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FISCAL RULES AND GOVERNMENT EFFICIENCY: AN EMPIRICAL ANALYSIS FROM 1996 TO 2020

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ABSTRACT

The paper investigates the effects of the main categories of fiscal rules (debt, revenue, expenditure and results) on the economic aggregates that each seeks to control. Using a dataset covering 180 countries from 1996 to 2020, the interaction between fiscal rules and government efficiency was analyzed. To measure the impact of these rules, we used the generalized method of moments (GMM). The results indicate that the effect of the rule, through the debt rule, is associated with expenditure control and a higher fiscal result. Furthermore, while the rules were shown to be substitutes for government efficiency in terms of debt control and higher fiscal results, they were also shown to be complementary in the case of expenditure.

Keywords: Fiscal rules. Fiscal Policy. Generalized Method of Moments.
JEL Classification: E31, E32, E37, F41

SUMMARY

1. INTRODUCTION

Fiscal rules are established in legislation as fixed numerical limits on fiscal variables, imposing lasting restrictions on fiscal policy and binding for at least three years (LLEDÓ et al., 2017). The need to create a restrictive measure is due to the existence of a debt, spending and deficit bias on the part of governments[1]. Therefore, the rules aim to correct distorted incentives and contain pressures to overspend in good times and avoid excessive deficits that could arise under unrestricted political discretion, in order to ensure fiscal discipline and the sustainability of public accounts (EYRAUD et al., 2018; VALENCIA; ULLOA-SUAREZ, 2022), and can also serve other objectives, such as economic stabilization, containing the size of government and supporting intergenerational equity (SCHAECHTER et al., 2012).

In general, adopting a fiscal rule or strengthening it becomes a political priority in periods when the economy is in difficulty or due to market pressures, in which strengthening the fiscal structure is considered an auxiliary component for the transition, due to the increased credibility of fiscal policy (SCHAECHTER et al., 2012; HEINEMANN; MOESSINGER; YETER, 2018; DAVOODI et al., 2022). However, it is clearly not a panacea for fiscal sustainability if other elements, including political will, are not present (SCHAECHTER et al., 2012).

In the 1990s, in parallel with the growing use of fiscal rules, several studies analyzed the impact of the rules on budgetary outcomes. Such as Alt and Lowry (1994), Bohn and Inman (1996) and Alesina et al. (1999), which demonstrated significant and positive impacts on fiscal aggregates. The studies already point out the challenge of assessing causality in the effects given the concern with endogeneity in the evaluations, i.e. the fact that a country has a fiscal rule in place may mainly reflect its preference for fiscal discipline, so its prudence would be greater even in the absence of the rule, as both facts can be shaped by similar factors[2]. In addition, the strictness of the fiscal rule may also be a reflection of the country's fiscal condition, with countries that have a higher level of public debt coinciding with tougher rules (HEINEMANN; MOESSINGER; YETER, 2018).

In the study conducted by Heinemann, Moessinger and Yeter (2018), performing a Meta-Regression Analysis of 30 empirical studies published between 2004 and 2014, it was found that fiscal rules have significant and positive effects on fiscal variables, but the positive corre-

1 For discussions on the main determinants of the deficit bias, see for example: Rogoff (1987), Debrun et al. (2008) and Tornell and Lane (1999).

2 For further discussion see Poterba (1994), Debrun et al. (2008) and Grembi, Nannicini and Troiano (2016)

lation tends to disappear once endogeneity is correctly treated, emphasizing the importance of taking the challenges to identification seriously.

Various strategies have therefore been adopted to deal with and circumvent the challenge of endogeneity. A first widely used approach consists of using instrumental variables. In Caselli and Reynaud (2020), the fiscal rule in a neighboring country was used as the instrument in a panel containing 142 countries between 1985 and 2015. The results indicate that migrating from a relatively weak fiscal rule to a strong one increases the fiscal balance by around 0.6% of GDP.

Badinger and Reuter (2017) found evidence of a significant impact of income and debt rules on the reduction of fiscal deficits, lower interest rate spreads and lower volatility in production. The instrumental variables used were government fragmentation and inflation targets for a sample of 74 countries in the period between 1985 and 2012.

In the study by Bergman, Hutchison and Jensen (2016), the Generalized Method of Moments (GMM) was used in a panel of 27 European Union countries to assess the relationship between fiscal rules and good governance. It was concluded that fiscal rules are effective in reducing structural primary deficits. However, the effect is smaller as government efficiency increases, indicating that fiscal rules and efficiency are institutional substitutes in promoting fiscal sustainability.

Finally, the study by Debrun et al. (2008) evaluated the importance of the design of the rules for the fiscal performance of 25 European countries in the period from 1990 to 2005, using the lag of the strength index as an instrument, concluding that design is a significant factor in the financial balance of European governments.

The second commonly used approach is the use of quasi-experimental designs. The work by Caselli and Wingender (2021) evaluated the 3% fiscal criterion introduced by the Maastricht Treaty on government deficits with a panel of EU members and candidates from 1970 to 2017. Using the *inverse probability weighting* method, they found that the rule had a statistically significant, positive and small impact on fiscal deficits.

The study by Grembi, Nannicini and Troiano (2016) tested the effectiveness of subnational fiscal rules in Italy using a *difference-in-discontinuities* approach, finding that the effect of the fiscal rule is stronger when certain political conditions are present in the locality. Finally, the work by Guerguil, Mandon and Tapsoba (2017) evaluates the impact of different types of flexible fiscal rules on the pro-cyclicality of fiscal policy, using the *propensity scores-matching* method, for 167 countries from 1990 to 2012. The evidence indicates that design is an important factor, so not all fiscal rules have the same impact.

Another strategy used is not to treat the rule solely as a binary variable, i.e. denoting only whether or not there is a rule, but rather to establish a 'strength' index based on key qualitative characteristics established in the literature that would increase its restrictive power. In this sense, there is evidence that improving the design of the rule has a significant effect on fiscal performance (EYRAUD et al., 2018; CASELLI; WINGENDER, 2021).

In general, the empirical literature focuses on evaluations of a specific type of tax rule, in relation to a restricted sample of countries or on a specific tax variable. This creates an opportunity for studies that seek to establish causality from a broader perspective.

This paper uses the methodology proposed by Bergman, Hutchison and Jensen (2016) with the use of the Generalized Methods of Moments (GMM) and with the use of the strength index of fiscal rules established by Schaechter et al. (2012) to evaluate the effects of fiscal rules in a global sample of 179 countries in the period between 1996 and 2021. The evaluation considers the four types of fiscal rules and their relationship with the four fiscal aggregates that the rules seek to restrict, as well as verifying the relationship between fiscal rules and good governance. In this way, the work is not limited to a specific subgroup of countries and it is possible to identify which type of rule has a significant effect, which of them has the greatest restrictive impact and in which of the macro-fiscal variables this effect manifests itself.

