

Institutional determinants of the effective tax rate in G7 and BRIC countries

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ABSTRACT

This paper studies the relationship between the corporate effective tax rate (ETR) and several institutional factors in the G7 and the BRIC countries (Brazil, Russia, India, and China). We use the panel data methodology with a data sample of 25,878 listed firms in 2010–2018. The results show that all the variables analyzed have an effect on the ETR. Some—such as the statutory tax rate, government effectiveness, regulatory quality, rule of law, and open markets—affect all countries, whereas others, such as corruption control and economic freedom, affect only the BRIC countries, and gross domestic product growth, the deficit, and gross debt only affect the G7 countries.

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1. Introduction

This study analyzes the institutional factors that influence the effective tax rate (ETR) borne by listed firms in the eleven largest economies in the world. According to World Bank data, in 2019 the eleven top countries in the ranking by gross domestic product (GDP) were, in order, the United States, China, Japan, Germany, India, the United Kingdom, France, Italy, Brazil, Canada, and Russia. Therefore, they comprise the G7 (Canada, France, Germany, Italy, Japan, the United Kingdom, and the United States) and the countries known as the BRIC (Brazil, Russia, India, and China). According to classifications by the International Monetary Fund (IMF) and the World Bank, the G7 countries are considered developed, whereas the BRIC countries are considered developing economies.

The fact that they are the world's largest economies makes them especially attractive for business. However, decisions on location and investment are complex because firms have to take many factors into account. According to a report by the IMF and the Organization for Economic Cooperation and Development (OECD) (IMF/OECD, 2017), after corruption and political certainty, the overall tax environment is the most important factor for consideration in deciding to invest or locate operations in a country. Moreover, the two most important tax factors in investment and location decisions are uncertainty about the ETR on profit and the anticipated ETR on profit.

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Taking into account that the ETR is one of the most important factors in the investment and location decisions by companies, it comes as no surprise that the literature on the subject is extensive, as shown in the reviews by [Hanlon and Heitzman \(2010\)](#), [Lietz \(2013\)](#), [Lopo Martinez \(2017\)](#), and [Wilde and Wilson \(2018\)](#). A large proportion of these studies focus on searching for the determinants of the ETR, which are basically the business characteristics, and a single country. However, especially over the past decade, some studies have covered several countries, as shown by [Delgado et al. \(2014\)](#), [Belz et al. \(2019\)](#), and [Fonseca-Díaz et al. \(2019\)](#).

In our opinion, when several countries are taken into account, it is essential to establish controls for the characteristics of each country. However, in previous studies, the focus is on business variables as determinants of the ETR; in some cases, no country-effect variables are included, and in others institutional factors are used as control variables.

Because previous research has found that business characteristics affect the ETR, we believe it is appropriate to analyze the effect of institutional factors as the main variables. In fact, the difference in results in the relationship between the ETR and business factors may stem from country characteristics. [Belz et al. \(2019\)](#) state that the size-ETR relation most likely varies across countries due to institutional features, such as the legal environment, law enforcement, or the set of accounting rules. Similarly, [Fonseca-Díaz et al. \(2019\)](#) show that in 63 countries certain institutional factors affect the ETR and the relations between the ETR and business variables. Finally, [Fernández-Rodríguez et al. \(2021\)](#) find that, in the BRICS (Brazil, Russia, India, China, and South Africa) and MINT (Mexico, Indonesia, Nigeria, and Turkey) countries, the ETR depends on both business characteristics and institutional factors. Moreover, they find that the relations between ETRs and business variables remain unchanged when institutional factors are controlled for.

In short, the scarce previous literature indicates the important role played in firms' tax burdens by the environment in which they operate. [Wilde and Wilson \(2018\)](#) highlight that increasing global competition, technological developments, changes in regulation, and dynamic political developments shape the environment in which firms operate, so there are likely to be opportunities for understanding the role that such conditions play in influencing corporate tax decisions.

