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A Study of the Effects of Regimes' Debt-to-GDP Ratios on Real GDP Growth Rates Based on Institutional Fragility

Abstract

We exploit a 61-country dataset over the period from 2000 to 2017 to conduct three variations of a dummy panel regression of economic growth on the debt-to-GDP ratio using the state fragility, institutional effectiveness, and institutional legitimacy indexes provided by the Center for Systemic Peace (CSP) as interactive variables and fixed effects respectively. Our paper is based on the methodology of *Kourtellos* et. al. (2013), which interpreted the CSP's institutional legitimacy scores as a measure of a country's democratic profile and employed them in a study of public debt on GDP growth in the periods 1980-1989, 1990-1999, and 2000-2009. In an effort to extend this analysis into the 2010s as well as expand the number of institutional variables from the CSP's State Fragility Index taken into consideration, we find insignificant results in our studies of overall state fragility and its two components of effectiveness and legitimacy. We find that poorer, more politically volatile countries with higher general regime instability on average see higher levels of growth in response to increases in their debt-to-GDP ratio relative to those that are more stable, although the low level of significance in our models for the low institutional stability prevent us from making a definitive inference of causality.

I. Introduction

The question of how public debt affects real GDP growth under various macroeconomic and social conditions has been a subject of rigorous study. The widespread tendency to rely on governments' fiscal spending in banking and finance, urban development, and military affairs, coupled with the substantial apparatus of healthcare, retirement, and other social programs across the world, including those that are conservative, those that are liberal, and those that resemble the structure of functional finance, has reinforced the political importance of these studies of how far national debt can be stretched. *Brown-Collier* et. al. (1995) write extensively on the expansion of Keynesian public investment policy in the contemporary era and the potential fiscal impact of large government spending projects directly targeted at social reform and sustainable development. At the end of 2011, Japan's central government debt was 233 percent of its GDP, the highest among the countries designated by the World Bank as "developed." In 2013, after the U.S. debt ceiling was lifted, the American debt-to-GDP ratio reached 102 percent. In Europe, Greece hit a record high 165.3 percent debt-to-GDP ratio in 2013 and then broke their own record in 2018 with the debt-to-GDP ratio reaching 181.2 percent.

The relationship between a regime's volume of fiscal debt relative to their annual GDP has been of considerable prominence and debate, especially in the period following the Great Recession, as governments around the world debate whether spending billions, trillions on policies such as free healthcare for all, expansions of entitlements programs, extensive social services, reparations for slavery, and dramatic sustainability development programs to fight climate change would destabilize economies. In the United States, Medicare-for-All and the prominent and in many ways infamous Green New Deal (Holmes 2011) touted by progressive

policymakers including Senator Bernie Sanders, Congresswoman Alexandria Ocasio-Cortez, and Senator Edward Markey are examples of such policy proposals.

Economic studies by-and-large find a negative relationship between heightened government spending and GDP growth, and most put the threshold of catastrophic effects around 75 to 100 percent of GDP, according to the Mercatus Center at George Mason University. High levels of debt may negatively affect capital stock accumulation, which would increase long-term interest and inflation rates, which negatively affect private consumption. *Elmendorf* (1996) applied Ricardian macroeconomic theory to his natural experiment study of the effects of government spending cuts on real interest rates and exchange rates, specifically the effect of U.S. government spending on the U.S. dollar. He finds that when spending was expected to be higher, real interest rates increased as did the real U.S. dollar exchange rate. Elmendorf analyzed the time periods prior to 1985 and between 1985-1990 using a time series analysis on a Data Resources, Inc. database that included non-quantitative variables not included in traditional vector autoregression analysis. *Goyal* (2004), studying the exogenous capital inflows into India in the second half of the 1990s finds two-directional causality between real interest rates and the fiscal deficit in an IS-LM framework, in addition to finding that reserve levels are a unidirectional instigating factor of rising interest rates.

Increased government borrowing also may instigate a crowding out effect that depresses public investment in infrastructure and education as high interest payments eat up an increasing amount of the budget deficit, which has a negative potential on long-term economic growth. One study that was of important public interest of spurring on the movement against high fiscal spending in the policymaking sphere was Carmen Reinhart and Kenneth Rogoff's "Growth in a Time of Debt" (2010), which found significance for catastrophic effects on low-term growth if

the debt-to-GDP ratio exceeded 90 percent. *Reinhart* was the subject of a global austerity movement and cited by then-U.S. Speaker of the House Paul Ryan in his presentation of the Congressional budget, which featured calls for cutting substantial components of American fiscal spending.