2. DATA

2.1 Tax rules

The main dataset related to fiscal rules is the "*IMF Fiscal Rules Dataset*", which covers the period from 1985 to 2021 and covers 106 countries. It also contains approximately 93 variables related to fiscal rules, with both quantitative and qualitative information. In terms of their characteristics, they provide insights into the design of fiscal rules, such as the type of rules (defined by which aggregate it seeks to restrict, whether between debt, expenditure, revenue or income), legal basis, coverage, escape clauses, application and support procedures, etc. In addition, the dataset also offers detailed descriptions of each rule and its key elements.

It is important to note that the data set covers both national and supranational tax rules. However, for the main analysis of this paper, the focus is on national tax rules. Figure 1 shows the distribution of national and supranational tax rules across the globe, showing that there is a global distribution and that many countries have more than one tax rule in place.

Figure 1 - Map showing the number of Fiscal Rules per country in 2021

Source: IMF dataset, own elaboration

Analyzing the data set, we found that a total of 84 countries have implemented at least one national fiscal rule. Of these, 38 have chosen to adopt fiscal rules related to public expenditure, while 49 countries have established rules on public debt. In addition, eight countries have enacted revenue-related fiscal rules. Finally, a total of 71 countries have adopted fiscal rules focused on the fiscal result.

2.1.1 Types of Tax Rules

As suggested above, the data is divided into four types of fiscal rules aimed at restricting four macroeconomic aggregates: the budget result, the degree of indebtedness, fiscal expenditure and fiscal revenue. In the case of rules aimed at the fiscal result, the interest can be in achieving current or structural fiscal balance, in the latter case taking into account the effects of the economic cycle.

The rules related to the public debt ratio establish an explicit anchor or ceiling, usually related to a percentage of GDP. These rules are considered easy to communicate, as they aim to achieve a debt target that is considered sustainable. However, a negative aspect pointed out in the literature is that debt levels are influenced by variables not controlled by the government and are not directly related to short-term fiscal policy (DAVOODI et al., 2022).

The rules established for the budget result aim to restrict the aggregate of the budget result

by imposing clear operational limits that can be specified for the overall, primary or structural balance. A positive feature of these rules is that the budget balance is an instrument largely controlled by the government and policymakers. However, challenges include the rigidity of expenditure and the procyclical effect of the budget result (DAVOODI et al., 2022).

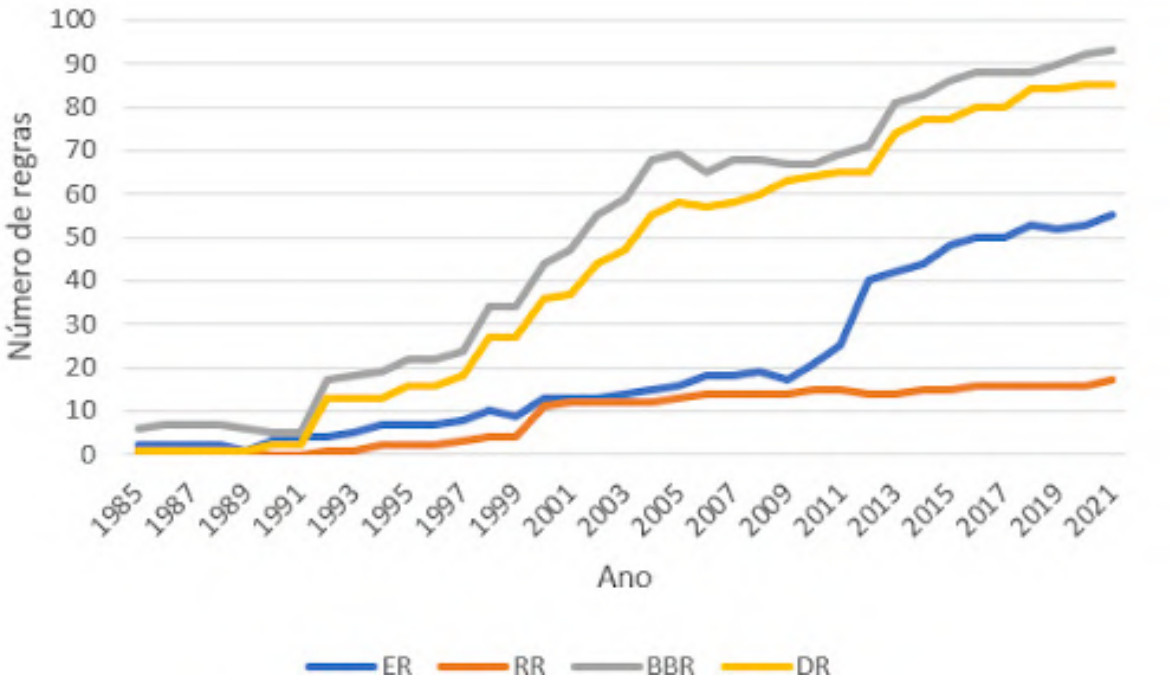
To address this second challenge, there is a variation called the structural result, which adjusts the values taking into account the economic cycle, with the aim of providing stabilization. This adjustment is usually related to a calculation of the output gap, which makes communicating and monitoring the rule more challenging (DAVOODI et al., 2022).

Spending rules aim to impose limits on total, primary or current government spending, and can be set in absolute terms or with a growth rate, varying over the years. A positive feature of these rules is that they restrict spending in periods of temporary economic growth, when there are unexpected revenues, and do not restrict spending in the event of adverse shocks, thus maintaining the objective of economic stabilization. In addition, these rules impose a limit that is relatively easy to monitor and operate (DAVOODI et al., 2022).

Revenue rules establish ceilings or floors for revenues with the aim of increasing collection or avoiding an excessive tax burden. These rules face challenges due to the cyclical nature of revenues, which can result in pro-cyclical policies since they do not take into account the operation of automatic stabilizers (DAVOODI et al., 2022).

Figure 2 shows the evolution of the types of rules over time. In general, the growth in the total number of fiscal rules over the years is remarkable, with a more significant increase during periods of crisis. The first leap occurred in the early 1990s, with the signing of the Maastricht Treaty in 1992, which established debt- and deficit-related criteria for participation in the European economic and monetary union (DAVOODI et al., 2022). In addition, there was a need for fiscal consolidation in order to qualify for the adoption of the single currency, the euro (SCHAECHTER et al., 2012).

