Fiscalflation in Germany?

Applying the FTPL to Post-Pandemic Inflation

July 1, 2024

Abstract

This paper applies the fiscal theory of the price level (FTPL) to study the drivers of inflation in Germany following the pandemic. The empirical analysis uses a novel empirical approach built on the FTPL's equilibrium condition. We find that the FTPL predicts an increase in the equilibrium price level of 6% from 2019 to 2022. The increase is driven by higher discount rates. In contrast, fiscal deficits had a mild deflationary effect. Only if expectations regarding the future structural fiscal stance changed during these years, the FTPL would be able to link the observed inflation surge to fiscal policy behavior.

Keywords: inflation; fiscal policy; fiscal theory of the price level

JEL Codes: E620, E630

1 Introduction

Declared dead by the Economist ten years ago, inflation has returned to Europe and has taken center-stage of economic policy debates after the Russian invasion of Ukraine in 2022.[1] Fiscal policy is frequently seen as a driver of inflation both by academic and policy makers. For example, German finance minister Christian Lindner asserts that "one cause of inflation are public expenditure policies."[2] Because of such propositions, the Fiscal Theory of the Price Level (FTPL) has gained much attention in recent years.

The present paper aims to contribute to the debate on the causes of inflation by empirically estimating the effect of fiscal policy in Germany in 2020-2021 on the price level. To this end, we take the FTPL's equilibrium condition and use it to directly estimate equilibrium price level reactions to fiscal policy changes. To the best of our knowledge, this approach has not been done before. The paper begins by briefly outlining the theoretical framework of the FTPL, which derives the price level from the relation between current debt and future surpluses of the government. Afterwards, we describe deficit spending in Germany in 2020-2021 and construct time series about expected nominal interest rates and nominal primary surpluses. For the latter, the paper exploits the current fiscal rule in the German constitution (so-called debt break). In a final step, we insert those time series into the FTPL's equilibrium condition and calculate price level changes. Our estimations suggest that the equilibrium price level in October 2022 was 6% higher than it was at the end of 2019. However, the estimates are very sensitive to changes in the interest rate on government debt. If during the pandemic people changed their expectations about future structural deficits from 0.35% of GDP (current debt rule) to 1%, the equilibrium price level in October 2022 would be 28% higher than in 2019. Finally, we discuss the shortcomings of our analysis, before summarizing its main lessons.

Our paper relates to two branches of the literature. First, it rests on the theoretical foundations built by the literature on price level determination with active fiscal policy, as first described by and further developed among others by Leeper (1991) and Cochrane (2001). The first comprehensive introduction to the FTPL was recently given by Cochrane (2023), which also forms the basis for section 2. An important study reconciling active fiscal policy in a monetary union with heterogeneous inflation across members is Maćkowiak and Schmidt (2023). We take the already existing theoretical framework from Cochrane (2023), but are the first to directly use its equilibrium condition as estimating equation.

Second, our paper adds to the literature that uses the FTPL to explain or forecast inflation following Sims (2011), who study the oil price shock of the 1970s. There is a growing body of work looking specifically at post-pandemic inflation. For example, Bianchi and Melosi (2022) integrate the FTPL in a small scale DSGE model and find that people perceived the probability of a switch to fiscal dominance to be higher

[1] https://www.economist.com/finance-and-economics/2013/04/13/the-death-of-inflation, accessed 10.02.2023
[2] https://www.zdf.de/nachrichten/politik/christian-lindner-faktencheck.html, accessed 22.06.2023

after the adoption of the American Rescue Plan Act (ARPA). They attribute half of the 7% US-inflation in 2022 to this factor. In a subsequent article, Bianchi et al. (2023) develop a New-Keynesian model which distinguishes between funded and unfunded debt (the latter being irrelevant for inflation). Their results indicate that the ARPA was partially financed by unfunded debt, so that fiscal policy contributed to inflation. Their model predicts ARPA alone to have raised inflation by 2 percentage points (pp) in 2022 and 1pp in 2024. Liemen and Posch (2022) follow a similar approach with an additional focus on the maturity structure of debt to study the effect of the US-CARES act in 2020. They estimate that the CARES act has created unexpected inflation of 6-8%. In a very recent working paper, Barro and Bianchi (2023) find that fiscal shocks as defined in a frictionless version of the FTPL do explain an important part of cross-country differences in inflation. According to their results, the FTPL is also able to explain inflation in the Eurozone, where it has been mostly shaped by area-wide fiscal spending instead of national spending programs. Our paper adds to this literature by studying in detail the effects of fiscal policies on price level changes in Germany in 2020-2022.

2 The Fiscal Theory of the Price Level

In the following, we derive the intertemporal model of the FTPL as presented in chapter 2 of Cochrane (2023). For simplicity, it is assumed that prices are perfectly flexible, discount rates are constant, debt always has a maturity of one period, and there are no risk premia.

Households The representative consumer in the model has a constant real endowment y each period or $P_t y$ in nominal terms. Additionally, he holds wealth from the previous period in the form of either money M_{t-1} or one-period bonds B_{t-1}. His expenses consist of consumption $P_t c_t$, taxes $P_t s_t$ (as there are no government purchases, taxes/transfers are equivalent to surpluses/deficits), and nominal one-period zero bonds B_t priced at Q_t. Note that s_t refers to *real primary* public surpluses/deficits (public deficits imply higher private income, either through interest payments on bonds or direct transfers). The consumer may also hold money M_t at the end of the period. He only receives utility $u(c_t)$ from consumption and discounts utility at rate β. Therefore, the optimization problem of the consumer reads

$$\max_{\{c_t\},\{B_t\},\{M_t\}} \mathbb{E}_t \sum_{j=0}^{\infty} \beta^j u(c_t) \quad \text{s.t.} \quad M_{t-1} + B_{t-1} + P_t y = P_t c_t + P_t s_t + Q_t B_t + M_t$$

Combining the resulting Euler equation with the equilibrium condition $c_t = y$ for market clearing gives the formula for the bonds price Q_t and, thereby, the nominal interest rate i_t on bonds

$$Q_t = \frac{1}{1+i_t} = \beta \cdot \mathbb{E}_t\Big(\frac{P_t}{P_{t+1}}\Big) = \frac{1}{R} \cdot E_t\Big(\frac{P_t}{P_{t+1}}\Big) \tag{1}$$

Since prices are perfectly flexible, the nominal interest rate is approximately the sum of the real interest rate (here constant because of a constant β) and expected inflation. This implies a Fisherian response to nominal interest rate changes by the central bank, i.e., inflation rises with higher nominal interest rates. Therefore, the central bank can influence expected inflation by changing interest rates through government bond sales or purchases.