For all these reasons, in this research we focus on analyzing the effect of institutional variables on the ETR, which affect all firms equally, whatever their individual characteristics. For this purpose, we consider some country-level variables that have been used in prior studies, as well as other new ones that we think may be relevant. Specifically, we test the effect on the ETR of the statutory tax rate (STR), GDP growth, government effectiveness, regulatory quality, rule of law, control of corruption, deficit, gross debt, the Fraser Institute's Economic Freedom of the World index (Fraser index), and open markets.

To the best of our knowledge, this is the first study on the determinants of corporate ETR that uses only institutional variables. This is its most outstanding contribution to the literature. In addition, we analyze the eleven largest economies in the world, for which there are no prior studies, over a long and recent period (2010–2018).

Moreover, to make our results more robust, we use three measures of ETR: the classic Cash ETR and two fairly new measures that amount to modifications of Cash ETR using STR. These two measures, developed by [Amiram et al. \(2013\)](#) but used very little since then, yield interesting results when several countries are studied, as seen in [Tang et al. \(2017\)](#), [Zeng \(2019\)](#), and [Fernández-Rodríguez et al. \(2021\)](#). To calculate the ETRs, we use the SP Capital IQ data base, and the institutional variables are taken from the Fraser Institute, Heritage Foundation, IMF, KPMG, and the World Bank.

Our results indicate that all the institutional variables considered affect the ETR. Some—such as the STR, governance effectiveness, regulatory quality, rule of law, and open markets—have an effect in all countries. Corruption control and economic freedom only have an effect in the BRIC countries and GDP growth, deficits, and gross debt only in the G7 countries. Specifically, corruption control is very important in emerging countries but has no influence at all in developed countries. So, greater control of corruption can be expected to lead firms in BRIC countries to pay more taxes. The results for the G7 show that firms' tax burdens are smaller when the country's debt and deficits are greater.

The paper is structured as follows. [Section 2](#) presents the literature review, analyzes the institutional variables that determine the ETR, proposes the hypotheses to be tested, describes the methodology, and shows the models to be estimated. [Section 3](#) describes the sample used and shows the results. Finally, [Section 4](#) presents the main conclusions.

2. Literature review and research design

2.1. Prior research

Based on the extensive prior literature on the business determinants of the ETR, in this section we focus on the studies that use some institutional variables. A summary of these studies is given in [Table 1](#).

[Table 1](#) shows that institutional characteristics are considered determinants of the ETR in a few studies. Moreover, no prior study includes them as the main variables, only as control variables. For this reason, in this paper we use institutional factors as the main variables, with some already used in prior literature and others that are novel.

In this review of the prior literature, mention must be made of the study by [Tang et al. \(2017\)](#) because, although it refers only to China, it is done by province. These researchers introduce the institutional variables that are characteristic of each region, such as deficits, GDP per capita, and other variables that are specific to the Chinese fiscal regime. We also include deficits as a variable that may be relevant to the tax burden in the G7 and BRIC countries.

Other related studies that, for various reasons, are not included in [Table 1](#) are discussed below.

There have been other studies about the determinants of the ETR in several countries, such as [Kim and Limpaphayom \(1998\)](#) on Hong Kong, Korea, Malaysia, Taiwan, and Thailand, over the period 1975–1992; [Buijink et al. \(2002\)](#) on EU-15 in 1990–1996; [Fernández-Rodríguez and Martínez-Arias \(2014\)](#) on the BRIC countries in 2000–2009; and [Delgado et al. \(2023\)](#) on the largest five

Table 1
Studies about corporate ETR determinants with institutional variables.

