Avoiding Unpleasant Surprises: An Analysis of German States' Budget Forecasts

Thiess Buettner, FAU and CESifo Tobias Goerbert, FAU†

July 27, 2021

Abstract

This paper explores budget forecasts over different forecast horizons. We argue that these forecasts tend to be pessimistic at a given forecast horizon if negative fiscal shocks are perceived to be more costly than positive fiscal shocks. We provide an empirical analysis of the German states' forecasts of the budget-balance over a period of fourty years. The results confirm the existence of a robust downward bias, supporting a strong negative perception of negative fiscal shocks over the short-term horizon. The bias increases in states with relatively large levels of public debt but is not associated with transfers, government ideology or election dates.

Keywords: Budget Balance; Forecasting; Subnational Governments; Biased Forecasts; Asymmetric Loss

JEL Classification: H68; E32; E62

†Friedrich-Alexander-Universitaet Erlangen-Nuernberg, Lange Gasse 20, 90403 Nuernberg, Germany, thiess.buettner@fau.de, tobias.goerbert@fau.de. We would like to thank Niklas Potrafke for kindly providing us with data on state politics. In addition, we also like to thank Anna Laura Mancini and Niklas Potrafke for helpful comments.

1 Introduction

Empirical research has shown that national budget forecasts tend to be overly optimistic, contributing to a possible 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, accuracy of budget forecasts has improved as a result (Beetsma et al. 2019).

Interestingly, at subnational level, the situation is different. A common finding in the large empirical literature on US states' budget forecasts is that revenue forecast are biased downwards, *i.e.* tend to be pessimistic (*e.g.*, Feenberg 1989, Rodgers and Joyce 1996, Rose and Smith 2012, Krol 2013). A possible explanation is that US states face balanced-budget rules that make it more difficult or politically costly to incur major deficits (Poterba 1995, Bohn and Inman 1996). Hence, they might have an incentive to provide a pessimistic revenue forecast, that helps to build a safety margin in order to comply with the fiscal rules (Leal et al. 2008). The struggle to meet budgetary targets is not unique to the US states but is a common challenge for subnational governments in general. Barrett et al. (2019) analyse 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.

This paper provides an empirical analysis of forecast biases of subnational governments' budget forecast. 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 than predict deficits or realized surpluses are larger than predict surpluses. Interestingly, the bias varies over the forecast horizon. Our results support that bias is strongest in the short-term and disappears over medium forecast horizons.

Our paper makes three contributions to the literature on fiscal forecasting. First, we provide new evidence on the existence of a downward bias or pessimism of fiscal forecasts at subnational level.

To this end, we exploit data on the German states' annual budget forecasts over a period of about 40 years, which have issued forecasting for five different horizons in this period. Our results show that German states' forecasts display considerable pessimism. For the current year, realized budget balances turned out to exceed the forecasts by almost 4 percent of total annual expenditures. We show that the bias increases in states with relatively large levels of public debt but is not associated with transfers, government ideology or election dates.

A second contribution of the paper is to relate the analysis of forecast biases to the notion of an asymmetric loss function. We provide a theoretical discussion showing that with an asymmetric loss function, the forecast error of the budget balance is related to the weight attached to negative fiscal shocks and to the risk of negative shock. This result is in line with Krol (2013), who shows that the "conservative bias" displayed by US states' budget forecasts is indicative of an asymmetric loss function and not a sign of irrational forecasts. Our results suggest that the loss associated with overpredicting the surplus, or underpredicting the deficit, as perceived by the German states is only relevant for shorter forecast horizons. Since the variance of the fiscal shocks increases over longer forecast horizons, this points at high political cost of realizing negative fiscal shocks in the short term.

A third contribution is to highlight the importance of unbiased macroeconomic projections for reliable budget forecasts at state level. Our results document that the forecast errors of the federal government's projection of GDP growth have noticeable effects on the accuracy of the states' budget forecasts. More specifically, we show that optimism in the federal governments' macroeconomic projections drives up the states' own forecasts of the budget balance. This supports the findings of Ademmer and Boysen-Hogrefe (2019) who show that the joint revenue forecasting process chaired by the federal government exerts considerable effects on the budgeting of the German states.

The rest of the paper proceeds as follows. Section 2 presents a theoretical discussion of budget forecasting and shows how bias emerges in the presence of an asymmetric loss function. Section 3 explains the methodology for the empirical analysis. Section 4 gives an overview of the dataset and the main variables used. Section 5 presents the basic results as well as a number of robustness checks. Section 6 concludes.

2 Biases in Forecast Errors

A (point) forecast of the budget balance $\mathsf{F}_{t-h}b_t$ for period t is characterized by the date at which it is produced. If $h = 0$, the forecast is produced in the same period, if $h = 1$, the forecast is a one-period ahead forecast and is produced in period $t - 1$, *etc.*

If a bias exists, forecasts differ from the true expected value. Formally,

$$\mathsf{F}_{t-h}b_t = \mathsf{E}_{t-h}b_t - \alpha_h. \tag{1}$$

α_h measures the bias, *i.e* a discretionary deviation of the h-period-ahead forecast from the expected value. If $\alpha_h > 0$, the forecast is pessimistic as the forecasted budget balance is below the expectation. If $\alpha_h < 0$, the forecast is optimistic as the forecasted budget balance is above the expectation.

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 ignores whether the realization exceeds the forecast or falls short of it, an adequate characterization is a quadratic loss function, which is commonly used in statistical analysis. 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 budgets are subject to balanced budget requirements, the government may be forced to consider raising taxes, cutting expenses or issue more debt. For budget forecasting this may imply that the same absolute deviation between forecast and realization is associated with a higher loss if the realized deficit is higher than the forecast, or if the realized surplus falls short of the forecast.