Government Each period, the government has to redeem outstanding bonds B_{t-1}. It has three financing options: (1) taxation $P_t s_t$, (2) new bond sales $Q_t B_t$, and (3) printing new money M_t. Its budget constraint reads

$$B_{t-1} = P_t s_t + Q_t B_t + M_t \tag{2}$$

Importantly, public surpluses s_t are *primary* surpluses because they exclude expenditures for serving the debt.

Equilibrium When the nominal interest rate i_t is positive, households do not want to hold any money M_t at the end of period t and all saving instead flows into bonds B_t. On the other hand, if $i_t = 0$ bonds and money are equivalent, so that we can count them together in B_t. As long as there are no negative nominal interest rates, the equilibrium condition, therefore, reads

$$B_{t-1} = P_t s_t + Q_t B_t \tag{3}$$

Note the crucial difference: Equation 2 is a *budget constraint* that has to hold for any value of P_t, while equation 3 is an *equilibrium condition* that only holds at equilibrium prices. Inserting the bond price Q_t from equation 1 into equation 3, dividing both sides by P_t and iterating forward yields the intertemporal equilibrium condition

$$\frac{B_{t-1}}{P_t} = \mathbb{E}_t \sum_{j=0}^{\infty} \beta^j s_{t+j} \tag{4}$$

It states that the real value of outstanding debt (left-hand side, LHS) must be equal to the present value of expected real surpluses (right-hand side, RHS). Since in period t nominal outstanding debt B_{t-1} is predetermined, any changes on the right-hand side translate into changes of the price level P_t. One may be tempted to predict a strong correlation between government deficits and inflation. This is not the case. If the government increases its real deficit (reduces real taxes) and credibly announces not to change policies otherwise, people indeed perceive this as an increase in their net wealth and demand more goods, generating inflation. The underlying assumption is that people expect the central bank to accommodate these policy decisions. However, if the government commits to real tax increases in the future, people need to save more to pay those taxes, so that demand may not change at all. As a consequence, whether a higher deficit today results in inflation or not depends on private expectations

about future fiscal policy. This insight is at the center of the empirical analysis in section 3.

Changing discount rates The model so far relies on many simplifying assumptions, most importantly flexible prices, constant real interest rates, and only one-period debt. To get closer to reality, one can make the discount rates variable, with β_k as the factor applied to discount from period k to period $k-1$ ($\beta_{t,0} = 1$):

$$\frac{B_{t-1}}{P_t} = \mathbb{E}_t \sum_{j=0}^{\infty} \Big[\prod_{k=0}^{j} (\beta_k) \cdot s_{t+j} \Big] \tag{5}$$

Now a decrease in expected surpluses may be offset by an (at least temporary) increase in discount rates, leaving the RHS as a whole unchanged. This is indeed a relevant channel in reality, where discount rates can be approximated by real interest rates on government bonds. These real return have not been constant in the last decades and have also noticeably changed in the last years. Cochrane (2022) also sees falling discount rates as "the most natural candidate" for explaining the long-period of low inflation in the decade before the pandemic.

Long-term debt Another extension to the FTPL comes with the introduction of long-term debt, which matters for the effects of monetary policy. Imagine that people hold a certain amount of long-term debt maturing after more than one period into the future. If the central bank increases nominal interest rates by selling more bonds, people know that inflation will be higher in the future. Consequently, prices of outstanding bonds fall. This is a negative wealth effect for bond holders, inducing private spending cuts. Consequently, the price level today falls in reaction to an increase in nominal interest rates, just as conventional theories would predict. Nevertheless, this comes at the expense of higher inflation in the future, when the additional bonds sold by the central bank come due. For the long-term equilibrium price level the maturity of debt does not matter. As John H. Cochrane puts it: "Monetary policy chooses when inflation happens, but not if it will happen."[3]

3 Inflationary Effects of German Fiscal Policy in 2020-2021

In the following empirical exercise, we apply the FTPL to Germany. More specifically, we will use equilibrium condition 4 to predict the change in the price level caused by fiscal policy during the years 2020-2021. To this end, we construct time series for all variables in the equilibrium condition 4, namely (varying) discount rates and nominal surpluses. Before we explain this process and the calculation of the predicted price level adjustments in section 3.2, we describe German fiscal policy in 2019-2021.

[3]Cochrane (2021): "The Fiscal Theory of the Price Level: An Introduction and Overview" (unpublished), available under https://www.johnhcochrane.com/research-all/fiscal-theory-jep-article, accessed 12.06.2023

3.1 Fiscal Policy in Germany

Germany in 2019 As stressed in the previous section, it is unexpected changes in fiscal policy or macroeconomic variables that drive unexpected inflation. Therefore, one needs to understand what people presumably expected at the end of 2019. The core inflation rate in the Eurozone had been 1% for the third year in a row, which is why the ECB had parked its policy interest rate at 0%. Real economic growth stood only at 0.5% in Germany and 1.2% in the Euro area.

The German center-right coalition was committed to a balanced budget without new borrowing. This principle of the *Schwarze Null* (black zero) was not enshrined into the constitution but formed a central pillar of the then coalition agreement. However, in light of the weak economic development as well as investment needs for the green transition, there were intense debates about whether to put an end to the black zero and exploit the borrowing limit in the constitutional *Schuldenbremse* (debt brake). This rule allows the government to borrow up to 0.35% of nominal GDP, corrected for business cycle fluctuations (see section 3.2.2 for more details). However, there was a broad political consensus that the constitutional *Schuldenbremse* should not be abolished (at most modified), and the markets rewarded the prudent reputation of German fiscal policy with an interest rate of -0.3% on 10 year public bonds.

