ABSTRACT

GROWTH IN A TIME OF PROJECTED DEBT

by Jacqueline Marie McCafferty

This paper presents a novel dataset of debt projections from 29 countries to analyze the relationship between public debt projections and economic growth. I find that when year-of debt is estimated to be above 90 percent, a 10-percentage point increase in the four-year projected debt level is associated with a 6.73 percentage point decline in 5-year forward average GDP per capita growth. Declines in economic growth are estimated to be larger for projections in the high debt regime as opposed to the normal debt regime. This study also finds that as the uncertainty of projection accuracy increases due to an increase in the projection horizon, the magnitude of the coefficient on the normal regime becomes statistically insignificantly different from zero. Alternative threshold levels are tested to identify the point at which high projected debt levels signal to agent's a possible policy change. My findings support the existing debt-growth and economic uncertainty literature and contribute the importance of debt projections and expectations in advancing our understanding of the relationship between government debt and economic growth.

GROWTH IN A TIME OF PROJECTED DEBT

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This thesis

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Dedication

To my family and friends, I thank you for all of your encouragement and support.

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I. Introduction

How do agents' responses to high debt projections impact economic growth? As government debt in countries around the world is surpassing levels previously thought to be untenable, uncertainty in the ability to reduce the debt burden is increasing. The implementation of austerity measures, rising interest rates and inflation loom as households and firms prepare for uncertain future economic stability. Rational, forward-looking agents' base consumption and investment decisions on forecasted debt levels given that high debt signals future policy change.

In this paper, I identify how high forecasted debt effects medium-term growth. I argue the main channel by which this occurs is through the influence of projections on agents' propensity to save in the present based on the perceived probability that contractionary fiscal measures will occur. As projected debt enters into the high regime, this probability increases as uncertainty surrounds the government's ability to repay debt without increasing interest rates or taxes, reducing government spending, or 'inflating the debt away'. I construct an original dataset of 29 countries to consider how expectations of future fiscal shortfalls impact medium-term growth.

My baseline specification applies a panel smooth threshold model, using projected debt levels of various horizons as the threshold variable. I interact this smooth threshold with the projected four-year debt level, the key regressor, to understand how increases in four-year forecasts impact growth differently as the regime is determined by projections over each horizon. I use a 90 percent debt-to-GDP ratio as the smooth threshold to determine if projected debt is in the *high* (above) or *normal* (below) regime. The threshold is set this level because it is the most frequently identified debt level at which economic growth begins decreasing in the literature. The smooth threshold is a continuous function of the projected debt level in year $t+h$ and bounded between 0 and 1. When year-of debt is estimated to be in the high regime, a 10-percentage point increase in the four-year projected debt level results in a 6.73 percentage point decline in GDP per capita growth over the next five years. In this setting, the high regime is associated with a decline in growth 3.47 percentage points larger in magnitude than the normal regime.

As forecasted four-year debt levels increase, the growth rate of GDP per capita declines by significantly more in the high regime than in the normal. This relationship holds when using any projected debt horizon as the state variable. These results align with findings such as Reinhart and Rogoff (2010), who estimate observations with debt levels over 90 percent have median growth 1 percent lower than countries with lower debt burdens. Similar thresholds and regime-specific effects have been identified in Minea and Parent (2012), Kumar and Woo (2012) and Cecchitti, Mohanty and Zompolli (2012). This paper relates to these works in identifying debt regime specific effects on economic growth in which high debt levels reduce growth in GDP. However, it contributes a new perspective of the effect of debt projections on economic growth.

The relationship between debt and growth has been widely studied since Reinhart and Rogoff (2010), but the effect on growth of reduced consumption and private investment behavior prior to the actual accumulation of debt has yet to be identified. In the rational expectation's

neoclassical growth literature, researchers would anticipate that high debt projections will inform on the potential for future austerity measures to take place. In this setting, agents expect the probability of implementation to increase as projected debt increases, especially as projected debt enters into the high regime and the need for austerity is perceived to be higher. As a result, households prepare for tax hikes and reduced government spending by increasing savings in the present to smooth future consumption and investment. Firms respond to the increased probability of contractionary government and household behaviors with high uncertainty in future economic stability. Consequently, firms reduce output and borrowing, causing the productivity of human capital to decline and further reduce output. Such intuition would thus predict, the magnitude of the actions taken by agents are directly related to the probability of future economic growth.

Our paper is related to two active literatures. The first considers the impacts of public debt on economic growth geared toward determining the existence of a non-linear relationship between actual debt and economic growth. Cecchitti, Mohanty, and Zompolli (2012) define the overlapping five-year forward average growth rate used as the dependent variable in my baseline specification. They assume the simultaneity bias influencing the relationship between debt and growth is minimized by measuring economic growth 5 years forward, half of the business cycle, from the year debt projections are reported. This growth rate also allows us to assume the controls variables are predetermined, further reducing the potential of this bias. Their model estimates that, when debt is at or above the 96 percent level, a 10-percentage point increase in debt results in a 13.8 percentage point decline in GDP per capita growth. The estimate for the normal debt regime is not statistically significantly different from zero. The results of my paper support the regime specific effects identified in Cecchitti, Mohanty and Zampolli (2012), with high regime debt levels associated with greater declines in economic growth over the following five years. my paper expands upon identifying regime effects of debt on growth by analyzing the influence of expectations on the debt-growth relationship through the use of forecasted debt levels.

Checherita-Westphal and Rother (2012) estimate a threshold between 90-100 percent. In their study, they identify the channels through which the high regime induces decline in growth as private saving, public investment and total factor productivity. While my paper does not set out to empirically identify these channels, the intuition behind my model supports their findings in that private savings will increase as debt is projected to be in the high regime. Therefore, it is possible that the channels through which economic growth declines cannot be completely attributed to the level of actual debt, but in part due to uncertainty in the government's fiscal stance and its ability to repay debt without contractionary measures taking place. This paper aims to identify how high debt projections negatively influence growth through expectations, separately from the effects caused by the actual debt level.

This leads to the second area of economic literature of which my study is related – agents' expectations based on high debt projections. Davig and Foerster (2018) model expectations leading to fiscal uncertainty episodes in which agents act based on beliefs of the future. They state that such episodes are relatively rare, but many countries have fiscal policies in place that increase their potential, primarily due to projections of rising debt levels. In this model, episodes present with several features: the announcement of possible future policy change, a skewed set of potential outcomes, the possibility that policy implementation does not actually occur, and a

known date of resolution. Within this paper's context, the announcement of possible future change occurs when debt is projected to be in the high regime, determined by the threshold variable. Uncertainty in the accuracy of projections as well as in the government's debt repayment strategy introduces a skewed set of potential outcomes. Expectations that contractionary policies will be implemented are formed based on projections and past knowledge, meaning that their actual execution may not occur. Lastly, the resolution date is within the projection horizon when policy change is or is not implemented.

