Prudent Projections?
An Analysis of German States' Budget Forecasts

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Abstract

This paper explores the performance of subnational governments' budget forecasts. Based on a theoretical discussion, we argue that the optimal bias of these forecasts may be non-zero. If negative fiscal shocks are perceived to be more costly than positive fiscal shocks, budget forecasts will tend to be pessimistic. We test this prediction in an empirical analysis of the German states' forecasts of the budget balance over a period of about 50 years. The results confirm the existence of a robust downward bias for the short-term horizon, which disappears for medium-term forecast horizons. Since budget risks tend to increase with the length of the forecast horizon, the strong pessimism found for current and next year budgets suggests that state governments face large short-term adjustment cost if adverse fiscal shocks are realized.

Keywords: Budget Balance; Forecasting; Subnational Governments; Forecast Bias; Asymmetric Loss; Budget Risk; Adjustment Cost

JEL Classification: H68; E32; E62

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1 Introduction

Accurate budget forecasts play a central role in budget planning and monitoring. Empirical research has shown, however, that countries' official budget forecasts tend to biased. As governments tend to build their forecast on optimistic growth forecasts (e.g., Jonung and Larch 2006, Giovannelli and Pericoli 2020), realized deficits are often larger and realized surpluses often smaller than forecasted, contributing to a deficit bias of fiscal policy (*e.g.*, Frankel 2011). In order to overcome this bias, an improvement of budget forecasts is commonly regarded as essential. Consequently, many countries have established independent fiscal councils, whose mandate is to oversee and endorse budget forecasts (*e.g.*, Debrun and Kinda 2017, Calmfors and Wren-Lewis 2011). In fact, forecast accuracy has improved as a result (Beetsma et al. 2019).

Interestingly, at the subnational level, the situation appears to be different. A common finding in the empirical literature on US states' budget forecasts is that revenue forecasts are biased downwards, *i.e.* tend to be pessimistic (*e.g.*, Feenberg et al. 1989, Rodgers and Joyce 1996, Rose and Smith 2012, Krol 2013). One explanation starts from the view that negative fiscal shocks are perceived as more costly than positive fiscal shocks, possibly indicating limited options to rely on debt finance given budget-balance requirements. In this case, fiscal forecasts may not simply aim at providing the most accurate predictions of the budget. Rather, in view of the adjustment cost in case of adverse shocks, the assessment of forecast errors could be asymmetric. This could result in systematic forecast biases, where the budget-balance is consistently underestimated.

This paper explores asymmetries in the assessment of forecast errors and resulting biases. We build our analysis on a theoretical model of fiscal forecasting that determines the optimal forecast using an asymmetric loss function in light of the prevailing uncertainty. Using German states as a testing ground, our results confirm the existence of a robust downward bias of forecasts of the budget balance in the sense that realized deficits are smaller and realized surpluses larger than predicted. Interestingly, the bias varies with the length of the forecast horizon. Our results indicate that the bias is strongest in the short-term and disappears over medium-term forecast horizons. This suggests that subnational governments face large short-term adjustment cost in case of adverse fiscal shocks. Over longer forecast horizons, adjustment cost are substantially lower.

Our paper makes two contributions to the literature on fiscal forecasting. The first contribution is to provide new evidence on the pessimism of fiscal forecasts at subnational level. We have assembled a dataset of the German states' annual budget forecasts, which enables us to explore the forecasts over a period of 51 years. Our analysis documents considerable pessimism in these forecasts. This is in line with the above mentioned literature on US states' budget forecasts and with literature on subnational governments' budgeting in general. Barrett et al. (2019) analyze US school districts and find that the districts are intentionally biasing revenue and expenditure forecasts early in the budgeting process in order to build up fiscal slack. Couture and Imbeau (2009) find that anti-deficit laws induce Canadian provinces to underestimate provincial revenue. For German states, existing empirical literature points to rather optimistic fiscal forecasts (e.g., Heinemann 2006). The literature partly attributes this to the reliance of the states on the coordinated revenue forecast in the German federation ("Working Party on Tax Revenue Estimates") (see also Buettner and Kauder 2015, Ademmer and Boysen-Hogrefe 2022) which is based on the federal government's official growth forecast. The latter suffers from an optimism bias similar to official growth forecasts in other countries. Controlling for common shocks, we find strong evidence for pessimism in the states' budget forecasts. This suggests that the cautionary motive of avoiding deficits found for subnational governments is also present in the German states' budget forecasting.

A second contribution of the paper is to explore how the forecast bias varies with the length of the forecast horizon. A large empirical literature explores the political costs associated with forecast errors (e.g, Paleologou 2005, Brogan 2012, Boukari and Veiga 2018, Bohn and Veiga 2021, Pina and Venes 2011). Based on the asymmetric loss function, we argue that budget forecasting is driven by a precautionary motive that results in biased forecasts, such that the forecasts display considerable pessimism. We provide estimates of the structural asymmetry parameter and show that the asymmetry is prevalent in the short run. This implies that the adjustment cost to adverse budget shocks dominate in the short-run. In the medium term, this concern matters less and forecasts tend to be optimistic.

The paper proceeds as follows. The theoretical discussion in Section 2 shows how a bias may emerge in the presence of an asymmetric loss function. Section 3 explains the empirical methodology. Section 4 gives an overview of the dataset. Section 5 presents the results and Section 6 concludes.

2 Optimal Bias in Budget Forecasts

A (point) forecast of the budget balance $f_{t,t+h}$ made in period t for period $t+h$ is characterized by the date at which it is produced. We refer to the date t as the *publication date* and to the date $t+h$ as the *realization date*.) If $h=0$, the forecast is produced in the same period, if $h=1$, the forecast is a one-period ahead forecast, *etc.* The forecast error is defined as

$$e_{t,t+h} = b_{t+h} - f_{t,t+h}, \tag{1}$$

and the expected forecast error is

$$\mathsf{E}_t\left[e_{t,t+h}\right] = \mathsf{E}_t\left[b_{t+h}\right] - \mathsf{E}_t\left[f_{t,t+h}\right]. \tag{2}$$

If the forecasts are unbiased, $\mathsf{E}_t\left[b_{t+h}\right] = \mathsf{E}_t\left[f_{t,t+h}\right]$, and the expected forecast error is zero. If forecasts deviate systematically from the realization, however, the expected forecast error is non-zero. A forecast is pessimistic, if the forecasted budget balance is below the expectation, and the expected forecast error is positive ($\mathsf{E}_t\left[e_{t,t+h}\right] > 0$). Similarly, the expected error of an optimistic forecast is negative ($\mathsf{E}_t\left[e_{t,t+h}\right] < 0$). Whether an actual forecast is biased, and if so, whether the bias is positive or negative, depends on the loss function of the forecaster (Zellner 1986).