However, a British graduate student named Thomas Herndon discovered flaws in the methodology of "Growth in a Time of Debt " while writing a replication paper on *Reinhart* and reran the initial model with some corrections and changes in methodology; the results of *Herndon* et. al. (2013) reflected the basic conclusions of *Reinhart* but found substantially less significance in their findings, enough to overturn its impact in policymaking spheres.

In a way, this paper seeks also to contribute to the conversation of austerity measures in countries of different growth trajectories, consumption levels, and institutional features. The most well-known case of austerity gone wrong is the fiscal condition of Greece in the modern era, which is analyzed in *Glomm* et. al. (2018), who consolidate an overlapping-generations model with household heterogeneity testing the effectiveness of various budget-limiting measures carried out by the Greek government in the 1990s and 2000s to save their debt-ridden economy. One of their key conclusions is that in the short period following spending cuts and tax increases, these economies—this study focuses on small economies, which are generally more institutionally fragile—will experience sharp contractions but will reroute toward higher growth in the long run. Not to mention, politically, it is very difficult to broadly cut social programs after they've been placed into effect, as seen in the turmoil of the public reaction to Greek spending cuts. A more detailed, angled response to *Reinhart* was *Kourtellos* et. al. (2013), who analyze the effects of deficit spending on GDP growth growth across a number of countries using structural threshold regression.

Our greatest contention is that in broad analyses of the effect of an increase in government debt, there has not been significant consideration of countries' institutional variables, namely their political, economic, and security concerns. In this paper, we were interested in conducting a linear panel regression analysis using three institutional fragility indexes presented in the Center for Systemic Peace's latest annual State Fragility Index and Matrix report. *Kourtellos* (2013) is particularly important to this paper, because the authors found strong evidence for threshold effects based on "democracy levels" as measured by the Center for Systemic Peace. *Kourtellos*, et. al. use a three-period pooled panel of 82 countries encompassing the years 1980-1989, 1990-1999, and 2000-2009. They employ a threshold regression model using a vector of Solow growth variables and their lagged values. In terms of institutional factors, Kourtellos employed two indexes, Political Effectiveness ("poleff") on the original 5-point scale and Political Legitimacy ("polleg") on the original 5-point scale averaged over each 10-year-period in their pooled panel, and augmented them to generate a unique indicator for "democracy levels" with a range of [0, 10]. However, for the purposes of this paper, we focused on extending their use of institutional fragility to the entire State Fragility Index, not just the political indexes, to estimate a coefficient representing the effect of the debt-to-GDP ratio on growth using a single-period panel to extend the analysis of public debt and growth rates into the 2010s for which comprehensive data was available, which was up to the year 2017. To account for the high number of country-year observations and low timespan, we extended our study ten years back to begin at 2000.

II. Methodology

We aim to isolate the effects on growth from the debt-to-GDP ratio by levels of political, security, and economic stability through the State Fragility Index offered by the Center for Systemic Peace. Countries are ranked from 0 to 25, with 25 being most fragile and 0 being least. The two major aggregated components of the overall index are an effectiveness index (0 to 13) and a legitimacy index (0 to 12), both of which are derived from security, political, and economic security indicators. The effectiveness and legitimacy scores are added together to form an overall fragility index. For more detailed explanations of these three indexes, see variable definitions for the variables *sfi*, *effect*, and *legit*. Whereas *Kourtellos* (2013) exploited only democracy metrics from the Center for Systemic Peace in their threshold model, we conducted a study focused on all of the State Fragility Index's institutional variables of effectiveness, legitimacy, and overall fragility.

Using a dataset consisting of 61 countries, we ran three variations of a time series panel regression using the dummy model for the State Fragility Index and its two components of effectiveness and legitimacy scores to estimate both a fixed-effect and interaction-term linear regression of the annual growth rate of real GDP in 2011 dollars at chained PPPs (*growthrate*, *米)* against the central government debt-to-GDP ratio (*cgd*, δ_i). For the values of effectiveness, legitimacy, and overall fragility, we categorized these values into high (E_h, L_h, F_h), medium (E_m, L_m, F_m), and low (E_l, L_l, F_l) binary dummy variables.

