanced budget in the medium term. If a positive initial value is chosen for debt, the debt ratio diminishes before stabilising around zero.

b The average value of the cyclical adjustment factor *k* corresponds nearly exactly to one in all simulation runs (column [4]). This means that the modified Hodrick-Prescott filter yields symmetrical results, not only when applied ex post to a series but also when applied on real time data. This symmetry is an important precondition to meet the requirement of a balanced budget (without having to correct for systematic deviations).

c With a value of 0.02 the standard deviation of the cyclical adjustment factor *k* corresponds closely to the average deviation of output from its trend, which is also 2% (by calibration). The theoretical values of *k*, which have been calculated using true (simulated) structural output figures, have roughly the same volatility as the calculation using the modified HP-filter. This means that the order of magnitude of the output gap is not underestimated by the HP-filter. It should not be forgotten, however, that growth forecasts usually underestimate real growth volatility. The present result means that the modified HP-filter[17] measurement does not contribute to a possible systematic underestimation of cyclical fluctuations.

d The cyclical adjustment factor exhibits a positive skewness: the frequency of values above one is higher than that of values below one (median and mode are above the average of one, tail is shorter towards zero). This seems consistent with the fact that *k* has a (theoretical) lower bound at zero, but no upper bound. This effect is small, however, as it does not translate into deviations of budget deficits and debt.

e The negative excess kurtosis (kurtosis below three) points to a somewhat platycurtic distribution (e.g. a distribution with "thin tails") – extreme values are relatively rare when compared to a normal distribution.

f The absolute value measurement error of the factor *k* (column [5]) is quite large, particularly in the case of the random walk, but the error is centred and symmetric, as can be inferred by the simple measurement error in column [6]. This result is perfectly compatible with the requirement of a balanced budget, but might indicate a problem regarding an adequate representation of the position in the business cycle.

4.2. Results with Respect to the Fiscal Policy Stance

The previously noted measurement error represents a liability regarding the requirement of an anti-cyclical fiscal policy stance[18]. The problem seems small in the first two simulation cases, where a cyclical output has been assumed. In those simulations, fiscal policy is anti-cyclical in nearly 90% of all cases (Table 2). In addition, pro-cyclical stances tend to occur when output is close to its trend and the fiscal balance is nearly balanced. In the case of output following a random walk with drift, policy is pro-cyclical in around 70% of all simulated observations.

17 This outcome is a specific feature of the HP-Filter that has been modified in the way of BRUCHEZ (2003). The modification reduces dependence of the trend value to observations at the margin of a sample. The modified filter is therefore not applied to an extended series in order to reduce the end of sample bias. Such an extension would strongly depend on forecasted values which are likely to underestimate true volatility.

18 The exact definition of what is pro- and what is anti-cyclical seems to vary across literature. An evaluation of a fiscal rule could therefore compare the outcomes with a situation where no rule or a different rule exists.

Table 1: Simulation Results: Balanced Budget and Cyclical Adjustment

n=10,000	Budget deficit	Accrued debt	Cyclical adjustment factor k			
	as a % of output	as a % of output	true (theoretical) ($k^* = y^* / y$)	calculated using filter ($k^{hp} = y^{hp} / y$)	absolute value of measurement error %-pts. $\lvert k^* - k^{hp} \rvert$	measurement error %-pts. ($k^* - k^{hp}$)
	[1]	[2]	[3]	[4]	[5]	[6]
A. Sinusoidal cycle						
Average	0.00%	–0.12%	1.000	1.000	0.67%	–0.02%
Standard deviation	0.32%	0.34%	0.020	0.022	0.33%	0.75%
Skewness[a]	–0.03	0.02	0.03	0.03	–0.49	0.01
Kurtosis (> 3)[b]	–1.48	–1.34	–1.50	–1.50	–1.07	–1.50
Maximum	0.50%	0.64%	1.029	1.032	1.07%	1.05%
Minimum	–0.53%	–0.82%	0.972	0.969	0.00%	–1.07%
B. Variable (random) length cycle						
Average	0.00%	–0.07%	1.000	1.000	0.80%	–0.02%
Standard deviation	0.20%	0.25%	0.019	0.020	0.58%	0.98%
Skewness	–0.04	–0.08	0.04	0.04	0.81	–0.08
Kurtosis (> 3)	–0.72	–0.55	–1.19	–0.75	0.23	–0.31
Maximum	0.47%	0.56%	1.034	1.055	2.78%	2.78%
Minimum	–0.61%	–0.74%	0.968	0.954	0.00%	–2.74%
C. Random walk with drift						
Average	–0.01%	–0.41%	1.000	1.000	2.97%	–0.01%
Standard deviation	0.72%	2.31%	0.018	0.024	2.24%	3.72%
Skewness	–0.01	–0.12	0.06	0.01	0.96	0.03
Kurtosis (> 3)	–0.01	–0.16	0.00	–0.02	0.74	–0.03
Maximum	2.11%	5.21%	1.057	1.076	12.06%	11.77%
Minimum	–2.34%	–7.01%	0.940	0.928	0.01%	–12.06%

