Economic Freedom and Debt: An Empirical Investigation on the Institutional Determinants of Public Debt

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Abstract

This paper investigates the role of the institutional framework in the accumulation of central government debt. We employ the Economic Freedom Index (EFI) as a proxy for institutional framework and study the causal link between institutions that promote economic freedom and the creation of public debt. Countries that score better on the quality of economic institutions are more likely to accrue lower levels of public debt. In particular, a 10-point enhancement in the EFI score can lead to reductions between 8.5 and 11.1 percentage points in debt-to-GDP ratios. We also observed that scores for open markets and government size affect public debt negatively across developed as well as developing countries. Additionally, the evidence suggests that countries with relatively lower levels of corruption and higher government integrity tend to accumulate lower levels of public debt. We stipulate these economic institutions increase the pool of available credit and reduce borrowing costs for governments hence affecting debt levels.

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Contents

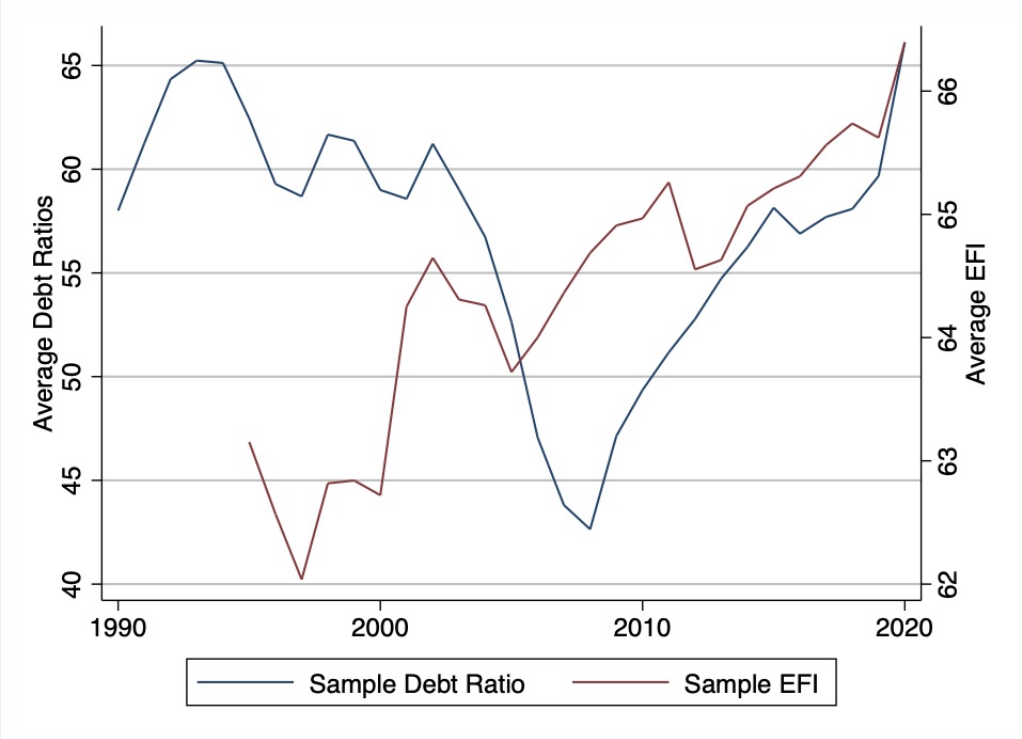
1 Introduction

The increasing involvement of government in economic activity and the expansion of the welfare state in the aftermath of the Second World War has been linked to a steady positive trend in public debt accumulation, especially in high-income countries. Governments have funded their budget deficits by issuing large volumes of bonds on the market and debt levels have soared substantially since. This phenomenon has not been only confined to developed countries. Poorer countries also experienced total or partial defaults on their public debt several times since the 1990s. The issue of government debt became particularly evident after the financial crisis of 2007/8 and the recent COVID-19 pandemic, which brought sovereign debts to rise to unprecedented levels. These were primarily the result of automatic stabilizers and extraordinary government spending destined for temporary relief packages. In other words, the structure of economic institutions was essential in understanding the pattern of debt creation over time. Secular trends suggest that many countries around the world have seen their public debt increase in the second half of the 20^{th} century together with the amendments in their institutions. However, some countries have amassed significantly different levels of debt and some economies seem more prone to public debt accumulation. Therefore, we want to investigate and provide an answer as to whether these changes in economic institutions are a leading force driving public debt differences across countries. For instance, it might be the case that a particular institutional framework allows governments to acquire debt more efficiently than others, or perhaps some fundamental structures of an economy can make it less likely for central governments to resort to public debt issuing.

The preponderance of literature on government debt focuses on the impact of public debt on economic growth and performance (Kumar and Woo (2010); Reinhart and Rogoff (2010); Panizza and Presbitero (2014); Eberhardt and Presbitero (2015)). There is insufficient empirical work, however, carried out on the macroeconomic factors that leads to the accumulation of debt in the long term. Furthermore, at the time this was written, there is no empirical work exploring a possible link between a country's institutional framework and its level of public debt. Our paper is a first attempt to initiate a discussion on the institutional origins of government debt and the determination of a possible causal link between a country's public debt and its economic institutions. To do so, we will be using the Economic Freedom Index (EFI) as a proxy for the quality of economic institutions. This index estimates the freedom and market orientation of economic institutions within any given country and assigns an average score to those institutions. Additionally, the empirical analysis will provide evidence

on potential structural reforms that governments could introduce in the pursuit of reducing government debt.

Figure 1: Sample Averages of Debt Ratios and EFI (1990-2020)



Notes: Annual sample averages of our dependent and independent variables for the period under consideration. **Sources:** EFI data from the *Heritage Foundation* while debt-to-GDP ratios mainly from *International Monetary Fund* (*IMF*).

Figure 1 shows the co-movement of debt-to-GDP ratios and EFI throughout the time period studied. It shows how, following a reduction of debt ratios in the early 2000s, there has been a rapid and steady increase in public debt since the financial crisis of 2007/8. Similarly, Figure 1 displays an upward trend in EFI scores since 1990s. Overall, this necessitates further analysis into this co-movement for the purpose of discerning a possible causal link between the two indicators.

Our main hypothesis is that higher EFI scores, which translates into better-quality economic institutions, lead to lower levels of government debt. In particular, we expect "Government Size" and "Open Markets" to be relatively better in capturing variations in government debt due to three main reasons. Firstly, countries with relatively small public sectors tend to score higher in economic freedom and they are less likely to accumulate government debt. Secondly, relatively more open markets create the economic conditions for more integrated international financial markets, hence the capacity of acquiring higher levels of public debt (Azzimonti et al. (2014)). Lastly, we expect countries with better quality economic insti-

tutions and laws to have a better perceived reputation amongst international lenders and, ergo, face lower interest rates. Therefore, we presume that institutional characteristics such as enforcement of property rights and ranking of government integrity to significantly influence borrowing conditions countries are facing. Generally, we expect economic institutions to promote economic growth and, as a consequence, reduce debt-to-GDP ratios.

This paper is organized as follows. Section 2 is a literature review on the existing research around the issue of public debt accumulation and its determinants. Section 3 describes the data we used to construct our sample, includes a review of the list of countries that comprise our sample, and details what econometric models we employ for our empirical estimations. Section 5 provides a exhaustive discussion of the results obtained from our estimation techniques, while Section 6 summarizes the main findings and suggests paths for further research into the institutional determinants of public debt.

2 Literature Review

The existing literature on public debt mainly focuses on the effects of public debt on the macroeconomic variables, particularly growth, productivity and investment, rather than its determinants. Barro (1979) theoretically demonstrated that public debt is exclusively a function of its previous lag rather than determined by other macroeconomic variables. On the contrary, there is empirical evidence that suggest sovereign debt can be the result of both exogenous as well as endogenous factors. For example, Swamy (2015) looks into several variables and runs Granger-causality test against the accumulation of debt. He finds that real GDP growth, foreign direct investment, government expenditure, inflation and population growth increase the level of debt while gross fixed capital formation, final consumption expenditure and trade openness have the opposite effect.

The role of population growth is another significant factor in the discussion since the ageing population around the world is likely to produce increased spending on welfare. Greiner et al. (2007) suggested that the sustainability of debt in the near future would depend on how governments respond to the ageing population, increasing costs for pension schemes, and health care. Pension schemes in the Eurozone were expected to grow from 3 to 5% of GDP and health care expenditures between 1 and 2% in the next decade. The estimated impact of such changes on government expenditure were found to be between 1.7 to 3.9% of GDP leading to an inevitable rise in debt-to-GDP ratios across Euro countries (EPC (2001)). Finally, Ellis and Schansberg (1999) demonstrate how ageing populations could lead to considerable fiscal consolidation as a greater proportion of younger voters favours the option of debt financing, whereas a majority of elderly voters prioritize debt reduction. It is interesting to pinpoint that Becker (1995) argues that there is evidence to suggest that the Ricardian equivalence holds and an increase in debt would not translate into net wealth for households with a positive effect on consumption. Further, Gogas et al. (2014) states that public debt does not Granger cause private consumption at 1% level of significance. This proposition implies that there is no space for present debt financing through future taxes, but government budgets should be constantly balanced.

Furthermore, Nickel et al. (2010) argues that debt levels were reduced only by decisive and lasting fiscal consolidations in the EU between 1985 and 2009. The reduction in debt was mostly achieved through cuts in government expenditures for wages and welfare. Further, there was evidence to suggest that countries can "grow their way out of indebtedness" by

creating an economic environment that promotes significant and stable GDP growth[1]. On the other hand, Forslund et al. (2011) finds that in countries with moderate or no capital controls inflation does have a negative impact on the share of domestic debt contrary to those with strict capital controls i place. This points in the direction of a possible institutional determinant of public debt.