Authors/Database	Countries/Years	Explanatory variables
Fernández-Rodríguez & Martínez-Arias (2011) Thomson Datastream	US and EU-20 1995–2007	Business: size, leverage, capital intensity, inventory intensity, and return on assets (ROA) Institutional: GDP growth and consumer price index (CPI)
Fernández-Rodríguez & Martínez-Arias (2012) Thomson Datastream	US and China 1995–2007	Business: size, leverage, capital intensity, inventory intensity, and ROA Institutional: GDP growth and CPI
Lee & Swenson (2012) Compustat	EU-23 2005–2007	Business: size, leverage, inventory intensity, ROA and property, plant, and equipment Institutional: STR and overall book-tax conformity score
Delgado et al. (2014) Compustat	EU-15 1992–2009	Business: size, leverage, capital intensity, inventory intensity, and ROA Institutional: STR
Jaafar & Thornton (2015) Amadeus	14 European countries 2001–2008	Business: size, leverage, capital intensity, inventory intensity, and profitability Institutional: STR, tax systems (worldwide or territorial) and financial-tax conformity jurisdiction
Tang et al. (2017) Accounting Research (CSMAR)	China (study by province) 1999–2006	Business: size, leverage, intangible assets, ROA, age, and sales growth Institutional: deficit, GDP per capita, and other variables specific to China
Fonseca-Díaz et al. (2019) Compustat	63 countries 1999–2009	Business: size, leverage, capital intensity, inventory intensity, and ROA Institutional: OECD member, level of development, index of economic freedom, government effectiveness, regulatory quality, rule of law, and GDP per capita growth
Zeng (2019) Datastream	36 countries 2011–2015	Business: size, leverage, capital intensity, intangible intensity, inventory intensity, and ROA Institutional: International Accounting Standards (IFRS), STR, government effectiveness, regulatory quality, rule of law, control of corruption, tax systems (worldwide or territorial), common-law country, developed country, and GDP per capita
Fernández-Rodríguez et al. (2021) Compustat	BRICS and MINT countries 2006–2015	Business: size, leverage, capital intensity, inventory intensity, ROA, sales growth, discretionary accruals, and deferred tax liabilities Institutional: STR, level of development, index of economic freedom, GDP growth, government effectiveness, regulatory quality, and rule of law

Source: Own elaboration.

European Union economies in 2006–2015. However, these papers do not use institutional variables because they analyze each country separately.

Molina-Morales et al. (2011) analyze the economic and institutional determining factors of fiscal pressure in 40 European countries over the period 1996–2006. These countries have different levels of economic development, different recent history, and different levels of cooperation and integration among them. However, this paper analyzes the tax burden of the countries defined as income tax (taxes and contributions to social security) in relation to GDP. Thus, their research is not comparable to ours because the dependent variable is different. However, some of the institutional variables they use are also included in our study.

However, Atwood et al. (2012) examine the impact of three tax system characteristics—required book-tax conformity, worldwide versus territorial approach, and perceived strength of tax enforcement—on corporate tax avoidance across 22 countries over the period 1993–2007. They do not use the ETR to measure tax avoidance but find evidence that tax system characteristics have an impact on tax avoidance. They use both business and institutional variables.

2.2. Institutional characteristics and the development of hypotheses

As stated in the previous subsection, certain institutional variables have been tested as control variables in prior papers. Some studies include the country's level of development as a determinant of the ETR, but in our case this would not be appropriate because we have two groups of countries that are differentiated by their level of development, G7 versus BRIC. Other variables previously used in the literature are the STR, GDP growth, institutional quality, and economic freedom. We include these variables as well as others that we believe may have an effect on firms' tax burden.

Among the most novel variables, we analyze deficits, only used by Tang et al. (2017) in their research in Chinese provinces, and gross debt, as deficits, debt, and taxation are related parameters. We also include open markets to test trade freedom, investment freedom, and financial freedom, which we believe might have an effect on the taxation of firms. Another new variable we include is control of corruption because we believe that it may affect firms' tax burden differently in G7 and BRIC countries.