In each of my baseline exercises, I find results supporting this hypothesis. Agents react to an announcement of possible policy change, though the severity of their reaction varies with their level of uncertainty in the future. High projected debt is just one way in which agents believe possible policy change is announced. If in the normal projected debt regime, an increase in the four-year forecasted debt may still cause agents to begin saving if they believe this additional debt will be financed through future tax hikes or reduced spending. The negative effect of public debt can be much larger if high public debt increases uncertainty or leads to expectations of future fiscal shortfalls, possibly through inflation and contractionary policy (Cochrane, 2011). As agents observe the debt stance projected to be in the normal regime in the medium-term future, the change in economic growth when four-year projected debt increases are found to be statistically insignificantly different from zero. my findings further support Davig and Foerster's model, in that when agents expect to be in the normal regime in four years, they do not view an increase in the four-year projected debt level as an announcement of future policy change, and therefore do not increase private savings and economic growth is unaffected.

In order to test the robustness of the results of the baseline specification, I run multiple additional regressions. The first uses a dummy variable for years after 2007, known as the post-Financial Crisis period. Controlling for this period allows us to analyze the relationship between debt and growth while parsing out any differences that may be related to the Great Recession that year fixed effects are unable to capture. Next, I run the baseline specification now including the Economic Policy Uncertainty index to account for agents' uncertainty of projection accuracy. Both of these alternative specifications increase the magnitude and statistical significance of the results.

I then test the robustness of the dataset by limiting the specification to only use projections from reports with at least a full year ahead horizon for the one-year projection. This is to omit the heterogeneity in the year-of and one-year projection horizons. Considering the medium-term projections are not influenced by this heterogeneity, the change in the estimates of these coefficients reveals that this model omits meaningful observations used in the baseline. Results remain statistically significant with the high projected debt regime resulting in more negative economic growth. Lastly, I run the baseline using countries with the most advanced economies in my sample: France, Germany, Italy, the United Kingdom, and the United States. Highly developed economies are estimated to be more susceptible to regime specific effects on growth, as well as in the magnitude of responses to increases in the key regressor, possibly due to the increased transparency and believed accuracy of the projections from these governments. These checks support the robustness of the results from the baseline specification and the finding that high projections lead to lower 5-year GDP per capita growth.

In order to test the robustness of my 90 percent threshold, I run alternative thresholds at 70, 80, 100, and 110 percent debt-to-GDP. This helps ensure the results are not specific only to the 90 percent level and the shifts in the regimes caused by alternative thresholds respond according to theory. The 70 and 80 percent thresholds yield regime estimates that are not statistically significantly different from one another. Increasing the threshold to the 100 percent debt level led to increases in the magnitude and statistical significance of the estimates which is expected given this level of debt signals an even higher probability of fiscal policy change. The results support the use of the 90 percent debt threshold to signal the level corresponding to the level at which the probability of policy change begins increasing.

The remainder of the paper is organized in the following six sections. In Section II, I discuss the data and the choice of control variables in the baseline specification. Section III discusses the intuition based on rational expectations neoclassical growth literature and the use of debt projections differs from the use of actual debt. Section IV details the empirical methodology used to estimate the effect of high projected debt on economic growth. Section V presents the main empirical results of the baseline specification using the panel smooth threshold model as well as the results when using a panel binary threshold model. Explanation linking the findings of the baseline specification to theory and intuition is also included in this section. Section VI presents the five robustness exercises performed to test the persistence of the main results. Section VII concludes the paper.

II. Data

In this study, I use panel data from 29 countries with a maximum period of 1980-2019. Government gross debt projections, recording a maximum of a four-year horizon, were manually scraped from individual government records. Debt projections for E.U. countries were found in the annual Stability and Convergence Program reports beginning in 1998 as a requirement of the EU Commission. U.S. debt projections are reported annually in the Congressional Budget Office's Long-Term Budget Outlook. The debt level is uniformly defined as the gross debt-to-nominal GDP ratio for each country. The use of individual government records, rather than a source such as the IMF, captures each government's perspective of future spending and revenue based on current economic indicators and knowledge of country-specific provision and tax schedules.

All countries reporting from the E.U. follow identical formulas for forecasting debt as set forth by the Maastricht definition of government debt[1]. The CBO is not subject to following this exact definition when projecting the government gross debt level for the United States but based on the provided calculations these projections can be assumed to be nearly, if not precisely, identical.

[1] The Maastricht debt is defined as the total consolidated gross debt at face value in the following categories of government liabilities (defined in ESA 2010): currency and deposits, debt securities and loans. The reference values for debt are based on concepts defined in the European System of Accounts (ESA 2010).

Country	Data Period	Max. Projection Horizon
Austria	1980-2019	4 years
Belgium	1998-2019	4 years
Bulgaria	2005-2019	3 years
Croatia	2013-2019	3 years
Cyprus	2004-2019	4 years
Czech Republic	2004-2019	3 years
Denmark	1998-2019	4 years
Estonia	2004-2019	4 years
Finland	1998-2019	4 years
France	1998-2019	4 years
Germany	1998-2019	4 years
Greece	1998-2019	4 years
Hungary	2004-2019	4 years
Ireland	1998-2019	4 years
Italy	1998-2019	4 years
Latvia	2004-2019	3 years
Lithuania	2004-2019	3 years
Luxembourg	2001-2019	4 years
Malta	2004-2019	3 years
Poland	2003-2019	3 years
Portugal	1998-2019	4 years
Romania	2006-2019	3 years
Slovakia	2003-2019	3 years
Slovenia	2004-2019	4 years
Spain	1998-2019	4 years
Sweden	1995-2019	3 years
The Netherlands	1998-2019	4 years
United Kingdom	1998-2019	4 years
United States	1983-2019	4 years

Control variables in this analysis are standard for the debt-growth literature to account for any changes in growth that cannot be attributed to debt. Panizza and Presbitero (2013), in their meta-analysis of the debt-growth literature, specify that the most frequently used controls come from the growth literature - population growth, the ratio of investment-to-GDP and a measure of the human capital stock. These series are collected from the Worldbank. Additional controls were determined based on the existing debt-growth literature. Also using data from the Worldbank, I have further included the log of GDP per capita to account for the "catch up effect" of GDP, CPI to adjust for the presence of inflation, and the age dependency ratio due to its growing influence

on expenditures in developed economies[2]. Lastly, I include the trade openness score from my World in Data to measure countries' exposure to international trade. Actual debt levels are from government records. Table 1 displays summary statistics of the control variables for the full dataset.