a A measure of asymmetry of the distribution.
b A measure of the frequency of extreme values. The figure represents the deviation from standard normal distribution kurtosis, which is 3.

One third of observations correspond to the delicate situation where output is below its trend and the fiscal balance is in surplus. In these cases, the surplus amounts on average to 0.64% of output. This result points to a possible problem with the policy stance, if output follows a non stationary process. Of course, the absence of "cycles" makes it more difficult to determine a correct policy stance.

Table 2: Simulation Results: Fiscal Policy Stance

(frequencies in % of total)	Sinusoidal cycles	Variable length cycle	Random walk with drift
cases of output above its trend	50.0%	50.0%	50.0%
case of a surplus	50.2%	49.8%	49.6%
case of anti-cyclical policy stance	89.2%	88.7%	30.9%
case of pro-cyclical policy stance	10.8%	11.3%	69.1%
of which:			
output below trend and surplus	5.5%	5.6%	34.3%
output above trend and deficit	5.3%	5.8%	34.7%
Average surplus in those cases, where a deficit would have been more adequate (as a % of output)	0.08%	0.06%	0.64%

4.3 Results with Respect to Adjustment Account

The calculation of the adjustment account[19] occurs when budget outcomes become available, i.e. after completion of the fiscal year. The simulations implemented this aspect by re-calculating cyclical adjustment and expenditure ceilings on availability of additional output data (one year later). The results show that the adjustment account remains close to balance. This result seems unrealistic when compared to effective data[20]. This result is the consequence of the simulation lacking the aspect of revenue forecasts as well as the assumption that effective expenditure correspond to budgeted expenditure. Revenue forecasts actually add much volatility to the expenditure ceiling and effective spending

19 see GEIER (2011) for a detailed description and analysis of this feature of the fiscal rule.
20 cf. recent Swiss federal accounts and GEIER (2011) for a simulation on historical data.

seems to undershoot with respect to the budget. The simulation shows that the cyclical factor alone is not a source of a bias towards either deficits or surpluses on the adjustment account.

Table 3: Simulation Results: Adjustment Account

n = 10,000	balance of adj. account:	
	a.) as a % of *expenditure*	b.) as a % of *output*
Sinusoidal cycles		
Average	–0.05%	–0.01%
Standard deviation	0.66%	0.10%
Skewness (Index)	0.00	–0.02
Kurtosis (>3)	–1.34	–1.34
Maximum	1.47%	0.20%
Minimum	–1.45%	–0.21%
Variable length cycles		
Average	–0.08%	–0.01%
Standard deviation	0.76%	0.08%
Skewness (Index)	–0.04	–0.07
Kurtosis (>3)	–0.35	–0.38
Maximum	1.99%	0.21%
Minimum	–2.34%	–0.22%
Random walk with drift		
Average	0.00%	–0.01%
Standard deviation	0.75%	0.23%
Skewness (Index)	0.02	–0.1
Kurtosis (>3)	–0.03	–0.03
Maximum	2.49%	0.68%
Minimum	–2.44%	–0.78%

5. Conclusions

The results show that the Swiss fiscal rule at the federal level or "debt brake" provides for a budget that remains almost perfectly balanced over the long term. The construction of the cyclical adjustment factor contributes to symmetric budget deficits and surpluses even under real time conditions. Remaining deviations from a balanced budget that arise from the cyclical adjustment could at least easily be compensated through subsequent compensation measures (using the feature of the compensation account). The constitutional requirement of a budget that is "balanced over a cycle" can therefore be met.