It is worth pointing out the negative effects caused by austerity policies on the level of public debt, especially after the financial crisis of 2007-2009. Whilst high levels of public debt might exacerbate recessionary shocks and make fiscal consolidations beneficial (Beetsma et al. (2015)), recent literature has highlighted how fiscal multipliers are larger in recession than in expansions, implying that fiscal consolidations during recessions are particularly costly in terms of growth (Auerbach and Gorodnichenko (2012a,b, 2013); Batini et al. (2012)). Cherif and Hasanov (2018) uses a VAR debt-feedback model to show that austerity measures only temporarily reduce debt ratios and public debt trends return to pre-shock levels, suggesting that austerity shock could be self-defeating. Another recent work Favero and Mei (2019) also discusses the impact of austerity policies on debt levels by testing separately tax rises and spending cuts. They find that both tax rises and spending cuts negatively affect growth and inflation, while spending cuts have a medium and long-term positive impact on public finances exclusively. This implies different debt-reducing plans can have heterogeneous effects on debt ratios. Similarly, Arellano and Bai (2017) construct a dynamic model in which tax raises do not avert the risk of defaulting on the sovereign debt given the distortionary effects of taxation on output. Further evidence on the negative effects of austerity on output was brought forth by Fragetta and Tamborini (2019). The authors estimate the detrimental effect of austerity policies on growth in the EU and the US showing how spending cuts are less harmful to growth in the long run compared to tax rise.

Previous literature also focused on the role of other factors in determining the level of government debt. Gnegne and Jawadi (2013) used the case studies of the UK and US to assess the importance of economic shocks such as business cycle downturns, oil shocks, debt crises and financial crashes to create structural breaks in the data. Additionally, Benfratello et al. (2018) finds corruption to be a significant determinant of debt levels. In particular, perceived government corruption has a larger effect on debt ratios for developed rather than developing countries. Overall, a unit increase in the Corruption Perspective Index (CPI) is expected to increase debt across all countries between 1.4 and 1.7 percentage points. These studies clearly show how corruption can be a drag on growth and, potentially, a hindrance to debt

[1]Debt-to-GDP ratios remain constant as long as the growth rate of GDP is equal to the cost of servicing the existing debt. Higher GDP growth rates would lead to a reduction of debt ratios suggesting the possibility that countries can grow their way out of debt.

reduction. Azzimonti et al. (2014) suggests that debt levels increase with the volatility of insurable income. Thus, as income inequality increases, industrialized economies in particular might find it optimal to accumulate higher levels of debt.

Preponderance of authors also focused on the differentiation between developed and developing economies. Sinha et al. (2011), for example, find GDP growth, government expenditure, expenditure on education and current account balance to be statically significant determinants of debt for high- and middle-income countries. FDI and inflation have no impact on public debt for high-income countries but are found to be of relevance for the middle-income ones. However, these variables become statistically insignificant when an auto-regressive model is employed. The effects completely disappear with the inclusion of the past realizations of debt. Population density and population above 65 years of age do not have an effect on advanced economies' levels of debt. The study by Bandiera (2008) regarding debt in low-income countries showed that there is high heterogeneity across the sample, suggesting that debt is determined by country-specific factors. The author shows that governmental institutions that deliver structural reforms at a slower pace are more prone to accumulate debt. Conversely, Bittencourt (2015) suggests that GDP growth is an important determinant for debt reduction in South American countries, whereas other factors such as inflation and inequality do not have a clear-cut effect on debt. In fact, GDP growth rates of 1% account for around 0.3-0.5% reductions in debt-to-income ratios. An equal increase in inflation can cause a reduction in debt of 0.6-0.7%, but results are not significant when the specification is instrumented out.

Some studies focused on the importance of institutions and economic liberalization in determining the level of government debt. This is what we are particularly interested in exploring. The research in this field is not extensive, but there are some insightful works that are worth following up with further empirical investigation. For instance, Alesina and Tabellini (1990) argue that institutions are key to debt accumulation. In particular, they argue that countries with shorter-lived governments will tend to follow more myopic and short-term fiscal budgets. This leads to increasingly myopic fiscal policy, which in turn translates into public debt accumulation. Moreover, Persson and Svensson (1989) argue that in a two-period model the political party with a higher preference for fiscal consolidation might increase spending in the first period in order to constrain the spending ability of the subsequent government. Further, they argue that political distortions and institutional soundness are important determinants of fiscal policy bias and government debt accumulation. Other authors like Bacchetta and Caminal (1992) and Miller and Foster (2012) highlighted the role of economic freedom

on the accumulation of debt whilst reaching two different conclusions. The former establishes a positive relationship between financial liberalization and debt, whereas the latter argues that gains in the Economic Freedom Index are highly correlated with lower stocks of government debt for all countries. However, their work is based on correlations rather than causation and the papers do not make a fully convincing argument in showing that certain types of institutions are key in determining debt levels.

Finally, it is important to address the relationship between interest rates and sovereign debt. On one hand higher stocks of public debt generally result in higher medium and long-term bond yields, on the other hand higher interest rates are likely to further feed public debt growth (Kumar and Baldacci (2010)). Most importantly, there is an ongoing debate in the literature over the link between public debt and bond yields in the long run. Some authors advocate how higher debt ratios lead to higher sovereign bond yields (Ghosh et al. (2013); Afonso and Rault (2015); Paniagua et al. (2017)). In particular, it highlights how bond yields for Eurozone countries are particularly sensitive to the size of the country's debt relative to the one in Germany (Codogno et al. (2003); Attinasi et al. (2009)). Although few studies have argued that some macroeconomic factors (for example ECB interest rate and market volatility) are less likely to explain the increase in government bond yields in the aftermath of the financial crisis in 2008 (Ebner (2009); De Grauwe and Ji (2012); Seremetis and Pappas (2013)), there is no common pattern of macroeconomic fundamentals that equally explain the bond yields across countries. Poghosyan (2014) mentions that potential growth rates reduce long-term yields and argue that macroeconomic shocks like the 2008 financial crisis move yields from their long-run equilibrium point. In general, the literature seems to agree that international factors have a larger impact than domestic factors on sovereign bond yields (Hsing (2015); Yakubovskiy et al. (2021)). Ford and Laxton (1999) shows that the increase in government debt across OECD countries from the 1970s was responsible for the rise in real interest rates. More recently, Ardagna et al. (2007) and Jacobs et al. (2020) suggest that fiscal discipline has a direct impact on real interest rate, with spillovers on long-term sovereign bond yields. They empirically show that the direct negative impact of growth on public debt is enhanced by an increase in the long-term real interest rate and that higher interest rates lead to the worsening of public debt ratios.

3 Data Description

The panel includes 71 countries across five continents in period between 1990 and 2020[2]. The selection of such economies was made upon careful consideration following the subsequent characteristics: membership to a monetary union, geographical proximity, trading relations, and stages of economic development. These factors considered allows for a reduction of the heterogeneity across countries, making the sample of developed and developing countries comparable and representative of the geographical area they are located in. In particular, there are 32 developed and 39 developing countries from different regions of the world. The distinction between development levels is necessary because developing countries arguably have lower capacities for debt accumulation since they face, amongst others things, higher monetary and financial constraints than developed economies (Schiantarelli (1996); Bernardini and Forni (2017)). Most of the data is retrieved from the World Bank, whilst missing observations and some variables were recovered from other sources such as the OECD, the IMF and central bank datasets. The economic rationale for the inclusion of the variables shown in the Table 3 was partially explained in the literature review section on the matter of government debt. The controls are included as potential co-founding factors of GDP growth, clearing the institutional effect of the Index from possible indirect growth channels that affect debt ratios.

Debt-to-GDP ratios come from Reinhart's database, which is mostly based on the Historical Public Debt database by the IMF[3]. We constructed transitory debt as the yearly fluctuation of debt ratios from its country's historical average. The intention is to separate the effect of our desired independent variables on the level of government debt in the short versus the long run. The variable for transitory debt is constructed as follows:

$$TransitoryDebt_{it} = TotalDebt_{it} - \sum_{i=1}^{71} \frac{TotalDebt_{it}}{t} \tag{1}$$

where the subscript i indicates a particular country and t indicates the time frame.

Subsequently, we collected data for the Index of Economic Freedom (EFI) from the institute that computes it, the Heritage Foundation[4]. The Index is a multi-dimensional score for a country's several economic institutions and regulations, ranking them by how much they

[2] A full list of countries with a breakdown in development levels is provided in the Appendix in Table 10.

[3] Available at: https://data.imf.org/?sk=806ED027-520D-497F-9052-63EC199F5E63. This is the main source of government debt statistics that Reinhart uses to compute complete public debt series. Not all statistics are based on this primary source. Carmen Reinhart's database for public debt statistics and its references can be found at: https://carmenreinhart.com/.