The Covid Pandemic Of course, everything changed when the Covid pandemic hit Europe in March 2020. The government not only had to implement severe health policy interventions, but also had to stabilize the economy. As there was no existing blueprint for such a crisis, the government acted under high uncertainty and readjusted its policies multiple times. On the federal level, this can be seen from the introduction of three supplementary budgets in 2020-2021.[4] Table 1 lists the authorized borrowing for each of the budget laws and compares it to the maximum amount which would have been legal if the *Schuldenbremse* had not been suspended during the pandemic. The difference between those numbers (excess borrowing) is important because the German debt rule requires to redeem it within a certain time frame. In the end, the government had to borrow less than it was authorized to, especially because businesses needed less liquidity support than anticipated. All in all, it was very difficult for people at the time to assess by how much the emergency measures actually affected current deficits and future surpluses.[5]

In the final parliamentary reading of the initial 2021 budget, the conservative CDU stressed the importance of returning to the debt break "as soon as possible". This view was shared by the liberal opposition

[4]Similar supplementary budgets were introduced on the state level in 2020, although their aggregated value of around €60 billion was much smaller. In 2021, total debt on the state level only increased by €2 billion.

[5]The same problem concerned the *Wirtschaftsstabilisierungsfonds* (WSF, economic stabilization fund), which was adopted in March 2023. It does not show up in Table 1 because it only enables financial transaction (e.g., purchasing corporate shares), not changing the net debt of the government (as long as there are no loan defaults). its borrowing does not fall under the debt break. Initially, it had a planned volume of €600 billion for loans, guarantees, and capital participation in businesses. In January 2022, this was scaled down to €150 billion. In the following, we will not include the WSF in our analysis, as its instruments are merely financial transactions not changing the net debt of the government, which is also why it does not fall under the debt break.

	Budget 2020				Budget 2021		
	Initial	*+ S I*	*+ S II*	*Ex-post*	*Initial*	*+ S*	*Ex-post*
Adopted	12/2019	03/2020	07/2020	09/2021	12/2020	04/2021	09/2022
Allowed	12.5	62.1	79.9	60.9	33.4	44.5	23.4
Total	5.9	161.9	198.7	102.8	197.8	257.8	215.4
Excess	0.0	99.8	118.7	41.9	164.5	213.3	192.0

Table 1: **Authorized Borrowing in budget Laws** of German central government in €billion; S = Supplementary Budget; ex-post = final revenue and expenditure account

party FDP, which also urged the government to use idle financial resources for debt reduction. This gave a strong signal for fiscal prudence after the federal election in October 2021, as it seemed very unlikely that a government without CDU or FDP would be possible. In fact, all parties except the very-left *Linke* wanted to maintain the debt break, and only the center-left Greens proposed a modification to it in the form of an investment clause. Despite the very loose fiscal policy during the pandemic, there was no reason to fear unsound spending in normal times. This believe manifested in a zero nominal interest rate on 10-year government bonds at the end of 2021.

3.2 Empirical Analysis

Our empirical method is based on equilibrium condition 5. To this end, we simply rearrange the equation and use 2019 as base year, so that the equilibrium price level at time t is calculated as

$$P_t = B_{2019} \cdot \mathbb{E}_t \Big[\sum_{j=0}^{30} \big(\prod_{k=0}^{j} \beta_k \big) \cdot S_{t,t+j} + \prod_{k=0}^{30} (\beta_k) \cdot S_{\text{post2050}} \Big]^{-1} \tag{6}$$

Our formula looks 30 periods into the future[6] and adjusts the length of the first time period to span from January 1st 2020 to date t. In contrast to equilibrium condition 4, fiscal balances and discount rates are here in nominal terms. Under the assumption that nominal interest rates are the sum of real interest rates and expected inflation, this makes no difference, as we would also need to discount future nominal fiscal balances by expected inflation to get the real present value. One can think of this version of the equilibrium condition as if people in January 2020 could have looked into the future and adjusted their expectations to what people at the future time t knew about the past and expected about future fiscal balances and (nominal) discount rates. The equilibrium price level would then have jumped directly to what it was at time t.

Our approach turns around the interpretation of the equilibrium condition in Cochrane (2023). There, the author states that "we can observe market expectations of future surpluses by observing changes

[6]Theoretically, equation 6 requires infinite time series on the RHS. Since one cannot do that empirically, we construct time series until 2050 and add a fixed nominal value for post-2050 surpluses to the time series, so that the price level in 2019 is set to 1. This is necessary, as changes in discount rates also change the present value of those surpluses. However, one could argue that due to the price level increasing stronger than expected in 2019, it would be more appropriate to assume constant expectations about post-2050 surpluses in *real* terms. If that is the case, the below estimates overestimate the price level effect.

in the value of debt". For this, one would observe price changes on the LHS of equation 4 to learn something about unobservable changes on the RHS. By doing it the other way around, our analysis could in principle predict price level adjustments that are very different from the ones observed.

As can be seen in Table 1, fiscal policy was adjusted multiple times during the pandemic. By using 6, we can evaluate the effect of each policy change *at the time of its introduction*. The latter part is important since the estimated price effect of a spending package depends on expectations at a given point in time (e.g., discount rates changing after date t also change the price level effect of a given stimulus). However, the way the pandemic shaped both fiscal policies and the macroeconomic environment poses two big challenges for the prediction of price level adjustments: First, there was a high uncertainty about spending needs. As shown in Table 1, planned and actual borrowing differed vastly. Therefore, it would have been very difficult to know in December 2020 how much additional debt the pandemic would have caused in the end. Because of this, we not only calculate price level effects around the introduction of the various budgets laws, but also after the ex-post expenditure account has taken place in October 2022. Second, the unprecedented combination of severe supply and demand restrictions caused by the pandemic hampered price level adjustment processes.[7] Therefore, even if people had assumed to have received a net wealth gain from government spending, they may had to postpone changes in their consumption pattern to after the pandemic. Consequently, price level adjustments were probably even slower than usually. Because of this and the occurrence of an enormous exogenous shock, namely the Russian invasion of Ukraine, it is of little use to compare our estimated with observed inflation shortly after the pandemic.

3.2.1 Initial Value of Government Debt

The first value to insert into equation 6 is outstanding government debt from 2019. By keeping the value of debt accumulated before 2020 constant, our analysis excludes revaluation effects on long-term debt. In reality, higher interest rates reduce the market value of outstanding long-term debt and, thereby, reduce the price level temporarily ceteris paribus. Importantly, however, a reduction in the market value of government debt implies higher (expected) inflation in the future. Leaving long-term debt out of the picture matters for the path of the price level over time (a sudden jump without, steady price level increase with long-term debt), but not for the magnitude of the aggregated change in the price level caused by a certain shock.