Figure 2 - Evolution in the number of tax rules (1985 - 2021)

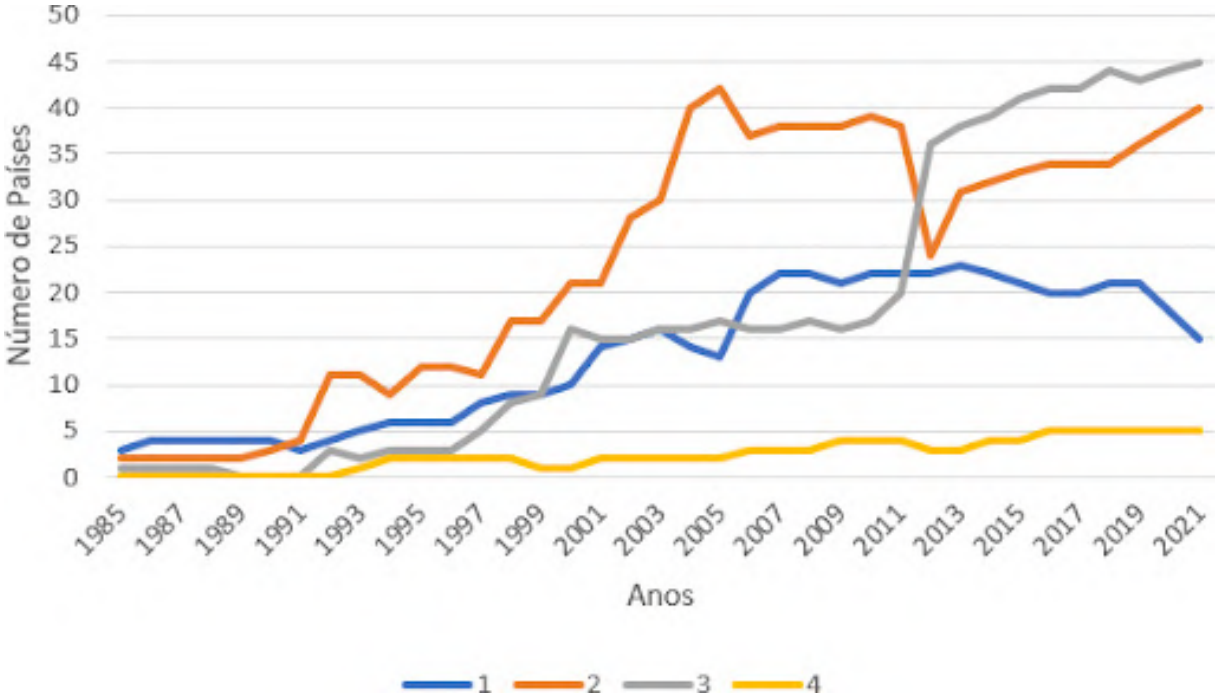


Note: Data from IMF dataset, with own elaboration. ER represents expenditure rules, RR represents revenue rules, BBR represents income rules and DR represents debt rules. This graph includes both national and supranational rules.

The second wave of growth was mainly driven by emerging economies in the early 2000s, when many countries adopted more than one fiscal rule and reformed their fiscal structures in response to experiences of excessive deficits (SCHAECHTER et al., 2012). The third wave was a response to the 2008 financial crisis (SCHAECHTER et al., 2012). Regarding the types of rules, until 2008, the most common were those related to the fiscal result and rules on debt. From 2008 onwards, new rules were created, mainly aimed at controlling expenditure.

In Figure 3, we can see a pattern of increase in the number of rules per country, which can be attributed to two reasons. Firstly, the combination of different rules can be sought as a way of achieving better results in fiscal control. For example, it is common to use a combination of expenditure and debt rules to promote fiscal sustainability. Although an expenditure rule on its own is not directly related to the objective of ensuring debt sustainability, it becomes a good operational instrument when accompanied by a public debt rule (DAVOODI et al., 2022).

Figure 3 - Number of countries with one or more tax rules over time



Note: Data from IMF dataset, with own elaboration. This graph includes both national and supranational rules.

The second reason is the common behavior of countries adopting a new rule without excluding the previous one of a different type (EYRAUD et al., 2018). This behavior can make it difficult to analyze in isolation the distinct effects between different types of fiscal rules, since rules can accumulate over time without a proper review or suspension of previous rules.

2.1.2 Strength of Tax Rules Index

Numerical fiscal rules may vary in terms of their design and, depending on their characteristics, these rules may be more or less likely to impact budget outcomes (DEBRUN et al., 2008; BOHN; INMAN, 1996). Thus, following the work of Debrun et al. (2008), Rules (2009), Bergman, Hutchison and Jensen (2016) and Caselli and Reynaud (2020), we will use a Fiscal Rule "Strength" Index, following the methodology of Schaechter et al. (2012), as a strategy to empirically evaluate the effect of the rule, and not only with a binary variable that would denote the existence or not of the fiscal rule. This index is constructed with key qualitative criteria that would attribute "strength" to a tax rule.

To do this, sub-indices are first constructed for each fiscal rule, with each sub-index being the simple sum of its indicators. Thus, we will have an index referring to the legal basis, an

index for institutional coverage, one for formal monitoring and execution procedures, an index that defines spending ceilings, an index referring to an accountability law and the last one referring to whether there are independent bodies that establish and monitor budget execution[3]. Table 1 describes the sub-indices that make up each of the rules, which are a simple sum of the indicators in the "IMF Fiscal Rules Dataset". All sub-indices are standardized to vary between zero and one.

The overall strength index of the fiscal rules is the sum of the strength indices of each of the four fiscal rules, so the value of the index can tell us the number of fiscal rules in force and institutional changes over time. In this sense, it is expected that more rules denote more strength in the process of restricting variables. Furthermore, the use of the index is expected to show that the rules not only restrict the variable of their type, but the entire set of fiscal aggregates.

In the database, the "*legal basis*" variable is assessed using a scoring scale, where 5 corresponds to a constitutional basis, 4 to an international treaty, 3 to a statutory basis, 2 to a coalition agreement and 1 to a political compromise. In the event that multiple statutory bases apply, the highest statutory base is considered.

According to Inman (1996), strong rules are characterized by a statutory basis that makes them difficult to modify or amend (they are enshrined in law or constitution), are enforced by a politically independent body and carry sanctions in case of violation. To calculate the Legal Coverage Index, the variable is divided by 5, normalizing the maximum score to 1.

3 The indicators vary between zero and one, with the exception of coverage and legal basis. These variables are rescaled to run between zero and one before inserting the composite scores.

Table 1 - Components of the Tax Rule Strength Index

Contents	Indicators	Standardization process
Legal coverage index	*legal basis*	Division by 5
Institutional Coverage Index	*Coverage*	Division by 2
Monitoring and Enforcement Coverage Index	*- Monitoring of compliance outside government* *- Formal enforcement procedure*	Division by 2
Multiannual Expenditure Limits Index",	*Aggregate* *- by Ministry* *- by line item*	Division by 3
Index of Fiscal Responsibility Legislation	*FRL*	
Budget Independence Index	*- Independent body sets budget assumptions* *- Independent body monitors implementation*	Division by 2

Note: All data is present and disaggregated in the IMF dataset.

The Institutional Coverage Index assessed by the "*Coverage*" variable can be assigned as follows: 2 if the rule applies to the general government or to a broader scope, 1 if it applies only to the central government. In addition, the number can be adjusted by 0.5 to take into account similar rules applied at different levels. Therefore, to create the institutional coverage index, the variable is divided by 2, resulting in a normalized score of 1.

The Monitoring and Enforcement Coverage Index is made up of two variables: "*Monitoring of compliance outside government*" and "*Formal enforcement procedure*". The first variable is assigned a value of 1 if there are monitoring mechanisms outside government, and 0 otherwise. The second variable takes the value 1 if there is a formal enforcement procedure, and 0 otherwise. Thus, the index is calculated by adding the two variables and dividing the result by 2, to obtain a maximum score of 1.

The nature of the body in charge of monitoring the rule is another element: a priori, an independent agency could encourage compliance by increasing the 'reputational' costs of breaking the rule. The nature of the enforcement mechanisms is also important (DEBRUN et al., 2008).