[4] Available at: https://www.heritage.org/index/. Accessed 15th July 2021

are considered to protect and enhance individual economic liberty. Before we set our minds on this particular resource, we have looked into alternative options such as the Economic of the World Freedom (EFW) Index. We realized that the sample size would significantly shrink if we used this indicator, especially in the years prior to 2000. This is primarily because, before 2000 the Index was collected every 5 years, and we did not want to compromise the validity of the data using the extrapolation methods. This would also impact our choice of estimation methods, as the reduced sample size will cause a considerable issue with the non-parametric estimation, particularly in terms of conversion criteria. Therefore, we decided to use the Index of Economic Freedom which covers 12 freedom categories, grouped into 4 main "pillars" (Rule of Law, Government Size, Regulatory Efficiency, and Open Markets). To give a better idea of how the Index is organized, we provide the following Table:

Table 1: The Index of Economic Freedom and Its Components

Pillars	**Components**
1. Rule of Law	Property Rights Government Integrity Judicial Effectiveness
2. Government Size	Government Spending Tax Burden Fiscal Health
3. Regulatory Efficiency	Business Freedom Labor Freedom Monetary Freedom
4. Open Markets	Trade Freedom Investment Freedom Financial Freedom

Table 1 clarifies how the Index is structured. Each country is assigned a score from 1 (*least free*) to 100 (*most free*) for each component. Each component has equal weight to compose the pillar and each pillar weighs a quarter of the overall score. In other words, each of the 12 components has equal weight toward the final overall score of the Index. Countries that score higher are deemed to be economically "freer". The 12 components, which are reduced to 9 due to data availability[5], and the overall index that they form is used in this paper as a proxy for a specific quality of economic institution. Throughout the econometric analysis, we had to drop three components due to the lack of data points. These three variables have far fewer observations in the sample compared to other components. The components dropped are Judicial Effectiveness, Fiscal Health and Labor Freedom. Although fiscal health repre-

[5]See Table 2 below to notice how the number of observations across markers is uneven. Highlighted observations indicate the excluded components. Although preliminary results including these variables produce insightful results, this was made at the expense of an extensive reduction in sample size and number of clusters. Perhaps one might want to increase the number of countries under study to be able to include these components (building a "small T big N" sample).

sents "average deficits as a percentage of GDP and debt as a percentage of GDP, reflecting the government budget management", its exclusion will not significantly affect the results, as it will be reflected in both pillars and full EFI calculations (Depren and Depren (2021), p.436). Equally, we are excluding this variable for the purposes of perfect predictability of the variations in our dependent variable. Overall, this Index and its layers were used as proxies for institutions' qualities and characteristics within a given country. It is important to bear in mind that the Index does not take into consideration social institutions and cultural norms. Countries that score very high in economic freedom are not necessarily countries that protect individual liberties outside the sphere of economics. In other words, this index is to be considered merely as a ranking based on a country's enforcement and protection of economic liberty. The breakdown of the descriptive statistics for the Index in presented in the table below:

Table 2: Descriptive Statistics for the Economic Freedom Index

Variable	Mean	Std. Dev.	Min.	Max.	N
EFI	64.4	10.0	33.5	90.5	1792
Rule of Law	55.5	23.1	9	95	1796
Government Size	66.6	18.1	15.2	95.5	1796
Regulatory Efficacy	71.0	10.9	26.9	96.5	1796
Open Markets	63.5	14.8	15	91.7	1796
Property Rights	59.7	23.7	5	98.4	1792
Government Integrity	51.7	24.3	9.8	100	1796
Judicial Effectiveness	122.1	71.2	1	244	**298**
Tax Burden	71.2	16.3	29.8	99.9	1795
Government Spending	61.8	25.2	0	98.7	1796
Fiscal Health	129.9	71.2	1	228	**320**
Business Freedom	70.0	15.4	20	100	1796
Labor Freedom	238.7	127.4	1	492	**1156**
Monetary Freedom	77.2	10.6	0	95.4	1796
Trade Freedom	73.7	13.6	0	95	1795
Investment Freedom	60.6	19.5	0	95	1796
Financial Freedom	56.3	18.9	10	90	1792

Notes: Numbers are rounded to one decimal place when necessary.

Noteworthy, the components that are represented by their number of observations in bold are those that were left out of our econometric analysis. Finally, the panel includes several macroeconomic variables to control for the general economic conditions in our regression models. These variables are summarized in the table below:

Table 3: List of Controls

Controls	Obs	Mean	Std. Dev.	Min	Max
GDP	2164	3.48	4.44	-50.25	35.22
Inflation	2152	12.25	102.69	-4.86	2947.73
Unemployment Rate	2172	6.67	5.26	.11	33.29
Life Expectancy	2201	71.74	9.64	26.17	85.08
Capital Formation	2138	23.36	6.80	-2.42	50.78
FDI	2154	5.26	20.06	-58.32	449.08
Gini	2201	36.95	8.54	.47	63.90
Democracy	2170	0.58	0.31	0	0.9
Bond Yields	1612	8.67	29.0	-21.03	557.36

Notes: Numbers rounded up to two decimal places when necessary. Summary statistics for bond yields in this table represent those produced after ipolation of our dataset on bond yields.

Firstly, we included variables that can control for variations in debt to accentuate business cycle changes. Accordingly, we have included data for capital formation, GDP growth and unemployment rates. We are controlling for GDP growth to avoid clouding the direct effect of institutional characteristics on debt ratios. Furthermore, we include inflation among our control variables. The change in prices can have important implications for the real level of public debt and has been a propelling force for debt reduction at times throughout history, namely the 1970s (Collard and Dellas (2007); Aizenman and Marion (2011)). Inflation also affects debt ratios through an increase in government revenues from taxation as prices soar. Our set of controls aims at capturing those characteristics in the population that might be causing changes in its composition and, therefore, changes in the structure of government spending. The variable aforementioned is life expectancy, which can capture variations of debt caused by demographic transformations. These are increasingly a matter of fiscal policy, especially amongst developed countries, as they impact government revenues and spending.

Another factor that might be affecting the composition of government expenditure is inequality. In fact, as inequality worsens governments might be facing higher expenses on benefits and lower tax revenue, directly affecting debt level. Thus, we include the Gini coefficient as an overall measure of inequality across countries. Variables such as capital formation, FDI, and unemployment rates are also included in our model to capture the economic and labour environments of the countries at hand. FDI is a particularly important variable in our model in relation to debt levels, especially for developing countries as the foreign investors don't just bring investment but also technological know-how and managerial expertise to the host country (Schnitzer (2002), p. 41). The penultimate variable that we have chosen is a proxy measuring the strength of democracy in the sample of countries we have selected since

democracies might be more prone to debt accumulation. In fact, a democratic regime would rather "cover its expenses through loans and then pay off the debt over a long period, a policy known as "tax smoothing" than impose dramatically higher taxes" in time of need (Schultz and Weingast (2003), p.5).

Finally we are introducing bond yields into our empirical model. As mentioned in the literature review, the addition of such control ensures we account for the effect of changes in debt costs on debt accumulations. In fact, variations in the cost of debt servicing can alter the sustainability of debt resulting in the necessity for countries to service sovereign debt with further bond issuance. Controlling for the possibility of such cycle, it allows us to properly demarcate an effect of EFI on total debt separated from servicing costs.

4 Methodology

This paper will explore three different types of models starting from linear, to non-parametric, all the way to dynamic. For each model that we are going to exploit, we will run, firstly, a model with the aggregate Index of Economic Freedom and, secondly, we will exploit the multi-dimensionality of the Index and we will run the same model including the pillars and components of EFI. Noteworthy, a simple unit root LLC test on the Economic Freedom Index showed that the Index contains a trend, similarly to all its pillars and components. The presence of trends in our dependent variables was not either unexpected or unusual given the nature of the variable. In fact, indices by construction include a trend, so it was very likely for EFI and its components to suffer from a deterministic trend. Accordingly, our linear and dynamic estimations control for time trends in order to avoid possible spurious regression issues. The same goes with the four pillars of EFI (rule of law, government size, regulatory efficacy, open markets) and the 9 testable components (property rights, government integrity, government spending, tax burden, business freedom, monetary freedom, trade freedom, investment freedom, financial freedom). In particular, we introduce a linear, quadratic and cubic time trend in our specifications. In addition, all regressions presented in this paper will be conducted using the aforementioned control variables in order to take into account key determinants of debt creation outlined both in the theory and empirical literature. When possible and informative, we will be using the notion of transitory debt to differentiate the effect of our regressors on short-term fluctuations of debt-to-GDP ratios. Finally, we run each model using three different samples: all, developing, and developed countries. This allows us to monitor how the effect of economic freedom might change based on the type of country we consider and understand whether its effect is homogeneous across countries at different stages of development.

The statistical model used in the fixed-effects linear estimation is the following:

$$totaldebt_{it} =$$
$$\beta_0+\beta_1 EFI_{it}+\beta_2 gdp_{it}+\beta_3 inflation_{it}+\beta_4 unemploymentrate_{it}+\beta_5 fdi_{it}+\beta_6 lifeexpectancy_{it}+$$
$$\beta_7 capitalformation_{it} + \beta_8 gini_{it} + \beta_9 democracy_{it} + \beta_{10} yield_{it} + t + t^2 + t^3 + \alpha_i + u_{it}$$

The analysis starts with the employment of a fixed effects model in analysing the relationship between government debt and the economic freedom index. The linear structure was selected as the initial step in establishing the direction and magnitude of the relationship before the more complex dynamic relationship is considered. In this case, we will not be

able to include the estimations for transitory debt as, by construction, the dependent variable of transitory debt is already demeaned. In other words, the estimations would yield the exact same results. The FE model also allows us to control for time-invariant characteristics that are both time and country-specific, constructing clustered standard errors at the country level. After checking for significant differences with a random-effects model using the Hausman test, we decided to employ a fixed-effects specification. Furthermore, pillars and components of the Economic Freedom Index are individually regressed in order to deal with collinearity issues.