Since we are interested in relative price level changes and since we scale the price level in 2019 to 1 by adding post-2050 surpluses, it does not matter much which measure is used for B_{2019}. However,

[7] Recall that the simplest version of the FTPL story goes like this: If people think that the real present value of government expenditures and the market value of public debt (implying future repayments by the government) rises above the real present value of taxes, this constitutes a net wealth gain. People then increase consumption and drive up prices, until the net wealth gain has melted away. During the pandemic, however, private spending was severely restricted because of supply bottlenecks and public health interventions. As a consequence, the personal savings ratio jumped from an average of 10.8% in 2019 to an average of 15.8% in 2020-2021 (reaching 20.1% in the second quarter of 2020), according to Bundesbank data.

because we calculate interest payments to the private sector from the initial value of debt and subsequent net borrowing (see section 3.2.2), the best debt measure for our analysis is gross debt provided by Eurostat/Destatis, i.e., the face value of consolidated government debt held by the non-public sector. This measure also provides information about which share of the debt is owed by the federal government and which share by states, which is relevant since different entities pay different interest rates.

3.2.2 Change in Nominal Primary Surpluses

Net borrowing The most difficult step of the present exercise is to create a time series capturing expectations about future surpluses. Importantly, we need to know which share of today's deficit people expect to be met with higher taxes in the future *in real present values*. Therefore, one also needs to take into account when the debt repayment happens. This is why we cannot just use conventional forecasts which look only a few years into the future. For example, the IMF's World Economic Outlook predicts primary surpluses up to five years ahead. Projections by government agencies are also insufficient in this regard. The *Finanzplan des Bundes* (Federal Finance Plan), which is the basis for the work of other institutions like the *Bundesrechnungshof* (Federal Audit Office) or the *Stabilitätsrat* (Fiscal Council), only spans over a period of four years. The forecasts of the Ministry of Finance for the European semester have the same forecast horizon. The only long-term projections over multiple decades (forty years) can be found in the *Tragfähigkeitsbericht* (Sustainability Report) that the Ifo research institute produces for the federal Ministry of Finance once per legislative period. However, it does not aim at predicting actual fiscal balances, but instead estimates an hypothetical future gap between revenues and expenditures assuming there are no policy changes. Therefore, it is not a useful data source for this analysis.

Because of the lack of existing annual forecasts about fiscal balances over many periods, we construct our own time series by exploiting the institutional framework for fiscal policy in Germany. For this, we make three assumptions: First, the constitutional fiscal rule (*Schuldenbremse*) is left unchanged in its current form. Second, the government (both the federal and the states) always runs a deficit up to the legal limit. Both of these assumptions seem to be justified in light of the narrative account of political events in section 3.1. The deficit limit $\overline{d}_f$ of federal entity f is calculated as

$$\overline{d}_f = a_f \cdot Y - \epsilon_f \cdot (Y - Y^*) - R_f \tag{7}$$

with Y as nominal GDP, Y^* as nominal potential GDP, $(Y - Y^*)$ as nominal output gap, ϵ_f as budgetary elasticity, and R_f as special repayment obligations; see for details Bundesministerium der Finanzen (2022). The parameter a_f is 0.35% on the federal level and zero on the state level. The budgetary

elasticity is 0.203 for the federal government and 0.301 for all state governments combined.[8] Although actually updated by the European Commission every four years, we treat the current elasticities as constant. Our third assumption concerns the development of Y and Y^*: we take the GDP forecasts up to four years ahead by the IMF and assume a nominal GDP growth of 3% afterwards. The estimates for the output gap up to four years ahead stem from the *Jahresprojektion* (annual projection) of the federal Ministry of Economic Affairs. For the following years, the output gap is assumed to be zero. The repayment obligations R_f are the consequences of using the escape clause of the *Schuldenbremse*. When the government decides to suspend the rule due to an unforeseen emergency like the Covid pandemic, it has to agree on a binding repayment schedule for the excessive borrowing $d - \overline{d}$. The additional debt on the federal level caused by excessive borrowing in 2020 will be repaid in equal installments from 2023 to 2042 (€2.1 billion p.a.), and the additional debt in 2021 from 2026-2042 (€11.3 billion p.a.). State governments can choose their own repayment schedules. For the sake of simplicity, we assume that all entities repay all excess borrowing between 2030-2040. The resulting surplus projections for an excess borrowing on the federal level of €42 billion in 2021 and €192 billion in 2022, as well as €60 billion on the state level in 2021 are depicted in Figure 1.[9]

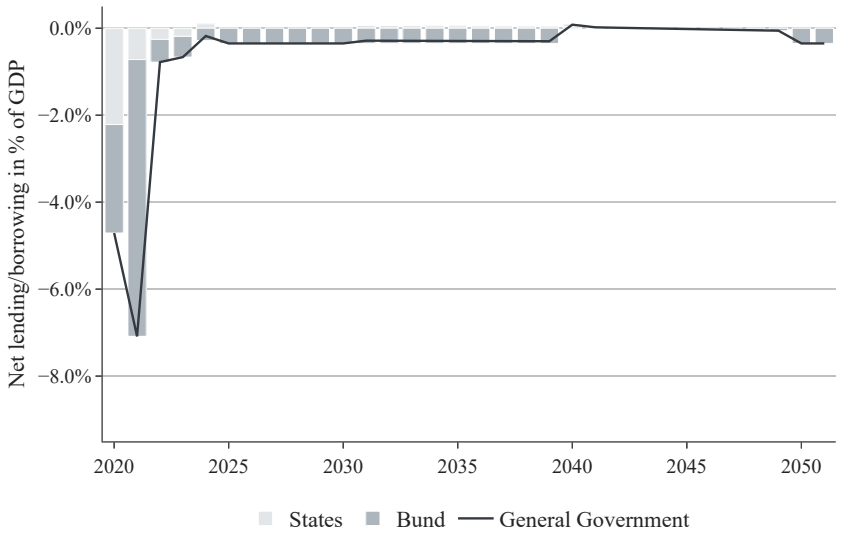


Figure 1: **Fiscal balances as share of GDP** excluding interest payments; ex-post values for federal debt (9/2022) and €60 billion on state level in 2020-2021, repaid over 10 years starting in 2030