To account for these asymmetries we follow Elliott, Timmermann, and Komunjer (2005) and augment a standard quadratic loss function with a term that captures the sign of the deviation. At time $t-h$, the expected loss from the forecast of the budget balance in t is

$$\mathsf{L}_{t-h}b_t = \mathsf{E}_{t-h}\left[\left(1+\gamma_h 1\left(F_{t-h}b_t > b_t\right)\right)\left(\mathsf{F}_{t-h}b_t - b_t\right)^2\right], \tag{2}$$

where $1\left(F_{t-h}b_t > b_t\right)$ is an indicator of whether the realization falls short of the forecast. γ_h is the weight attached to this event taking place h periods ahead. If $\gamma_h = 0$, the expected loss function is equal to the conventional quadratic function. If $\gamma_h > 0$, however, a realization that falls short of the forecast is associated with a higher loss than a realization that is equal or higher than the forecast.

By inserting from equation (1), the expected loss depends on the choice of α_h. If the forecaster chooses α_h to minimize the expected loss, formally:[1]

$$\begin{aligned} \alpha_h^* &= \min_{\alpha_h}\left\{\mathsf{L}_{t-h}b_t\right\}, \quad \text{where} \\ \mathsf{L}_{t-h}b_t &= \mathsf{E}_{t-h}\left[\left(1+\gamma_h 1\left(E_{t-h}b_t - \alpha_h > b_t\right)\right)\left(E_{t-h}b_t - \alpha_h - b_t\right)^2\right] \end{aligned} \tag{3}$$

The property of the resulting bias as a function of loss asymmetry and risk, is summarized by the following proposition.

Proposition:

Suppose the budget in period t is subject to a random variable with expected value in period $t-h$ of β_{t-h}. There are two possible states of nature. If a positive shock arises, the budget realization is $b_t = \beta_{t-h} + \sigma_h$. If a negative shock hits, the realization is $b_t = \beta_{t-h} - \sigma_h$. If both shocks are equally likely, the optimal value of α_h obeys

$$\alpha_h^* = \frac{\sigma_h \gamma_h}{2+\gamma_h}.$$

Proof see Appendix A.1.

[1] Note that the analysis assumes that forecasters can optimize forecasts independently over the different forecast horizons. This assumption implies that base effects can be neglected: i.e. a forecast for the next period does not restrict the forecasters ability to make a prediction for the subsequent period.

The expression for α_h in the proposition indicates that the optimal forecast shows a positive bias, iff $\gamma_h > 0$. This is intuitive, since it indicates that a situation where the realization falls short of the forecast is associated with a higher loss. Conversely, when the loss function is symmetric ($\gamma_h = 0$), it is not optimal to produce a biased forecast and $\alpha_h = 0$. Note that the bias increases with the weight attached to a realization falling short of the forecast γ_h.[2] Moreover, the size of the bias rises with an increase in the variance of outcomes (σ_h^2).

3 Empirical Methodology

To assess budget forecasts, we study their predictive power based on the outcome b_t that is observed only after realization of the stochastic component in the budget. The outcome b_t is related to its expectation at the beginning of period t by

$$b_t = \mathsf{E}_t b_t + \epsilon_t,$$

where ϵ_t is the stochastic component, i.e. the innovation in period t. More generally, the expectation at the beginning of period $t - h + 1$ is related to its expectation at the beginning of period $t - h$ by

$$\mathsf{E}_{t-h+1} b_t = \mathsf{E}_{t-h} b_t + \epsilon_{t-h}.$$

By repeated insertion

$$b_t = \mathsf{E}_{t-h} b_t + \sum_{j=0}^{h} \epsilon_{t-j}. \tag{4}$$

[2]The derivative with respect to γ_h is

$$\frac{\partial \alpha_h^*}{\partial \gamma_h} = \frac{\sigma_h}{2 + \gamma_h} \left(1 - \frac{\gamma_h}{2 + \gamma_h} \right) > 0.$$

Hence, the outcome is equal to the expected value at the beginning of period $t-h$ plus the sum of innovations in the periods until period t. Inserting from equation (1) yields

$$b_t = \mathsf{F}_{t-h} b_t + \alpha_h + \sum_{j=0}^{h} \epsilon_{t-j}.$$

Rearranging terms, we obtain an expression for the forecast error:

$$b_t - \mathsf{F}_{t-h} b_t = \alpha_h + u_{t-h,t}, \qquad \text{where} \qquad u_{t-h,t} = \sum_{j=0}^{h} \epsilon_{t-j} \tag{5}$$

Hence, the observed forecast error is driven by two components. One is a stochastic component comprising a (one-side) moving-average process of order h. The other component is the actual forecast bias, the properties of which depend on the incentives of forecasters.

Our empirical analysis employs panel data from German states. Hence, we can generalize the forecast error by introducing variation among states. Assuming that parameters are constant over time, we can use regression analysis to test for a bias. A general specification is:

$$b_{i,t} - \mathsf{F}_{t-h} b_{i,t} = \alpha_h + \mu_i + \delta_t + u_{i,t-h,t} \tag{6}$$

As shocks differ over time, it may be useful to add fixed effects for the respective time-period (δ_t). Since states display differences in risk, *i.e.* differences in the variance of shocks to revenues and expenditures, state-fixed effects may be included (μ_i). We use clustering to account for the correlation in the forecast errors among different horizons which emerges from the fact that the forecasts for different horizons are produced at the same time. More specifically, the standard errors are clustered at the level of state and publication-year intersections.

In the first step of the empirical analysis, we aim at testing whether there is a systematic forecast bias, and, if such bias is found, we want to estimate its sign and magnitude. In the second step, we explore the magnitude of the forecast error over different time horizons relative to the variance of the fiscal shocks. Thirdly, we explore whether certain characteristics of the states are associated with a possible forecast bias. This includes information about public debt and dependency of federal transfers. In a last step, we test for possible political economy effects on the forecast errors and the bias.

4 Data

The dataset collects the budget forecasts made by the German states in the time period from the year 1977 to the year 2018. The forecasts span five different horizons: the shortest horizon ($h = 0$) refers to the current year, the longest horizon ($h = 4$) refers to the budget four years ahead. In the time period until the year 1993 the data captures the forecasts of the ten states in West-Germany. From the year 1994 on, the dataset also includes Berlin and the five new states that entered the Federal Republic of Germany in the unification process. To obtain forecast errors all forecasts are contrasted with the realized or actual budget balance. 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. Since states' budget differ substantially in size, the forecasts and realized values are scaled in percent of the respective total primary expenditures (excluding interest on debt) in the previous year.