If the forecaster aims at minimizing deviations between forecast and realization and assesses deviations regardless of whether the realisation exceeds or falls short of the forecast, an adequate characterization of the forecaster's objective function is a quadratic loss function, which is commonly used in statistical analysis. In this case, we would observe unbiased forecasts. In the context of public budgets, however, a deficit turning out lower than predicted may have quite different implications for public policy than a deficit that turns out higher than predicted. In the former case, the government has leeway in its budget and the budget can be executed without further action. In the latter case, in particular, if access to debt finance is limited, the government may be forced to consider cutting expenses or raising taxes. For budget forecasting, this could imply that the same absolute deviation between forecast and realization is associated with a higher loss if the forecast turns out to be too optimistic, i.e. if the realized deficit is higher than the forecast, or if

the realized surplus falls short of the forecast.

If the government can rely on debt issuance and is not forced to do short-term adjustments in its spending plans or to raise taxes, incurring a larger deficit than expected is likely to be less of a problem. If the government has full access to the capital market, it is also conceivable that forecasts tend to be optimistic in order to convince the legislator to pursue an expansionary policy. This could be particularly relevant in case of higher forecast horizons, as the burden of adjustment likely falls on future governments. Hence, it is also possible that it is actually preferred to have a situation where the realized deficit is higher than the forecast, or if the realized surplus falls short of the forecast.

In order to discuss an asymmetric assessment of forecast errors, we follow Elliott and Timmermann (2004) and employ a piecewise linear loss function, also referred to a lin-lin loss function. Accordingly, forecast outcomes are assessed depending on whether the forecast error is positive or negative. Formally, the loss function $L\left(e_{t,t+h}\right)$ can be specified as

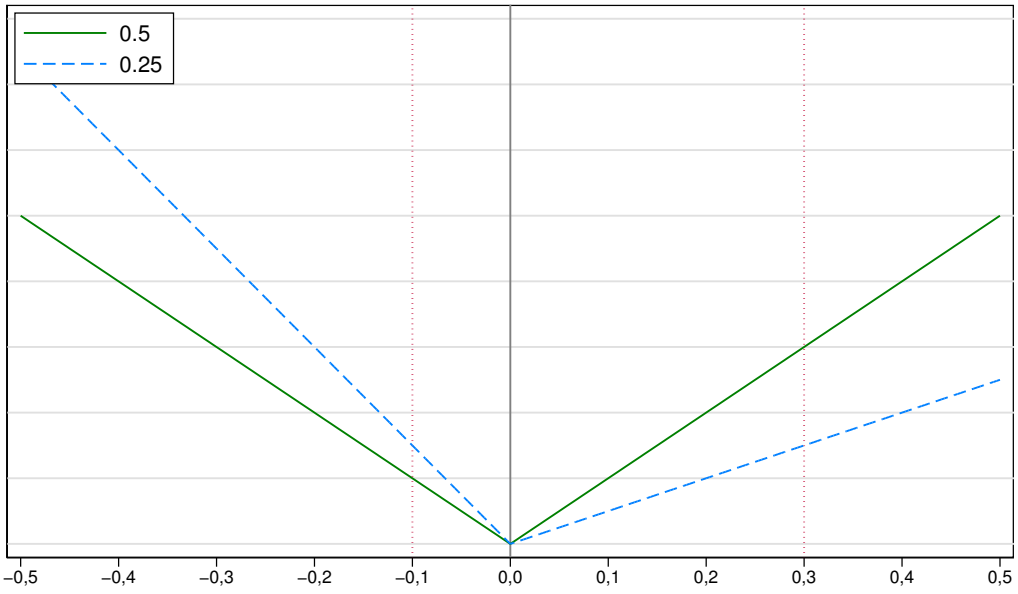
$$L\left(e_{t,t+h}\right) = \left[\gamma_h + \left(1 - 2\gamma_h\right) \cdot 1\left(e_{t,t+h} < 0\right)\right] \left|e_{t,t+h}\right|, \qquad 0 < \gamma_h < 1, \tag{3}$$

where $1\left(e_{t,t+h} < 0\right)$ is a binary indicator function that takes the unit value if $e_{t,t+h} > 0$.

Figure 1 illustrates the lin-lin loss function for two alternative values of the asymmetry parameter. For each level of the forecast error, it plots the value of the respective loss function for forecasts that turn out too optimistic, just right, or too pessimistic. If the budget balance turns out smaller than predicted, the forecast is too optimistic and the forecast error is negative and vice versa. Suppose $\gamma = 0.5$. In this case the function is symmetric and shows the same value regardless of whether the forecast error is positive of negative. In the case of $\gamma = 0.25$, a negative forecast error is associated with a higher loss than a positive forecast error. As indicated by the dashed vertical lines, in this case, a forecast error for the budget balance in terms of total expenditures of 0.3% creates the same loss as a forecast error of about -0.1%.

The optimal forecast $f^*_{t,t+h}$ can be determined, by minimizing the expected loss $\mathsf{E}_t\left[L\left(e_{t,t+h}\right)\right]$. As shown in Elliott and Timmermann (2004), if the forecasted variable is normally distributed with

Figure 1: Loss from Forecast Errors



Lin-lin loss function with asymmetry parameter γ equal to 0.5 or 0.25.