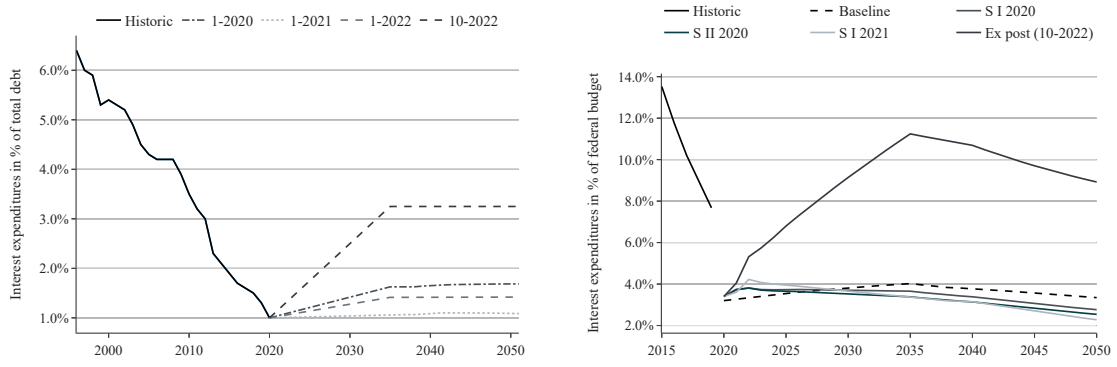
Interest payments Since 4 requires a time series for the primary surplus, we need to add interest payments to the fiscal balances calculated above. Because interest payments depend on the level of

[8]Note that in Germany municipalities are legally part of their state entities and treated as such here. The social security insurances as fourth legal entity are quantitatively much less important and excluded from this analysis.

[9]Note that these numbers deviate from net borrowing as reported by Eurostat (-4.3%/-3.7%/-2.6% of GDP in 2020/2021/2022), since in our analysis borrowing directly enters the books when the respective budget law is passed, not when the respective bonds are actually issued.

debt and, therefore, on the cumulative sum of past deficits, there is a similar data shortage as with fiscal balances. But even if one knows the level of debt, it is not straightforward to calculate interest expenditures. After all, they not only depend on market interest rates, but also on the maturity structure of the public bond portfolio (as well as on the share of inflation- or otherwise indexed bonds). Estimating interest expenditures in such a detailed manner would be beyond the scope of this paper. However, assuming a constant implicit interest rate (total interest payments divided by total outstanding debt) would imply unrealistic jumps at the beginning of the estimation period (post-2020).

Therefore, we assume that the implicit interest rate on central government debt grows linearly for 15 years until it reaches the expected nominal interest rate in 2035 (derived from the yield curve of AAA-bonds, see section 3.2.3). Consequently, the development of the implicit interest rates is solely determined by nominal interest rates expectations 15 years ahead. Figure 2a depicts the derived development of the interest rate on total federal debt. Figure 2b combines that with the estimated debt levels over time implied by the different emergency borrowing laws (on the federal level, see Table 1) and the fiscal policy paths calculated above. As one can see, even the interest payments following high deficits and the high interest rates at the end of 2022 do not lead to an unprecedented interest expenditure share in the federal budget. The assumption of people expecting the institutional framework to remain in place and respected seems, therefore, not unrealistic. To further assess the validity of our estimates, Appendix B compares the interest expenditures by the central government with more sophisticated estimates by Grimm et al. (2022). The estimates are very close to each other.



(a) **Implicit interest rate** (b) **Interest expenditures** as share of federal budget

Figure 2: **Assumptions about interest rates on government debt** derived from nominal interest rate expectations; both panels only refer to the central government; panel (b) assumes a federal budget sized 10% of nominal GDP and refers to the different budget laws presented in Table 1

3.2.3 Change in Discount Rates

Formula 6 discounts nominal surpluses with the expected nominal interest rate, which we estimate now. According to the expectation theory, the yield i^m of a bond with maturity m is the product of expected

annual short-term yields i_t up to maturity: $1+i^m = \prod_t^m (1+i_t)$. For the calculation of expected nominal interest rates, we use the Euro area yield curve based on AAA-rated government bonds provided by the ECB. As shown in figure 3, the resulting discount rates do indeed vary over time, but only change strongly at the end of 2022.

However, as outlined in Deutsche Bundesbank (2023), the yield curve is not fully determined by short-term nominal interest rate expectations alone, but also influenced by risk and scarcity premia. The distortions caused by these premia should not be a big concern for our analysis, since the empirical assessment in Deutsche Bundesbank (2023) suggests that they remained at very low and constant levels in 2020 and 2021. This is because the rising inflation risk premium and the declining real term premium cancel each other out. In 2022, term premia started to increase, while scarcity premia began to decline, when the ECB raised the supply of public bonds through assets sales in the wake of quantitative tightening. Therefore, one can assume our estimates at least for 2020-2021, as shown in Figure 3, to be relatively undistorted.

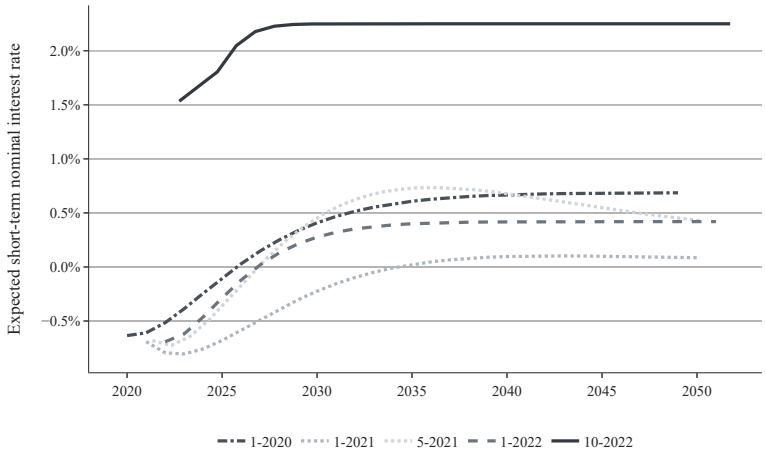


Figure 3: **Short-term interest rate expectations** derived from nominal Euro Area yield curve based on AAA-bonds

3.3 Estimated Price Level Adjustments

Figure 4 presents the results from inserting the above time series into equation 6. It shows how fiscal deficits together with the changes to expected surpluses and interest rates affected the equilibrium price level. Focusing on the estimated price level effects (red squares), the first thing to notice is that most of them are in a range between 0% and 5%. Only in April 2021 the equilibrium price level was almost 18% higher than in 2019. This was also the only time that the emergency borrowing led to a higher price level than in a situation without such borrowing (gray circles), due to the combination of high deficits and low interest rates on government bonds. Had the implicit interest rate not shifted downwards by half a

percentage point since 2019, future surpluses would have risen more and the price level effect would have been slightly negative (-3%, pink triangles). At the end of 2022 there is a very different picture: On the one hand, without the much higher interest rates (+1.5pp compared to 2019) increasing future surpluses via higher interest expenditures, fiscal policy would have been extremely inflationary. On the other hand, the higher discount rates reduced the real present value of future surpluses and made the fiscal stance much more inflationary than it would have otherwise been. In the end, because of the combination of these two effects, the emergency borrowing increased the equilibrium price level by 6%.