Table 1: Summary Statistics

VARIABLES	(1) N	(2) Mean	(3) SD	(4) Min	(5) Max
CPI 1-year growth rate	582	0.0213	0.0191	-0.0596	0.143
Population 1-year growth rate	583	0.348	0.763	-2.258	3.651
Age dependency ratio	583	49.73	4.495	38.46	61.80
Investment-to-GDP ratio	583	22.61	4.179	10.22	41.54
Human Development Index	566	0.873	0.0401	0.758	0.955
GDP per capita 5-year average growth rate	444	0.102	0.163	-0.242	0.618
Trade Openness	583	108.7	67.22	16.60	408.4
Log of GDP per capita	583	10.17	0.614	8.269	11.69

III. Intuition: Projected Debt and Uncertainty

Government agencies from each country project debt levels using forecasted total government expenditures and revenues, the debt level from the previous year, and the expected interest on debt over the specified horizon, modeled in equation (1),

$$E_t D_{i,t+h} = \gamma_i + E_t D_{i,t+h-1}(1 + r_{t+h}) + (Expend_{i,t+h} - TotRev_{i,t+h}) \quad (1)$$

where $E_t D_{i,t+h}$ is the projected debt in country *i* in year *t* with horizon *h*. Projected debt is assumed, in this paper, to be in one of two regimes: *high projected debt* (≥90%) and *low projected debt* (<90%). If a country's debt projections are in the high regime, agents anticipate a higher probability of corrective action. That corrective action, per Yared (2019), can take the form of: 1. austerity through tax increases or government spending decreases, 2. austerity through tax increases and government spending decreases, 3. inflation, or 4. continued debt accumulation. Agents have knowledge of past austerity measures taken in their country, but ideological differences across time and governing bodies along with varying levels of budget flexibility hinder their ability to respond to high projected debt with 100% confidence in which measures will be taken.

Households are assumed to be rational and forward-looking. As government debt projections are reported, households observe the current debt stance and the expected position in the projection horizon. Projections offer more insights on the probability for tax hikes, government spending decreases, and increased interest rates than prevailing debt levels provide. Whether or not there is any indication of the implementation of new policy, the knowledge that debt is projected to be in the high regime increases the perceived probability of the government's future fiscal strategy.

[2] Auerbach et al. (2017)

Potential tax increases result in increased private savings in the present to smooth consumption in the future. Increased taxes restrict the household's ability to consume and invest at the same levels in the future as they do now. High government debt is typically the result of high public investment which causes crowding out effects, decreasing private investment opportunities and access to capital. As investors become increasingly uncertain of the government's ability to repay debt, they expect interest rates to increase which will further reduce investment and consumption in the future.

Firms respond to their insights of the government's repayment strategy as well as to the real and expected actions of households, generating additional uncertainty. Based on firms' perceptions of how the government will change policy to reduce debt, they will become increasingly uncertain of their own ability to borrow funds and produce output. Future demand for goods and services will change if taxes increase and interest rates rise, causing firms to begin decreasing output. Decreased capital stock due to lower private investment will force firms to adjust by providing fewer training and labor opportunities, in turn reducing the productivity of human capital.

These behaviors are solely based on the actions taken by forward-looking agents' before expected policies are implemented. Increased private savings in preparation for such debt strategies have yet to be accurately defined in current analyses of the relationship between debt and growth. Hence, there is potential of an upward bias on the coefficient on debt in past studies of the debt-growth relationship. The uncertainty of future fiscal and monetary policy will result in behaviors that are not optimal to what actions the government actually takes, but to the best way risk averse agents can smooth consumption given current perceptions of the debt stance.

Debt projections provide more information about optimal consumption/savings behavior than the current debt level. Current debt informs on past fiscal policy, debt levels, and deficits. Therefore, projections provide information on the present and future while actual debt provides information on the past. Present debt influences growth through the same mechanisms of reduced consumption and investment, but in this state, it is caused by the implementation of one of the four specified government actions. Why, then, would agents wait to act until interest rates and taxes rise or until the government reduces expenditures if these projections are available? This would not be forward looking, rational behavior. The mechanism by which GDP growth slows due to high debt levels begins and is magnified by the actions taken by agents prior to the actual accumulation of debt, in which projections inform on the perceived probability of policy changes.

IV. Empirical Methodology

The baseline specification uses a panel smooth threshold regression (PSTR) to model the heterogeneous impacts on growth between high and low projected debt regimes using country and year fixed effects. The model assumes a 90% debt-to-GDP threshold exists, as per the literature[3]. Therefore, the estimation is the effect to which high debt projections, rather than high actual debt, influence the growth rate of GDP. The baseline specification is represented by:

[3] A 90% threshold, or evidence supporting its existence, are reported in Reinhart and Rogoff (2010), Kumar and Woo (2012), Checherita-Westphal and Rother (2012), Minea and Parent (2012).

$$\overline{g}_{i,t+1,t+k} = \frac{1}{k}[y_{i,t+k} - y_{i,t}] \quad (2)$$

and

$$\overline{g}_{i,t+1,t+k} = \alpha_i + \Omega_1' E_t D_{i,t+4}[1 - H(E_t D_{i,t+h};\ \gamma, \tau)] + \Omega_2' E_t D_{i,t+4} H(E_t D_{i,t+h};\ \gamma, \tau)\ + \beta_1 Debt_{i,t} + \beta_2 y_{i,t} + \Psi X_{i,\,t} + \lambda_t + \epsilon_{i,t,t+k} \quad (3)$$

where $\overline{g}_{i,t+1,t+k}$ is the overlapping k-year forward average growth rate of per capita GDP between year *t+1* and year *t+k*. The log of nominal GDP per capita is $y_{i,t}$, which is also a control to capture the "catch-up effect" of GDP. The key regressor, $E_t D_{i,t+4}$, is the four-year projected debt ratio. $Debt_{i,t}$ is the actual level of debt used to control for the impacts of the current debt level. A vector, $X_{i,\,t,}$ of controls: CPI growth, annual population growth, age dependency ratio, investment to GDP ratio, and the Human Development index (HDI). α_i represents country fixed effects, λ_t denotes time fixed effects, and $\epsilon_{i,t,t+k}$ are errors.

The overlapping five-year forward average GDP per capita growth rate is from the growth literature. Cecchitti, Mohanty and Zampolli (2012) use k=5 noting that this rate reduces the potential effects of cyclical movement in the business cycle and also estimates the medium-term impacts of debt projections on GDP growth. Kourtellos, Stengoes, and Tan (2012) suggest using k=10 to further reduce this potential, but the limited number of observations in my data cannot allow for this value of k. This rate also minimizes the potential of endogeneity bias and reverse causality by assuming that all regressors, except for annual population growth, are predetermined with respect to the five-year forward average GDP growth rate, i.e., exogenous.