There are two control variables which need further explanations, particularly given that they affect the stability of our methodology - government bond yields and GDP growth rates. The former, as reported in Table 3, is a control variable with the least amount of observations, restricting to some extent the scope of our analysis. However, the variable still represents a very important part of our econometric model. In particular, it ensures we account for the effect of changes in debt costs on debt accumulation. For this reason, we decided to perform extrapolation for those countries that have some observations available. This procedure is undertaken in order to ensure the feasibility of some of our estimation strategies, in particular GMM and non-parametric, whilst containing the variable's restraining impact on our sample size. On the other hand, the latter represents a contentious topic in the existing literature since it is regarded as both a determinant and an effect of higher debt ratios. In order to elucidate and re-enforce the direction of causality between debt ratios and growth rates in our model, we run Granger causality test to check for the relationship between debt and GDP growth. We find that causality mostly goes from GDP growth to debt and our econometric results suggest the relationship to be consistently negative. In other words, higher growth rates lead to lower debt ratios. Finally, the use of GDP growth as a control variable is essential since growth rates likely represent the channel through which many other macroeconomic variables affect debt (eg. innovation and technological improvements affect GDP growth rates and, in turn, that has an impact on debt ratios).

Furthermore, we considered the non-parametric estimation. This type of estimation is agnostic to the functional form of the relationship between the dependent and independent variables, opting for a kernel distribution. Therefore in doing this analysis we are trying to minimize the misspecification error. More specifically, we exploit a non-parametric kernel so that we estimate a local-linear and local-constant kernel regression. These estimations also produce informative graphical evidence of the obtained structural form of the relationship. Particularly interesting and important for inference are the marginal effects plots that such

estimations allow us to produce. These plots show how a unit change in our independent variable, at any point of its distribution, affects our dependent variable. The graphical representations obtained are useful to understand whether the causal change that we are exploring may or may not change at different levels of economic freedom scores. This will provide some important causal evidence in our non-parametric model. For this type of econometric estimation, we are employing bootstrapped standard errors. It follows that we do not control for time trends in this type of specification given that non-parametric models capture time variations implicitly by considering the entire range of observations and estimate the relationship based on the local characteristics of the data.

In addition to that, we include results of a generalized method of moments (GMM) regression by controlling for the dynamic relationship between total debt and our independent variables. The standard errors in this instance are HAC and the control variables remain the same across all specifications. The GMM models will help us identify the relative importance of the debt lags in the relationship investigated. More precisely, it will indicate the importance of EFI as a determinant of both changes in transitory and total debt. This econometric model also provides further evidence of the established relationship between our variables of interest, government debt and economic freedom index scores. We include the first two lags of both total and transitory debt and we instrument them in order to exploit the dynamic relationship. The validity of the instruments will be measured using both the AR test and the Hansen J statistic. For completeness, the GMM model tested is specified as follows:

$$totaldebt_{it} = \beta_0 + \beta_1 totaldebt_{i,t-1} + \beta_2 totaldebt_{i,t-2} + \beta_3 EFI_{it} + \beta_4 gdp_{it} + \beta_5 inflation_{it} + \beta_6 unemploymentrate_{it} + \beta_7 fdi_{it} + \beta_8 lifeexpectancy_{it} + \beta_9 capitalformation_{it} + \beta_{10} gini_{it} + \beta_{11} democracy_{it} + \beta_{12} yield_{it} + \alpha_i + t + t^2 + t^3 + u_{it}$$

5 Empirical Results

5.1 The Linear Model

The fixed-effects (FE) model is our initial estimation strategy, including variables of interest and selected macro controls. The sample is first analyzed in its entirety and the same econometric model is tested in the developed and developing countries sub-samples. The FE specification can accommodate time-invariant characteristics that could be affecting our estimates across countries. Apart from GDP growth, our estimation model includes the controls specified in the previous section. Standard errors are also clustered at the country level and results are presented in Table 4.

Table 4: Linear Fixed Effects Regressions of Economic Freedom Index on Public Debt

	(1) Full Sample	**(2)** Developing	**(3)** Developed
EFI	-0.857***	-1.05***	-1.51***
	(0.260)	(0.304)	(0.453)
GDP	-0.298	-0.542*	0.041
	(0.190)	(0.300)	(0.287)
Controls	Yes	Yes	Yes
_cons	274.59***	236.16**	473.72*
	(87.26)	(86.82)	(270.93)
N	1283	586	696
R^2	0.41	0.33	0.57

Clustered standard errors in parenthesis. Significance levels: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

The results present some preliminary evidence of a causal link between economic freedom and the level of debt-to-GDP ratios. Particularly, the estimates indicate a more pronounced effect of EFI scores on debt ratios of developed countries. Across the whole sample, the coefficient of the EFI is about -0.85. In other words, the results imply that increasing your Economic Freedom score by 10 points leads on average to a 8.5 percentage points reduction in public debt. After checking for collinearity between EFI scores and GDP, as institutional framework might affect GDP growth, results do not change significantly when using or not GDP as a control of debt ratios[6]. As aforementioned, the effect of economic freedom on government debt produces larger debt reductions in developed countries. In particular, a point increase in economic freedom scores results in a more than one (1.5) percentage points reduction in debt for developed countries compared to developing ones, where we observe

[6]The same linear regression model with the exclusion of GDP growth rates as a control yield an estimated beta of -1.15 and a SE of 0.295. The same behavior is noticed for the two sub-samples of developing and developed countries where coefficients remain around -1.

a one-to-one negative relationship between our variables of interest. The intuition behind the results is the same we presented above when stating our hypothesis. Economic institutions promoting a free-market economy are important factors for the fiscal health of both developing and developed countries. Likely, they advance safer and healthier economic environments which, in turn, incentivize income growth and better policy by the government. Noteworthy, the predictive power of GDP growth rates is statistically indifferent from zero in most estimations suggesting that economic institutions, rather than growth rates, are important determinants of public debt ratios across countries. Not only the coefficient for growth rates is hardly statistically different from zero for developing countries, but it becomes insignificant in the full sample where sample size is increased. Finally, it is important to highlight that our empirical model performs well in explaining debt variations as suggested by our recorded within R^2. For developed countries, our model came close to explaining two thirds of the variations in public debt.

In order to look further into the predictive power of the index, we exploit the several dimensions offered by the composition of the Index, namely pillars and components. We examine the factors within EFI that directly affect our dependent variable to understand which institutional characteristics are causal determinants of public debt and help us understand its variations. Accordingly, we regress the four pillars of the Index on government debt previously summarized in Table 5. Each pillar is individually regressed on debt ratios in order to avoid collinearity issues with the Index as explained in the previous section. In addition to that, we have controlled for a few time trends in all regression in Table 5. The same methodology was pursued for the further 9 components of EFI, which can be found in in Table 6[7]. Further methodological details about the regression models are included in the notes below each figure.

[7]Note that, as explained before, the components of EFI are actually 12 divided equally across 4 pillars but we did not have enough observations for 3 more recent components for which sample size would have not been satisfactory.

Table 5: Individual Fixed-Effects Regressions of EFI Pillars on Debt Ratios

	(1) Full Sample	(2) Developing	(3) Developed
Rule of Law	-0.234**	-0.506**	-0.106
	(0.119)	(0.209)	(0.128)
Gov. Size	-0.564***	-0.712***	-0.836***
	(0.146)	(0.204)	(0.229)
Regulatory Eff.	-0.090	-0.259*	0.258
	(0.127)	(0.134)	(0.231)
Open Markets	-0.129	-0.071	-0.525*
	(0.174)	(0.234)	(0.287)
Controls	Yes	Yes	Yes
N	1287	587	700

Clustered standard errors in parenthesis below coefficients. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. The coefficients reported are those obtained by individually regressing the corresponding pillar of EFI on debt ratios in order to avoid multicollinearity issues. Each regression included the same controls and sample of countries, including growth rates.

The component that stands out immediately in terms of significance and magnitude of an effect is "Government Size"[8]. Whilst statistically significant in our larger full sample, we also detect sizeable effects of scores in government size on debt ratios across our sub-samples. The score on government size has a slightly larger effect in developed countries, with unit increases in government size scores approximately resulting in percentage points reductions in debt ratios between 0.7 and 0.8. The other information convened by this table is the importance of the "Rule of Law" score. In particular, this pillar, which keeps track of government corruption and the functioning of the judicial system, turns out to be an important explanatory variable in the case of developing countries[9]. This suggests that the efficient enforcement of property rights and the level of government corruption are particularly important drivers of government debt variations for these countries, as we will see further in this section. Overall, it is clear that the scores on government size and rule of law drive the significance of the overall Index in explaining debt variation, whilst other determinants, as a whole, do not seem determinants of GDP ratios. There is some preliminary evidence that, perhaps, open market scores can be determinants in the case of developed countries which we will be investigating later in this section when employing non-linear models. Since the EFI index is an equally weighted average of pillar scores, it is likely the case that the interaction of 4 pillars, even those statistically insignificant, explains further variation in debt ratios. Similarly, it might also be the case that some components within each pillar might be of interest in explaining which particular economic institutions impact the level of debt-to-GDP ratios

[8] Important to note down that an increase in government size score stands for a decrease in the size of government. Hence the negative sign on the government size coefficient is consistent with the notion that smaller governments in fiscal terms result in lower debt.

[9] For developing countries, the coefficient on scores for the rule of law is close to that of government size scores suggesting the two dimensions are almost equally important as debt determinants.

across countries. Accordingly, we investigate the effect of components on government debt by decomposing the pillars and running the same linear fixed-effects econometric model.