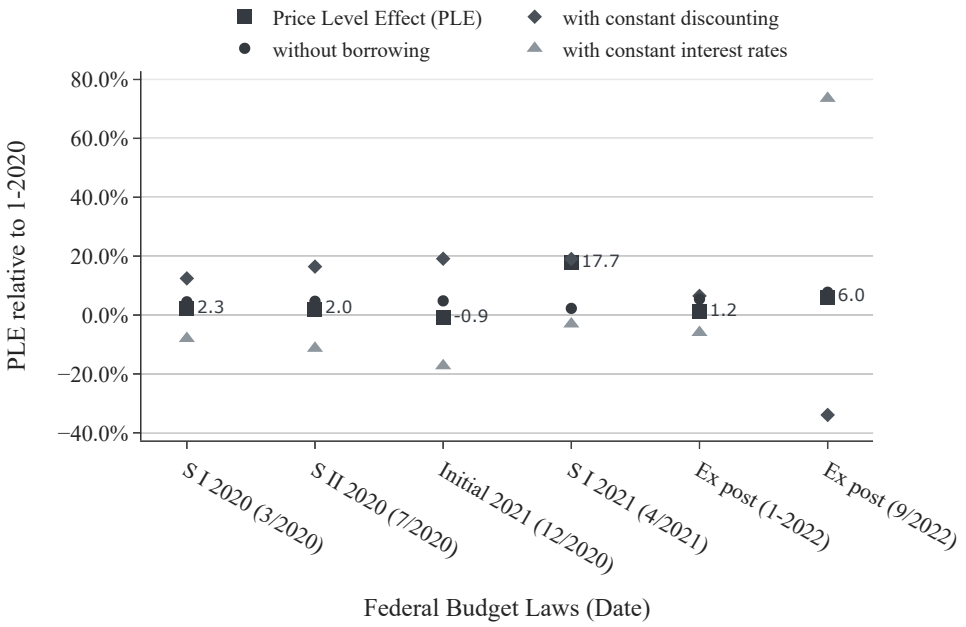


Figure 4: **Estimated price level effect for different federal budget laws** compared to price level in 2019; the emergency borrowing of state governments is held constant at €60 billion

To make this point even clearer, imagine a scenario in which the government sets the interest rate it pays on its total debt (the implicit interest rate) freely without affecting the constant discount rate. In this case, there is exactly one nominal implicit interest rate which holds the real present value of fiscal balances PVS and thereby the price level constant, regardless of the amount of emergency borrowing. It can be easily shown that this interest rate is (unsurprisingly) $i_g^* \approx r^e + \pi^e$.[10] If the government credibly promises to increase taxes to fully pay off the additional deficit D in the future and to pay interest at a rate equal to the (nominal) discount rate of private agents, any amount of borrowing is non-inflationary. While allowing for changing discount rates makes the analysis more complex, the intuition of the above condition remains the same. Only if the interest rate on newly issued government bonds is below the

[10]With emergency borrowing D that pays $i_g \cdot D$ interest and that is fully redeemed after p years, and with the constant discount rate $\delta = \frac{1}{(1+r^e)(1+\pi^e)} \approx \frac{1}{1+r^e+\pi^e}$ being determined by expected real interest rates r^e and expected inflation π^e, this condition reads $\Delta PVS = -D + \delta^p \cdot D + \sum_{n=1}^{p} \delta^n \cdot i_g D \stackrel{!}{=} 0$. Noting that the third addend is a simple partial geometric sum, this simplifies to $i_g^* \approx r^e + \pi^e$.

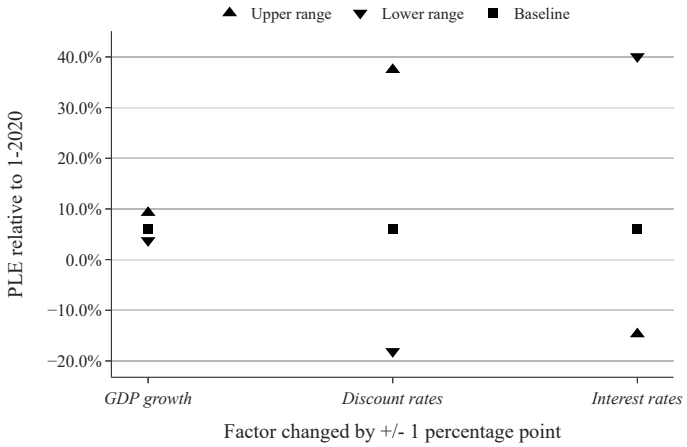


Figure 5: **Sensitivity of price level effects** to changes in constructed time series

expected nominal interest rate (due to a negative term premium, for example) or if the market expects a partial default or infinite roll-over of the additional debt, government spending is inflationary in the FTPL model. In our ex-post scenario, the inflation-neutral implicit interest rate i_g^* is around 1.5%.

4 Discussion

Figure 4 already shows how sensitive the estimated price level effects are to changes in interest and discount rates. Figure 5 provides an even clearer picture by showing the effect of shifting the constructed time series by 1pp up- or downwards. In line with the rule derived previously, changing nominal interest rate expectations or interest rates paid by the government has a similar effect. Small deviations stem from the fact that, in contrast to the above formula, the variables are not constant and that the implicit interest rate does not change 1:1 with interest rate expectations (see section 3.2.2). Importantly, even relatively minor deviations from the above time-series lead to substantially differently estimates for the equilibrium price level. If expected nominal interest rates were 1pp higher and discount factors accordingly lower, the present value of future surpluses falls so much that the equilibrium price level is about 30% higher. Changes to nominal GDP growth, affecting the amount of borrowing allowed under the debt break, do not make a big difference.