μ_h and σ_h, a closed form solution for the optimal forecast can be obtained. More specifically, in this case, the first-order condition for the optimal forecast obeys

$$1 - \gamma_h - \Phi\left(-\frac{\mu_h - f_h}{\sigma_h}\right) = 0,$$

$\Phi(.)$ is the cumulative density of standard normally distributed error. Noting that $\Phi(.)$ is symmetric, the optimal forecast is

$$f_h^* \quad = \quad \mu_h - \sigma_h \Phi^{-1}(\gamma_h). \tag{4}$$

Hence, the forecast differs from the expected budget balance μ_h, whenever $\gamma_h \neq 0.5$. When the loss function assigns a higher weight to negative forecast errors, $\gamma_h < 0.5$, the second term on the right-hand side of equation 4 is negative and the forecast exceeds the expected budget balance. This is intuitive, since it captures a constellation where the loss is high, in particular, if the realized budget balance falls short of the forecast. Note that the bias rises with the budget risk, i.e. the

standard deviation of the forecast error (σ_h).

The variance of the forecast error is a measure of the difficulties to forecasting the budget balance. As with other stationary macroeconomic variables, the variance of the forecast error will increase with the length of the horizon until the "content horizon" is reached (Galbraith and Tkacz 2007). This enables us to make empirical predictions as to how the bias might vary over the forecast horizon. Based on the ordering of the variance by forecast horizon

$$\sigma_0^2 \leq \sigma_1^2 \leq ... \leq \sigma_H^2, \tag{5}$$

we can derive predictions as to how the bias varies with the length of the forecast horizon. Let us first assume that the asymmetry parameter is constant, i.e. it does not vary with the length of the forecast horizon $\gamma_h = \gamma$. In this case, the optimal bias would increase in absolute terms with the length of the forecast horizon: $\left|e^*_{t,t}\right| \leq \left|e^*_{t,t+1}\right| \leq ... \leq \left|e^*_{t,t+H}\right|$. This prediction is intuitive, as the higher risk associated with a longer forecast horizon provides a stronger incentive to deviate from the expectation.

However, it is not obvious that the asymmetry parameter is constant. In fact, as we argued above, adverse budgetary shocks that reduce the budget balance could be associated with higher political cost, if adjustment through spending cuts or tax increases is required. This is likely to be most relevant for the current budget ($h = 0$), where spending appropriations are already fixed, where part of the budget is already spent, and where little options are available to raise revenues. Dealing with adverse budgetary shocks might also be difficult if they affect the next budget period ($h = 1$) as planning of next year's budget is perhaps already on the way. Rearranging budget plans may require to amend and revise agreements already reached with political stake-holders and interest groups. Conversely, adjustments are likely to be far less problematic if shocks affect budgets in later years ($h \geq 2$).

Since both the variance of the forecast error and the political costs of a false prediction determine the level and direction of the forecast bias, the empirical observation of how the bias varies with the length of the horizon does not generally allow us to draw conclusions about the political costs. However, in the light of the theory, if the bias decreases with the length of the forecast horizon

despite the increasing variance of the forecast error, the political costs of the forecast error must actually fall with the length of the forecasting horizon.

How the bias varies with the length of the horizon, depends on which of the two determinants dominates. Given the ordering of variance as in equation (5), a decline of the optimal bias in absolute terms, when increasing the length of the forecast horizon,

$$\left|e^*_{t,t}\right| \geq \left|e^*_{t,t+1}\right| \geq ... \geq \left|e^*_{t,t+H}\right|,$$

is only possible iff

$$|\gamma_0| \geq |\gamma_1| \geq ... \geq |\gamma_H|.$$

Hence, the asymmetry parameter increases in absolute terms with the length of the forecast horizon.

Against this backdrop, the empirical analysis aims to test two qualitative predictions: (1) whether a bias towards pessimistic forecasting can be observed, and (2) whether this bias increases or decreases with the length of the forecasting period.

3 Empirical Methodology

Our empirical analysis aims at testing whether there is a systematic bias in the budget forecast of German states and, if such bias is found, we want to explore its sign and magnitude. More specifically, we want to explore how the bias varies with the length of the forecast horizon and what this variation implies about the forecaster's loss function. Descriptively, we might explore the average forecast error $a_h = \frac{1}{T}\sum_{j=1}^{T} e_{j,j+h}$, where $j \in T$ is an index for the period to which the forecast refers. Based on our theoretical analysis, given the budget risk, the average forecast error varies with the horizon-specific asymmetry parameter. If the forecaster's loss function attaches a higher weight to negative as compared to positive forecast errors for horizon h, $\gamma_h < 0.5$ and a_h is positive, indicating a systematically pessimistic forecast.

Hence, if the asymmetry parameter is constant, as the risk is increasing with the forecast horizon,

we should expect a_h to be larger in absolute terms for forecasts with a longer horizon. However, if the asymmetry is larger for short-term forecasts, due to higher adjustment costs, for example, a_h may also decline in absolute terms with the forecast horizon.

To estimate the actual degree of forecast asymmetry, we employ a GMM estimation that enables us to estimate the structural asymmetry parameter γ_h. More specifically, we follow Elliott, Timmermann, and Komunjer (2005) and model forecasts as conditional expectations based on relevant circumstances and information. Formally, estimation employs and observes a vector $\mathbf{z}_t$ at the time t when the forecast $f_{t,t+h}$ was produced. If the forecast $f_{t,t+h}$ is chosen to minimize a lin-lin loss objective function as assumed in the theoretical discussion, the following moment conditions holds:

$$\mathsf{E}\left[\mathbf{z}_t' \left[1\left(e_{t,t+h} < 0\right) - \gamma_h\right]\right] = 0, \tag{6}$$

where the number of moment conditions depends on the dimension of $\mathbf{z}_t$. Following Elliott, Timmermann, and Komunjer 2005), γ_h is identified by the unique minimum of a quadratic form

$$\mathsf{Q}\left(\gamma_h\right) \coloneqq \mathsf{E}\left[\mathbf{z}_t' \left[1\left(e_{t,t+h} < 0\right) - \gamma_h\right]\right]' \mathbf{S}^{-1} \mathsf{E}\left[\mathsf{z}_t' \left[\mathbf{1}\left(e_{t,t+h} < 0\right) - \gamma_h\right]\right], \tag{7}$$

where $\mathbf{S}$ is a positive definite weighting matrix. In fact, since the forecast is linear in $\mathbf{z}_t$, the asymmetry parameter follows