Factors that the present analysis does not take into account and that could potentially turn out to challenge this result include the difference between effective and budgeted spending, revenue forecast errors due to errors in GDP forecasts or a lack of correspondence between GDP-cycles and revenue cycles. In the latter case, the cyclical adjustment factor could not compensate for those cyclical fluctuations of revenues. Another source of deviation may be extraordinary spending that is not subject to the fiscal rule in the same way as ordinary spending.[21]

Regarding the fiscal stance, there is a concern that the budget rule might not allow budget deficits when the output gap is indicating a recession (or below average use of production factors). The present results pinpoint the difficulty of dealing with possible random fluctuations of GDP. True cyclical fluctuations of output are adjusted fairly well. In this case, errors in estimating the position in the business cycle seem to appear mostly near full-employment, where the output gap is close to zero. In the case of output following a random walk with drift fiscal policy is frequently pro-cyclical. This result points to a possible problem with the policy stance, if output follows a non stationary process. In such a case, the calculation method of a trend output should be reassessed. Possible alternatives would have to minimise estimation errors for the output gap. This might be achieved by an adjustment of the smoothing parameter of the HP-Filter or the use of additional variables, e.g. using a production function or a multivariate filter. Whether this will become necessary remains to be seen as in the light of the study of SCHALTEGGER and WEDER (2010) the rule seems to be quite successful so far in contributing to an anti-cyclical fiscal stance.

21 These questions are specifically adressed in GEIER (2011).

References

Alesina, Alberto and Roberto Perotti (1995), "The Political Economy of Budget Deficits", *IMF Staff Papers*, 42, pp. 1–31.

Auerbach, Alan J. (2008), "Federal Budget Rules: The US Experience", NBER Working Paper 14288.

Badinger, Harald (2009), "Fiscal Rules, Discretionary Fiscal Policy and Macroeconomic Stability: An Empirical Assessment for OECD Countries", *Applied Economics*, 42, pp. 829–847.

Blanchard, Olivier (1990), "Suggestion for a New Set of Fiscal Indicators", *OECD Working Papers*, 79.

Bodmer, Frank (2003), „Eine Analyse der Einnahmenprognosen", Working Paper, 2003/7, Swiss Federal Finance Administration.

Bodmer, Frank (2006), "The Swiss Debt Brake: How it Works and What Can Go Wrong", *Swiss Journal of Economics and Statistics*, 142(3), pp. 307–330.

Bodmer, Frank and Alain Geier (2004), "Estimates for the Structural Deficit in Switzerland", 2002 to 2007, *OECD Journal on Budgeting*, 4(2), pp. 77–100.

Bohn, Henning and Robert P. Inman (1996), "Balanced-Budget Rules and Public Deficits: Evidence from the U. S. States", *Carnegie-Rochester Conference Series on Public Policy*, 45, pp. 13–76.

Brennan, Geoffrey and James M. Buchanan (1985), *The Reason of Rules: Constitutional Political Economy*, Cambridge.

Bruchez, Pierre-Alain (2003), "A Modification of the HP Filter Aiming at Reducing the End Point Bias", Working Paper, 2003/3, Swiss Federal Finance Administration.

Bruchez, Pierre-Alain (2003a), "Will the Swiss Fiscal Rule Lead to Stabilization of the Public Debt?", Working Paper, 2003/4, Swiss Federal Finance Administration.

Colombier, Carsten, with the collaboration of Frank Bodmer, Pierre-Alain Bruchez, Alain Geier, Toni Haniotis, Margit Himmel and Urs Plavec (2004), „Eine Neubewertung der Schuldenbremse", Working Paper, 2003/1, Swiss Federal Finance Administration.

Debrun, Xavier, Natan P. Epstein and Steven A. Symansky (2008), "A New Fiscal Rule: Should Israel Go Swiss?", IMF Working Paper, 08/87.

Dabàn, Teresa, Enrica Detragiache, Gabriel di Bella, Gian Maria Milesi-Ferretti and Steven Symansky (2003), "Rules-Based Fiscal Policy in France, Germany, Italy and Spain", IMF Occasional Paper, 225.