4.1 A Debt Rule Reform

But what if the debt rule itself changes? To study the effects of this, we assume an expected debt break reform allowing the federal government a structural deficit of 0.7% of nominal GDP (from 0.35% today), and the state governments a combined structural deficit of 0.3% (from 0% today). Importantly, in this scenario the expectation of a debt rule reform is formed after 2019, i.e., people in 2019 believed the old

rule to stay in place. A rationale for this could be that people believe the pandemic to cause lasting damage to the economy, so that the macroeconomic environment for fiscal policy changed structurally. Or perhaps it was only during these years that people realized that the government may have to increase its leeway for debt financing to manage the green transition.

Indeed, expectations of a looser fiscal policy in the future as described above lead to a much higher price level effects, namely an equilibrium price level increase of 42% in 1/2020 and of 28% in 10/2022 compared to 2019. These numbers do align with the observation of high annual inflation rates over multiple years. Importantly, the sensitivity to interest rate changes is even higher now: If the implicit interest on government debt remained at its 2019 level, the lower future surpluses (higher deficits) caused by the debt rule reform would be met by less increasing interest payments, so that the primary surpluses fall and the price level rises by even more. Also, the higher structural borrowing increases the level of debt in each future period, which is why interest expenditures and, therefore, the sensitivity to interest rate changes rise in absolute terms. Of course, markets reacting to these different outlooks by demanding higher interest rates on government bonds makes such a scenario unrealistic. Nevertheless, even in this reform scenario the debt-to-gdp ratio of the general government falls (to 37% in 2050 compared to 30% in baseline scenario). Further note that the price level increase stems from the expectation of lower surpluses in the future due to the debt rule reform. The emergency borrowing during the pandemic still has a deflationary effect through interest rates in the future. Figure 6a and 6b in the appendix shows these results graphically.

4.2 Role of the European Monetary Union

The fact that Germany is part of the European Union and the Eurozone raises a major concern about the above analysis. In principle, the FTPL would predict a single price level across the monetary union, adjusting the real value of public debt of all members to the real present value of surpluses of all members. However, it is far more difficult and beyond the scope of this paper to construct the necessary time series, especially nominal surpluses, for the Eurozone as a whole.[11] Moreover, the heterogeneous price levels and changes across member states, as studied in Jordà and Nechio (2023), pose a challenge to the FTPL. To reconcile the FTPL with these observations, Maćkowiak and Schmidt (2023) present a model of a monetary union with active fiscal policy. Here, the aggregated fiscal policy stances determine the price level of the union as a whole, while country-specific preferences for various consumption goods leads to differences in relative prices levels across member countries. Such a setup is in line with Barro and Bianchi (2023), which find that only European but not national fiscal policy shocks influence inflation for countries in the Eurozone.

[11] A possible approach of exploiting the institutional setting to estimate fiscal balances analogous to the one chosen above would be to assume that the current fiscal rules are respected and exploited to the legal maximum. However, there have been violations of these rules in the past and it was already foreseeable that they would be reformed after pandemic.

Moreover, the pandemic also brought an important novelty for the European project: the first issuance of common debt. In December 2020, the EU Council passed a stimulus package of €750 billion (in 2018 prices) under the name of Next Generation EU (NGEU). This not only affected the aggregate fiscal stance in Europe and, more specifically, the Eurozone but also should have changed expectations regarding German fiscal balances in the future, as half of the money granted by NGEU came as a loan that has do be redeemed by national governments. This is another argument for why it is necessary to look at fiscal policy both on the German and the European level.

What does all of this mean for the above analysis? With regard to the relatively narrow research question not much at first sight. As we aim at evaluating the *change* in the equilibrium price level induced by *German* fiscal policy, it makes sense to exclude other factors. This again highlights that the results should be interpreted as partial effects, not as predictions for price level changes. However, taking the monetary union as a whole as starting point would indeed matter for implementing equation 6: While the numerator B_{2019} cancels out anyways when calculating relative price level changes P_t/P_{2019}, adding (even constant) surpluses from other Euro countries to the denominator lowers the relative changes induced by German balances alone. Only if the present value of Euro-wide aggregated surpluses today and in the future decrease as much in relative terms as they do in Germany, our estimates are undistorted. If they they decrease even stronger, relative price level adjustments would be higher. This shortcoming necessitates great caution in the interpretation of our quantitative results. However, the lower the spillover between Euro-members (e.g., due to strong home biases in consumption), the lower the bias in our analysis, just as in Maćkowiak and Schmidt (2023).

4.3 Influence of Monetary Policy

As described in 3.1, not only fiscal but also monetary policy reacted to the pandemic. While the ECB did not change its interest rate target (until July 2022), it purchased a lot of public bonds to hold interest rates down. Importantly, this does not imply a reduction on the outstanding market debt on the LHS of equation 4, as it constitutes a mere asset swap. Still, the balance sheet of the central bank is important: private sector assets held by the central bank can be used to reduce the amount of public money in the future through asset sales; interest earned on private assets is transferred to the government and decreases the stock of outstanding public mone); interest paid on reserves increases the stock of public money. To assess how the policy response of the ECB to the pandemic precisely affects the price level adjustments, one needs to make assumptions about expectations regarding all these and other aspects.

Nevertheless, as with the European perspective, the effects of monetary policy during the pandemic do not matter for our research question. However, note that our analysis is based on people expecting that fiscal deficits are not fully redeemed by in real terms, which implies that monetary policy is expected

to accommodate fiscal policy in a certain way. Also, interest rates set by the ECB do influence our calculations. On the one hand, higher nominal interest rates increase the discount rates in our formula and, thereby, lead to a higher equilibrium price level. On the other hand, they increase the amount of interest the government has to pay on its debt, which had a deflationary effect. The relevance of these channels can be seen in figure 5. As the two channels are of similar importance quantitatively but work in opposite directions, the indirect effects from monetary policy do not alter much our results.

5 Conclusion

What lessons can be drawn from our analysis? First, a simple version of the FTPL together with reasonable assumptions about fiscal expectations can produce price level estimates of a reasonable magnitude. Therefore, one can read our results as a proof-of-concept of our newly developed approach for applying the FTPL, despite the rather high sensitivity of the estimates to changes in inputs. The discussion already points out some shortcoming of our approach, most importantly fiscal policy on the European level, whose inclusion into the empirical framework offers promising paths for future work.