The next index is the "*Multiannual Expenditure Limits Index*", made up of three variables. The first variable, called "*Aggregate*", is assigned a value of 1 if there are aggregate mul-

ti-annual spending limits, and 0 otherwise. The second variable, "*by ministry*", takes the value 1 to indicate the existence of specific limits by ministry and 0 otherwise. The third variable, "*by line item*", takes the value 1 if there are limits defined by specific item and 0 otherwise. The sum of the three variables is divided by 3 to normalize the index.

The next component of the fiscal rule index is called the "Fiscal Responsibility Legislation Index". This index is made up exclusively of the "FRL" variable, which indicates the presence or absence of specific fiscal responsibility legislation in a given country. A score of 1 is given if legislation is present and 0 otherwise.

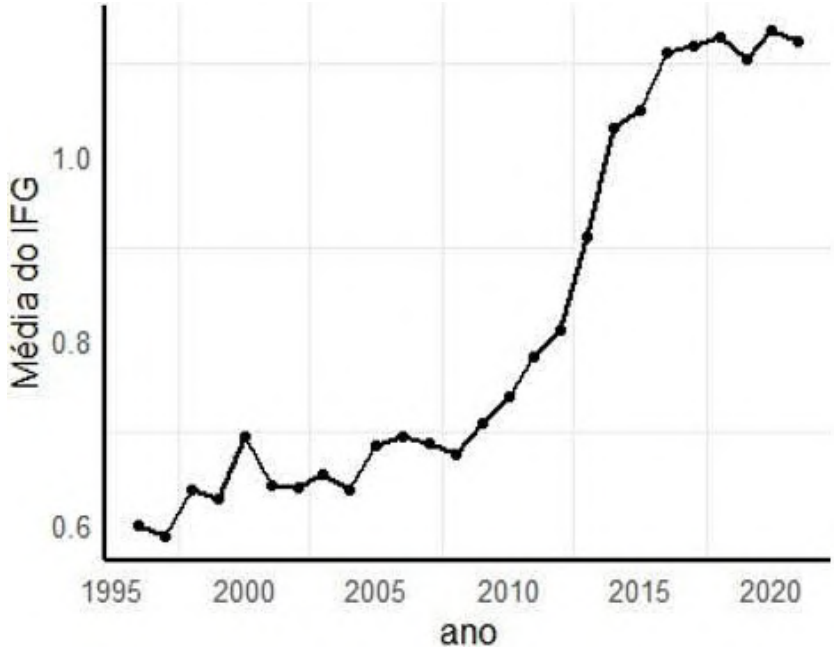
The last index, called the "Budget Independence Index", is made up of two variables. The first variable is "*Independent body sets budget assumptions*", which takes the value 1 if there is a body outside the government responsible for setting budget assumptions, and 0 otherwise. The second variable is "*Independent body monitors implementation*", which takes the value 1 if there is a body outside the government in charge of monitoring implementation, and 0 otherwise. The sum of these two variables is divided by 2 to normalize the index, resulting in a maximum score of 1.

A growing number of advanced and some emerging economies are using independent bodies to further increase the credibility of their fiscal rules. Independent Fiscal Councils, i.e. institutions with a specific mandate to assess and monitor the implementation and impacts of fiscal policy.

Thus, we use the sums of the indices mentioned above to determine the strength index of each rule present in the country. In the case of revenue rules, the Multi-Year Expenditure Limits Index is not taken into account, as it relates only to expenditure. The index for each rule is normalized to have scores between 0 and 5. To create the overall index of fiscal rules, we add up the strength indices of each rule and normalize them to score between 0 and 5.

Figure 4 shows the average increase in the strength index of tax rules over time, from 0.6 in 1996 to around 1.1 in 2021. This result is expected due to the accumulation of rules and the incorporation of new qualitative characteristics suggested by international experience. The highest index value is for Latvia between 2014 and 2021, at 3.06, and the lowest is for Rwanda, at 0.10 between 2019 and 2021.

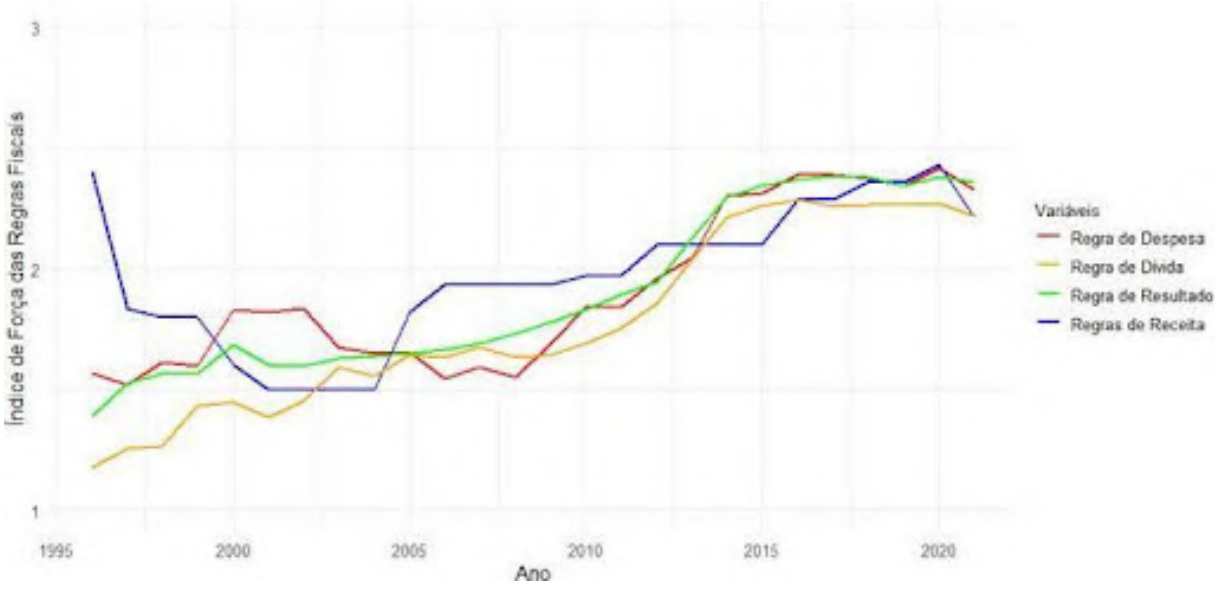
Figure 4 - Increase in the fiscal rule strength index over time



Source: Own elaboration with data from IMF dataset

On the other hand, in Figure 5, when we analyze the values of the strength of tax rules index broken down by type of rule, we see a general increase over time. In 1996, the average value was around 1.5, while in 2021, there was a convergence to an average value of around 2.5. The highest values achieved stand out: in the debt rule, Latvia obtained the highest value, reaching 3.97 between the years 2014 and 2021. As for the expenditure and fiscal result rules, Brazil has the highest values, both registering 4.30 between 2016 and 2021. As for the revenue rule, the Netherlands achieved the highest value, reaching 3.9 in the years 2020 and 2021.

Figure 5 - Average strength index of each tax rule in relation to time



Note: Data from IMF dataset with own elaboration.