$$\gamma_h = \frac{\mathsf{E}\left[\mathbf{z}_t\right]' \mathbf{S}^{-1} \mathsf{E}\left[\mathbf{z}_t \left[1\left(e_{t,t+h} < 0\right)\right]\right]}{\mathsf{E}\left[\mathbf{z}_t\right]' \mathbf{S}^{-1} \mathsf{E}\left[\mathbf{z}_t\right]}, \tag{8}$$

where $\mathbf{S} = \mathsf{E}\left[\mathbf{z}_t \mathbf{z}_t' \left[1\left(e_{t,t+h} < 0\right) - \gamma_h\right]^2\right]$. The empirical estimate of the asymmetry parameter $\widehat{\gamma}_h$, is obtained by replacing the expectations $\mathsf{E}\left[\mathbf{z}_t\right]$ and $\mathsf{E}\left[\mathbf{z}_t' \left[1\left(e_{t,t+h} < 0\right)\right]\right]$ by their respective sample moments and a consistent estimate for $\widehat{\mathbf{S}}$. Since $\mathbf{S}$ depends on γ_h, this estimate is obtained recursively in a standard procedure for GMM estimators.[1]

To explore whether the asymmetry parameter varies with the forecast horizon, we provide separate

[1]Based on an initial estimate of γ_h, which is obtained by inserting an identity matrix for $\mathbf{S}$, $\widehat{\mathbf{S}}$ can be calculated using $\widehat{\mathbf{S}} = T^{-1} \sum_{t=0}^{T} \mathbf{z}_t \mathbf{z}_t' \left[1\left(e_{t,t+h} < 0\right) - \gamma_h\right]^2$. This first estimate of $\mathbf{S}$ can then be used to obtain a new value for γ_h and so forth; this procedure is repeated until the values for S and γ_h converge.

estimates for each horizon. Rather than estimating the set of equations separately, we estimate the parameters for the individual horizons jointly. This enables us to exploit cross-horizon correlation in a GMM system estimator.

As we are using panel data for German states, we can distinguish forecasts not only by date and horizon but also by the respective state. Formally, the observed forecast errors $e_{i,t,t+h}$ can be decomposed as

$$e_{i,t,t+h} = e_i + e_t + e_{t,t+h}, \tag{9}$$

where i is an indicator of the respective state. In this equation, e_i denotes a component that is specific to each state. e_t is an error that is common to each forecast constructed in the same publication year across all states. In fact, parts of the forecast for each state rely on figures generated by the federal government, in particular concerning tax revenues or the effects of tax reforms (e.g., Buettner and Kauder 2015, Ademmer and Boysen-Hogrefe 2022). Specification errors in federal forecast models might then be passed on to the state budget forecasts if the states mechanically translate federal forecasts into their own budgets. If the introduction of fixed effects, controlling for the forecast-error components e_i and e_t changes the values of the γ parameters, we may conclude that the states treat the components from eq. (9) differently.

4 Data

Our dataset covers the budget forecasts made by the German states in the time period from 1973 to 2023. The forecasts span five different horizons: the shortest horizon ($h = 0$) refers to the current year, and the longest horizon ($h = 4$) refers to the budget year four years ahead. In the time period until 1993, the data captures the forecasts of the ten states as well as West Berlin in West-Germany. From the year 1994 on, the dataset includes the ten West-German states as well as re-unified Berlin and the five new states that entered the Federal Republic of Germany in the re-unification process.

Table 1: Descriptive Statistics

	obs.	mean	s.d.	min	max
Budget balance					
Forecast (+0)	549	-9.183	7.552	-35.308	14.794
Forecast (+1)	548	-8.043	7.077	-36.325	12.288
Forecast (+2)	537	-7.299	6.784	-31.769	13.336
Forecast (+3)	525	-6.317	6.672	-33.020	16.888
Forecast (+4)	509	-5.406	6.451	-34.470	17.526
Forecast error (+0)	549	2.207	5.688	-49.832	26.951
Forecast error (+1)	548	1.326	6.127	-51.146	30.498
Forecast error (+2)	537	0.678	7.119	-59.087	38.997
Forecast error (+3)	525	-0.321	7.444	-63.901	24.192
Forecast error (+4)	509	-1.067	7.796	-65.815	38.912
Actual	704	-6.872	8.933	-63.616	25.758

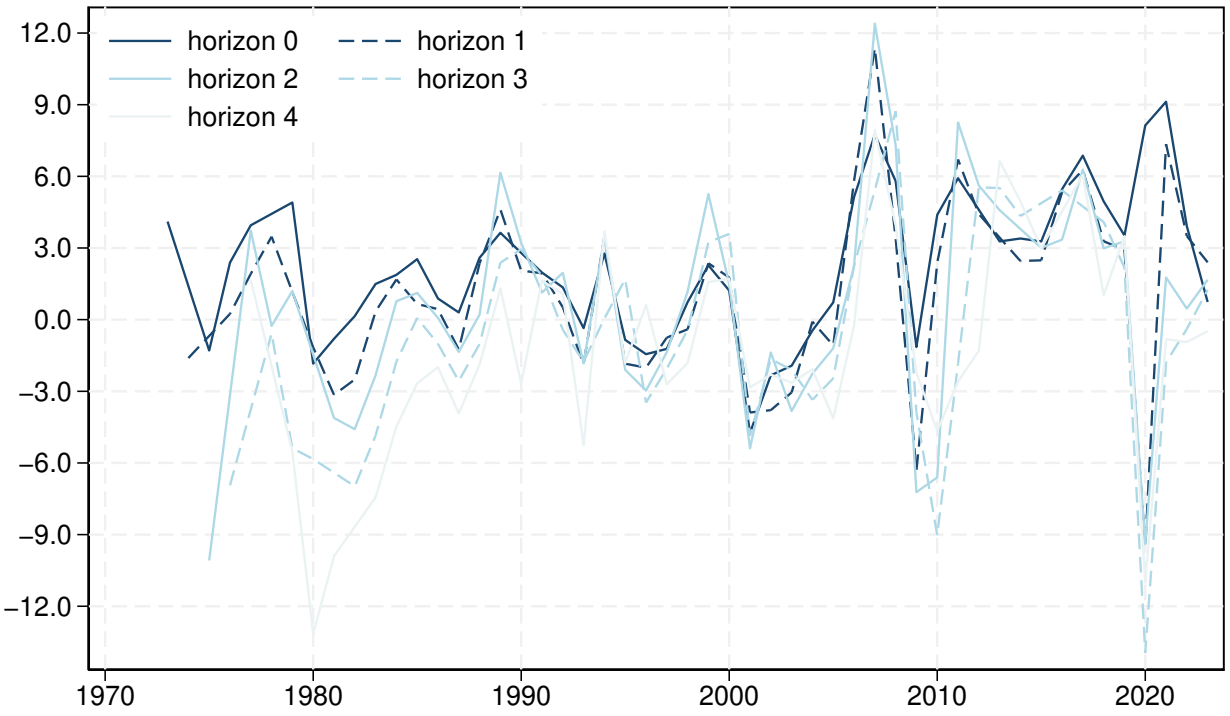
Forecasts and actual budget balance referring to the current year (+0) or in subsequent years (+1 to +4) are expressed in % of primary expenditures in the period preceding the first year of the forecast (-1). The GDP forecast error variables refer for the nominal GDP growth rates. The GDP forecast error for the current year (+0) refers to the annual growth rate. For subsequent years it refers to the biennial, triennial, quadrennial and quinquennial growth rates.