Table 1 provides descriptive statistics. Over all five horizons the data includes 2,167 budget forecasts. For the current year, 462 forecasts are included, the number decline with increasing horizon. The means of the forecasts vary with the horizon. The mean actual budget balance indicates that on average states were running a deficit. As the mean forecasted balance is higher then the actual deficit over shorted horizons, the mean forecast error is positive for these horizons. While the mean forecast error declines with the horizon, the variance is increasing. This is also evident in Figure 1, which shows separate plots for the forecast errors by their horizon. At higher horizons the forecast errors display a characteristic cyclical variation, with overprediction in downturns in the beginning of the first decade after millenium and after 2008.

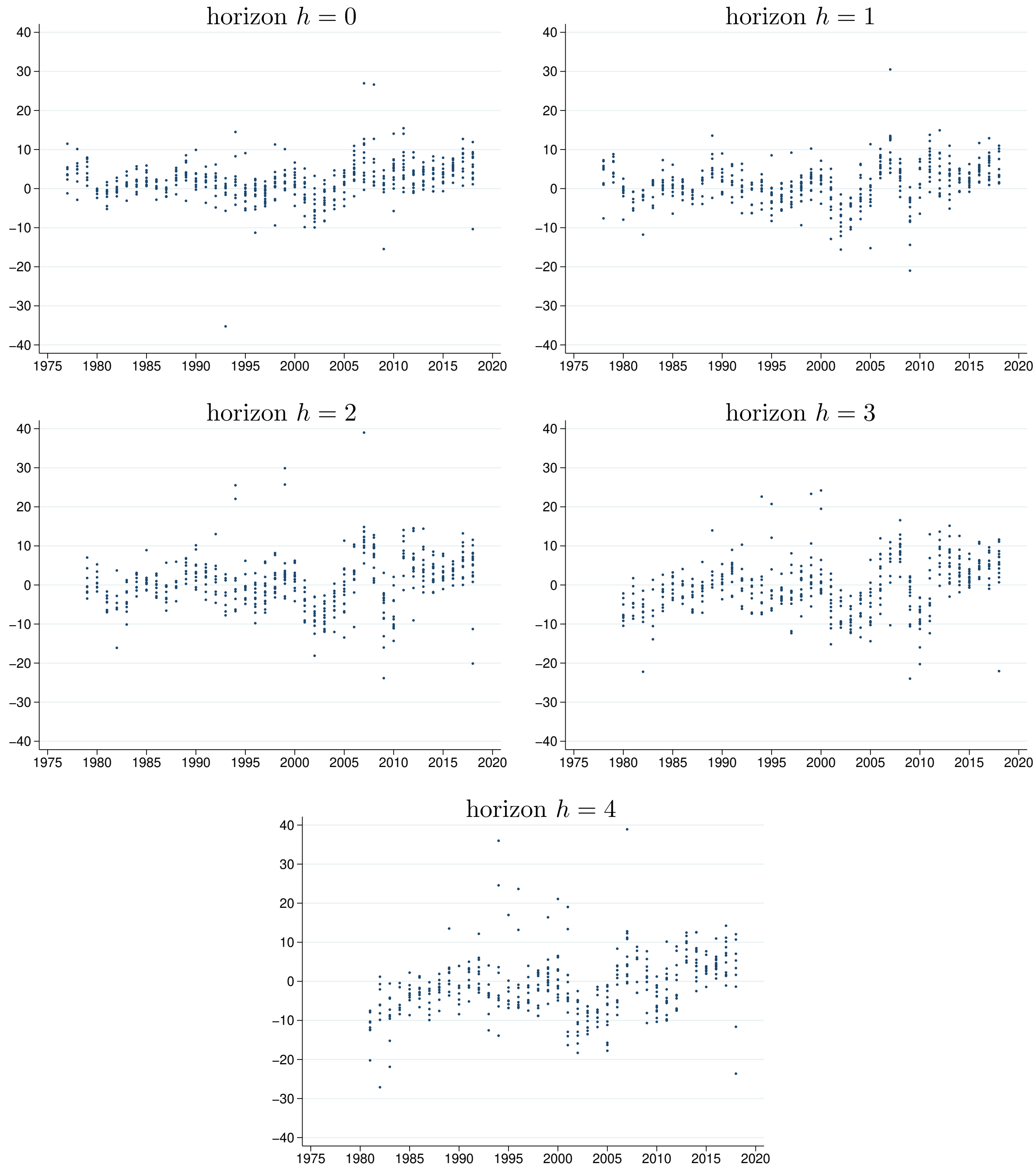
While all states prepare their own budget forecasts, tax revenue forecasting is coordinated at the federal level. Twice a year a joint working group composed by the federal government, all state governments, the central bank, council of economic advisors and research institutes as well

Table 1: Descriptive Statistics

	obs.	mean	s.d.	min	max
Budget balance					
Forecast (+0)	462	-9.147	6.982	-33.142	14.794
Forecast (+1)	450	-8.320	6.505	-30.190	12.288
Forecast (+2)	440	-7.885	6.572	-28.864	13.336
Forecast (+3)	425	-7.025	6.416	-27.595	16.888
Forecast (+4)	390	-6.232	6.220	-29.071	17.526
Forecast error (+0)	462	2.018	4.847	-35.258	26.951
Forecast error (+1)	450	1.276	5.297	-20.993	30.498
Forecast error (+2)	440	0.784	6.742	-23.847	38.997
Forecast error (+3)	425	-0.339	6.806	-23.981	24.192
Forecast error (+4)	390	-1.144	7.681	-27.112	38.912
Actual	2,167	-7.196	8.560	-39.941	25.758
GDP growth rate					
Forecast error (+0)	42	0.015	0.953	-2.000	2.400
Forecast error (+1)	41	-0.538	2.711	-7.292	5.292
Forecast error (+2)	40	-1.515	4.283	-7.804	9.820
Forecast error (+3)	39	-2.764	5.765	-11.308	14.820
Forecast error (+4)	38	-4.323	7.467	-15.374	18.157
Public debt					
Total debt	462	166.22	90.738	8.941	512.400
Short term maturity in %	462	22.379	12.510	0.000	97.324
Other control variables					
Intergov.revenue	462	26.965	11.741	2.313	68.225
Government ideology	462	0.516	0.458	0.000	1.000
Election current year	462	0.193	0.395	0.000	1.000
Election next year	462	0.235	0.424	0.000	1.000

Forecasts, actual budget balance, public debt total and intergovernmental revenue are expressed in % of primary expenditures in the period preceding the forecast publication. Forecasts and actual values of annual GDP growth rates are transformed to cover growth over the full forecast horizon. Forecast error of GDP growth is the difference between the actual GDP growth rate over the respective horizon in % and the corresponding rate for the forecast by the federal government (BMWI). Government ideology is an indicator variable with zero value for right-wing, and unit value for left-wing government. Election year variables are binary.