Table 6: Individual Fixed-Effects Regressions of EFI Dimensions on Public Debt

	(1) Full Sample	(2) Developing	(3) Developed
Property Rights	-0.062	-0.289**	-0.0002
	(0.100)	(0.135)	(0.146)
Gov. Integrity	-0.244**	-0.371**	-0.111
	(0.098)	(0.169)	(0.122)
Gov. Spending	-0.527***	-0.576***	-0.601***
	(0.107)	(0.120)	(0.167)
Tax Burden	-0.116	-0.282	-0.128
	(0.161)	(0.212)	(0.190)
Business Freedom	-0.065	-0.339**	-0.022
	(0.115)	(0.145)	(0.194)
Monetary Freedom	0.043	-0.091	0.324*
	(0.123)	(0.131)	(0.177)
Trade Freedom	-0.152	-0.030	-0.611
	(0.184)	(0.198)	(0.520)
Investment Freedom	0.076	0.090	-0.123
	(0.126)	(0.161)	(0.159)
Financial Freedom	-0.099	-0.100	-0.146
	(0.108)	(0.138)	(0.144)
Controls	Yes	Yes	Yes
N	1283	587	696

Coefficients reported are those obtained by individually regressing the corresponding component of EFI on debt ratios in order to avoid collinearity issues between independent variables. Each regression contains the same controls and is performed over the same sample of countries.

The results in Table 6 corroborate the importance of government size in producing variations in debt ratios. In particular, results suggest that government spending bears a leading role in increasing public debt[10]. The coefficient is negative and significant for all three samples of countries and appears to be similar for all specifications, fluctuating between -0.53 in the full sample to -0.60 amongst developed countries, implying that government spending decreases lead to larger reductions in government debt in developing countries. Findings in Table 6 also show that tax burden, the other components of government size scores, is not statistically different from zero in determining debt ratios, suggesting that previous results for the pillar are driven by government spending reductions. However, even in the case tax burden scores we will be checking later the possibility of non-linear relationships with debt-to-GDP ratios. In general, results on EFI components suggest that public debt reductions come from reductions in government purchases. Finally, the table's results also address some

[10]Note that the coefficient on "Government Spending" is negative because this variable represents the indexed score in the Economic Freedom Index. The score will increase when government spending and consumption decline as a percentage of GDP. Thus, the negative coefficient indicates that higher scores (low public spending) lead to reductions in debt ratios.

of the preliminary evidence we gathered in the previous estimation (Table 5). In fact, these estimations substantiated the idea that the rule of law is an important determinant of debt-to-GDP ratios, especially in developing countries. The importance of such pillar is driven by the variations in scores for government integrity, which represents a score for government corruption. Both the scores for government integrity and property rights are significant for developing countries, but government integrity scores were also found to be different from zero in the full sample. Overall, the results suggest that the score on the rule of law, namely corruption and property rights, is an important determinant of debt in developing countries, while government spending and not tax regimes are key to determine debt accumulations across all countries.

After discussing the components that drive the significance of government size in the table above, there are some preliminary conclusions reached on what type of economic institutions are key for determining public debt within our empirical linear models. First and foremost, it is the role that government spending has in determining debt. This clearly suggests that countries with higher government spending will inevitably accumulate more public debt (Bohn (1998)) and, vice versa, government spending cuts lead to lower levels of public debt. Secondly, tax burden scores, a proxy for the level of fiscal imposition, does not seem to be a linear determinant of public debt, possibly due to significant non-linearities. Thirdly, results for the linear models suggest that the rule of law and government integrity as a measures of property rights enforcement and government corruption are determinants of debt in the full sample, although debt ratios are more sensitive to changes in such scores in developing rather than developed countries. Specifically, the cohort of developed countries showed that linear changes in government debt are particularly driven by changes in government spending scores and, somewhat, by scores on monetary freedom, suggesting a role of more independent central banks in accumulating public debt.

5.2 Non-Parametric and Dynamic Models

The non-parametric model allows us to estimate the relationship between public debt and economic institutions without enforcing any predetermined functional form between our dependent and independent variables. This model is a suitable option in our case since the dataset is large enough to exploit this type of econometric estimation, although the high restrictions enforced on the sample of developing countries might lead to high standard errors due to a small sample size. We will follow the same structure as before, while also including

transitory debt as one of the two dependent variables. This allows us to establish the relationship between the Index and short-term variations of debt from its historical average[11]. Table 7 shows the first set of results of the economic freedom index on total and transitory government debt. The marginal effects will be outlined on a graph to provide inferential evidence on the relationship between the variables of interest.

Table 7: Non-Parametric Regressions of EFI on Total and Transitory Debt

	(1) Full Sample	(2) Developing	(3) Developed	(4) Full Sample	(5) Developing	(6) Developed
EFI	-1.071***	-0.426*	-1.515***	-0.357***	-0.505	-0.525
	(0.162)	(0.242)	(0.219)	(0.115)	(0.426)	(0.417)
GDP	-1.657***	-0.656	-1.032***	-0.554**	-1.103	-0.143
	(0.469)	(0.477)	(0.392)	(0.244)	(0.939)	(0.170)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
N	1205	552	641	1205	552	641

Notes: Bootstrapped standard errors in parentheses. Dependent variables: debt ratios in levels for $(1)(2)(3)$, transitory debt for $(4)(5)(6)$. Each estimation includes a detrended EFI independent variable. Each column represent a different sample of countries as indicated.

It is important to mention that non-parametric estimations result in the automatic removal of some observations when estimating the model, due to the lack of convergence to a functional form. This will further affect the size of samples across estimations. The results support precursory evidence on the effect of higher EFI scores on debt ratios, confirming its diverse magnitude across the sample of developed and developing countries. Most importantly, the non-parametric estimations restate that EFI negatively affects debt ratios across the full sample and the cohort of developed countries. In other words, the causal effect of EFI on debt for the whole sample and developed countries could be detected in both total debt levels and short-run variations of debt from historical averages. It is worth pinpointing the size of the EFI coefficient for developed countries which is almost identical in magnitude to the one in linear estimation. This means that a point increase in the Index score for a developed country leads to more than a percentage point reduction in debt-to-GDP ratios compared to a 1 percentage point reduction predicted in the whole cohort of countries. Moreover, overall results across samples are in in line with those in the linear models, with the magnitude of the coefficient for the full sample remaining around -1 (from -0.43 to -1.5). Additionally it is worth highlighting that EFI scores affect short-term debt fluctuations in the whole sample, with its coefficient of -0.357 significant at a 1% significance level. This evidence indicates that EFI is predictive of short-term shocks in public debt across our sampled countries. The

[11] Remember that transitory debt is calculated as the variation at any time t of the debt ratio from its historical average, the latter being the arithmetic average within the time frame of our study.

estimations also reassess the importance of growth rates in reducing debt ratios, turning out to be statistically different from zero in developed countries, whilst they are insignificant in developing ones. However, the impact of GDP growth rates on debt ratios is still smaller than that of EFI scores in our sub-samples.

Table 8: Non-Parametric Regressions of EFI Pillars on Total and Transitory Debt

	(1) Full Sample	(2) Developing	(3) Developed	(4) Full Sample	(5) Developing	(6) Developed
Rule of Law	-0.201	-0.162***	-0.390	-0.090***	-0.046	0.055
	(0.195)	(0.050)	(0.255)	(0.025)	(0.040)	(0.364)
Gov. Size	-0.670***	-0.810***	-0.660***	0.025	-0.234***	-0.194***
	(0.167)	(0.090)	(0.072)	(0.036)	(0.083)	(0.067)
Regulatory Eff.	0.193	-0.193	-0.463	-0.303	-0.289	0.142
	(0.132)	(0.154)	(0.739)	(0.246)	(0.213)	(0.134)
Open Markets	-0.753***	0.057	-0.971***	0.013	-0.024	-0.059
	(0.200)	(0.199)	(0.200)	(0.173)	(1.20)	(0.133)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
N	1224	560	700	1224	560	700

Bootstrapped standard errors in parentheses. Dependent variables: debt ratios in levels for (1)(2)(3), transitory debt for (4)(5)(6). Each independent EFI pillar is regressed individually to avoid collinearity issues. Each column represent a different sample of countries.

We then run non-parametric models for the four pillars of EFI. The results are presented in Table 8. The coefficients uncover further evidence on the relationship between different types of economic institutions and our dependent variable which was not present in the linear estimation. Apart from the confirmation that government size still is an important predictive component of variations in public debt, using transitory debt as a dependent variable shows that the score on government size also has a impact on short-term variations of government debt in both samples. The same estimation seems to corroborate the idea that economic institutions in developing countries enforcing a high-quality rule of law are strongly associated with countries that are less prone to accumulate high levels of government debt. Furthermore, the non-parametric model shows that there are interesting negative effects of open markets scores in our sub-samples. In particular, this score is a good predictor of debt variations in the sample of developed countries, although a significant effect is also detected across all countries. This result is substantiated by previous evidence from Bengoa and Sanchez-Robles (2003) which showed how liberalized markets allow reaping higher benefits from capital flows and, therefore, promote higher income growth. These effects are surprisingly not noted for developing countries, meaning we should decompose the pillar in its components in order to separate the potential effects of them on public debt. In a nutshell, the scores on government size and openness of markets are debt-reducing determinants, with

variations in government size scores predicting some short-term variations in debt ratios too and scores on the rule of law only being determinants for developing countries.