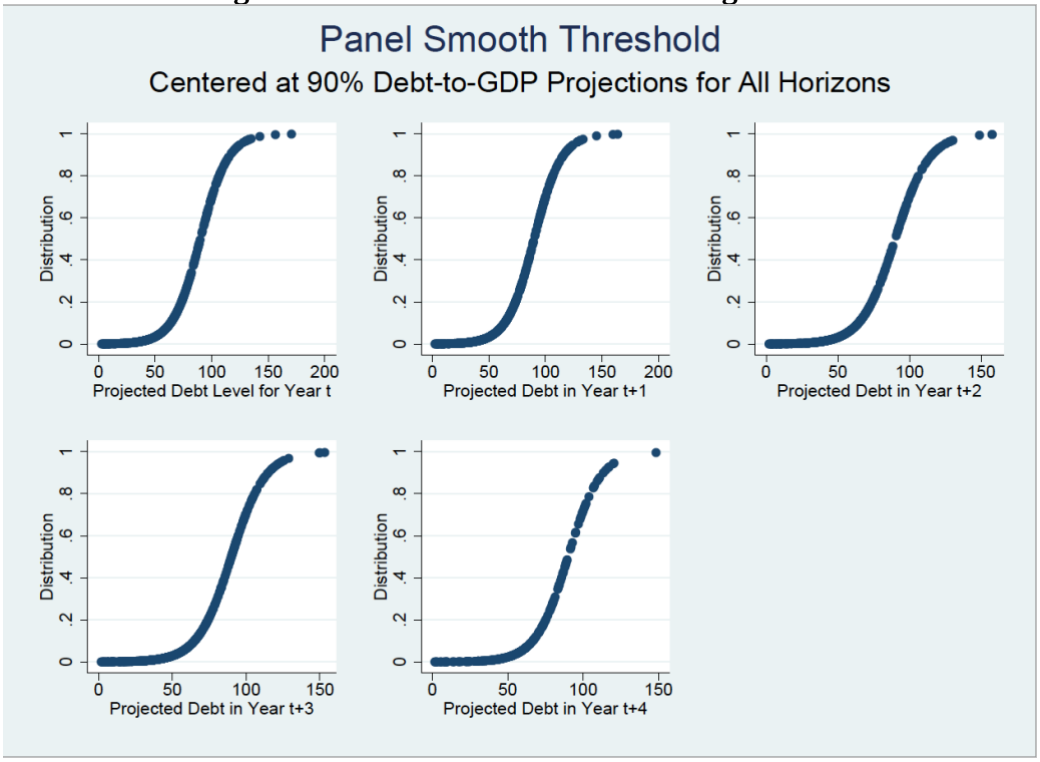
The continuous function of the smooth threshold is denoted by $H(E_t D_{i,t+h};\ \gamma, \tau)$. It is represented in the following transition function:

$$z_t = \frac{(E_t D_{i,t+h} - \tau)}{SD(E_t D_{i,t+h})}$$

$$H(E_t D_{i,t+h};\ \gamma, \tau) = \frac{\exp(-\gamma z_t)}{1+\exp(-\gamma z_t)}, \gamma < 0 \quad (4)$$

Here, $E_t D_{i,t+h}$, expected debt in year t+h is the threshold variable and is assumed to be predetermined at date t. The slope parameter, γ, denotes the smoothness of transitions at the threshold τ. The function is normalized between 0 and 1, which denotes the normal projected debt regime and the high projected debt regime. Figure 1 presents the projected debt at each horizon used as the smooth threshold.

Figure 1: Panel Smooth Threshold Regression



The use of the 90% threshold as opposed to identifying one empirically within this data is deliberate. In contrast to the current literature, the threshold in this setting indicates the debt level at which agents believe the probability of policy change increases. Given that there is no uniform threshold that signals the likelihood of policy implementation in country i in year t with 100% certainty, the chosen threshold is based on the debt level most frequently identified in the literature as the point at GDP growth begins to decline. Therefore, the 90 percent threshold is used as identified by Reinhart and Rogoff (2010), Minea and Parent (2012), Checherita-Westphal and Rother (2012), and Kumar and Woo (2010). I consider the robustness of my results under alternative threshold assumptions and find consistent results.

The baseline specification measures the effect of the debt projection on GDP growth apart from the impact caused by actual debt. The threshold variable informs agents on the expected debt stance of their government in year $t+h$, and therefore, allows them to react based on the regime and the level of uncertainty generated by the length of the horizon. The longer the projection horizon the more uncertain agents are of its accuracy. However, longer term forecasts reveal the government's expectations of the future given its current stance, allowing agents to determine whether or not a debt 'problem' is likely. Therefore, agents put less merit in the accuracy of medium-term forecasts but, since they are forward-looking, determine optimal consumption and investment based on the expected regime from these projections. This is yet another way in which debt projections act differently than actual debt levels in this context.

V. Baseline Results

In Table 2 I report the results of the baseline panel smooth threshold regression model. Each column specifies the baseline regression using a different projection horizon as the threshold variable with Column 1 using the year-of estimate and Column 5 using the four-year debt projection. Row 1 lists the estimated change in the overlapping 5-year forward average GDP per capita growth rate from a one percentage point increase in the four-year projected debt if the debt projection for year t+h is in the high regime. Row 2 lists these results for the threshold of debt projections for year t+h in the normal regime. A coefficient of -0.001 would imply that a 10-percentage point increase in four-year projected debt results in a 1 percentage point decline in the overlapping five year forward average GDP per capita growth rate.

Table 2: Baseline specification with debt projection t+h as threshold (90%)

VARIABLES	(1) Threshold: Proj t	(2) Threshold: Proj t+1	(3) Threshold: Proj t+2	(4) Threshold: Proj t+3	(5) Threshold: Proj t+4
Smooth High Debt	-0.00673***	-0.00619***	-0.00565***	-0.00514***	-0.00478***
	(0.00181)	(0.00164)	(0.00149)	(0.00143)	(0.00142)
Smooth Normal Debt	-0.00326**	-0.00270**	-0.00217*	-0.00189	-0.00192
	(0.00132)	(0.00128)	(0.00125)	(0.00126)	(0.00128)
Actual Debt (t)	0.00304*	0.00266	0.00239	0.00182	0.00113
	(0.00183)	(0.00170)	(0.00157)	(0.00151)	(0.00149)
Constant	3.189***	3.190***	3.298***	3.325***	3.272***
	(0.462)	(0.456)	(0.444)	(0.442)	(0.448)
Observations	166	166	165	165	166
R-squared	0.703	0.708	0.721	0.722	0.710
# of Countries	21	21	21	21	21
Country FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
Control Variables	Yes	Yes	Yes	Yes	Yes
Adj. R^2	0.637	0.643	0.659	0.660	0.646
F-statistic	31.98	32.72	34.71	34.77	33.09
Prob>F	0.00000	0.00000	0.00000	0.00000	0.00000
F-test: High v. Normal	11.81	14.19	17.32	17.52	15.39
Prob>F	0.000781	0.0002	0.0001	0.0000511	0.0001

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

All results for the smooth high variable, in which the debt projection of horizon h is in the high regime, are significant at the 0.01 level. The coefficients on smooth normal debt are statistically significant only in the first three columns. Column 1 shows results using the year-of projected debt level as the threshold. When the four-year debt projection increases by 10 percentage points the GDP per capita growth rate declines by 6.73 percentage points for the high regime and declines by 3.26 percentage points for the low regime over the following five years. Each threshold results in statistically different estimates of the smooth high and smooth low debt coefficients with F>10 which can be found in the bottom two rows of Table 2.