European Commission (1995), "Technical Note: The Commissions Services' Method for the Cyclical Adjustment of Government Budget Balances", *European Economy*, 60.

Fatas, Antonio and Ilian Mihov (2003), "The Case for Restricting Fiscal Policy Discretion", *The Quarterly Journal of Economics*, MIT Press, 118(4), pp. 1419–1447.

Feld, Lars P. and Gebhard Kirchgässner (2008), "On the Effectiveness of Debt Brakes: The Swiss Experience", in: Reinhard Neck and Jan-Egbert Sturm, *Sustainability of Public Debt*, Cambridge (USA).

Geier, Alain (2011), *Die Schuldenbremse des Bundes: Hintergründe und Wirkung*, Dissertation, University of Neuchatel.

Giorno, Claude, Pete Richardson, Deborah Roseveare and Paul van den Noord (1995), "Estimating Potential Output, Output Gaps and Structural Budget Balances", OECD Working Paper, 152.

Gramlich, Edward M. (1990), "Fiscal Indicators", OECD Working Paper, 80.

Hagemann, Robert (1999), "The Structural Budget Balance, the IMF's Methodology", IMF Working Paper, 99/95.

von Hagen, Jürgen (1992), "Budgeting Procedures and Fiscal Performance in the European Community", in: Commission of the European Community, *Economic Papers*, 96.

Kumar, Manmohan, Emanuele Baldacci, Andrea Schaechter, Carlos Caceres, Daehaeng Kim, Xavier Debrun, Julio Escolano, Jiri Jonas, Philippe Karam, Irina Yakadina and Robert Zymek (2009), "Fiscal Rules—Anchoring Expectations for Sustainable Public Finances", International Monetary Fund Staff Paper.

Lampart, Daniel (2005), „Die konjunkturelle Ausrichtung der Schweizer Finanzpolitik im internationalen Vergleich", KOF Working Papers, 109.

Müller, Christian (2003), „Anmerkungen zur Schuldenbremse", KOF Working Papers, 81.

Poterba, James (1997), "Do Budget Rules Work?", in: Alan J. Auerbach ed., *Fiscal Policy: Lessons From Empirical Research*, Cambridge: MIT Press, pp. 53–86.

Poterba, James. M. (1994), "State Responses to Fiscal Crisis: The Effects of Budgetary Institutions and Politics", *Journal of Political Economy,* 102, pp. 799–821.

Schaltegger, Christoph A. (2002), „Budgetregeln und ihre Wirkung auf die öffentlichen Haushalte: Empirische Ergebnisse aus den US-Bundesstaaten und den Schweizer Kantonen", *Schmollers Jahrbuch*, 122, pp. 369–413.

Schaltegger, Christoph A. and Martin Weder (2010), „Fiskalpolitik als antizyklisches Instrument ? Eine Betrachtung der Schweiz", *Perspektiven der Wirtschaftspolitik*, 11(2), pp. 146–177.

Swiss Federal Council (2008), „Botschaft über die Ergänzungsregel zur Schuldenbremse vom 19 September 2008“, *Bundesblatt 2008*, 42, pp. 8491–8540.
Swiss Federal Council (2006), „Bericht des Bundesrates über die Schuldenentwicklung der öffentlichen Haushalte (Schuldenbericht) vom 23. August 2006“.
Swiss Federal Council (2003), „Botschaft zum Entlastungsprogramm EP 03 vom 2. Juli 2003“, *Bundesblatt 2003*, 32, pp. 5615–5802.
Swiss Federal Council (2001), „Zusatzbericht zur Botschaft zur Schuldenbremse vom 10. Januar 2001“, *Bundesblatt 2001*, 24, pp. 2387–2420.
Swiss Federal Council (2000), „Botschaft zur Schuldenbremse vom 5. Juli 2000”, *Bundesblatt 2000*, 35, pp. 4653–4726.

SUMMARY

The Swiss fiscal rule or “debt brake” is applied to simulated data of economic output and fiscal revenues. The budget remains almost perfectly balanced and the debt ratio stable over the medium and long term: The cyclical adjustment of the debt brake is effective in terms of its primary objective of achieving a balanced budget over the medium term. The rule also performs well with respect to the objective of taking into account the position of the economy in the cycle. In the case of a non-stationary GDP series, however, this result can not be guaranteed anymore.