Our dataset spanned an 18-year panel from 2000 to 2017 and included each country's human capital index (*hc*, η_i), population (*pop*, λ_i), and average household absorption (*rdana, Δ*). In our two models involving non-institutional estimators, we included the 1st lag of the debt-to-GDP ratio (*lagcgd*, δ_{ii}), the log of population (*logpop*, λ_{log}), the 1st lag of human capital

(*laghc,* η_{ii}), and the log of real domestic absorption (*logrdana,* Δ_{log}) to account for year-to-year effects on the growth rate, understanding that the values of these variables at the start of the year would affect the rest of the year.[1]

For Model (1), we employed interactive terms multiplying each country's SFI dummy indicator (0, 1) and the debt-to-GDP ratio to isolate effects by institutional stability level. We excluded all other explanatory variables, treating institutional stability as an almost purely exogenous factor. Some economic variability is accounted for given that each of these institutional indexes contains an economic component; the economic effectiveness score is derived using GDP/capita and the economic legitimacy score is derived using the share of export trade in manufactured goods. Nevertheless, this regression likely suffers from omitted variable bias in the absence of more substantial estimators.

$$米_{1e} = s_1 E_h \delta_i + s_1 E_m \delta_i + s_1 E_l \delta_i + u_i$$

$$米_{1l} = s_1 L_h \delta_i + s_1 L_m \delta_i + s_1 L_l \delta_i + u_i$$

$$米_{1f} = s_1 F_h \delta_i + s_1 F_m \delta_i + s_1 F_l \delta_i + u_i$$

Model (2) is structured in the same way as Model (1) using the same interactive terms, to study the differences of debt on growth between regimes with different institutional effectiveness, legitimacy, and overall fragility levels. Unlike Model (1), we included our four macroeconomic estimators: the log of GDP/capita, the log of population, the 1st lag of human capital, and the log of real domestic absorption.

[1] Data for the debt-to-GDP ratio was unavailable for the period between 2000 and 2004 for Iraq and the period between 2000 and 2001 for Vietnam. These observations were excluded from the observation.

$$米_{2e} = d\delta_i + h\eta_{ii} + p\lambda_{log} + a\Delta_{log} + s_1E_h\delta_i + s_1E_m\delta_i + s_1E_l\delta_i + u_i$$

$$米_{2l} = d\delta_i + h\eta_{ii} + p\lambda_{log} + a\Delta_{log} + s_1L_h\delta_i + s_1L_m\delta_i + s_1L_l\delta_i + u_i$$

$$米_{2f} = d\delta_i + h\eta_{ii} + p\lambda_{log} + a\Delta_{log} + s_1F_h\delta_i + s_1F_m\delta_i + s_1F_l\delta_i + u_i$$

Model (3) employs fixed effects instead of interactive estimators to study growth trajectories for countries of different institutional characteristics in general, without considering the debt-to-GDP ratio. For this regression, we used the high, low, medium effectiveness, legitimacy, and overall fragility indicators in fixed effect dummy estimation. Like Model (2), Model (3) also includes the log of GDP/capita, log of population, 1st lag of human capital, and log of real domestic absorption.

$$米_{3e} = d\delta_i + h\eta_{ii} + p\lambda_{log} + a\Delta_{log} + FE(D_{eh}) + FE(D_{em}) + FE(D_{el}) + u_i$$

$$米_{3l} = d\delta_i + h\eta_{ii} + p\lambda_{log} + a\Delta_{log} + FE(D_{lh}) + FE(D_{lm}) + FE(D_{ll}) + u_i$$

$$米_{3f} = d\delta_i + h\eta_{ii} + p\lambda_{log} + a\Delta_{log} + FE(D_{fh}) + FE(D_{fm}) + FE(D_{fl}) + u_i$$

We define our effectiveness, legitimacy, and overall fragility dummies in the following manner:

Overall fragility (0 - 25)	Low fragility = 1 if *sfi* [0, 3] (404 country-year observations), else 0 Medium fragility = 1 if *sfi* [4, 10] (318 country-year observations), else 0 High fragility = 1 if *sfi* [11, 25] (371 country-year observations), else 0
Effectiveness (0 - 13)	High effectiveness = 1 if *effect* [0] (307 country-year observations), else 0 Medium effectiveness = 1 if *effect* [1, 5] (440 country-year observations), else 0 Low effectiveness = 1 if *effect* [6, 13] (346 country-year observations), else 0
Legitimacy (0 - 12)	High legitimacy = 1 if *legit*[0, 1] (314 country-year observations), else 0 Medium legitimacy = 1 if *effect* [2,5] (432 country-year observations), else 0 Low legitimacy = 1 if *legit* [6, 12] (347 country-year observations), else 0

Relevant Variable Definitions

Variable	Source	Definition
growth	*PWT 9.0, World Bank*	Percentage change in real GDP in 2011 dollars at chained PPPs
cgd	*IMF, Trading Economics*	Central government debt to GDP ratio
gdppc	*derived*	GDP per capita. PWT 9.0's real GDP divided by the population
logppc	*derived*	Logarithm of GDP per capita.
sfi[2]	*Center for Systemic Peace (CSP)*	Index for overall state fragility, defined as 0 to 25, with 0 being the most stable, and 25 being the most fragile. Computed by adding effectiveness score *effect* to legitimacy score *legit*.
effect	*CSP*	Index for state effectiveness. Component of *sfi*. General security and political violence index + regime/government stability index + economic effectiveness index (computed using GDP/capita), scaled from 0 to 13, with 13 being the least effective.
legit	*CSP*	Index for state legitimacy. Component of *sfi*. State repression index + regime/governance inclusion ("democracy") index + economic legitimacy index (computed using share of export trade in manufactured goods). Scaled from 0 to 12, with 12 representing countries with the lowest legitimacy.
hc	*PWT 9.0*	Human capital index, computed using returns to education and years of secondary and tertiary schooling for the male population over 25.
laghc	*derived*	1st lag of human capital
pop	*PWT 9.0*	Population in millions
logpop	*derived*	The logarithm of population + 0.05
rdana	*PWT 9.0*	Real domestic absorption, measure of household consumption in constant 2011 dollars
logrdana	*derived*	The logarithm of real domestic absorption.

[2] For full details on the computation of the SFI index, see *Marshall, Monty G. & Gabrielle Elzinga-Marshall, "State Fragility Index and Matrix," Center for Systemic Peace, 2016*.

Descriptive Statistics

Variable	*Mean*	*Standard Deviation*	*Max*	*Min*
growth	3.765	4.212	26.417	-36.700
cgd	51.668	36.690	260.964	1.562
logppc	9.321	1.231	11.926	6.299
sfi	7.658	6.392	24.000	0.000
effect	3.696	3.575	12.000	0.000
legit	3.962	3.163	12.000	0.000
hc	2.560	0.715	4.328	1.129
laghc	2.560	0.715	4.328	1.129
pop	61.397	158.097	1339.180	0.592
logpop	3.083	1.424	7.250	-0.474
rdana	959407	2234754	18650000	2978
logrdana	12.341	1.823	16.741	7.999

III. Results

First, we assess the nature of growth in countries of different institutional features without a direct consideration of the debt-to-GDP ratio in Model (3) using fixed effects of low and high. We exclude the medium dummy variable without expanding the low and high categories to keep our data consistent between our three regressions. Furthermore, we are assessing the differences in growth based on low vs. high stability countries, and because our dummy variables already segregate the three-tier sample, there is no variability to be lost in excluding the medium stability countries.

Our effectiveness fixed effects model (Table 5) shows high significance in the estimates of the two fixed effect variables. Relative to our intercept, low effectiveness regimes—which we can define as low security, poorer regimes with high vulnerability to both external and political violence—are associated with higher levels of GDP growth, +2.05, while high effectiveness regimes—which we can define as politically stable, richer countries—are associated with a lower level of growth, -1.32 percent. Despite reflecting a similar phenomenon, our legitimacy fixed effects model (Table 6) shows considerably lower strength, with neither fixed effect yielding significant estimates. High legitimacy regimes—high-export states with greater democratic inclusion—experience a lower relative growth rate, -0.413, while low legitimacy countries—more authoritarian states with higher levels of state repression—also experience a lower growth rate, -0.315, albeit not as low as high legitimacy countries. In terms of our overall fragility fixed effect regression (Table 7), we see a statistically insignificant correlation between countries of high fragility (low effectiveness and low legitimacy) and a relative -0.126 difference. Meanwhile, low fragility countries experience a -0.638 relative difference in growth.