The difference between the coefficients on smooth high and smooth normal debt regimes is largest, 3.49 percentage points, when using the threshold of one-year projected debt (Column 2) and smallest, 2.86 percentage points, when using the four-year projected debt (Column 5), with an average difference of 3.31 percentage points across all horizons. These results indicate that projections in the high regime result in more negative economic growth than projections in the normal regime. Not only this but, as the projection horizon increases across each column in Table 2, the estimates for the high regime remain statistically significant and negative as four-year projected debt increases, whereas the normal regime becomes statistically insignificantly different from zero.

This is another key result from the baseline specification. When the four-year projection horizon is used as the threshold variable, a 10-percentage point increase in the four-year projection results in a 4.78 percentage point decrease in the 5-year GDP per capita growth rate for the high regime. When the projected debt regime is based on short-term projections within 2 years from the present, columns 1-3, agents are more certain of the short-term future of their economy. The impacts of higher certainty in short-term projections but uncertainty in the government's debt repayment strategy as medium-term debt rises leads to higher magnitude negative effects on growth, especially for high short-term projections. As the threshold variable increases to medium-term projections, columns 4 and 5, agents are not as certain of the forecast's accuracy but gain more knowledge of the economic outlook in the medium-term. Agents in countries with high medium-term forecasts will respond to increases in four-year projections by increasing savings, as the probability of policy change increases and the government's ability to reduce debt in the long term becomes increasingly uncertain. Agents in countries with normal four-year projected debt will be less responsive to an increase in its level as they do not expect the increase to result in policy change or economic instability.

Relating back to the model from Davig and Foerster (2019), fiscal uncertainty episodes begin with the announcement of a possible policy change which are signaled by the projected debt regime or the projected increase in the four-year debt level. The projected regime signals policy change when agents believe a high regime indicates either the increased probability of austerity measures or increased interest rates and inflation. An increase in the four-year debt forecast can also imply an announcement of future policy change but only if agents believe this increase implies a need for contractionary policy measures. The probability of policy implementation is dependent on the projected debt regime and horizon of the threshold variable.

Table 3 shows results of the PSTR without controls. The coefficients on smooth high debt remain statistically significant and remain more negative than those for smooth normal debt

regime. The inclusion of controls when estimating the results in Table 2 yields an increased difference between the high and normal regimes compared to the results in Table 3. This contributes additional support to the relationship between projected debt regimes and growth, which is strengthened once accounting for factors affecting growth apart from debt. High projected debt results in increasingly negative economic growth when controlling for factors influencing growth, whereas this impact for projected debt in the normal regime decreases once the factors are considered.

Table 3: Baseline specification without control variables

VARIABLES	(1) Threshold: Proj_t	(2) Threshold: Proj_t1	(3) Threshold: Proj_t2	(4) Threshold: Proj_t3	(5) Threshold: Proj_t4
Smooth High	-0.00363***	-0.00352***	-0.00351***	-0.00352***	-0.00370***
	(0.000686)	(0.000665)	(0.000661)	(0.000659)	(0.000665)
Smooth Normal	-0.00285***	-0.00220**	-0.00183	-0.00163	-0.00189*
	(0.00103)	(0.00109)	(0.00111)	(0.00109)	(0.00105)
Constant	0.281***	0.250***	0.235***	0.225***	0.238***
	(0.0483)	(0.0507)	(0.0520)	(0.0522)	(0.0511)
Observations	203	200	199	199	203
R-squared	0.138	0.139	0.143	0.148	0.153
# of Countries	23	23	23	23	23
Country FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
Controls	No	No	No	No	No
Adj. R^2	0.0215	0.0209	0.0253	0.0306	0.0386
F test	14.21	14.13	14.57	15.13	16.05
Prob>F	1.87e-06	2.05e-06	1.41e-06	8.76e-07	3.90e-07
F test: High v. Normal	0.656	1.836	2.937	3.903	3.835
Prob>F	0.419	0.177	0.0884	0.0498	0.0518

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Notice the R-squared values have decreased significantly to lower levels when the control variables are omitted. Including the controls largely impacts the explanatory power of the baseline specification, while debt alone can explain a sizable amount of the variation in economic growth.

The panel smooth threshold regression model is used to account for varying debt levels within the high and normal projected debt regimes. It is a continuous function of the projected debt level in year $t+h$. Its transition function is normalized to be bounded between 0 and 1. It is important to observe the results when applying the simpler version of the PSTR, the panel binary threshold regression model. Here, the threshold is now a dummy variable for the projected debt that equals 0 in the normal regime and 1 in the high regime. Table 4 presents results from a binary threshold panel model.

Table 4: Binary threshold panel model with 90% threshold

VARIABLES	(1) Threshold: Proj_t	(2) Threshold: Proj_t1	(3) Threshold: Proj_t2	(4) Threshold: Proj_t3	(5) Threshold: Proj_t4
High Debt	-0.00413***	-0.00388***	-0.00429***	-0.00355**	-0.00337***
	(0.00145)	(0.00147)	(0.00143)	(0.00136)	(0.00129)
Low Debt	-0.00277**	-0.00276**	-0.00288**	-0.00232*	-0.00184
	(0.00131)	(0.00133)	(0.00131)	(0.00130)	(0.00127)
Actual Debt (t)	0.000425	0.000438	0.000978	0.000188	-0.000446
	(0.00150)	(0.00156)	(0.00153)	(0.00147)	(0.00138)
Constant	3.439***	3.481***	3.502***	3.673***	3.585***
	(0.455)	(0.459)	(0.449)	(0.450)	(0.437)
Observations	166	166	166	166	166
R-squared	0.696	0.690	0.700	0.698	0.714
# of Countries	21	21	21	21	21
Country FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes
Adj. R^2	0.628	0.621	0.634	0.631	0.651
F test	30.88	30	31.57	31.17	33.77
Prob>F	0.00000	0.0216	0.00000	0.00291	4.91e-05
F test: High v. Normal	8.243	5.406	10.47	9.194	17.60
Prob>F	0.00475	0.0000	0.00152	0.00000	0.00000

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

The results are similar to those in the smooth threshold model, but with a smaller difference between the high and normal debt regimes. Here, the variation in the coefficients as the horizon of the threshold variable increases is non-monotonic. The most negative coefficients on both high debt and low debt occur when the two-year projection is used as the threshold variable interacted with the four-year projection. The variation between regime estimates at each horizon threshold is smaller than in the PSTR and the model as a whole is less statistically significant. While the main results that the high projected debt regime more negatively influences economic growth than the normal regime, the use of the binary threshold limits its ability to account for the severity of, or lack of, a countries debt problem. This specification strengthens my findings of the relationship between debt projections while also providing further support that the baseline specification is the best choice model.