Figure 1: Budget Forecast Errors by Horizon



State budget forecast error in % of total primary expenditure measured at the end of the preceding year by year of production of the forecast. Data from years 1977 to 1993 for the ten western German states. From 1994 to 2018 for all German states.

representatives of municipalities provide a tax revenue forecast for Germany as whole.[3] As this revenue forecast is based on the federal government's projection of the GDP, the literature has identified the GDP forecast of the federal government as a source of bias in the German tax revenue forecasts (*e.g.*, Buettner and Kauder 2015). To see whether this influences states' own budget forecasts, we include the forecast error of the GDP growth rate as explanatory variable. In accordance with Lehmann and Wollmershäuser (2020) who show that the federal government's GDP projections are overly optimistic for higher forecast horizons, the descriptive statistics show negative means for the forecast error for higher horizons. For a period of four years ahead, the GDP growth turns out to be 4.3 percentage points smaller than predicted.

The above theoretical discussion suggests that budget forecasts may be biased if the loss function is asymmetric. More specifically, if a negative fiscal shock exerts greater losses for the forecasting government, forecasts are pessimistic. As states with higher debt levels may be more concerned about negative fiscal shocks and may even worry more about risks associated with rolling over debt, the strength of the bias could increase with the debt level and the fraction of debt financed short term. To test for this, we include a variable capturing total outstanding state debt as well as a variable indicating the fraction of debt with remaining time to maturity below one year (short-term maturity). The former is expressed relative to the primary expenditures, the latter is defined in percent of total debt. Note that the level and maturity refer to the previous period and the scaling is done using primary expenditures of the last year.

Further control variables capture possibly relevant political circumstances when forecasts are made. Since states with heavy reliance on intergovernmental revenue may operate under a soft-budget constraint, they might have an incentive to manipulate forecasts. To explore this empirically, we add a variable that reflects the importance of intergovernmental revenue. It measures the total volume of transfers received in percent of primary expenditures. In the analysis, we lag this indicator because only the realized value for the preceding year is known at the date when the forecast is prepared.

Besides rollover risks and soft-budget constraints, the asymmetric losses may also occur in the

[3] For a description of tax revenue forecasting in Germany, see OECD (2015).

context of elections. In particular, governments in the last term of their office may present overestimated tax projections in order to bring forward expenditures or tax cuts that benefit its own constituents (Bischoff and Gohout 2010). Whether state elections are held in the respective or upcoming year is captured by two binary variables. We also employ an indicator of government ideology following Kauder, Krause, and Potrafke (2018). It has zero value for right-wing governments and unit value for left-wing/liberal governments.

5 Results

5.1 Basic Results

Table 2 reports basic regression results. The first column reports the average forecast error across all forecast horizons, states and periods. The positive coefficient indicates that on average budget balances turned out to be larger than expected by about 0.6 percent of primary expenditures. Column (2) provides the results if the sample is restricted to the ten states in West Germany, which are observed over a much longer period.

Column (3) introduces different forecasts by forecast horizon. The coefficients point to significant differences in the forecast error. Note that inference is based on robust standard errors which take account of the likely correlation of errors over the different horizons. For the current year, the actual balance turns out to be higher than the forecast by 2.0 percent of expenditures. The pessimism declines with the horizon and turns to optimism for forecasts that deal with periods three and four years ahead. As reported in column (4), similar results are obtained if the sample is restricted to the ten states in West Germany.

Columns (5) and (6) report results of specifications that include period-specific effects for the budget period. This removes the effects of common shocks, in particular of macroeconomic shocks. While the forecast errors for short-horizons prove robust, the optimism associated with higher-horizons is not found in this specification. This indicates that the optimism over higher-horizons is associated with the macroeconomic development.

Table 2: Budget Balance Forecast Error: Basic Results

Horizon	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
0 to 5	0.582 ***	0.284						
	(0.205)	(0.221)						
0			2.018 ***	1.891 ***	4.207 ***	4.207 ***	3.920 ***	3.866 ***
			(0.226)	(0.247)	(1.196)	(1.200)	(1.371)	(1.385)
1			1.276 ***	1.086 ***	3.365 ***	3.373 ***	3.090 **	3.033 **
			(0.250)	(0.265)	(1.207)	(1.213)	(1.388)	(1.407)
2			0.784 **	0.452	2.993 **	2.849 **	2.724 *	2.509 *
			(0.322)	(0.351)	(1.222)	(1.233)	(1.393)	(1.412)
3			-0.339	-0.680 *	1.989	1.861	1.726	1.524
			(0.330)	(0.379)	(1.225)	(1.238)	(1.396)	(1.420)
4			-1.144 ***	-1.657 ***	1.139	0.849	0.867	0.490
			(0.389)	(0.440)	(1.220)	(1.231)	(1.390)	(1.408)
States	all	west	all	west	all	west	all	west
Year f.-eff.	no	no	no	no	yes	yes	yes	yes
State f.-eff.	no	no	no	no	no	no	yes	yes
N	2,167	1,636	2,167	1,636	2,167	1,636	2,167	1,636
R^2	0.000	0.000	0.039	0.042	0.392	0.356	0.427	0.377

Dep. Variable is forecast error of budget balance in % of actual primary expenditure in the year previous to the forecast publication. hi is a dummy for forecast horizon. Columns (5) and (6) include fixed effects for the respective observation year. Columns (7) and (8) include also state fixed-effects. Robust standard errors in parentheses, clustered at state and publication-year intersection. The R^2 refers to the total variation.