In addition, the lowest values per type of rule were also observed. With regard to the debt rule, Montenegro recorded the lowest value (0.27) in the period from 2017 to 2021. In the case of expenditure rules, Botswana had the lowest value, registering 0.58 in 2003 and 2004. Regarding the fiscal result, Rwanda obtained the lowest value, with 0.41 in the years 2020 and 2021. As for the revenue rule, Kenya recorded the lowest value, with 0.7.

It should be noted that, in this approach, some degree of judgment is required when assigning the scores, so the index captures, as far as possible, specific features that would increase the effectiveness of the rules However, a high score may well coexist with poor fiscal results because the presence of a feature does not necessarily imply that it is also implemented correctly (SCHAECHTER et al., 2012). However, there is evidence that improving rule design can have a significant effect on fiscal performance (EYRAUD et al., 2018; CASELLI; WINGENDER, 2021).

2.2 Government efficiency

The notion that strong domestic fiscal institutions, together with fiscal rules, may be necessary to reduce or eliminate deficit bias is an important point in the study by Bergman, Hutchison and Jensen (2016). Thus, following Bergman, Hutchison and Jensen (2016) to assess the effectiveness of fiscal rules in combating deficit bias, the World Bank's "government efficiency" index, known as the "*Worldwide Governance Indicators*" (WGI), was used. This index is based on data collected through surveys sent to companies, citizens and experts in various countries, covering the period from 1996 to 2021[4] and including 214 countries.

The WGI is made up of aggregate indicators from six governance dimensions:

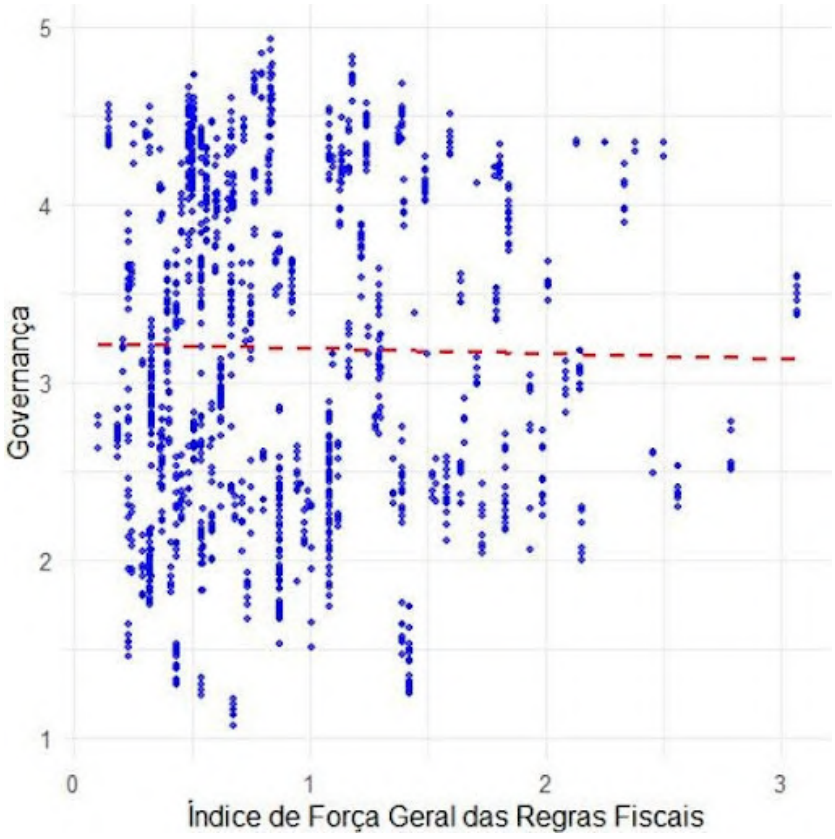
(i) Voice and Accountability, (ii) Political Stability and Absence of Violence/Terrorism, (iii) Government Effectiveness, (iv) Regulatory Efficiency, (v) Rule of Law and (vi) Control of Corruption. The "Government Efficiency" indicator within this index seeks to reflect perceptions about the efficiency of public services, the quality of public service, the government's independence from political pressure, the formulation and implementation of policies and the credibility of the government's commitment to these policies.

4 At first it was published every 2 years, so the years 1997, 1999 and 2001 were missing. To add observations in 1997, 1999 and 2001, the average of the previous year and the following year were used.

As this indicator ranges from -2.5 to 2.5, higher values indicate greater government efficiency. To facilitate empirical analysis, the data was normalized to a value between 0 and 5.

An important conceptual issue, with significant statistical implications, is the possibility that fiscal rules are simply a reflection of a deep preference for fiscal discipline Debrun et al. (2008). In this sense, fiscal rule design and governance may be highly correlated. Figure 6 allows for a visual inspection and further analysis of this correlation. However, after examining the data presented, no evidence of correlation was identified between the two variables in question.

Figure 6 - Correlation between Governance Index and General Strength of Fiscal Rules Index



Source: IMF dataset and Worldwide Governance Indicators with own elaboration

3. METHOD

The model chosen to measure the effect of the design of the tax rules is the Generalized Method of Moments (GMM) based on (BERGMAN; HUTCHISON; JENSEN, 2016) and applied to the 4 aggregate variables. In this sense, the GMM-System proposed by Blundell

and Bond (1998)[5] will be used in two-steps form[6], including estimates of the coefficients and standard errors corrected for finite samples, as proposed by Windmeijer (2005). Equation (1) reports this specification.

$$Y_{it} = \beta_1 Y_{it-1} + \beta_2 \text{IF}_{it} + \beta_3 \text{EG}_{it} + \beta_4 \text{IF}_{it} * \text{EG}_{\text{it}} + BX_{it} + \alpha + \gamma + \varepsilon_{\text{it}} \qquad (1)$$

Where Y_{it} is the variable in each model representing one of the 4 variables constrained by the fiscal rule, *IF* represents the fiscal rule strength index, *EG* the government efficiency index, X_{it} are the control variables, the GDP growth rate (%), the logarithm of GDP per capita, the consumer inflation rate and the terms of trade index. Finally, α and γ represent the country and year fixed effects respectively.

The fundamental identification condition for a GMM model is the strict exogeneity of some of the explanatory variables (or the availability of strictly exogenous instrumental variables) conditional on unobservable individual effects. This allows the use of past, present and future values of strictly exogenous variables to construct instruments for lagged dependent variables and other non-exogenous variables, after the permanent effects have been differentiated, according to Arellano and Bond (1991).

Furthermore, as assumed by Bergman, Hutchison and Jensen (2016), the "General Strength Index"[7] and the "Government Efficiency" variable are considered strictly exogenous variables and will be used as instruments. To improve efficiency, the Anderson-Hsiao approach, using longer lags of the dependent variable as additional instruments, as proposed by Roodman (2009a), can be adopted. Thus, the variable Y_{it-k} will also be used as an instrument, with $k > 2$.