To obtain forecast errors, all forecasts are contrasted with the realized or actual budget balance up to the year 2023. Note that the forecast errors are defined as actual budget balance minus forecasted balance. Thus, a positive forecast error indicates that the actual surplus exceeds the forecast or that the actual deficit is smaller than predicted.

Since states' budgets differ substantially in size, forecasts and realized values are scaled in percent of the respective total primary expenditures (excluding interest on debt) in the year preceding the year when the forecast was made.[2]

[2]If budget forecasts are published with a time lag, we take expenditure in the year preceding the first forecasted year.

Figure 2: Forecast errors

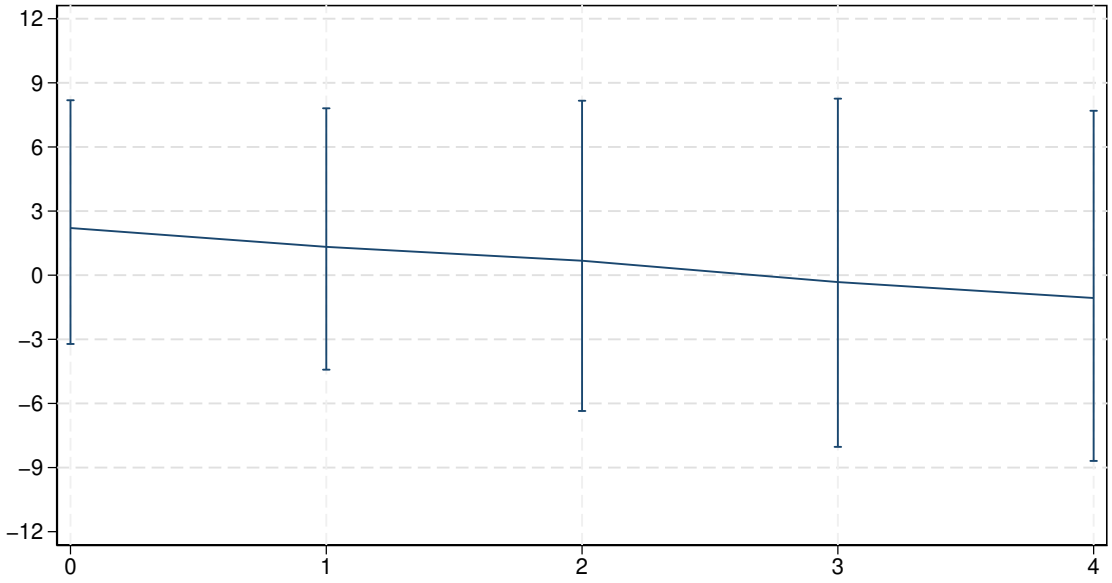


Average forecast error of budget balance in % of total primary expenditure. Data from years 1973 to 1993 for the ten western German states. From 1994 to 2023 for all German states.

Table 1 provides descriptive statistics. Over all five horizons the data includes 2,668 budget forecasts. For the current year, 549 forecasts are included, the number of observations declines a bit for longer horizons as some realizations are not known by now. The mean actual budget balance indicates that on average states were running a deficit of about 7% of the primary expenditures. The mean forecast error varies with the horizon. It tends to show positive figures for shorter and negative figures for longer forecast horizons.

For the current year, the mean forecast error suggests that the actual budget balance turns out to be higher than the forecast by about 2.2 percent of primary expenditures. For the next year, the bias is of a smaller magnitude of about 1.3 percent of the expenditures. Overall, the pessimism seems to decline with the length of the forecast horizon and turns to optimism for forecasts that deal with periods three and four years ahead.

Figure 3: Budget Balance Forecast Errors by Horizon



Mean forecast error and 10 and 90% percentiles of the budget balance forecast error by horizon.

Figure 2 plots the average forecast errors over time by horizon. Compared to the longer horizons, the error of the forecast for the current budget year shows smaller fluctuations. The longer horizons display a stronger cyclical variation. See, for instance the pronounced overprediction in the year 2009 when budgets were hit by the aftermath of the financial crisis, or in 2020 when the COVID crisis happened.

As shown in Table 1, the standard deviation of the forecast error clearly increases with the length of the forecast horizon, pointing to the particular difficulty of making reliable forecasts for longer horizons. This is also highlighted in Figure 3, which plots the 10% and 90% percentiles of the distribution of the forecast error together with the mean forecast error by forecast horizon.

5 Results

Table 2 explores the empirical distribution of forecast errors using regression analysis. The first column reports the average forecast error across all forecast horizons, states and periods. The positive coefficient indicates that, on average, budget balances turn out to be larger than expected by roughly 0.6 percent of primary expenditures. However, there is substantial variation over the forecast horizon.