Across all three categories, the results suggest that poorer, volatile, more unstable countries grow faster than more stable countries. This may be explained by the "catch-up" effect, in which poorer regimes have access and reference to technology resources, financial aid, and political structures from richer countries. As a result, these regimes enjoy the benefits of lower diminishing marginal returns from capital as much as richer countries, which aids in generating higher economic growth.

In Model (1) (Table 1), we assess the relationship between the debt-to-GDP ratio and the GDP growth rate using interactive estimators without considering other explanatory variables. In treating countries' institutional factors as a purely exogenous factor, we get a baseline of effects to improve upon in Model (2), which inputs four macroeconomic estimators into the exclusive model—the log of GDP per capita, the log of population, the 1st lag of human capital, and the log of real domestic absorption.

As reflected in Model (3)'s effectiveness regression, Model (1) yields the highest significance in the effectiveness model. Countries with low effectiveness experience a relative +0.011 change in growth rate given an increase in the debt-to-GDP ratio, while medium effectiveness countries experience a -0.019 change, while high effectiveness countries experience a -0.032 change. Once we add in the four macroeconomic estimators in Model (2) (Table 2), all three numbers decrease in absolute value but still reflect the same pattern. Countries with low effectiveness experience a +0.008 change in growth based on an increase in the debt-to-GDP ratio, countries with medium effectiveness a relative -0.018 change, and countries with high effectiveness a -0.026 change. Our models imply that poorer countries with lower regime stability and a higher vulnerability to political violence tend to see more benevolent effects on growth from increased central government debt loads.

The story is similar in the legitimacy model, although with considerably lower significance and absolute value. Low legitimacy countries tend to experience a +0.007 change in growth given an incremental increase in debt, and medium countries a -0.009 change, both significant only at the ten percent level. However, high legitimacy countries appear to experience a much lower relative change in the growth rate with an estimate of -0.033 with high statistical significance. In Model (2), after adding in explanatory variables (Table 3), the estimate for low legitimacy countries changes dramatically, switching signs. In the terms of state legitimacy, much variability is lost in the omission of our macroeconomic variables, implying that the "democracy levels" employed by *Kourtellos* (2013) make a great deal of difference in whether countries with low political inclusion and high levels of state repression experience higher or lower levels of growth once country-specific economic indicators are taken into account. Low legitimacy countries now experience a -0.003 change in growth, medium legitimacy countries -0.007, and high legitimacy countries -0.022. The high legitimacy interactive estimator is the only one of significance in this particular variation. Our model suggests that regimes of all legitimacy levels see a negative effect on growth from an increased debt-to-GDP ratio, but countries with higher levels of state repression, lower levels of democratic inclusion, and low levels of exports (implying low or inefficient levels of domestic production) are associated with smaller effects.

It is appropriate and relevant to note that countries with low legitimacy and high effectiveness, or vice versa, would yield erroneous measures of the effect of the debt-to-GDP ratio on economic growth if we were to only consider the effectiveness and legitimacy models. For example, a country may be stable and free from political violence or external violence risks because of its strict autocratic or authoritarian control, such as Saudi Arabia or the People's

Republic of China. Such a country would be classified under high effectiveness but low legitimacy. Another example would be a country that is ruled by an structural unsound government but is democratically inclusive, which would be classified as low effectiveness but high legitimacy, such as Greece in the modern era. A country with high levels of exports but low levels of infant mortality would see an averaged neutral legitimacy score. Therefore, to account for these overlapping institutional factors, we consider a model using the overall fragility index, which combines effectiveness and legitimacy factors.

In terms of overall fragility, we find high fragility countries experience a relative +0.009 change in the growth rate given an increase in the debt-to-GDP ratio with significance at the five percent level while low fragility countries a -0.029 correlation with high significance. In Model (2), after more explanatory variables are added into the regression, high fragility countries are associated with a 0.000 change in the growth rate with low statistical significance, while medium fragility countries and high fragility countries are associated with a relative -0.006 and -0.020 changes in the growth rate respectively, both with high statistical significance. We would expect the overall fragility model to reflect the same pattern of our effectiveness and legitimacy models, as the fragility index is derived by adding the effectiveness score of a country to the legitimacy score.