VI. Robustness Checks

To further examine the consistency of my findings, I consider several alternative specifications to evaluate the robustness of my baseline results.

I begin by included a control that is a dummy variable that equals one if the year is greater than or equal to 2008 and zero otherwise in the baseline specification, still including all oter controls. Taking the post-recession time period into account allows us to control for the confounding effects of the Financial Crisis on both debt and growth as well as incorporate potential influences from the changes made in accounting requirements for countries after the crisis4. This time period is associated with decreases in economic growth unrelated to increases in debt, despite the high increases in government debt during this time. Country and year fixed effects are used in the baseline specification to account for changes across countries and across years, but the effects of the Great Recession may not be completely removed from my main estimates on the projected regimes. Table 5 reports the results including the post-2008 dummy variable.

Table 5: Dummy variable for post-Financial Crisis

VARIABLES	(1) Threshold: Proj_t	(2) Threshold: Proj_t1	(3) Threshold: Proj_t2	(4) Threshold: Proj_t3	(5) Threshold: Proj_t4
Smooth High Debt	-0.00624***	-0.00548***	-0.00480***	-0.00424***	-0.00387***
	(0.00174)	(0.00158)	(0.00145)	(0.00139)	(0.00138)
Smooth Normal Debt	-0.00225*	-0.00162	-0.00106	-0.000775	-0.000805
	(0.00129)	(0.00126)	(0.00123)	(0.00124)	(0.00127)
Actual Debt (t)	0.00395**	0.00334**	0.00294*	0.00230	0.00157
	(0.00176)	(0.00163)	(0.00151)	(0.00144)	(0.00143)
Post-2008 Dummy	-0.109***	-0.106***	-0.104***	-0.103***	-0.102***
	(0.0290)	(0.0287)	(0.0280)	(0.0280)	(0.0286)
Constant	1.999***	2.051***	2.192***	2.235***	2.191***
	(0.543)	(0.534)	(0.517)	(0.515)	(0.526)
Observations	166	166	165	165	166
R-squared	0.732	0.735	0.748	0.748	0.736
# of Countries	21	21	21	21	21
Adj. R^2	0.669	0.674	0.689	0.689	0.674
F test	33.19	33.76	35.86	35.83	33.88
Prob>F	0.00000	0.00000	0.00000	7.65e-06	0.00000
F test: High v. Normal	16.80	18.70	21.78	21.69	19.08
Prob>F	7.14e-05	2.97e-05	7.35e-06	0.00000	2.49e-05

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

The coefficients on both regimes decrease very slightly in magnitude and become more statistically significantly different from one another when including the post-2008 dummy. Also, as the projection horizon of the threshold variable increases, the projected normal regime becomes less reactionary to an increase in the four-year projected debt level. The negative

[4] The E.U. Commission changed the publication date of the Stability and Convergence reports to April during the recession and introduced additional requirements for governments when forecasting economic indicators to increase transparency and accuracy in projections.

coefficient on the post-2008 dummy variable is statistically significant at the .01 level for all thresholds. This finding supports my intuition that the recession is linked to exogeneous decreases in economic growth unrelated to debt projections. The main findings from the baseline results hold, and the statistical significance of the model increases when controlling for the post-2008 period.

Not only was the post-2008 time period associated with decline in economic growth and increases in debt levels, but it also highlighted the inaccuracies of debt projections during the onset of such large recessionary periods. Economic policy uncertainty (EPU) is widely studied and is indexed in Baker, S. R., N. Bloom, and S. J. Davis (2016). This index is based on multiple components relating to politics and economics. For example, the U.S. EPU is determined by uncertainty results reported in 10 large newspapers, reports from the CBO, and the Federal Reserve Bank of Philadelphia's Survey of Professional Forecasters. This index allows us to determine the level of uncertainty in economic policy and, therefore, projections, in a given year. The EPU index has been calculated for 10 countries within my sample. Including this index as a control variable allows us to test the robustness of my baseline results that as uncertainty increases in debt projections, economic growth for debt projected in the normal regime is not impacted by an increase in four-year projected debt. These results are reported in Table 6.

Table 6: Economic Policy Uncertainty

VARIABLES	(1) Threshold: Proj_t	(2) Threshold: Proj_t1	(3) Threshold: Proj_t2	(4) Threshold: Proj_t3	(5) Threshold: Proj_t4
Smooth High Debt	-0.0104***	-0.00941***	-0.00797***	-0.00682***	-0.00596***
	(0.00236)	(0.00204)	(0.00186)	(0.00180)	(0.00180)
Smooth Normal Debt	-0.00482***	-0.00392***	-0.00314**	-0.00275*	-0.00268*
	(0.00156)	(0.00147)	(0.00146)	(0.00149)	(0.00153)
Actual Debt (t)	0.00741***	0.00648***	0.00519**	0.00413**	0.00336*
	(0.00233)	(0.00211)	(0.00199)	(0.00196)	(0.00198)
EPU Index	-2.53e-05	3.66e-05	2.16e-05	-3.11e-05	-8.84e-05
	(0.000240)	(0.000237)	(0.000238)	(0.000242)	(0.000247)
Constant	0.514	0.512	0.752	0.915	1.020
	(0.865)	(0.833)	(0.817)	(0.831)	(0.863)
Observations	97	97	97	97	97
R-squared	0.798	0.807	0.805	0.796	0.785
# of Countries	10	10	10	10	10
Adj. R^2	0.745	0.756	0.753	0.742	0.728
F test	27.35	28.80	28.47	26.96	25.19
Prob>F	0.00000	1.35e-05	0.00000	0.000111	0.000968
F test: High v. Normal	17.67	21.66	20.76	16.63	11.79
Prob>F	7.09e-05	0.00000	1.95e-05	0.00000	0.00000

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

The results of this alternative specification result in an increase in the magnitude of the estimate for both regimes. High projected debt levels are still associated with higher decreases in economic growth, with a 1-to-1 relationship estimated for the high projected debt regime. Also, the statistical significance of the model and the difference between the coefficients remains high. Despite this, the coefficients on the EPU index are statistically insignificant from zero. It is important to note that this is most likely due to the limitations of my dataset and the EPU index dataset and not due to the lack of significance of economic policy uncertainty to my model. The baseline results are still found in this alternative specification but, with only 97 observations, this should not be considered a highly robust regression.