Given the problem of the number of instruments being quadratic in T, we applied, as suggested by Roodman (2009b), the method of collapsing the instruments to avoid their proliferation and the associated consequences, such as adjustments to the endogenous variables, bias in the estimates and weakening of the overidentification tests. This is because, in the standard, uncollapsed form, each instrumental variable generates a column for each period and lag available up to that time period.

5 Blundell and Bond (1998) argue that the difference-GMM estimator proposed by Arellano and Bond (1991) can show persistence in the series, and as a result, the level variables become weak instruments for the difference equation, implying bias and low precision in finite samples.

6 The one-step method assumes that the error terms are independent and homoscedastic for each cross-section over time. On the other hand, in the two-step method the residuals obtained in the first stage are used to construct a consistent estimate of the variance covariance matrix, relaxing the assumptions of independence and homoscedasticity Roodman (2009a).

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In addition, one of the problems with using lags is the trade-off between delay length and sample length. However, by using the collapsing method, which results in stacked blocks in the instrument matrix, this choice dilemma is eliminated, and it becomes practical to include all valid lags of untransformed variables as instruments, when available[8]. For endogenous variables, this means lags starting at 2. For a variable that is predetermined but not strictly exogenous, lag 1 is also valid, according to Roodman (2009a). Therefore, the endogenous control variables X_{it-k}, with k > 2, will be used as the GMM instrument.

Along with the coefficients associated with the variables, the first and second order autocorrelation tests will be presented, as well as the Hansen/Sargan test to identify excessive restrictions (joint validity of all the instruments). In order to consider the model specification robust, we expect to reject the null hypothesis of first-order autocorrelation, not reject the null hypothesis of second-order autocorrelation and not reject the Hansen/Sargan test. In the appendix, we present the model without the endogeneity treatment.

4. RESULTS

In the methodology of the work by Bergman, Hutchison and Jensen (2016), one of the objectives was to assess whether stricter fiscal rules are more effective when combined with a high level of government efficiency (complementarity hypothesis) or whether they are less effective when combined with a high level of government efficiency (substitutability hypothesis). The results of these hypotheses are related to the sign of the interaction between the Fiscal Rule Strength Index variable and Government Efficiency (GE), with a negative sign indicating that they are political/institutional substitutes, while a positive sign would indicate that they are complementary.

Table 2 presents the evaluation using the General Strength of Fiscal Rules Index (GFSI) in relation to the 4 fiscal aggregates. For the debt variable, the results indicate that government efficiency and the general strength index of fiscal rules are substitutes. This means that the effect of the increased rule design decreases as government efficiency increases. In this case, the individual effects did not show statistical significance, only the interaction between them.

With regard to the expenditure variable, the result of the strength index is significant, indicating that a stronger rule is associated with lower expenditure. In addition, the interaction

8 But the guideline is to have a number of instruments equal to or less than the number of groups of individuals Roodman (2009a).

shows a positive result, suggesting that a "stronger" rule and "government efficiency" are complementary from a political/institutional point of view. As for the revenue and result variables, none of the three coefficients of interest showed statistical significance. Furthermore, the revenue model was not robust, while all the validation tests were robust for the other three variables.

Table 2 - Effect of the general strength index of fiscal rules and the interaction with government efficiency in relation to macro-fiscal aggregates

Variável	Dívida	Despesa	Receita	Resultado
IFG	7,768	-2,921*	0,467	0,827
EG	-2,230	0,879	1,629	-0.537
IFG * EG	-3,268*	1,029**	-0,256	-0,241
Crescimento do PIB	-0,634***	-0,141***	0,038	0,261***
PIB per capita	4,092 ***	-0,170	1,638	0,692
Inflação	-0,061	-0,014***	-0,008	0,015***
Termos de trocas	-0,003	0,013***	0,020**	0,005
Y_{it-1}	0,866***	0,807***	0,561***	0,497***
N° de países	178	176	179	176
Observações	6657	6755	6930	6745
Instrumentos	131	136	136	136
Teste de Sargan	0,30	0,18	0,20	0,346
AR (1)	0,000	0,000	0,15	0,03
AR (2)	0,397	0,839	0,26	0,14

AR (2) are first and second order autocorrelation tests, respectively. Only p-values are shown for the Sargan/Hansen J tests for overidentification and the two autocorrelation tests.*** indicates significance at the 1% level, ** at the 5% level and * at the 10% level.

Analyzing the strength index of each rule in relation to the four macroeconomic variables. In Table 3, we examine the performance of the debt rule (IFDR) and its relationship with government efficiency. We see that the impact of the rule on debt is reflected in the expenditure and fiscal result variables. With regard to the expenditure variable, the debt rule is significant and

negative, indicating a reduction in expenditure in response to the rule. Government efficiency is significant and positive, revealing higher spending in countries with higher efficiency scores. In addition, the strength index and efficiency are complementary from a political/institutional point of view, reinforcing the mutual effects.

With regard to the fiscal result, the strength index is significant, indicating an increase in the fiscal result due to the application of the rule. However, the coefficient relating to government efficiency is not statistically significant. The interaction between these two variables is shown to be substitutive. As for the debt and revenue variables, none of the three coefficients of interest is statistically significant. The model for the revenue variable is not yet robust, while all the validation tests showed robustness for the other three variables.

Table 3 - Effect of the strength of rule index on debt and interaction with government efficiency in relation to macro-fiscal aggregates

Variável	Dívida	Despesa	Receita	Resultado
IFDR	3,615	-2,512**	-0,231	2,241*
EG	-2,281	0,93**	1,759	-0.379
IFDR * EG	-1,627	0,837**	-0,045	-0,774***
Crescimento do PIB	-0,637***	- 0,150***	0,046	0,251***
PIB per capita	4,04 ***	-0,159	2,193	1,054**
Inflação	-0,062**	-0,014***	-0,009	0,015***
Termos de trocas	-0,001	0,013***	0,022**	0,005
Y_{it-1}	0,860***	0,799***	0,562***	0,498***
N° de países	178	176	179	176
Observações	6657	6755	6930	6755
Instrumentos	131	136	136	136
Teste de Sargan	0,21	0,104	0,236	0,280
AR (1)	0,000	0,000	0,148	0,031
AR (2)	0,38	0,877	0,266	0,140

Note: IFDR refers to the general strength index of the debt rule and EG the efficiency of the government.

AR (1) and AR (2) are first and second order autocorrelation tests, respectively. Only p-values are shown for the Sargan/Hansen J tests for overidentification and the two autocorrelation tests *** indicates significance at the 1% level, ** at the 5% level and * at the 10% level.

When analyzing the expenditure-related rule (IFER) in the four variables (Table 4), it can be seen that, among the coefficients of interest, only government efficiency shows statistical significance in relation to the expenditure variable, indicating that government efficiency may be associated with an increase in expenditure. However, according to the Sargan test, the instruments cannot be considered valid with 10% confidence. In addition, another model that is not robust is the revenue model, as indicated by the first-order autocorrelation test.