What our interaction term models conclude with varying levels of significance is that for countries that are more stable, more democratic, better run, and richer, an increase in the debt-to-GDP ratio is consistently associated with a negative effect on the GDP growth rate, although very small in absolute value. Statistical significance is considerably higher if we take only the effectiveness score in our institutional measure, but the pattern is reflected across all three indicators from the State Fragility Index.

IV. Discussion

Despite high significance, one variable of note was our consistently negative human capital coefficient, which implies that lower levels of education is correlated with higher growth rates. However, given the Penn World Table's definition of its human capital index—which is derived using years of education as well as returns to education—this could be because countries with high institutional fragility and lower levels of growth experience lower returns to schooling, human capital development, and political inclusion as a result of higher risks of armed conflict, state repression, and regime instability as measured by the State Fragility Index. As a result, we neglected to use the contemporaneous variable and instead relied on the 1st lag of human capital, which gave us the education condition of a country going into a given year, instead of exiting a given year.

Additionally, similarly to our issues with the human capital variable, our models experience positive relationships between GDP per capita and the growth rate, implying that richer countries grow more quickly. We experimented with different combinations of explanatory variables, but the coefficient sign remained the same. This implies that richer countries tend to grow faster than poorer countries, which would suggest diverging economies that conflict with the commonly noted principle of macroeconomic convergence.

Furthermore, there is a notable flaw in our use of the real domestic absorption variable, wherein contemporaneous values could indicate year-to-year levels of economic consumption conditions while neglecting business cycle effects.

Kourtellos (2013) concludes that when a country's institutions are of "sufficiently high equality," then public debt is growth neutral. However, when a country's institutions are below a

certain threshold, the authors find that more public debt is associated with *lower* growth, all else equal. In terms of the overall fragility regression, our results contradict the findings of *Kourtellos*, who find that there is a more detrimental effect on smaller, more unstable economies with high public debt.

However, one key difference between our model and the *Kourtellos* model is that while they used an augmented combination of the political legitimacy and political effectiveness indicators in the State Fragility Index to represent "democracy" levels, we used the consolidated legitimacy and effectiveness indicators to represent a country's holistic security, political, economic, and social profile.

In terms of legitimacy, our results reflect the conclusions of *Kourtellos*, in showing that countries with low levels of democracy experience negative growth along with the rest of the world, although with much lower statistical significance. Another issue to take into account is that countries with lower quality institutions on average experience higher levels of debt relative to their GDP levels and may lend erroneous effects to our models. In comparison to the structural threshold regression model employed by *Kourtellos*, our model is considerably weaker, less inclusive, and less sophisticated. One of the major flaws with our methodology is the high possibility that, like typical problems of cross-country growth regressions, the limited number of explanatory variables in our panel regression might just be proxying for an array of excluded variables. Furthermore, we employed fewer regressors and did not include initial income, public investment, fertility, life expectancy, inflation, and tropics as explanatory terms, as *Kourtellos* did. Additionally, while we employed a basic dummy panel estimation, *Kourtellos* used a linear Solow growth model augmented by the debt-to-GDP ratio to conduct a threshold model.

V. Conclusions

Our model shows with significance that generally, an incremental increase in the debt-to-GDP ratio is correlated with a larger increase in growth for countries whose institutional fragility are categorized as medium or high. Most of our statistical significance comes from the effectiveness score. We find that countries with more unstable general security metrics, higher likelihood to engage or be engaged in military violence, higher vulnerability to internal political violence, and experience general regime stability on average see higher levels of growth in response to increases in their debt-to-GDP ratio relative to those that are more stable. In fact, the only positive effect on growth comes from our effectiveness model for low effectiveness countries, albeit without statistical significance.

Our regression for legitimacy somewhat reflects the conclusions of *Kourtellos*, albeit with lower levels of significance, that countries with low levels of democratic inclusion and high levels of state repression will see negative effects on growth from increased debt. A key difference in our study of democracy relative to *Kourtellos* is that we see a higher negative effect for countries of high legitimacy, rather than a negligible, insignificant effect. In terms of overall fragility, it is the high fragility countries we find with a neutral growth effect from an increase in the debt-to-GDP ratio. In addition to extending *Kourtellos*' study of the debt-to-GDP ratio based on a country's institutions into the 2010s, as well as broadening the scope of institutional indicators in our models, we hope this paper adds a notable fixture to how we analyze the effect of public debt on GDP growth based on institutional factors in the era of austerity versus high fiscal spending.