Table 3: Fiscal Risks over the Forecast Horizons

States	all				West Germany			
	obs.	var.	s.d.	γ	obs.	var.	s.d.	γ
Horizon +0	462	17.450	4.177	30.468	347	17.134	4.139	28.289
Horizon +1	450	14.683	3.832	8.331	339	13.611	3.689	9.243
Horizon +2	440	23.875	4.886	2.520	332	24.023	4.901	2.098
Horizon +3	425	26.361	5.314	1.013	322	27.771	5.270	0.814
Horizon +4	390	38.105	6.173	0.327	296	40.083	6.331	0.168

Residual variance, residual standard deviation and estimates of γ for the regressions shown in columns (7) and (8) of Table 2. We exploit our result for the optimal forecast bias from above and use $\hat{\gamma}_h = 2/(\hat{\sigma}_h/\hat{\alpha}_h - 1)$ to estimate the loss perception of a negative fiscal shock.

Column (7) and (8) show results obtained when also state fixed effects are included. Those effects may be important since the biases in forecasts are presumably different between states. If small states are subject to higher revenue uncertainty, for instance, the above theoretical discussion suggests that they might display a stronger bias. By including state fixed effects, differences in exposure to risk across states is controlled for. Note that both state and year fixed effects are jointly significant and the coefficient of determination shows that 42.7 or 37.7 percent of the variation of forecast errors is captured by specifications that employ a full set of fixed effects. The results of these specifications support the bias in budget forecasts for shorter horizons.

From a theoretical perspective, the bias is increasing with both the loss perception of a negative fiscal shock (captured above by γ_h) and the potential magnitude of the shock (captured above by σ_h). Table 3 reports the estimated residual variance and standard deviation as well as implied coefficients of the loss perception for the regressions shown in columns (7) and (8) of Table 2. Residual variance clearly increases with the forecast horizon. This points to an increase of fiscal risk over the time horizon of the forecast. Since the estimated bias decreases with the forecast horizon, the perceived loss of a negative shock is particularly large in the short term. Over the medium term, the asymmetry in the perceived loss disappears completely.

Table 4: Budget Balance Forecast Error: GDP Forecast and Fiscal Conditions

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
h0	4.596 ***	4.490 ***	3.419 **	3.606 **	3.175 **	3.771 **	3.960 **	3.262 *
	(1.380)	(1.397)	(1.400)	(1.414)	(1.480)	(1.511)	(1.638)	(1.819)
h1	3.968 ***	3.820 ***	2.840 **	2.979 **	2.599 *	3.124 *	3.381 **	2.635
	(1.403)	(1.425)	(1.416)	(1.431)	(1.495)	(1.527)	(1.668)	(1.869)
h2	3.928 ***	3.572 **	2.864 **	2.788 *	2.622 *	2.951 *	3.403 **	2.444
	(1.410)	(1.429)	(1.418)	(1.436)	(1.491)	(1.527)	(1.669)	(1.867)
h3	3.333 **	2.944 **	2.334	2.214	2.094	2.377	2.870 *	1.871
	(1.428)	(1.454)	(1.426)	(1.443)	(1.497)	(1.529)	(1.678)	(1.888)
h4	2.985 **	2.372	2.053	1.698	1.817	1.860	2.584	1.356
	(1.443)	(1.466)	(1.438)	(1.453)	(1.499)	(1.532)	(1.668)	(1.845)
GDP for.err.	0.322 ***	0.297 ***	0.338 ***	0.312 ***	0.335 ***	0.315 ***	0.333 ***	0.313 ***
	(0.047)	(0.051)	(0.048)	(0.052)	(0.047)	(0.052)	(0.047)	(0.051)
Total debt			0.012 ***	0.009 **	0.012 ***	0.009 **	0.011 ***	0.009 **
			(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Short-t. debt					0.034	-0.023		
					(0.050)	(0.060)		
Interg. rev.							-0.017	0.011
							(0.026)	(0.035)
States	all	west	all	west	all	west	all	west
Year f.-eff.	yes	yes	yes	yes	yes	yes	yes	yes
State f.-eff.	yes	yes	yes	yes	yes	yes	yes	yes
N	2,167	1,636	2,167	1,636	2,167	1,636	2,167	1,636
R^2	0.450	0.401	0.456	0.405	0.456	0.405	0.456	0.405

Dep. Variable is forecast error of budget balance in % of actual primary expenditure in the year previous to the forecast publication. hi is a dummy for forecast horizon. All models shown include fixed effects for the respective observation year and state. Robust standard errors in parentheses, clustered at state and publication-year intersection. The R^2 refers to the total variation.

5.2 Robustness Tests

As noted above, as a source of bias in revenue forecasts, previous literature has pointed to the role of the federal government's forecast of GDP growth. Since this forecast is also underlying the states' own budget forecasts it is likely that part of the bias in the budget balance is related to the biased forecasts of the growth by the federal government.

The effects of the GDP forecast error on the forecast of the budget balance are explored by including the forecast error of GDP growth as a control variable in the equation (6). Table 4 provides the results. As above, the table reports pairs of specifications which differ in the estimation sample.

In both specifications the GDP growth forecast error shows a strong positive effect, indicating that a more optimistic macroeconomic growth forecast drives up the forecast error of the budget balance. Conditional on the GDP growth forecast error, the optimism over the longer forecast horizons is removed. However, the pessimism in the shorter horizon is not much affected. Quantitatively, the forecast error for the budget balance in the current period amounts to 4.6 percent of primary expenditures. This pessimism declines with the horizon and is only significant for the four-period-ahead forecast error of all German states at the 5 percent level.

Columns (3) and (4) report results of specifications that include total debt. The positive sign indicates that the forecast pessimism increases with the level of debt. The point estimate indicates that an increase of debt (in % of expenditures) by one standard deviation results in an increase in the forecast error by 1.1 percentage points (0.8 for western German states). The structure of debt in terms of the fraction of debt with maturity less than one year shows no noticeable effects (see columns (5) and (6)). Similarly, dependency on transfers shows no effects either (see columns (7) and (8)).