Column (2) distinguishes the average forecast error by forecast horizon. The results indicate a significant variation of biases with the forecast horizon: in the short term, the forecast error points to considerable pessimism of about 2.2% of primary expenditures. The bias declines as the length of the horizon is increased, and for the four-year ahead forecast error the sign changes: the significant negative coefficient indicates that the forecast is optimistic at this longer time horizon. While this pattern resembles the above descriptive statistics, the regression results indicate that the differences in the forecast error along the time horizon are statistically significant, albeit the coefficients for longer horizons are comparatively less precisely estimated. The differences across horizons are statistically significant in specifications (2) to (4) as indicated by the row for identical effects across horizons.

Column (3) reports results of a specification including state-fixed effects. This specification takes account of differences in risk across states that may be associated with differences in the size of the states. Note that the fixed effects are orthogonalized. Hence, the estimates of the forecast error by horizon are directly comparable to the estimates presented in column (2). For all forecast horizons, coefficients decline somewhat but the qualitative results prove robust. The same result is obtained in column (4), where realization year fixed effects are also included to control for differences in risk over time.

Table 3 displays basic GMM estimates that enable us to recover empirical estimates of the structural asymmetry parameter γ. The estimates in Table 3 rely on the assumption of zero cross-horizon covariances, thereby allowing us to make use of the whole sample. Specification (2) includes state fixed effects and (3) introduces publication year fixed effects, while specification (4) uses both.

Table 2: Forecast Error: Basic Results

	(1)	(2)	(3)	(4)
Constant	0.596*			
	(0.291)			
Horizon (+0)		2.207***	2.169***	2.240***
		(0.322)	(0.361)	(0.208)
Horizon (+1)		1.326***	1.069***	1.146***
		(0.303)	(0.349)	(0.217)
Horizon (+2)		0.678 **	0.457	0.534***
		(0.287)	(0.303)	(0.156)
Horizon (+3)		-0.321	-0.656 *	-0.578***
		(0.335)	(0.334)	(0.140)
Horizon (+4)		-1.067 **	-1.310***	-1.214***
		(0.406)	(0.389)	(0.218)
State FE			✓	✓
Realization year FE				✓
N	2668	2668	2668	2668
R^2	0.000	0.035	0.275	0.301
Identical effects across horizons		33.06***	29.68***	29.06***

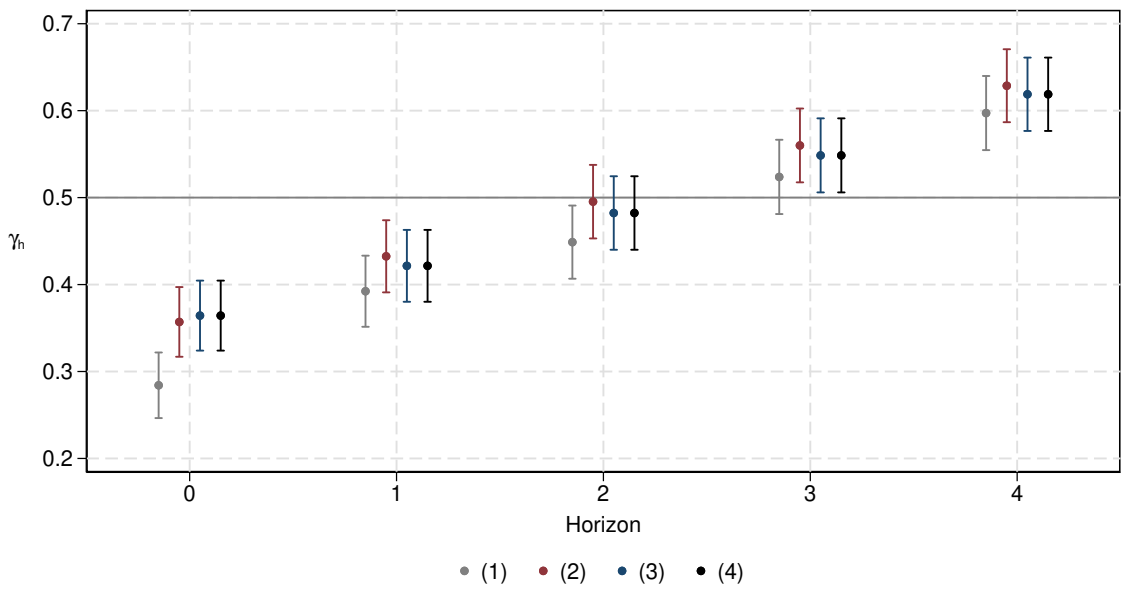
Dep. variable is forecast error of budget balance in % of actual primary expenditure in the year previous to the forecast publication. Standard errors in parentheses are clustered at state level. Stars denote 10% ($\star$), 5% ($\star\star$) and 1% ($\star\star\star$) significance levels. The R^2 refers to the total variation explained by the regression. The reported test for H_0 : equal coefficients shows the respective F-statistic.

Table 3: GMM Estimates for the Asymmetry Parameter (Full Sample)

	(1)	(2)	(3)	(4)
Horizon (+0)	0.284	0.357	0.364	0.364
	(0.019)	(0.020)	(0.021)	(0.021)
Horizon (+1)	0.392	0.432	0.422	0.422
	(0.021)	(0.021)	(0.021)	(0.021)
Horizon (+2)	0.449	0.495	0.482	0.482
	(0.021)	(0.022)	(0.022)	(0.022)
Horizon (+3)	0.524	0.560	0.549	0.549
	(0.022)	(0.022)	(0.022)	(0.022)
Horizon (+4)	0.597	0.629	0.619	0.619
	(0.022)	(0.021)	(0.022)	(0.022)
State FE		✓		✓
Publication year FE			✓	✓
N	2668	2668	2668	2668
$P\left(\lvert Z\rvert \geq \lvert z\rvert \mid H_0\colon \gamma_1 = \gamma_0\right)$	0.000	0.010	0.052	0.052
$P\left(\lvert Z\rvert \geq \lvert z\rvert \mid H_0\colon \gamma_2 = \gamma_1\right)$	0.059	0.038	0.044	0.044
$P\left(\lvert Z\rvert \geq \lvert z\rvert \mid H_0\colon \gamma_3 = \gamma_2\right)$	0.014	0.034	0.030	0.030
$P\left(\lvert Z\rvert \geq \lvert z\rvert \mid H_0\colon \gamma_4 = \gamma_3\right)$	0.017	0.024	0.022	0.022

Standard errors in parentheses. The p value reports the results of the test of the component hypothesis $H_0\colon \gamma_h = \gamma_{h-1}$.