VI. Appendix

Table 1.
Model (1): Interactive Terms Only
Degrees of Freedom: 1,089

Estimators	*Estimates, effectiveness*	*Estimates, legitimacy*	*Estimates, overall fragility*
Intercept	4.411 (***) (0.221) p: 0.000 t: 19.892	4.372 (***) (0.216) p: 0.000 t: 20.209	4.259 (***) (0.222) p: 0.000 t: 19.181
*Low * debt/GDP*	0.011 (**) (.004) p: 0.005 t: 2.831	0.007 (.) (.004) p: 0.0858 t: 1.720	-0.029 (***) (0.004) p: 0.000 t: -7.568
*Medium * debt/GDP*	-0.019 (***) (0.006) p: 0.001 t: -3.322	-0.009 (.) (.005) p: 0.0655 t: -1.843	-0.004 (0.007) p: 0.546 t: -0.604
*High * debt/GDP*	-0.032 (***) (0.004) p: 0.000 t: -8.138	-0.033 *** (0.004) p: 0.000 t: -8.071	0.009 (*) (0.004) p: 0.021 t: 2.316
Model Adjusted R-squared	0.093	0.076	0.081
Model F-statistic	38.44	31.09	32.94
Model P-value	0.000	0.000	0.000
Residual Standard Error	4.01	4.048	4.038

Significance Indicators:
0%: (***)
0.1%: (***)
1%: (**)
5%: (*)
10%: (.)

Table 2
Model (2): Interactive Terms, Effectiveness
Degrees of Freedom: 1,084

Estimators	*Estimate*	*T value*	*P(>|t|)*
Intercept	5.473 (**) (1.689)	3.241	0.001
Low * debt/GDP	0.008 (0.005)	1.526	0.127
Medium * debt/GDP	-0.018 (**) (0.006)	3.124	0.002
High * debt/GDP	-0.026 (***) (0.004)	-6.025	0.000
Log of GDP/capita	3.071 (***) (0.796)	3.857	0.000
Log of population	2.997 (**) (0.913)	3.283	0.001
1st lag of human capital	-0.985 (***) (0.268)	-3.675	0.000
Log of real domestic absorption	-2.953 (**) (0.909)	-3.250	0.001

Residual standard error: 3.955 on 1084 degrees of freedom
Multiple R-squared: 0.1235, Adjusted R-squared: 0.1178
F-statistic: 21.81 on 7 and 1084 DF, p-value: 0.000

Table 3.
Model (2): Interactive Terms, Legitimacy
Degrees of freedom: 1,084

Estimators	*Estimate*	*T value*	*P(>|t|)*
Intercept	8.777 (***) (1.508)	5.822	0.000
Low * debt/GDP	-0.003 (0.005)	-0.622	0.534
Medium * debt/GDP	-0.007 (0.005)	-1.445	0.149
High * debt/GDP	-0.022 (***) (0.005)	-4.890	0.000
Log of GDP/capita	3.318 (***) (0.819)	4.050	0.000
Log of population	3.683 (***) (0.920)	4.003	0.001
1st lag of human capital	-0.852 (**) (0.270)	-3.155	0.002
Log of real domestic absorption	-3.610 (***) (0.919)	-3.927	0.000

Residual standard error: 3.984 on 1,084 degrees of freedom
Multiple R-squared: 0.1108, Adjusted R-squared: 0.105
F-statistic: 19.29 on 7 and 1,084 DF, p-value: < 2.2e-16

Table 4.
Model (2): Interactive Terms, Overall Fragility
Degrees of freedom: 1,084

Estimators	*Estimate*	*T value*	*P(>|t|)*
Intercept	7.896 (1.695)	4.658	0.000
Low * debt/GDP	-0.020 (***) (0.004)	-4.776	0.000
Medium * debt/GDP	-0.006 (***) (0.007)	-0.877	0.381
High * debt/GDP	0.000 (0.005)	0.062	0.951
Log of GDP/capita	3.313 (***) (0.817)	4.054	0.000
Log of population	3.530 (***) (0.936)	3.773	0.000
1st lag of human capital	-0.857 (**) (0.270)	-3.178	0.002
Log of real domestic absorption	-3.500 (***) (0.931)	-3.760	0.000