Table 4 - Effect of the strength of rule index on expenditure and interaction with government efficiency in relation to macro-fiscal aggregates

Variável	Dívida	Despesa	Receita	Resultado
IFER	4,459	-1,830	1,048	0,725
EG	-2,393	1,099**	2,059	-0.379
IFER * EG	-1,808	0,643	-0,371	-0,218
Crescimento do PIB	-0,631***	-0,143***	0,042	0,257***
PIB per capita	4,588***	-0,04	2,034	0,630
Inflação	-0,062	-0,014***	-0,008	0,015***
Termos de trocas	-0,008	0,014***	0,021**	0,005
Y_{it-1}	0,862***	0,806***	0,561***	0,496***
N° de países	178	176	179	176
Observações	6657	6755	6930	6755
Instrumentos	131	136	136	136
Teste de Sargan	0,265	0,08	0,22	0,20
AR (1)	0,000	0,000	0,153	0,04
AR (2)	0,37	0,83	0,270	0,12

Note: IFER refers to the general strength index of the expenditure rule and EG the efficiency of the gover-

nment. AR (1) and AR (2) are first and second order autocorrelation tests, respectively. Only p-values are shown for the Sargan/Hansen J tests for overidentification and the two autocorrelation tests.*** indicates significance at the 1% level, ** at the 5% level and * at the 10% level.

In the revenue rule, as shown in Table 5, none of the coefficients of interest showed statistical significance. This may be related to the very definition of revenue, as described by Davoodi et al. (2022), in which the rule can establish floors or ceilings for revenue, without a clear definition of whether it is to restrict growth or decline. Furthermore, in this case, the model for the revenue variable does not yet show robustness, as evidenced by the first-order autocorrelation test.

Table 5 - Effect of the strength of rule index on revenue and interaction with government efficiency in relation to macro-fiscal aggregates

Variável	Dívida	Despesa	Receita	Resultado
IFRR	8,165	-4,187	0,246	2,704
EG	-3,015	0,860	1,788	-0.200
IFRR * EG	-2,627	1,201	-0,270	-0,893
Crescimento do PIB	-0,749***	-0,138	0,053	0,292*
PIB per capita	4,666	-0,039	2,561	1,333
Inflação	-0,052	-0,014**	-0,008	0,015**
Termos de trocas	-0,007	0,012	0,024**	0,006
Y_{it-1}	0,855***	0,801***	0,567***	0,499***
N° de países	178	176	179	176
Observações	6657	6755	6930	6755
Instrumentos	131	136	136	135
Teste de Sargan	0,961	0,588	0,550	0,858
AR (1)	0,000	0,000	0,14	0,04
AR (2)	0,39	0,84	0,26	0,16

Note: IFRR refers to the general strength index of the revenue rule and EG the efficiency of the government.

AR (1) and AR (2) are first and second order autocorrelation tests, respectively. Only the p-values are presented for the Sargan/Hansen J tests for overidentification and the two autocorrelation tests. *** indicates significance at the 1% level, ** at the 5% level and * at the 10% level.

With regard to the fiscal result rule (Table 6), there is significance in the coefficients of interest associated with the debt variable. Government efficiency shows a negative and statistically significant result, indicating that greater efficiency is associated with lower debt. In addition, the interaction between the fiscal rule and government efficiency has a negative sign, suggesting an indication of substitutability between these two variables in this specific rule. In this context, only the model related to the revenue variable was not robust.

Table 6 - Effect of the strength of rule index on the fiscal result and interaction with government efficiency in relation to macro-fiscal aggregates

Variável	Dívida	Despesa	Receita	Resultado
IFBBR	2,387	-0,965	1,048	0,382
EG	-2,81*	0,783	1,470	-0.521
IFBBR * EG	-1,170**	0,375	-0,380	-0,129
Crescimento do PIB	-0,625***	-0,142***	0,035	0,261***
PIB per capita	4,331 ***	-0,222	1,545	0,785*
Inflação	-0,055	-0,014***	-0,007	0,015***
Termos de trocas	-0,005	0,013***	0,019**	0,005
Y_{it-1}	0,866***	0,812***	0,564***	0,492***
N° de países	178	176	179	176
Observações	6657	6755	6930	6755
Instrumentos	131	136	136	136
Teste de Sargan	0,29	0,12	0,16	0,32
AR (1)	0,000	0,000	0,14	0,02
AR (2)	0,37	0,86	0,25	0,12

Note: IFBBR refers to the overall strength index of the fiscal result rule and EG government efficiency. AR

(1) and AR (2) are first and second order autocorrelation tests, respectively. Only the p-values are shown for the Sargan/Hansen J tests for overidentification and the two autocorrelation tests. *** indicates significance at the 1% level, ** at the 5% level and * at the 10% level.

From the point of view of the variables, it was found that, for the debt variable, the general strength index and the fiscal result rule show substitutability with government efficiency. In addition, efficiency proved to be important for debt reduction when evaluating the outcome rule.

With regard to the expenditure variable, there is an indication of complementarity between government efficiency and the general strength index of fiscal rules in the debt rule. Government efficiency is significant and positive for the debt and expenditure rule. For the general index and the debt rule, the Strength Index shows significant and negative results, indicating that the rule is associated with lower expenditure.

In relation to the fiscal result, the debt rule is the only one that is significant, indicating that it is associated with a higher fiscal result. In addition, there is an indication that the debt rule and government efficiency are political/institutional substitutes, reinforcing the result of Bergman, Hutchison and Jensen (2016). As for revenue, none of the models were robust.

5. FINAL CONSIDERATIONS

As previously stated, fiscal rules are established as fixed numerical limits on fiscal variables established in legislation and binding for at least three years (LLEDÓ et al., 2017), the need to create a restrictive measure is, as documented by several studies, due to the existence of a debt, spending and deficit bias on the part of governments (EYRAUD et al., 2018); (VALENCIA; ULLOA-SUAREZ, 2022).

The rules aim to correct distorted incentives and contain pressures to overspend in good times and avoid excessive deficits that could arise under unrestricted political discretion, in order to ensure fiscal discipline and the sustainability of public accounts (EYRAUD et al., 2018); (VALENCIA; ULLOA-SUAREZ, 2022). However, it is clearly not a panacea for fiscal sustainability if other elements, including political will, are not present (SCHAECHTER et al., 2012). However, an important point is that countries with fiscal rules can present observed or unobserved characteristics that promote good fiscal policy, regardless of the existence of a rule (POTERBA, 1994).

In this work, the Generalized Methods of Moments (GMM) strategy was applied to identify the causal effects of tax rules. The model was applied to a group of 180 countries between 1996 and 2020. The performance of the four fiscal aggregates was evaluated: debt as a percentage of GDP, expenditure as a percentage of GDP, revenue as a percentage of GDP and fiscal result as a percentage of GDP.

The results reveal a distinct relationship between efficiency and fiscal rules. For the debt and fiscal outcome variable, we found that stricter rules have an effect in countries with high government efficiency, indicating a substitutability between the variables. However, when it comes to expenditure, government efficiency and the strength of fiscal rules seem to act as institutional complements. Furthermore, there are indications that greater government efficiency without the presence of a fiscal rule leads to higher expenditure.

The analysis of specific rules, such as those on debt, expenditure, revenue and fiscal result, also offers valuable insights. We found that the debt rule is the only one with significant results associated with a reduction in expenditure and an improvement in the fiscal result. Looking at the overall strength index, we found that a set of rules considered to be "stronger" is also associated with controlling the expenditure variable. However, for the revenue variable, the results are still inconclusive, highlighting the fact that none of the models presented robust results for analysis.