Table 5 reports results obtained when including government ideology or election dates. Columns (1) and (2) indicate that government ideology itself is not clearly correlated with the forecast error. Note in particular that the sign changes between the basic estimation sample and the sample that covers only the western German states. Though Bischoff and Gohout (2010) find that states issue optimistic tax revenue forecasts when reelection is uncertain, election years do not show major effects on the forecast error of the budget balance. Of course, it is possible that the election dates exerts different effects over the horizon. In particular, in an election year, the short-term pessimism might be reduced as the realization of positive or negative shocks will take place after a new government is elected. However, also horizon-specific effects were not found in corresponding regressions (results available upon request). The lack of correlation between the forecast error of the budget balance and political variables corroborates the findings of Kauder, Potrafke, and Schinke (2017).

Table 5: Budget Balance Forecast Error: Ideology and Elections

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
h0	3.284 **	3.728 ***	3.418 **	3.608 **	3.367 **	3.610 **	3.332 **	3.583 **
	(1.416)	(1.428)	(1.402)	(1.417)	(1.403)	(1.416)	(1.408)	(1.420)
h1	2.707 *	3.099 **	2.841 **	2.984 **	2.788 *	2.983 **	2.756 *	2.960 **
	(1.431)	(1.444)	(1.419)	(1.434)	(1.420)	(1.432)	(1.425)	(1.436)
h2	2.735 *	2.903 **	2.865 **	2.795 *	2.812 **	2.792 *	2.782 *	2.772 *
	(1.431)	(1.448)	(1.421)	(1.439)	(1.421)	(1.438)	(1.427)	(1.443)
h3	2.212	2.322	2.338	2.224	2.282	2.218	2.256	2.201
	(1.437)	(1.450)	(1.428)	(1.446)	(1.431)	(1.447)	(1.436)	(1.451)
h4	1.941	1.795	2.058	1.709	2.003	1.702	1.978	1.686
	(1.446)(	1.458)	(1.440)	(1.455)	(1.439)	(1.450)	(1.443)	(1.454)
F.e. GDP g. r.	0.341 ***	0.309 ***	0.340 ***	0.315 ***	0.338 ***	0.312 ***	0.341 ***	0.315 ***
	(0.048)	(0.052)	(0.048)	(0.052)	(0.048)	(0.052)	(0.048)	(0.053)
Lagged debt	0.011 ***	0.009 **	0.011 ***	0.009 **	0.012 ***	0.009 **	0.011 ***	0.009 **
	(0.003)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Gov. ideology	0.393	-0.342						
	(0.411)	(0.445)						
Election year			0.377	0.326			0.454	0.348
			(0.318)	(0.377)			(0.331)	(0.394)
Year before election					0.172	-0.013	0.278	0.078
					(0.360)	(0.402)	(0.375)	(0.420)
States	all	west	all	west	all	west	all	west
Year f.-eff.	yes	yes	yes	yes	yes	yes	yes	yes
State f.-eff.	yes	yes	yes	yes	yes	yes	yes	yes
N	2,167	1,636	2,167	1,636	2,167	1,636	2,167	1,636
R^2	0.456	0.405	0.456	0.405	0.456	0.405	0.457	0.405

Dep. Variable is forecast error of budget balance in % of actual primary expenditure in the year previous to the forecast publication. hi is a dummy for forecast horizon. All models shown include fixed effects for the respective observation year and state. Robust standard errors in parentheses, clustered at state and publication-year intersection. The R^2 refers to the total variation.

6 Conclusions

Whereas national budget forecasts often tend to be 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 more than 40 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. The bias increases in states with relatively large levels of public debt but is not associated with transfers or political variables.

Our results support the view that biased forecasts arise if the loss function of the forecaster is asymmetric. Since the experience of the German states points at an increase of fiscal risk over a longer forecast horizon, it is remarkable that the bias declines rather than increases with the horizon. Our findings indicate that the perceived loss of a negative fiscal shock by the German states is particularly large in the short term and disappears over the medium term. A potential explanation is that governments mainly struggle with meeting the budgetary targets for the current and next budgets and try to prepare for a negative fiscal shock by creating some fiscal slack.

With regard to the role of fiscal rules, our findings raise the question, whether and how the asymmetry of the perceived loss changes under such rules. In the period under consideration the German states have mostly operated without tight fiscal rules. With the introduction of the debt brake in the year 2020 this has changed. Future research will show whether this has led to changes in the forecast biases.

References

Ademmer, Martin and Jens Boysen-Hogrefe (2019). "The impact of forecast errors on fiscal planning and debt accumulation". In: *Kiel Working Paper*.

Barrett, Nathan et al. (2019). "Forecast bias and fiscal slack accumulation in school districts". In: *The American Review of Public Administration* 49.5, pp. 601–613.

Beetsma, Roel et al. (2019). "Independent fiscal councils: Recent trends and performance". In: *European Journal of Political Economy* 57, pp. 53–69.

Bischoff, Ivo and Wolfgang Gohout (2010). "The political economy of tax projections". In: *International Tax and Public Finance* 17.2, pp. 133–150.

Bohn, Henning and Robert P Inman (1996). "Constitutional Limits and Public Deficits: Evidence from the US. States". In: *Carnegie-Rachester Conference Series on Public Policy*. Vol. 45, pp. 13–76.

Buettner, Thiess and Björn Kauder (2015). "Political biases despite external expert participation? An empirical analysis of tax revenue forecasts in Germany". In: *Public Choice* 164.3, pp. 287–307.

Calmfors, Lars and Simon Wren-Lewis (2011). "What should fiscal councils do?" In: *Economic Policy* 26.68, pp. 649–695.

Couture, Jérôme and Louis M Imbeau (2009). "Do governments manipulate their revenue forecasts? Budget speech and budget outcomes in the Canadian provinces". In: *Do They Walk Like They Talk?* Ed. by Imbeau Louis M. New York: Springer, pp. 155–166.