Residual standard error: 3.985 on 1,084 degrees of freedom
Multiple R-squared: 0.1104, Adjusted R-squared: 0.1047
F-statistic: 19.22 on 7 and 1,084 DF, p-value: 0.000

Table 5.
Model (3): Fixed Effects, Effectiveness
Degrees of freedom: 1,084

Estimators	*Estimate*	*T value*	*P(>|t|)*
Intercept	2.988 (2.044)	1.462	0.144
Debt-to-GDP ratio	-0.010 (**) (0.003)	-3.043	0.002
Log of GDP/capita	3.417 (***) (0.778)	4.391	0.000
1st lag of human capital	-0.707 (**) (0.271)	-2.605	0.009
Log of population	3.014 (***) (0.904)	3.332	0.001
Log of real domestic absorption	-3.091 (***) (0.892)	-3.465	0.001
Fixed effect: high effectiveness	-1.323 (***) (0.367)	-3.601	0.000
Fixed effect: low effectiveness	2.053 (***) (0.437)	4.693	0.000

Residual standard error: 3.95 on 1,084 degrees of freedom
(1 observation deleted due to missingness)
Multiple R-squared: 0.1257, Adjusted R-squared: 0.1201
F-statistic: 22.27 on 7 and 1,084 DF, p-value: 0.000

Table 6.
Model (3): Fixed Effects, Legitimacy
Degrees of freedom: 1,084

Estimators	*Estimate*	*T value*	*P(>|t|)*
Intercept	11.876 (***) (1.565)	7.591	0.000
Debt-to-GDP ratio	-0.011 (**) (0.003)	-3.130	0.002
Log of GDP/capita	4.019 (***) (0.858)	4.685	0.000
1st lag of human capital	-0.921 (**) (0.281)	-3.280	0.001
Log of population	4.600 (***) (0.966)	4.762	0.000
Log of real domestic absorption	-4.569 (***) (0.960)	-4.760	0.000
Fixed effect: high legitimacy	-0.413 (0.363)	-1.138	0.256
Fixed effect: low legitimacy	-0.315 (0.334)	-0.942	0.346

Residual standard error: 4.002 on 1,084 degrees of freedom
Multiple R-squared: 0.1027, Adjusted R-squared: 0.09692
F-statistic: 17.73 on 7 and 1,084 DF, p-value: 0.000

Table 7.
Model (3): Fixed Effects, Overall Fragility
Degrees of freedom: 1,084

Estimators	*Estimate*	*T value*	*P(>|t|)*
Intercept	10.992 (***) (1.960)	5.608	0.000
Debt-to-GDP ratio	-0.010 (**) (0.003)	-2.945	0.003
Log of GDP/capita	3.833 (***) (0.831)	4.614	0.000
1st lag of human capital	-0.800 (**) (0.284)	-2.811	0.005
Log of population	4.311 (***) (0.968)	4.454	0.000
Log of real domestic absorption	-4.308 (***) (0.953)	-4.522	0.000
Fixed effect: high fragility	-0.126 (0.410)	-0.307	0.759
Fixed effect: low fragility	-0.638 (0.394)	-1.620	0.105

Residual standard error: 4.001 on 1,084 degrees of freedom
Multiple R-squared: 0.1033, Adjusted R-squared: 0.09751
F-statistic: 17.84 on 7 and 1,084 DF, p-value: 0.000

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A response study to *Reinhart-Rogoff* (2010), a 2013 paper by Kourtellos, Stengos, and Tan in the Journal of Macroeconomics analyzes the effects of deficit spending on productivity growth across a number of countries using structural threshold regression. The authors exploit a balanced 10-year period panel dataset covering 82 countries in 1980–1989, 1990–1999, and 2000–2009 for its categorical nature, and also to average out business cycle effects. One important aspect of this study is the way in which it categorizes the different regimes it analyzes in its sample-splitting model not necessarily by economic strength and size (as did *Reinhart-Rogoff*), but by several key governance variables: the political effectiveness and legitimacy indexes presented in the Center for Responsive Politics' State Fragility Index. *Kourtellos* concludes that increased deficit spending is most detrimental in countries in the "Low-Democracy" category, and has a negligible effect on countries in the "High-Democracy" category.

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