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APPENDIX A- Fixed Effect

Table A1 - Fixed effects - General strength index

	Dívida	Despesa	Receita	Resultado
	(1)	(2)	(3)	(4)
IFG	-24.368***	-1.027	-1.394	-0.322
	(5.633)	(0.907)	(1.046)	(1.050)
EG	-1.991	0.225	0.164	-0.092
	(2.156)	(0.350)	(0.397)	(0.406)
Crescimento do PIB	-0.907***	-0.151***	0.069***	0.221***
	(0.085)	(0.013)	(0.015)	(0.015)
PIB per capita	-15.565***	2.535***	1.357***	-1.158***
	(1.202)	(0.193)	(0.220)	(0.223)
Inflação	0.159***	-0.018***	-0.006	0.011**
	(0.034)	(0.004)	(0.005)	(0.005)
Termos de troca	-0.134***	0.008**	0.025***	0.018***
	(0.021)	(0.003)	(0.004)	(0.004)
IFG:EG	11.501***	0.148	0.483	0.321
	(1.816)	(0.295)	(0.340)	(0.341)
Observations	3,600	3,646	3,745	3,646
R^2	0.139	0.124	0.049	0.071
Adjusted R^2	0.093	0.078	-0.001	0.022
F Statistic	78.700*** (df = 7; 3415)	69.950*** (df = 7; 3463)	26.288*** (df = 7; 3558)	37.939*** (df = 7; 3463)

Table A2 - Fixed effects - Debt strength index

	Dívida	Despesa	Receita	Resultado
	(1)	(2)	(3)	(4)
IFDR	-40.869***	0.054	-0.165	-0.212
	(3.326)	(0.545)	(0.633)	(0.630)
EG	-2.558	0.255	0.206	-0.083
	(2.135)	(0.350)	(0.397)	(0.405)
Crescimento do PIB	-0.918***	-0.151***	0.069***	0.221***
	(0.084)	(0.013)	(0.015)	(0.015)
PIB per capita	-12.609***	2.482***	1.345***	-1.118***
	(1.171)	(0.189)	(0.216)	(0.219)
Inflação	0.157***	-0.018***	-0.006	0.011**
	(0.034)	(0.004)	(0.005)	(0.005)
Termos de troca	-0.153***	0.008**	0.025***	0.018***
	(0.020)	(0.003)	(0.004)	(0.004)
IFDR:EG	14.351***	-0.146	0.066	0.208
	(1.125)	(0.185)	(0.215)	(0.214)
Observations	3,600	3,646	3,745	3,646
R^2	0.153	0.124	0.049	0.071
Adjusted R^2	0.108	0.078	-0.001	0.022
F Statistic	88.458*** (df = 7; 3415)	69.962*** (df = 7; 3463)	26.996*** (df = 7; 3558)	37.841*** (df = 7; 3463)

Table A3 - Fixed effects - Expenditure rule strength index

	Dívida	Despesa	Receita	Resultado
	(1)	(2)	(3)	(4)
IFER	4.600	1.073*	1.188*	0.046
	(3.932)	(0.624)	(0.717)	(0.722)
EG	-1.443	0.251	0.218	-0.070
	(2.161)	(0.350)	(0.396)	(0.405)
Crescimento do PIB	-0.897***	-0.149***	0.070***	0.221***
	(0.086)	(0.013)	(0.015)	(0.015)
PIB per capita	-15.042***	2.335***	1.270***	-1.048***
	(1.174)	(0.188)	(0.213)	(0.217)
Inflação	0.160***	-0.018***	-0.006	0.011**
	(0.034)	(0.004)	(0.005)	(0.005)
Termos de troca	-0.140***	0.009***	0.025***	0.017***
	(0.021)	(0.003)	(0.004)	(0.004)
IFER:EG	0.973	-0.328	-0.303	0.045
	(1.244)	(0.200)	(0.230)	(0.232)
Observations	3,600	3,646	3,745	3,646
R^2	0.131	0.123	0.050	0.070
Adjusted R^2	0.084	0.077	0.0001	0.021
F Statistic	73.560*** (df = 7; 3415)	69.178*** (df = 7; 3463)	26.616*** (df = 7; 3558)	36.969*** (df = 7; 3463)

Table A4 - Fixed effects - Revenue rule strength index

	Dívida	Despesa	Receita	Resultado
	(1)	(2)	(3)	(4)
IFRR	14.974*	-4.748***	-4.199**	1.203
	(9.026)	(1.499)	(1.699)	(1.737)
EG	-1.000	0.249	0.218	-0.067
	(2.178)	(0.349)	(0.396)	(0.405)
Crescimento do PIB	-0.918***	-0.150***	0.069***	0.220***
	(0.086)	(0.013)	(0.015)	(0.015)
PIB per capita	-13.580***	2.406***	1.371***	-1.023***
	(1.167)	(0.184)	(0.210)	(0.214)
Inflação	0.154***	-0.017***	-0.006	0.011**
	(0.035)	(0.004)	(0.005)	(0.005)
Termos de troca	-0.149***	0.009***	0.026***	0.017***
	(0.021)	(0.003)	(0.004)	(0.004)
IFRR:EG	-2.152	1.261***	1.214**	-0.213
	(2.828)	(0.466)	(0.534)	(0.541)
Observations	3,600	3,646	3,745	3,646
R^2	0.116	0.125	0.050	0.070
Adjusted R^2	0.068	0.079	0.001	0.021
F Statistic	63.916*** (df = 7; 3415)	70.521*** (df = 7; 3463)	26.908*** (df = 7; 3558)	36.981*** (df = 7; 3463)

Table 5 - Fixed effects - Strength of result rule index

	Dívida	Despesa	Receita	result
	(1)	(2)	(3)	(4)
IFBBR	6.215**	−1.359***	−1.519***	−0.153
	(2.818)	(0.456)	(0.525)	(0.528)
EG	−0.410	0.146	0.106	−0.068
	(2.163)	(0.350)	(0.397)	(0.406)
Crescimento do PIB	−0.907***	−0.151***	0.068***	0.221***
	(0.085)	(0.013)	(0.015)	(0.015)
PIB per capita	−16.154***	2.585***	1.435***	−1.124***
	(1.199)	(0.191)	(0.218)	(0.222)
Inflação	0.162***	−0.018***	−0.006	0.011**
	(0.034)	(0.004)	(0.005)	(0.005)
Termos de troca	−0.136***	0.008**	0.025***	0.018***
	(0.021)	(0.003)	(0.004)	(0.004)
IFBBR:EG	−0.046	0.312**	0.456***	0.141
	(0.864)	(0.141)	(0.162)	(0.163)
Observations	3,600	3,646	3,745	3,646
R^2	0.133	0.126	0.051	0.071
Adjusted R^2	0.087	0.080	0.001	0.022
F Statistic	75.117*** (df = 7; 3415)	71.387*** (df = 7; 3463)	27.236*** (df = 7; 3558)	37.690*** (df = 7; 3463)