Figure 4: Asymmetry Parameters by Horizon (Full Sample)



GMM estimates for the asymmetry parameter from Table 3 together with the respective 95% confidence interval

Figure 4 plots the coefficient together with confidence intervals by horizon. The horizontal reference line at $\gamma_h = 0.5$ indicates the case of symmetric loss.

The results point in a similar direction as the descriptive analysis: we find pronounced pessimism for the current-year forecasts that mostly disappears at the two-year-ahead horizon. We can reject the null of a symmetric loss function for the current-year forecast and the four-year-ahead forecast at the 5 percent significance level across all specifications (1) to (4). For the three-year-ahead forecast and especially the four-year-ahead forecast, we find evidence for optimism. In particular, we can reject the null of $\gamma_3 = 0.5$ across all specifications except (4). For $h = 4$, we can rejected it across all specifications. As indicated by the overlapping confidence intervals between the specifications across all horizons in figure 4, we cannot find evidence for a heterogeneous treatment of different error components, i.e., there seem to be no cost differences between the error components (see eq. (9)).

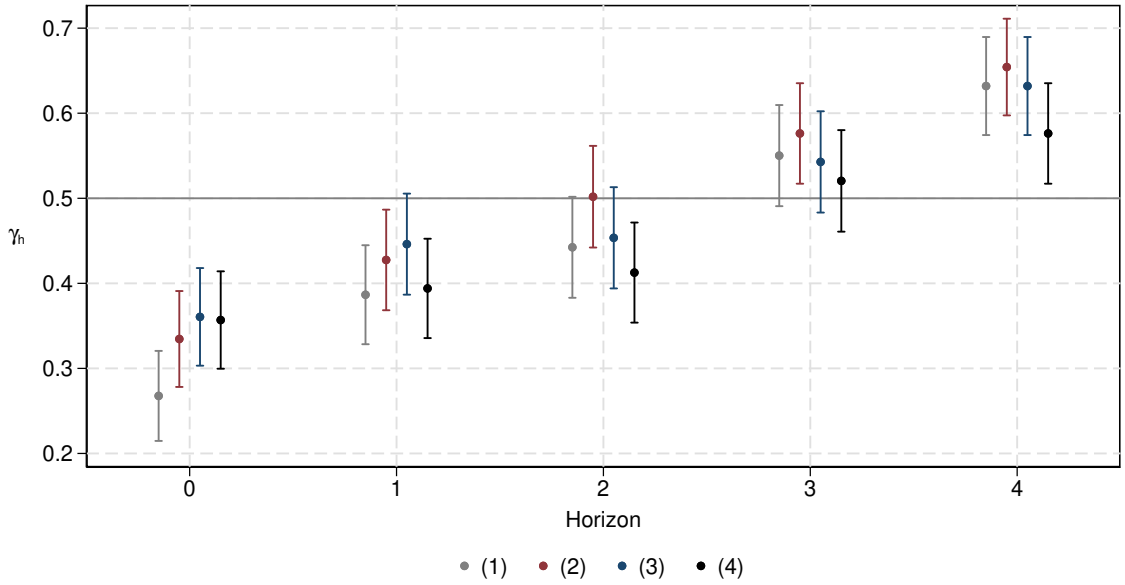
he estimates in Table 4 account for the cross-horizon covariances by introducing a panel structure

Table 4: GMM Estimates for the Asymmetry Parameter (Panel Approach)

	(1)	(2)	(3)	(4)
Horizon (+0)	0.268	0.335	0.361	0.357
	(0.027)	(0.029)	(0.029)	(0.029)
Horizon (+1)	0.387	0.428	0.446	0.394
	(0.030)	(0.030)	(0.030)	(0.030)
Horizon (+2)	0.442	0.502	0.454	0.413
	(0.030)	(0.030)	(0.030)	(0.030)
Horizon (+3)	0.550	0.576	0.543	0.520
	(0.030)	(0.030)	(0.030)	(0.030)
Horizon (+4)	0.632	0.654	0.632	0.576
	(0.029)	(0.029)	(0.029)	(0.030)
State FE		✓		✓
Publication year FE			✓	✓
N	269	269	269	269
$P\left(\lvert Z\rvert \geq \lvert z\rvert \mid H_0\colon \gamma_1 = \gamma_0\right)$	0.000	0.000	0.002	0.172
$P\left(\lvert Z\rvert \geq \lvert z\rvert \mid H_0\colon \gamma_2 = \gamma_1\right)$	0.031	0.003	0.781	0.507
$P\left(\lvert Z\rvert \geq \lvert z\rvert \mid H_0\colon \gamma_3 = \gamma_2\right)$	0.000	0.001	0.002	0.000
$P\left(\lvert Z\rvert \geq \lvert z\rvert \mid H_0\colon \gamma_4 = \gamma_3\right)$	0.001	0.002	0.000	0.038

Standard errors in parentheses. The p value reports the results of the test of the component hypothesis $H_0\colon \gamma_h = \gamma_{h-1}$.

Figure 5: Asymmetry Parameters by Horizon (Panel Approach)



GMM estimates for the asymmetry parameter from Table 4 together with the respective 95% confidence interval

based on the state and the realization year. However, this comes at the cost of losing observations due to the requirements of the covariance matrix estimator. As above, specification (2) contains state fixed effects, (3) includes publication year fixed effects, and (4) uses both. Figure 5 provides the corresponding plot.

Despite a considerable loss in observation, the results are again largely consistent with the basic GMM estimates above: up to $h = 1$, the point estimates indicate pessimism, which seems to mostly diminish for the two-year-ahead forecast. In addition, optimism becomes apparent at $h = 3$ and is most pronounced at $h = 4$. In comparison to the previous estimates using the full sample (table 3 and figure 5), the confidence intervals are wider, making it overall harder to reject the null of a symmetric loss function. Nevertheless, we reject $H_0 : \gamma_1 = 0.5$ and $H_0 : \gamma_4 = 0.5$ at the five percent significance level for all specifications. Moreover, we do not collect evidence for heterogeneity in loss functions for different error components.