Uncertainty in economic policy, based on the uncertainty literature, is a key factor influencing agents' responses to debt projections and the effects of such responses on economic growth. While this exercise lacks observations and statistical significance, I believe that expanding upon the economic policy uncertainty index and debt projection datasets will allow this area of literature to expand immensely.

Another limitation of my data is heterogeneity in some of the horizons of the projections. Reports from the Stability and Convergence Program have varying reporting dates. The reporting month and year for which an E.U. country is providing debt projections before 2010 results in heterogeneity among the horizon of the first projection (Proj_t). In some instances, a report for year t may be published at the beginning of year t+1 in which the year-of "projection" is actually an estimate. The requirements of the reporting measures changed in 2010, which led many countries not to report the 2009/2010 fiscal year. However, after 2010 all reports were published by April of year t. The U.S. data from the C.B.O. is not subject to such limitations. Therefore, the omission of these observations where the reporting year of the publication varies from the first projection of the debt level, I ran the baseline specification only including projections where the reporting year is equal to year t. Table 7 reports these results.

Here, estimates in the first two rows are less significant, but the relationship between projections in the high debt regime resulting in more negative impacts on GDP growth remain. Also, the results vary less across each threshold variable. The coefficients between the smooth high and smooth normal debt regimes are statistically significantly different from one another in columns 3-5 ($F>10$). The main results hold in this alternative specification, with reduced statistical significance.

It is important to note that the majority of the reports omitted from this regression were published during the onset of the Great Recession around 2008-2010, the period known for high increases in government debt and decreases in economic growth which may influence results by omitting these observations. Also, the omission of these projections from the regressions in columns 3, 4, and 5 reduces the magnitude of the coefficients on both projected debt regimes, despite the fact that these observations were not impacted by the heterogeneity in the shorter horizons. This allows me to further conclude that the variation in these results is due to the loss of key observations and not due to the omission of shorter horizons of the year-of and one-year projected debt levels. Nonetheless, the key findings from the baseline specification remain in this regression.

Table 7: Projection Horizon Heterogeneity

VARIABLES	(1) Threshold: Proj_t	(2) Threshold: Proj_t1	(3) Threshold: Proj_t2	(4) Threshold: Proj_t3	(5) Threshold: Proj_t4
Smooth High	-0.00484**	-0.00434**	-0.00406**	-0.00370**	-0.00336**
	(0.00194)	(0.00180)	(0.00167)	(0.00161)	(0.00159)
Smooth Normal	-0.00186	-0.00148	-0.00114	-0.000952	-0.000953
	(0.00143)	(0.00140)	(0.00136)	(0.00136)	(0.00138)
Actual Debt (t)	0.00133	0.000945	0.000860	0.000428	-0.000199
	(0.00191)	(0.00181)	(0.00170)	(0.00163)	(0.00161)
Constant	3.101***	3.094***	3.156***	3.148***	3.088***
	(0.506)	(0.505)	(0.494)	(0.494)	(0.502)
Observations	149	149	148	148	149
R-squared	0.712	0.713	0.725	0.725	0.715
# of Countries	20	20	20	20	20
Country FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes
Adj. R^2	0.641	0.643	0.658	0.658	0.645
F test	29.38	29.58	31.13	31.18	29.81
Prob>F	0.00000	0.00248	0.00000	0.000749	0.00173
F test: High v. Normal	8.955	9.557	11.82	11.98	10.28
Prob>F	0.00337	0.00000	0.000808	0.00000	0.00000

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Given differences in the responses of economic growth to high debt levels in countries with varying levels of economic development, it is important to test the robustness of results across different groups of countries. I begin by reporting the most developed countries, based on economic indicators, in my data: France, Germany, Italy, the United Kingdom, and the United States. These countries have the most highly developed economies within the sample. Table 10 presents the results of this regression.

Here, projected debt levels in the high regime result in even more negative impacts of an increase in the four-year projected debt level on GDP growth. Column 1 estimates a 1-to-1 relationship in which a 10-percentage point increase in the four-year projected debt level results in a 10-percentage point decline in the 5-year forward average of the GDP per capita growth rate. Potentially, this reveals agents in highly developed countries are more susceptible to the effects of projected debt regimes and four-year projected debt on GDP per capita growth. This may occur due to increased confidence in their government's level of transparency as well as

the accuracy of the projections, leading to more dramatic savings decisions when projections increase. Though, it is important to note that the number of observations has decreased to 76 for this specification which may be why these results are similar to those in Table 6.

Table 8: Highly Developed Economies

VARIABLES	(1) Threshold: Proj_t	(2) Threshold: Proj_t1	(3) Threshold: Proj_t2	(4) Threshold: Proj_t3	(5) Threshold: Proj_t4
Smooth High	-0.0108***	-0.00883***	-0.00711***	-0.00586***	-0.00489**
	(0.00251)	(0.00227)	(0.00210)	(0.00203)	(0.00199)
Smooth Normal	-0.00444***	-0.00338**	-0.00254	-0.00203	-0.00179
	(0.00163)	(0.00159)	(0.00158)	(0.00160)	(0.00163)
Actual Debt (t)	0.00658***	0.00513**	0.00360*	0.00230	0.00121
	(0.00236)	(0.00222)	(0.00210)	(0.00204)	(0.00199)
Constant	-0.221	-0.0638	0.239	0.424	0.539
	(1.082)	(1.094)	(1.099)	(1.127)	(1.161)
Observations	76	76	76	76	76
R-squared	0.758	0.751	0.741	0.727	0.715
# of Countries	5	5	5	5	5
Country FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes
Adj. R^2	0.703	0.693	0.681	0.664	0.649
F test	19.16	18.37	17.41	16.24	15.27
Prob>F	0.00000	4.62e-05	0.00000	0.000871	0.00372
F test: High v. Normal	21.83	19.25	16.12	12.26	9.100
Prob>F	1.69e-05	0.00000	0.000166	0.00000	0.00000

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.10

In order to test the significance of the 90 percent debt threshold as well as to ensure the results are not specific only to this debt level, different threshold levels are tested. Table 9 reports estimates with the smooth threshold centered at 70 and 80 percent. Again, in this context the threshold indicates the point at which agents believe the probability that policy change will occur increases. Decreasing the threshold places far more debt projections in the high regime and, therefore, indicates the point at which agents will begin increasing savings in preparation for fiscal shortfalls. In both tables, the high projected debt regime yields estimates with more negative coefficients than the normal projected debt regime, though the coefficients in both cases are not statistically significantly different from one another.