The results in Table 11, available in the appendix, explain further the trends observed in the previous table. The pillar of government size is, once again, driven by the effect of government spending and tax burden. Notably, this estimation reiterates how government spending cuts are effective debt-reducing policies both in developed and developing countries, whilst tax reductions reduce debt levels only in the sample of developed countries. Furthermore, Table 11 shows that the rule of law scores affects debt ratios mainly through the score on government integrity, in other words by the level of a country's corruption. Most importantly, it provides more evidence in explaining the established negative relationship between open markets scores and debt-to-GDP ratios. The table shows that all three components of the score for open markets - trade, investment and financial freedom - are determinants of debt ratios across countries. In particular, the estimation shows financial freedom to be the most largest contributor to government debt variations, as a unit change in its score leads to a 0.5 percentage point changes in debt-to-GDP ratios. The score for financial freedom comprehends a measure for the efficiency and regulatory environment of financial markets within a country. The score takes into account, amongst others, of the independence of the central bank, government interference on the allocation of credit, government ownership of financial entities and the openness to foreign competition. The negative effect of better scores in such component on debt ratios might be explained partly by a higher degree of independence of the central bank which more adamantly strives to pursue its mandate for controlled prices and the lower ownership of government of financial bodies which might give government larger access to national savings to allocate public debt. The negative effect is predominantly registered across developed countries, suggesting that the second channel proposed is more likely to be causing the statistically significant negative relationship between our variables of interest. Moreover, the decomposition of the pillar for open markets shows a stark difference between developing and developed countries. Debt levels in developing countries are sensitive to changes in trade freedom scores, suggesting the importance of low barriers to trade for these countries. Contrarily, debt ratios in developed countries are determined by changes in investment and financial freedom, perhaps hinting at the possible importance of eased capital flows in determining the stock of capital available, its borrowing costs and a country's growth rates.

Finally, we employ a GMM model that investigates the dynamic relationship between debt and EFI. We employed a GMM model as a further check for the existence of a negative re-

lationship between EFI scores and debt ratios while accounting for the possible dynamic nature of public debt. In order to do so, it follows that the model includes the first two lags of our dependent variable and the Economic Freedom Index scores are, again, detrended. The results of these estimations can be found in the table below.

Table 9: GMM Estimations of Economic Freedom Index on Total and Transitory Debt

	(1) Full	(2) Developing	(3) Developed
$Debt_{t-1}$	-0.194***	-0.089**	-0.088**
	(0.040)	(0.040)	(0.035)
$Debt_{t-2}$	-0.122***	-0.072*	-0.050*
	(0.043)	(0.042)	(0.029)
EFI	-1.114***	-0.968*	-1.075***
	(0.400)	(0.550)	(0.252)
Controls	Yes	Yes	Yes
N	917	361	556

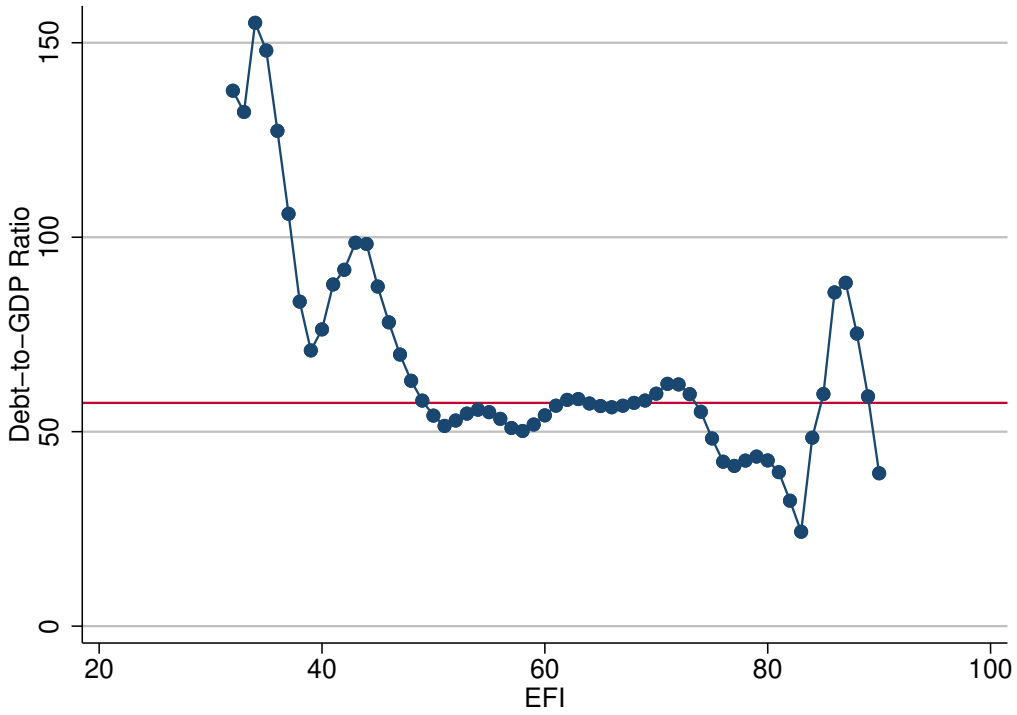
Clustered standard errors in parenthesis, p-value and asterisks. Two lags of dependent variable included, small sample correction.

The results support the existence of a negative relationship between a country's score on economic freedom and public debt accumulation. The results are particularly promising given their close similarity of EFI coefficients to those in our linear model in Table 4, suggesting the reliability of our previous econometric exercises. EFI scores still have a negative effect on debt ratios, all included around -1. In particular, a 10-point increase in EFI scores lead, according to GMM results, to an average 11.1 percentage point reduction in debt-to-GDP ratios across all countries. The effect seems more pronounced in developed countries, although the effect of improved EFI scores remain strongest in the whole sample. We employ this model in order to underpin our results from non-parametric estimations and obtain very similar patterns[12].

Having now a better idea of which and how economic institutions affect public debt through EFI scores, we resort to further non-parametric analysis. The graphs of marginal effects for non-parametric estimations can help us to provide further evidence on the causal relationship between debt ratios and economic institutions (Figure 2) and offer an opportunity to visualize the non-linear changes of debt ratios across EFI scores.

[12]The GMM estimations of the effect of EFI pillars on debt ratios support the negative effective that open markets and government size scores have on our dependent variable. When regressing the further 9 components that make up the 4 pillars, our estimates show a significant and positive impact of property rights (similar to Figure 11). This suggests that countries with lower expected property expropriation are more likely to accumulate debt since investors are more encouraged to provide credit in exchange for a lower probability of debt default. Further, GMM results on components propone the negative role that government spending and tax burden scores have on debt levels. The same pattern is found for some components that make up the "Open Markets" pillar such as trade and financial freedom.

Figure 2: Marginal Effects Plot for Unit Increases of EFI



Note that the red horizontal line in this figure and in all the following marginal effects plots simply represent the average debt-to-GDP ratio within our sample.

The marginal effects plot above highlights the overall negative effect of EFI scores on the level of government debt. Figure 2 demonstrates that there are larger gains when EFI scores are below 50. After this threshold, there is an interval of EFI scores that does not affect the level of debt significantly in any direction as the level of debt fluctuates around its mean. However, the marginal effects plot also shows that changes in the EFI scores affect public debt significantly for scores above or around 70. In particular, this plot could be further evidence of the non-linearities in the relationship between public debt accumulation and economic freedom which substantiates the reasons for preferring a non-parametric estimation to a linear one. The overall trend confirms the estimates that we have obtained in the previous econometric analysis and suggest that marginal changes in EFI scores are particularly effective in reducing debt levels at the extremes of its distribution.

Figure 3: Marginal Effects of Unit Increases of EFI Scores for Developing Countries

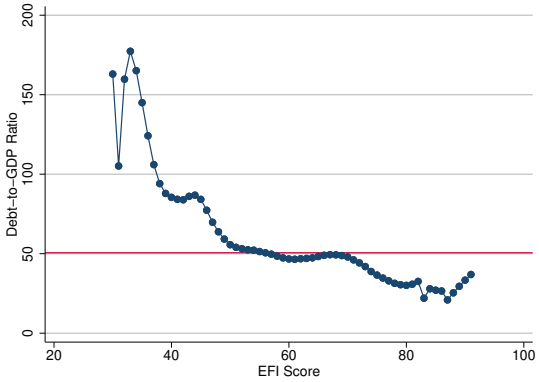
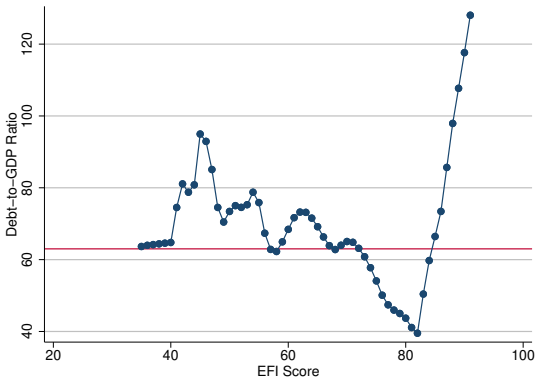


Figure 4: Marginal Effects of Unit Increases of EFI Scores for Developed Countries



The visualization of marginal effects for developing and developed countries confirm what we just noticed for the whole sample, although with some further interesting insights. For developing countries it seems that the larger marginal decreases in debt ratios happen at low levels of EFI scores, meaning that there are large benefits in striving to improve very low scores. Marginal negative effects fade away around an EFI score of 50, although they remain negative and levels of debt below the sample's average are highly associated with high scores in economic freedom. In the case of developed countries, marginal effects tend to be negative for most part of the distribution in EFI scores. However, the relationship seems to be less linear than in the case of developing countries. In particular, marginal effects are positive at the extreme of the EFI score distribution, below a score of about 50 and above 80.

Following the validation of the results for our non-parametric model and GMM model, and proving that there are some differences amongst countries at different developmental stages, we are going to focus on the discussion of non-parametric marginal effects for pillars and components that were previously found to be important determinants of debt levels. We are referring to scores for government size and open markets.