Debrun, Xavier and Tidiane Kinda (2017). "Strengthening post-crisis fiscal credibility: fiscal councils on the rise–a new dataset". In: *Fiscal Studies* 38.4, pp. 667–700.

Elliott, Graham, Allan Timmermann, and Ivana Komunjer (2005). "Estimation and testing of forecast rationality under flexible loss". In: *Review of Economic Studies* 72.4, pp. 1107–1125.

Feenberg, Daniel R et al. (1989). "Testing the Rationality of State Revenue Forecasts". In: *The Review of Economics and Statistics* 71.2, pp. 300–308.

Frankel, Jeffrey (2011). "Over-optimism in forecasts by official budget agencies and its implications". In: *Oxford Review of Economic Policy* 27.4, pp. 536–562.

Kauder, Björn, Manuela Krause, and Niklas Potrafke (2018). “Electoral cycles in MP’s salaries: Evidence from the German states”. In: *International Tax and Public Finance* 25.4, pp. 841–866.

Kauder, Björn, Niklas Potrafke, and Christoph Schinke (2017). “Manipulating Fiscal Forecasts: Evidence from the German States”. In: *Finanzarchiv* 73.2, pp. 213–236.

Krol, Robert (2013). “Evaluating state revenue forecasting under a flexible loss function”. In: *International Journal of Forecasting* 29.2, pp. 282–289.

Leal, Teresa et al. (2008). “Fiscal forecasting: lessons from the literature and challenges”. In: *Fiscal Studies* 29.3, pp. 347–386.

Lehmann, Robert and Timo Wollmershäuser (2020). “The macroeconomic projections of the German government: A comparison to an independent forecasting institution”. In: *German Economic Review* 1.ahead-of-print.

OECD (2015). *Budget review: Germany*. OECD Journal on Budgeting. Paris.

Poterba, James M (1995). “Balanced budget rules and fiscal policy: Evidence from the states”. In: *National Tax Journal* 48.3, pp. 329–336.

Potrafke, Niklas (2020). “Dragnet-Controls and Government Ideology”. In: *Defence and Peace Economics* 31.5, pp. 485–501.

Rodgers, Robert and Philip Joyce (1996). “The effect of underforecasting on the accuracy of revenue forecasts by state governments”. In: *Public Administration Review*, pp. 48–56.

Rose, Shanna and Daniel L Smith (2012). “Budget slack, institutions, and transparency”. In: *Public Administration Review* 72.2, pp. 187–195.

Zellner, Arnold (1986). “Biased predictors, rationality and the evaluation of forecasts”. In: *Economics Letters* 21.1, pp. 45–48.

A Appendix

A.1 Proof of Proposition

Under the assumption about the budget realization process, the loss function can be evaluated under the different states of nature:

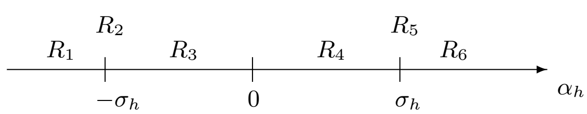
$$\mathsf{L}_{t-h}b_t = \frac{1}{2}\left(1+\gamma_h 1\left(\sigma_h > \alpha_h\right)\right)\left(\sigma_h - \alpha_h\right)^2 + \frac{1}{2}\left(1+\gamma_h 1\left(\sigma_h < -\alpha_h\right)\right)\left(\sigma_h + \alpha_h\right)^2 \tag{A.7}$$

The first-order derivative of the loss function is:

$$\begin{aligned}\frac{\partial \mathsf{L}_{t-h}b_t}{\partial \alpha_h} &= -\left(1+\gamma_h 1\left(\sigma_h > \alpha_h\right)\right)\left(\sigma_h - \alpha_h\right) + \frac{1}{2}\left(\sigma_h - \alpha_h\right)^2 \gamma_h \frac{\partial 1\left(\sigma_h > \alpha_h\right)}{\partial \alpha_h} \\ &\quad + \left(1+\gamma_h 1\left(\sigma_h < -\alpha_h\right)\right)\left(\sigma_h + \alpha_h\right) + \frac{1}{2}\left(\sigma_h + \alpha_h\right)^2 \gamma_h \frac{\partial 1\left(\sigma_h < -\alpha_h\right)}{\partial \alpha_h}\end{aligned}$$

In the evaluation of this expression, it is convenient to separate six intervals for the parameter α_h (see figure A.1).

Figure A.1: Parameter Intervals



R1: $-\sigma_h > \alpha_h$ R4: $0 \leq \alpha_h < \sigma_h$

R2: $-\sigma_h = \alpha_h$ R5: $\alpha_h = \sigma_h$

R3: $-\sigma_h < \alpha_h < 0$ R6: $\alpha_h > \sigma_h$

R1: In the first range, the derivative of the loss function is:

$$\frac{\partial \mathsf{L}_{t-h}b_t}{\partial \alpha_h} = \left(1+\gamma_h\right) 2\alpha_h < 0$$

The inequality follows, since $\alpha_h < 0$ in this parameter range.

R2: If $-\sigma_h = \alpha_h$, the derivate is:

$$\frac{\partial \mathsf{L}_{t-h} b_t}{\partial \alpha_h} = (1+\gamma_h)\, 2\alpha_h - \frac{1}{2}(\sigma_h - \alpha_h)^2 \gamma_h < 0$$

The inequality follows, since $\alpha_h < 0$ in this parameter range.

R3: If $-\sigma_h < \alpha_h < 0$, the derivate is:

$$\frac{\partial \mathsf{L}_{t-h} b_t}{\partial \alpha_h} = 2\alpha_h + \gamma_h \alpha_h - \gamma_h \sigma_h < 0.$$

R4: If $0 \leq \alpha_h < \sigma_h$, the derivate is:

$$\frac{\partial \mathsf{L}_{t-h} b_t}{\partial \alpha_h} = -(1+\gamma_h)(\sigma_h - \alpha_h) + (\sigma_h + \alpha_h)$$

Since $\sigma_h < \alpha_h$, this derivative is ambiguous. The first term is negative, the second term is positive. If α_h is close to zero, $\alpha_h (2+\gamma) < \sigma_h \gamma$ and the expression is negative. This also holds if $\alpha_h = 0$. If α_h is close to σ_h, however, the second term is close to zero and the expression is positive.