Table 9: Thresholds centered below 90 percent

VARIABLES	(1) Threshold: Proj_t	(2) Threshold: Proj_t1	(3) Threshold: Proj_t2	(4) Threshold: Proj_t3	(5) Threshold: Proj_t4
Smooth threshold centered at 70%					
Smooth High	-0.00259	-0.00282*	-0.00282*	-0.00278**	-0.00279**
	(0.00187)	(0.00158)	(0.00143)	(0.00138)	(0.00137)
Smooth Normal	-0.00231*	-0.00200	-0.00147	-0.00116	-0.00113
	(0.00137)	(0.00148)	(0.00153)	(0.00156)	(0.00157)
F test: High v. Normal	0.0326	0.324	1.080	1.821	2.195
Prob>F	0.857	0.570	0.000	0.000	0.141
Smooth threshold centered at 80%					
Smooth High	-0.00529***	-0.00479***	-0.00437***	-0.00408***	-0.00392***
	(0.00192)	(0.00166)	(0.00149)	(0.00142)	(0.00140)
Smooth Normal	-0.00263*	-0.00201	-0.00145	-0.00120	-0.00129
	(0.00133)	(0.00133)	(0.00133)	(0.00134)	(0.00135)
F test: High v. Normal	4.491	5.857	8.120	9.286	8.959
Prob>F	0.0359	0.01680	0.00507	0.0000	0.00328

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

The statistical insignificance between regime coefficients lends further support to the 90 percent threshold level, in which estimates in all columns have F>10. As the threshold increases from 70 percent to 80 percent, the coefficients grow in magnitude and statistical significance. This finding aligns with the intuition of this model in that the closer the threshold gets to the point at which policy is expected to change, the more statistically significantly different the coefficients between the regimes will become.

Table 10 employs thresholds at 100 and 110 percent, respectively. Using a higher threshold than 90 percent is important for ensuring the relationship between debt and growth remains statistically significant and negative and is not specific only to the 90 percent level.

Table 10: Thresholds centered above 90 percent

VARIABLES	(1) Threshold: Proj_t	(2) Threshold: Proj_t1	(3) Threshold: Proj_t2	(4) Threshold: Proj_t3	(5) Threshold: Proj_t4
Smooth threshold centered at 100%					
Smooth High	-0.00655***	-0.00631***	-0.00591***	-0.00539***	-0.00494***
	(0.00169)	(0.00158)	(0.00148)	(0.00144)	(0.00144)
Smooth Normal	-0.00339**	-0.00308**	-0.00267**	-0.00239*	-0.00234*
	(0.00131)	(0.00128)	(0.00125)	(0.00125)	(0.00128)
F test: High v. Normal	14.45	17.48	20.26	18.93	15.26
Prob>F	0.000217	0.000000	0.000000	2.66e-05	0.00000
Smooth threshold centered at 110%					
Smooth High	-0.00578***	-0.00569***	-0.00543***	-0.00501***	-0.00458***
	(0.00162)	(0.00155)	(0.00149)	(0.00146)	(0.00147)
Smooth Normal	-0.00318**	-0.00302**	-0.00273**	-0.00248*	-0.00239*
	(0.00131)	(0.00129)	(0.00126)	(0.00127)	(0.00130)
F test: High v. Normal	12.25	14.54	16.05	14.08	10.41
Prob>F	0.000632	0.00000	0.00000	0.00000	0.00157

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

In Table 10, the results increase slightly in magnitude from the baseline specification, with the difference between the high and normal projected debt regimes remaining statistically significantly different (F>10). This result is expected as the requirement for projected debt to be in the high regime raises, in which agents expect more drastic austerity measures or negative effects of debt as it surpasses total GDP levels and therefore respond with even more conservative savings behavior.

When centered at 110 percent, the coefficients on smooth high and smooth normal debt decrease below their magnitudes from the baseline specification. The two regimes remain statistically significantly different from one another. It is likely if projected debt is in the high

regime under the 110 percent threshold there has been a debt 'problem' for years, therefore reducing agents' uncertainty in the government's debt repayment strategy and generating savings decisions in line with their uncertainty levels. It is necessary to further explore this finding using a larger data sample with more countries as well as more projected debt levels over 110 percent in order to determine the true impact of extremely high projections at this level.

High projected gross government debt is associated with more negative economic growth given an increase in the four-year projected debt level in all of the alternative specification. This lends further support that my baseline results are robust and align with current debt-growth literature with the extension of including debt projections. Each alternative specification finds statistically significantly different estimates on the coefficients for both regimes for at least one of the thresholds. The monotonic relationship between an increase in the projection horizon and a decrease in the magnitude of coefficients is also found in these robustness checks. With the coefficients on the normal projected debt regime being statistically insignificantly different from zero as uncertainty in the projection increases. This lends further support to the Davig and Foerster (2018) model of fiscal cliff episodes.

Incorporating the EPU index into studies of uncertainty in debt projections would be a worthwhile test as the sample of debt projections continues to grow in the future. Another meaningful expansion of this study would be identifying the channels through which economic growth declines as in Checherita-Westphal and Rother (2012). Empirically identifying the channels through which high debt projections influence economic growth can advance my understanding of the role expectations play in the debt-growth relationship.

VII. Conclusion

In this paper, I investigate the link between public debt and economic growth. I find robust evidence that high projected debt is associated with decreased economic growth. When year-of debt is estimated to be in the high regime, a 10-percentage point increase in the four-year projected debt level results in a 6.73 percentage point decline in GDP per capita growth over the following five years. Averaging across all projection horizons of the threshold variable, high projected debt is associated with a 3.31 additional percentage point decline in GDP per capita growth of a five-year period than normal projected debt levels. When the threshold is determined by medium-term forecasts, rather than short-term, the effect of increasing the key regressor on growth diminishes in the normal regime with estimates statistically insignificantly different from zero. This effect is not observed for the high regime, indicating that high four-year projections negatively affect GDP growth.

The negative effects of high debt levels on GDP growth has been identified in the literature with many estimating a 90 percent debt-to-GDP threshold. The findings of this paper support Davig and Foerster (2018), in that economic growth declines from high projected debt levels if the probability of increased debt acts as a signal of possible policy implementation. In order to understand the true implications of debt on economic growth, it is necessary to include debt projections as a factor influencing forward-looking rational agent's savings decisions apart from the effects of the actual debt level.

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