The empirical results paint a remarkably clear pattern: the estimate of the asymmetry parameter

rises substantially as the forecast horizon increases. From an economic perspective, this suggests high adjustment costs in particular at short horizon, and much lower adjustment costs over a longer horizon. In fact, the adjustment cost appears to fall monotonically over the forecast horizon. Formally, we can specify this as a testable hypothesis

$$H_0 \colon (\gamma_0 \geq \gamma_1) \vee (\gamma_2 \geq \gamma_1) \vee (\gamma_3 \geq \gamma_2) \vee (\gamma_4 \geq \gamma_3)$$

against

$$H_1 \colon \gamma_0 < \gamma_1 < \gamma_2 < \gamma_3 < \gamma_4,$$

i.e., the alternative hypothesis of monotonicity. A simple approach based on pairwise tests is to reject H_0 (the global null hypothesis) if every partial hypothesis is rejected. Intuitively, this requirement does not inflate our overall type I error, but it comes at the cost of being very conservative. We report the p values for each of the pairwise tests, using the two-sided instead of the one-sided test, which doubles the resulting p values in comparison to the one-sided test. Setting the significance level to $\alpha = 0.1$, we reject the global null across all constellations in Table 3. In Table 4, we do not reject it for the two specifications containing publication year fixed effects. Overall, the γ parameter appears to increase monotonically over the forecast horizons.

The results indicate that the states' budget forecasts tend to be pessimistic at shorter forecast horizons. As forecasters tend to avoid adverse budget outcomes, this points to an asymmetry in the loss function underlying these forecasts. As the risk of budget forecasting increases with the length of the forecast horizon, it seems reasonable to predict that the pessimism increases with the length of the forecast horizon. Interestingly, the opposite is the case: the pessimism is found in particular for the short-term horizon. The pessimism disappears for the medium-term horizon even though the budget risk is higher for this horizon. This suggests that the cost of adverse budget outcomes is much higher in the short-term.

6 Conclusions

Whereas official budget forecasts of developed countries are criticized for being overly optimistic, the literature dealing with subnational governments has often found that budget forecasts are pessimistic. Exploiting the experience with budget forecasting by the German states over a period of 50 years, our results confirm the existence of a robust downward bias of forecasts of the budget balance in particular with respect to shorter forecast horizons. If the length of the forecast horizon increases, the pessimism in the forecast disappears. For medium-term forecasts, the forecast error even points to optimism.

Based on our analysis, the decline of the bias, as the length of the forecast horizon increases, cannot be attributed to differences in risk. A more convincing explanation points to an asymmetry in the loss function of the forecaster associated with the political cost of adverse budget outcomes. Anticipating the struggles to meeting budgetary targets under adverse shocks, governments avoid a difficult budget situation and rather aim at creating some slack by means of pessimistic budget projections.

While our analysis is silent about what drives the political cost of adverse budget outcomes, it should be noted that our results are obtained for subnational jurisdictions. For these jurisdictions, smoothing adverse shocks by debt finance is likely less of an option than for national governments, in particular, if the respective country can issue debt in its own currency. Hence, dealing with adverse budget outcomes may involve lower political cost for national governments as access to the capital market enables these governments to smooth out fluctuations.

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A Appendix

A.1 Data Description

Budget forecast in percent of realized primary expenditure: Forecast of the working balance defined as total revenue minus total expenditure in delineation from the national financial statistics. We divide the balance by realized primary expenditure in the last fiscal year before a given forecast has been prepared and compute primary expenditure as total expenditure minus interest expenditure. Those variables cover the core budgets of the individual federal states. Items not included in the definition of the balance are current net debt assumptions, net of current flows in and out of reserve funds as well as net of revenue generated from cash surpluses and expenditure spent on compensating cash deficits from previous years. Forecasts are reported by the individual governments of the German federal states in their medium-term budget plans. Data on realized expenditure aggregates is taken from the Federal Statistical Office. This ratio is multiplied by 100.

Budget forecast error in percent of realized primary expenditure: Variable *Realized budget* minus variable *Budget forecast*. A positive value means the actual outcome of the budget has been underestimated by a given forecast, while a negative value indicates that the budget has been overestimated.

Forecast of GDP growth rate: The Federal government's official forecasts of nominal GDP growth rates are based on the forecasts of annual growth rates $\hat{g}_{t,t+h}$ published by the Working Party on Tax Revenue Estimation (*Arbeitskreis Steuerschätzung*) in spring of year t for the year $t+h$. For horizons longer than one year, the realized and forecasted annual growth rates are aggregated to biennial, triennial, quadriennial and quinquennial growth rates. More specifically, the rate of economic growth forecasted for the period from year t to year $t+h$ is calculated using: $\hat{y}_{t,t+h} = \prod_{r=0}^{h} (1 + \hat{g}_{t,t+r}) - 1$.

Tax revenue forecasts in annual growth rates: The forecasted values for the nominal tax revenues can be found in the results of the conferences by the Working Party on Tax Revenue Estimation (*Arbeitskreis Steuerschätzung*). As with the GDP growth rates, we agreggate the

realized and forecasted annual growth rates to biennial, triennial, quadriennial and quinquennial growth rates using the formula for compound growth rates: $\hat{y}_{t,t+h} = \prod_{r=0}^{h} (1 + \hat{g}_{t,t+r}) - 1$. Moreover, we use values that refer to the aggregate of all states, as disaggregated data for the individual states are not publicly available.

Realized budget in percent of realized primary expenditure: Realization of the working balance defined as total revenue minus total expenditure in delineation from the national financial statistics. We divide the balance by realized primary expenditure in the last fiscal year before a given forecast has been prepared and compute primary expenditure as total expenditure minus interest expenditure. Those variables cover the core budgets of the individual federal states. Items not included in the definition of the balance are current net debt assumptions, net of current flows in and out of reserve funds as well as net of revenue generated from cash surpluses and expenditure spent on compensating cash deficits from previous years. Data on realized expenditure aggregates is taken from the Federal Statistical Office. This ratio is multiplied by 100.