R5: If $\sigma_h = \alpha$, the derivate is:

$$\frac{\partial L_{t-h,t}}{\partial \alpha_h} = \alpha_h + \sigma_h > 0$$

R6: If $\sigma_h < \alpha$, the derivate is:

$$\frac{\partial L_{t-h,t}}{\partial \alpha_h} = 2\alpha_h > 0$$

Since the expected loss declines monotonically, when increasing α_h in the ranges 1, 2, and 3, we know that α_h cannot be negative. Since the expected loss increases when α_h increases in ranges 5 and 6, a global minimum may exist in range 4. In fact, if $\alpha_h = \frac{\sigma_h \gamma_h}{2+\gamma_h}$ the derivative is zero, and the first-order condition for a minimum of the loss function is fulfilled.[4] ■

[4] The second order condition is:

$$\frac{\partial^2 L_{t-h,t}}{\partial \alpha_h^2} = \mathsf{E}_{t-h}\left[2\left(1 + \gamma_h 1\left(E_{t-h} b_t - \alpha_h > b_t\right)\right)\right],$$

A.2 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.

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.

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 error of multiple year growth rate of nominal GDP: Data on forecasts of year-

which is positive.

on-year growth rates of nominal GDP is taken from press releases of the official tax estimate in spring each considered year. Preliminary realized values on year-on-year growth rates of nominal GDP as reported by the federal government in its Annual Economic Reports (*Jahreswirtschaftsberichte*). Multiple year growth rates are calculated $x_{t,h} = \big(\prod_{r=0}^{h}(1 + x_{t,r}/100) - 1\big) \times 100\%$, where t represents observation year and h forecast horizon. Forecast error is computed preliminary realized value minus forecast.

Debt in percent of realized primary expenditure: Debt from credit market measured at end of previous year in percent of actual primary expenditure spent in that year. Primary expenditure is calculated total expenditure minus interest expenditure by the authors. Both expenditure aggregates are adjusted for debt repayments, flows into reserve funds as well as expenditure spent on compensating cash deficits from previous years. Data on debt, total expenditure and interest expenditure is taken from the federal statistical office.

Debt with residual term of 1 year at maximum in percent of total debt: Debt from credit market with residual term of 1 year at maximum in percent of total debt from credit market, measured at end of previous year. Data on both measures is taken from the federal statistical office. Percentages are computed by the authors.

Intergovernmental revenue in percent of realized primary expenditure: Transfers are computed total revenue minus tax revenue in previous year in percent of primary expenditure in that year by the authors. Total revenue is adjusted for debt assumptions, flows out of reserve funds as well as revenue generated from cash surpluses. Primary expenditure is calculated total expenditure minus interest expenditure by the authors. Both expenditure aggregates are adjusted for debt repayments, flows into reserve funds as well as expenditure spent on compensating cash deficits from previous years. Data on total revenue, tax revenue, total expenditure and interest expenditure is taken from the federal statistical office.

Government ideology: Data on government ideology is taken from(Kauder, Krause, and Potrafke 2018) and (Potrafke 2020) and extent to the period 2018 by the authors. Data on the years 1977 and 1978 are added for Saarland and on 1977 for Bremen. A value of 0, 0.5 and 1 indicates a right-wing, center or left-wing (liberal) government, respectively.

Election year: Data on election years is taken from(Kauder, Krause, and Potrafke 2018) and

(Potrafke 2020) and extent to the period 2018 by the authors. Data on the years 1977 and 1978 are added for Saarland and on 1977 for Bremen. A value of 1 is assigned if there was an election in a given state and year, 0 else.

Year before election: Data on election years is taken from(Kauder, Krause, and Potrafke 2018) and (Potrafke 2020) and extent to the period 2018 by the authors. Data on the years 1977 and 1978 are added for Saarland and on 1977 for Bremen. A value of 1 is assigned if there was an election next year in a given state and year, 0 else.

Table A.1: Descriptive Statistics: West German States

	N	mean	s.d.	min	max
Budget balance					
Forecast (+0)	347	-10.043	6.955	-31.247	14.794
Forecast (+1)	339	-9.321	6.573	-30.190	12.288
Forecast (+2)	332	-8.984	6.544	-28.864	13.336
Forecast (+3)	322	-8.172	6.426	-27.595	16.888
Forecast (+4)	296	-7.361	6.273	-29.071	17.526
Forecast error (+0)	347	1.891	4.589	-35.258	26.624
Forecast error (+1)	339	1.086	4.874	-20.993	14.933
Forecast error (+2)	332	0.452	6.390	-23.847	29.879
Forecast error (+3)	322	-0.680	6.787	-23.981	24.192
Forecast error (+4)	296	-1.657	7.567	-27.112	35.985
Actual	1,636	-8.541	8.101	-39.941	11.103
GDP growth rate					
Forecast error (+0)	42	0.015	0.953	-2.000	2.400
Forecast error (+1)	41	-0.538	2.711	-7.292	5.292
Forecast error (+2)	40	-1.515	4.283	-7.804	9.820
Forecast error (+3)	39	-2.764	5.765	-11.308	14.820
Forecast error (+4)	38	-4.323	7.467	-15.374	18.157
Public debt					
Total	347	173.163	93.352	32.210	512.400
Short-term in % of total	347	11.322	4.040	0.000	34.776
Other control variables					
Intergov.revenue	347	27.115	11.818	2.313	68.225
Government ideology	347	0.506	0.483	0.000	1.000
Election current year	347	0.216	0.412	0.000	1.000
Election next year	347	0.241	0.428	0.000	1.000

Forecasts, actual budget balance, public debt total and intergovernmental revenue are expressed in % of primary expenditures in the period preceding the forecast publication. Forecasts and actual values of annual GDP growth rates are transformed to cover growth over the full forecast horizon. Forecast error of GDP growth is the difference between the actual GDP growth rate over the respective horizon in % and the corresponding rate for the forecast by the federal government (BMWI). Government ideology is an indicator variable with zero value for right-wing, and unit value for left-wing government. Election year variables are binary.