Figure 5: Marginal Effects of Unit Increases of Government Size Scores on Debt Ratios

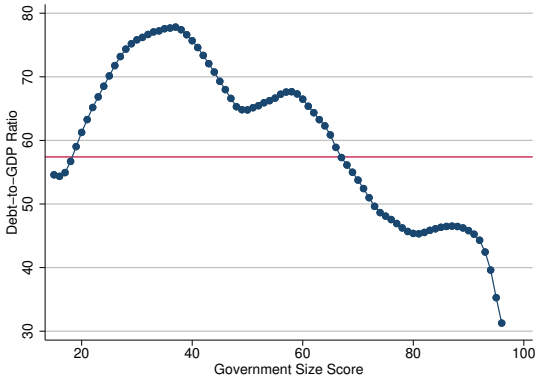


Figure 6: Marginal Effects of Unit Increases of Open Markets Scores on Debt Ratios

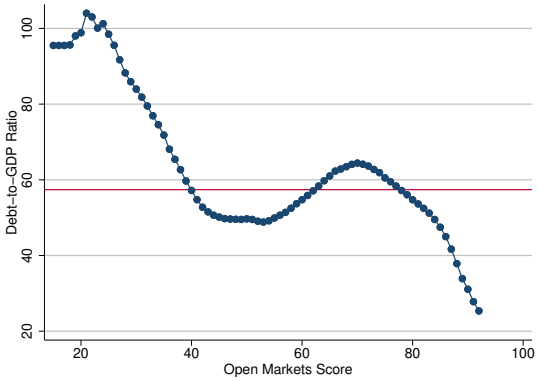


Figure 5 and 6 show the marginal effects for unit changes in the scores of two EFI pillars, respectively government size and open markets. The graphs confirm the behavior of scores against debt ratios. Figure 6 resembles the marginal effects of the overall EF index, with large reductions in debt ratios for unit increases at the extremes of the Open Markets score distribution. There is instead little change to debt ratios for marginal unit changes in the open market score around its average[13]. Marginal unit changes above the average open markets score correspond to falls in debt ratios. The behavior of the marginal changes in government size scores is partially different since it does not contain marginal effects flattening out at particular levels of the score distribution. There is a clear negative trend that persists across government scores. Nonetheless, Figure 5 illustrates how marginal effects on debt-to-GDP ratios exponentially increase in magnitude as we move towards the right tail of the government size distribution, with the exception of two intervals of government size scores; namely the mid-50s and 80s. Overall, the graphs confirm that countries that score above average on the open markets and government size categories exhibit below-average levels of public debt.

Finally, we consider the marginal effects plots for two interesting components of EFI that showed contrasting behaviors in our non-parametric regressions in Table 11. In particular, we decided to show in Figure 7 the marginal effects of unit changes in the tax burden scores whilst in Figure 8 we wanted to graph the counter-intuitive effect of property rights on public debt.

[13] The sample average of for open market scores, as summarized in Table 2, is 63.53.

Figure 7: Marginal Effects of Unit Increases of Tax Burden Scores on Debt Ratios

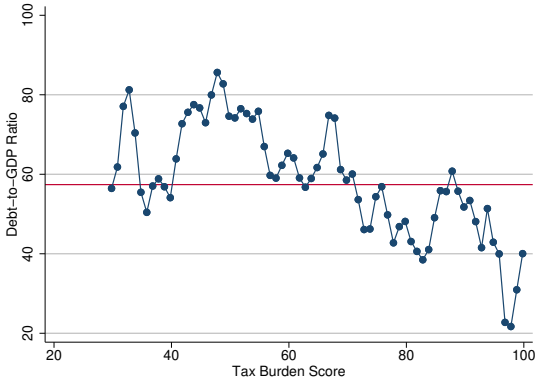


Figure 8: Marginal Effects of Unit Increases of Government Spending Scores on Debt Ratios

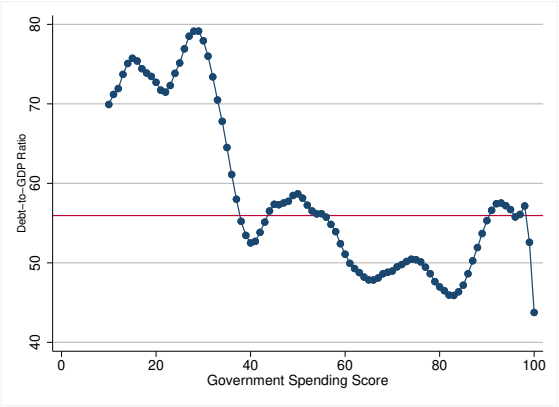


Figure 7 gives further insights into the effect of tax burden scores have on debt ratios. High scores in this category mean lower average fiscal imposition in a given country. The marginal effects of unit changes in the score support the evidence of the overall negative trend we captured in our non-parametric regression model. However, the illustration of marginal effects across the score distribution shows how unit increases in tax burden score begin to consistently predict a fall in debt ratios only after a score of 60. Before that threshold, the relationship between the two variables looks rather inconclusive. Once again this supports previous econometric evidence that suggested the presence of non-linearity in the relationship of our interest. On the contrary, in Figure 8 we plot the only variable in our econometric models that has a positive effect on the accumulation of public debt[14]. In fact, as aforementioned, higher scores on property rights were associated with increasing levels of public debt. This arises possibly from a reduced probability of appropriation of foreign debt, hence producing a larger pool of potential lenders and lower debt servicing costs. With this in mind, higher property rights scores will be linked with larger levels of debt-to-GDP ratios. Excluding the extremes of property rights score distribution, there is a visible upward trend between scores of 20 and 80[15]. It is of equal importance to state that marginal effects of unit increase in property rights score cross the average level of government debt around the average score in this category[16]. This means that unit increase in property rights scores above its average are associated with above-average debt-to-GDP ratios.

[14] Noteworthy, scores for the enforcement of property rights took into account the likelihood of private property expropriation in a given country. Higher scores in this category meant a lower probability of expropriation of property.

[15] This interval includes about 70% of all observations in our sample.

[16] The average in property rights score is 59.74.

Figure 9: Marginal Unit Increases of Rule of Law Scores on Debt Ratios in Developing Countries

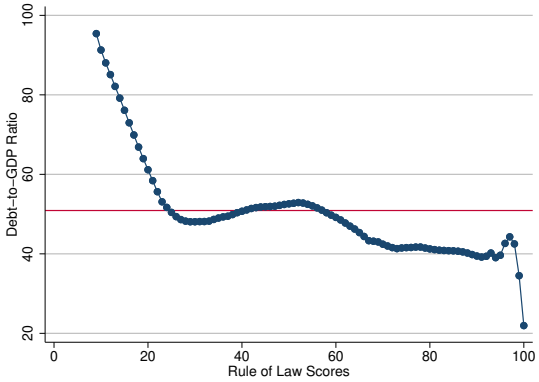
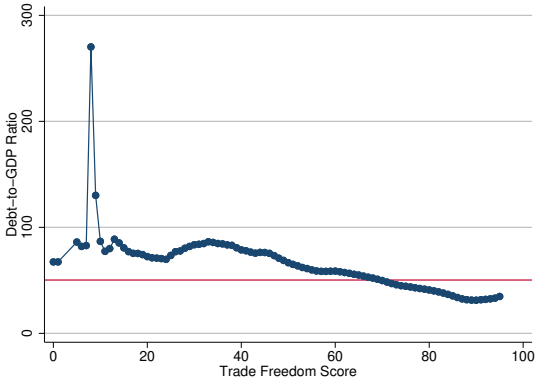


Figure 10: Marginal Unit Increases of Trade Freedom Scores on Debt Ratios in Developing Countries



Lastly, we dwell into a couple of economic institutions that resulted crucial in determining public debt levels across developing countries. In particular, our empirical models suggested that scores for the pillar on the "rule of law" and the component of trade are highly associated with changes in government debt. The former is a score comprehensive of the quality of property rights, the level of public corruption and the effectiveness of the legal system. The empirical models underlined that the enforcement of property rights and government integrity are particularly important in determining debt levels. As shown in Figure 9, the marginal effects of rule of law scores are not linear, however they are clearly negatively correlated with debt accumulation in developing countries. Notably, these countries make very large marginal gains in improving such institutions on the left hand side of rule of law scores. In other words, marginal reductions in public debt are significantly higher when the improvements in the enforcement of private property rights and government corruption until these institutions reach an acceptable level[17]. Following such improvements, it seems that there is an intermediate level of "Rule of Law" scores that have little to no effect on debt levels. The negative marginal effects of improvement in property rights and corruption seem to kick in again around a score of 60 where developing countries manifest some further marginal reductions in government debt. The link between government corruption and debt ratios was one we expected to observe in our sample. More corrupted governments are more likely to favor lobbying and political circles leading to higher costs for public contracts, less efficient roll out of public purchases and lower quality services. Thus, less corrupted governments will be less likely to accumulate large amounts of public debts. The possible link between property rights and debt ratios in developing countries probably stem from the ability to

[17] It seems from the marginal effect plot that this level comes at around a "Rule of Law" score of 30.

attract larger volumes of foreign investment (FDI) that improve current account balances. In fact, developing countries with a better enforcement of property rights will exhibit lower probabilities of property expropriation and, hence, be safer places for foreign investment. Apart from the more direct improvements for current accounts, larger volumes of FDI flows are also linked to higher employment levels, productivity gains and multiple other propellers of growth.