Second, the analysis sheds light on how to apply the FTPL in practice. On the one hand, it is important to not only focus on current deficits but also on their effect on future fiscal balances, especially with regard to interest expenditures. On the other hand, our analysis showed that even in times of very expansionary fiscal policy the macroeconomic environment (here especially discount rates) may be the dominating factor in determining inflation.

Third, our results cast doubt on simplistic narratives about fiscal deficits in Germany being responsible for the sustained high inflation - and even hints at possible opposite conclusions from a FTPL perspective. Only if the pandemic changed expectations about the structural fiscal stance, our analysis would support the interpretation of current price level changes as 'fiscalflation' (although not driven by pandemic borrowing). If politicians could be sure that this was the case, they could increase the structural deficits as expected and not create any additional inflation. If they did not and made people change their minds about future surpluses, there would occur a disinflation. Only time will tell whether one of those scenarios comes true.

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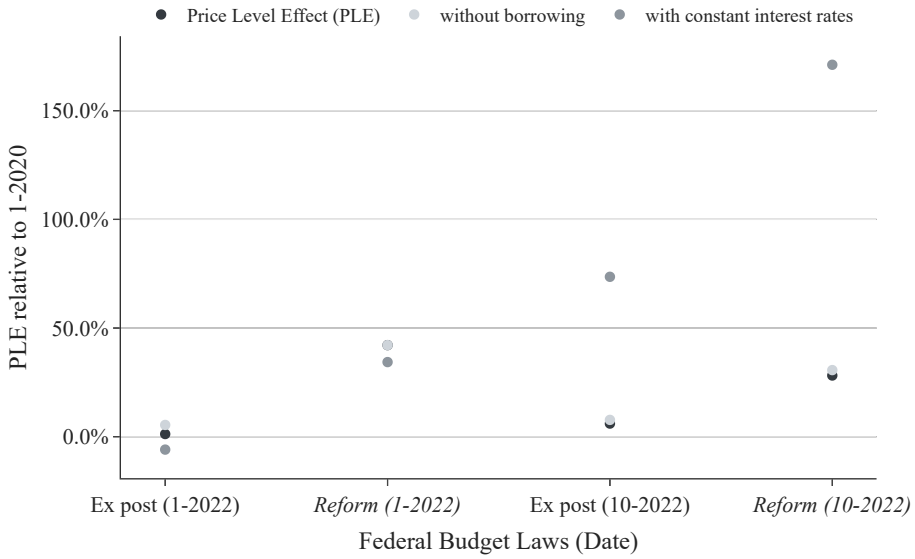
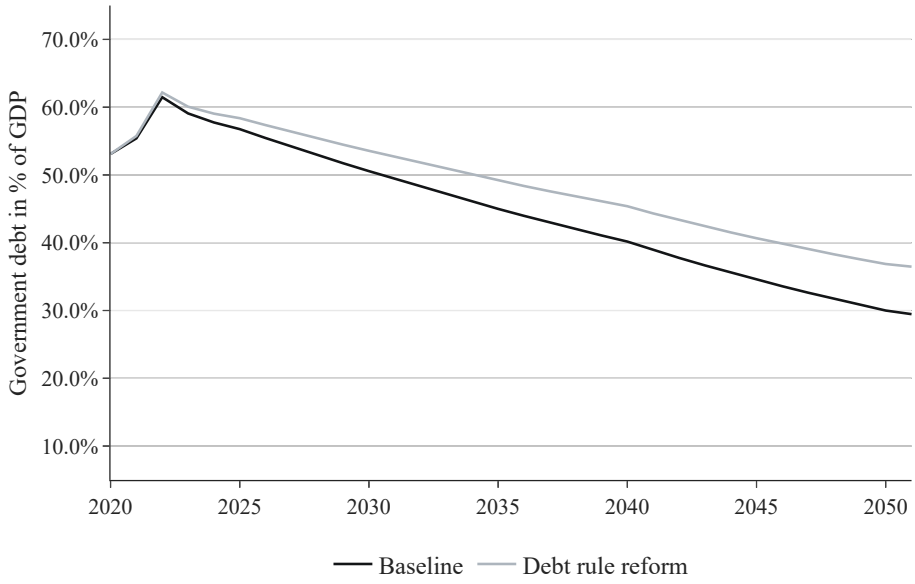
A Price level effects in reform scenario



(a) **Price Level Effects**



(b) **Public debt trajectories**

Figure 6: **Comparison of baseline and reform scenario**

B Comparison of interest expenditures with Grimm et al. (2022)

Grimm et al. (2022) calculate interest expenditures assuming that debt-to-GDP ratio stays constant at 2021 levels, and bonds sales after 2020 are based on 2018 maturity structure. Interest rates on government bonds are based on the observed Yield Curve on June 6th 2022. GDP growth is taken from the IMF's World Economic Outlook in April 2022 and extrapolated to 2034. Grimm et al. (2022) only study central government debt, which is also the number we report for our own scenarios in Figure 7.

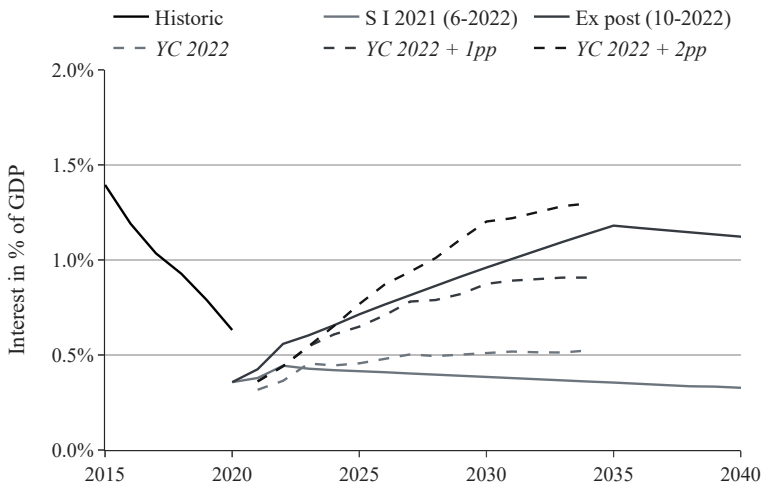


Figure 7: **Expected interest expenditures as share of federal budget** Comparison of own estimates with results from Grimm et al. (2022) based on government bond yield curves and maturity structure of debt