The latter is a score estimating the amount of trade barriers in place in a given country and year. In general, it calculates the total tariff and non-tariff barriers to international imports. The evolution of marginal effects across the distribution of trade freedom scores appears to be much more linear, although it does present some interesting points worth highlighting. Principally, the negative marginal effects of freer trade begin around the score threshold of 40 after which the relationship between debt-to-GDP ratios and trade freedom scores is negative and linear-like. In other words, marginal effects remain constant for which consecutive unit increase in trade freedom scores. Lower trade barriers are likely associated with lower debt levels since they are likely to improve a country's current account and improve their pool of resources available. Our empirical analysis found this to be particularly for developing countries and this is no coincidence - these countries tend to rely more heavily on trade volumes for their current account surpluses. Finally, freer trade can also improve a country's government debt by improving the allocation of resources, boosting productivity gains and restructuring domestic production, all of which have positive spillovers on growth and, therefore, debt ratios.

6 Conclusion

6.1 Concluding Remarks

This paper investigates the causal relationship between the Index of Economic Freedom (EFI) and debt-to-GDP ratios. The index was used as a proxy for the quality of economic institutions. Our measurement of different types of economic institutions is a comprehensive index of judicial and regulatory factors that a given country's economy entails, whilst controlling for political institutions. Our hypothesis claimed that better scores on the Economic Freedom Index would lead to lower levels of public debt by improving efficiency in the allocation of resources, lower levels of corruption and improvements in the stock and costs of loanable funds. More broadly, we wanted to uncover which types of economic institutions play a key role in the accumulation of public debt in a given country whilst controlling for the potential growth channel of GDP on public debt ratios. Our results are unique, as previous academic research mainly focused on institutions as a back-channel through which debt levels are affected. The analysis in this paper upholds our hypothesis and ascertained the following details.

Firstly, we found extensive evidence of a causal relationship between the EFI and public debt accumulation. All regression models and specifications purport a negative relationship between economic freedom and public debt. In other words, higher economic freedom scores lead to lower levels of government debt accumulated over time. This finding was present for all functional forms used to estimate this relationship; linear, non-parametric, and dynamic. More specifically, we found that a 10-point improvement in the EFI score can lead to reductions between 8.5 - 11.1 percentage points in public debt ratios[18].

Secondly, we find that the index score on government size is the leading factor in debt reduction across countries. In particular, results show estimators to be between -0.56 and -0.67 for the whole sample, whilst about -0.8 and -0.7 respectively across developing and developed countries[19]. Our empirical examination of the further components of the Index showed that developing and developed countries are affected differently by these fiscal components. In particular, tax burden does not play a role in determining debt reductions, unlike government spending, across developing countries (Table 11). On the other hand, we find that

[18] These are the coefficients for the full sample in the FE and GMM models, respectively Table 4 and 9, with the FE estimator being the lower bound whereas the GMM estimator being the upper bound of our estimated interval. Note that both coefficients have corresponding standard error attached and, therefore, different 95% confidence intervals.

[19] These coefficients on government size scores are taken from results in the linear and non-parametric regressions of pillars on government debt ratios.

debt reductions amongst developed countries are predominantly, although not exclusively, driven by changes in government spending. This has an important policy implication for countries at different stages of development facing high levels of public debt. Developing countries react better when a policy improves scores on government spending (i.e. reducing government purchases, expenditure, etc.), perhaps because governments in these countries allocate public funds less efficiently and suffer from higher levels of corruption. Whereas developed countries should focus on both public expenditure and tax cuts in order to reduce debt-to-GDP ratios, although empirical estimations for this cohort of countries suggest government spending scores are more consistently significant determinant of debt levels. Overall, the results indicate that better scores on the government size lead to lower levels of public debt.

Thirdly, our non-parametric model estimates show that open markets pillar is an important determinant of variations in debt ratios. In particular, a point increase in a country's open markets score leads to a 0.75 percentage point reduction in debt-to-GDP ratios. This effect is particularly pronounced in the sample of developed countries. Table 11 outlines that trade, investment and financial freedom scores are all significant predictors of variations in debt ratios, with their coefficients ranging between -0.25 and -0.53. If developing countries are sensitive to trade openness[20] only, the cohort of developed countries yielded significant results in the case of investment and financial freedom as mentioned in the previous section.

Lastly, we find that there is extensive evidence of non-linearity that is affecting the causal relationship between EFI scores and debt ratios. The plots of marginal effects of EFI and some of its most relevant components show that unit increases across the score distributions do not lead to equitable changes in debt ratios. When considering the overall EFI, we showed that the sharpest falls in public debt are associated with marginal changes of EFI scores at the extremes of the distribution (Figure 2). Correspondingly, the marginal effects of unit changes in open markets scores contain the highest levels of change around the extremes of its distribution (Figure 6).

6.2 Policy Implications and Further Research Questions

Our research paper aimed at highlighting the importance of institutional factors in debt-reduction policies. The main empirical findings suggest that countries willing to reduce their public debt should consider two institutional factors: the size of government and the open-

[20] Remember that trade freedom scores are proxies of the level of trade barriers a country imposes on imports.

ness of markets. Regardless of the stage of development a specific country is experiencing, our findings suggest that governments should be considering a reduction in government spending if they are to reduce debt ratios, although developed countries can have similar luck by changes in taxes. Furthermore, the paper has shown the importance of legal institutions in determining debt levels, with particular emphasis on the role played by government integrity and corruption. There is also some evidence that suggests a potential importance of monetary freedom, in the form of central bank independence, in determining debt levels. Interestingly enough, the relationship is positive meaning that improvements in a central bank's independence leads to larger debt levels.

It is our intention to follow this paper up with this extension in order to extend the sample size and the inference power, improving the results in particular for estimations, like the non-parametric models, that suffer from a small sample size. Further research questions might also arise from the need to address the channels through which these institutional characteristics are resulting in debt reductions. In particular, future research might focus on more specific indicators of institutional performance. For instance, it would be interesting to study which type of tax induces debt reduction in developing countries more than in others. Moreover, it would be important to focus on the role of corruption and the channels through which it affects debt accumulation. This research paper also represents the first insight into the understanding of institutional importance in public debt accumulation across countries. The index would be a more efficient measure for creating an economic environment that promotes sustainable public debts by taking into account stages of development and the different weights that each component bears in the overall score. A revision of weights in the EFI would be the first step in this direction.

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7 Appendix

Table 10: List of Sample Countries, by Development Level and Region

List of Sampled Countries			
Developed		**Developing**	
Australia	Norway	Algeria	Mexico
Austria	Portugal	Argentina	Morocco
Belgium	Singapore	Bahrain	Myanmar
Canada	Slovakia	Brazil	Oman
Cyprus	Slovenia	Burkina Faso	Paraguay
Denmark	South Korea	Burundi	Philippines
Estonia	Spain	Cambodia	Qatar
Finland	Sweden	Cameroon	Russia
France	UAE	Chile	Rwanda
Germany	United Kingdom	China	Saudi Arabia
Greece	United States	Egypt	Senegal
Ireland	Hong Kong	Vietnam	South Africa
Israel		India	Sierra Leone
Italy		Indonesia	Tanzania
Japan		Ivory Coast	Thailand
Latvia		Jordan	Togo
Lithuania		Kenya	Tunisia
Luxembourg		Kuwait	Uganda
Malta		Laos	Uruguay
Netherlands		Malasya	
Region	**No. of Countries**	**Region**	**No. of Countries**
Europe	23	Asia	18
North America	3	Middle East	7
South America	5	Oceania	1
Africa	14	Overall	71

Table 11: Non-Parametric Regressions of EFI Components on Total and Transitory Debt

	(1) Full Sample	(2) Developing	(3) Developed	(4) Full Sample	(5) Developing	(6) Developed
Property Rights	-0.001	-0.006	-0.201	-0.044	-0.551***	0.158
	(0.063)	(0.235)	(0.231)	(0.028)	(0.133)	(0.214)
Gov. Integrity	-0.230***	0.098	-0.595***	-0.084	-0.189	0.050
	(0.067)	(1.103)	(0.230)	(0.074)	(0.792)	(0.148)
Gov. Spending	-0.021	-0.266***	-0.415***	-0.045	-0.278***	-0.140***
	(0.173)	(0.062)	(0.050)	(0.155)	(0.105)	(0.048)
Tax Burden	-0.874***	-0.406	-0.332***	0.176	0.295	0.118
	(0.171)	(0.433)	(0.067)	(0.528)	(0.233)	(0.189)
Business Freedom	-0.257**	-0.330**	-0.318	-0.089	-0.334***	0.128
	(0.109)	(0.143)	(0.211)	(0.080)	(0.070)	(0.093)
Monetary Freedom	0.409**	0.092	-0.066	-0.190	-0.163	-0.015
	(0.206)	(0.196)	(0.617)	(0.144)	(0.129)	(0.390)
Trade Freedom	-0.255***	-0.342***	-0.197	-0.026	-0.030	-0.204
	(0.075)	(0.067)	(0.192)	(0.041)	(0.050)	(0.452)
Investment Freedom	-0.304***	0.019	-0.206***	-0.045	0.090	-0.117
	(0.117)	(0.158)	(0.076)	(0.092)	(0.228)	(0.099)
Financial Freedom	-0.537***	-0.019	-0.705***	-0.100**	-0.129	-0.302***
	(0.067)	(0.109)	(0.183)	(0.043)	(0.100)	(0.082)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
N	1283	554	640	1283	554	640

Bootstrapped standard errors in parentheses. Dependent variables: debt ratios in levels for (1)(2)(3), transitory debt for (4)(5)(6). Each independent EFI pillar is regressed individually to avoid collinearity issues. Each column represent a different sample of countries.