Another variable in our study is economic freedom, which has previously been analyzed using the Heritage Foundation's Index of Economic Freedom. However, we measure it using the Fraser index, which is the indicator best known and most widely used by researchers (Balliew et al., 2020).

We now discuss each of these variables and propose our hypotheses and possible dependent relationships with the ETR by firms.

Table 2
Trends in STRs in G7 and BRIC countries (2010–2018) (%).

Location	2010	2011	2012	2013	2014	2015	2016	2017	2018
Canada	31.00	28.00	26.00	26.00	26.50	26.50	26.50	26.50	26.50
France	33.33	33.33	33.33	33.33	33.33	33.33	33.33	33.33	33.00
Germany	29.41	29.37	29.48	29.55	29.58	29.72	29.72	29.79	30.00
Italy	31.40	31.40	31.40	31.40	31.40	31.40	31.40	24.00	24.00
Japan	40.69	40.69	38.01	38.01	35.64	33.86	30.86	30.86	30.86
United Kingdom	28.00	26.00	24.00	23.00	21.00	20.00	20.00	19.00	19.00
United States	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	27.00
G7 Average	33.40	32.68	31.75	31.61	31.06	30.69	30.26	29.07	27.23
Brazil	34.00	34.00	34.00	34.00	34.00	34.00	34.00	34.00	34.00
China	25.00	25.00	25.00	25.00	25.00	25.00	25.00	25.00	25.00
India	33.99	32.44	32.45	33.99	33.99	34.61	34.61	34.61	35.00
Russia	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00
BRIC Average	28.25	27.86	27.86	28.25	28.25	28.40	28.40	28.40	28.50
World Average	24.65	24.52	24.38	24.17	23.88	23.77	23.62	24.06	24.02

Source: KPMG (2020) and own calculations.

2.2.1. Statutory tax rate (STR)

Over the past few decades, countries have significantly lowered corporate tax rates in what has been called “a race to the bottom”. Slemrod (2004) shows a decline in corporate rates since the 1980 s and gives evidence of the role of international competitive pressures on corporate taxation. Abbas and Klemm (2013) find a partial race to the bottom in their study of 50 emerging and developing economies from 1996 to 2007. Egger and Raff (2015) find strong evidence that countries behave strategically when choosing their tax system. In particular, countries respond to rival governments’ tax reductions by reducing their own STRs. Given this international trend, the major economies can also be expected to follow this decline in the STR, as a competitive factor and to attract investment. The STRs in force in the major economies over the time frame considered are shown in Table 2.

This downward trend, however, is observed only in the G7 countries. In the BRIC countries, there was almost no variation during the period analyzed: Brazil, China, and Russia did not touch their tax rates during the period studied, and India raised its rates by one percentage point. In the G7, however, the average STR dropped by more than six percentage points, though it is true that in 2010 their average STRs were quite a bit higher than those in the BRIC countries, mainly because of the high rates in Japan and the United States.

The competition among countries detected in prior research does not seem to affect the BRIC countries, whose STRs varied between 20% and 30% in 2018. Yet, in the G7, with the exception of the United Kingdom, which in 2018 had at a low STR of 19%, STRs were between 24% and 30%—that is, they all applied fairly similar tax rates. It is striking that most of the large economies applied STRs above the global average. In fact, in the 2010 s, Russia and the United Kingdom were the only countries whose legal tax rates were below the average global STR.

According to Delgado et al. (2018), the STR should be distinguished from the ETR because the former is the amount of tax liability (before any credits) relative to taxable income, which is defined by the tax law and reflects tax benefits and subsidies built into the law, whereas the latter attempts to measure taxes paid as a proportion of economic income. Lee and Swenson (2012), Delgado et al. (2014), and Jaafar and Thornton (2015) find a positive relation between corporate ETRs and STR. In line with these studies, we expect a positive relation between STR and ETR in both the G7 and BRIC countries, although Fernández-Rodríguez et al. (2021) show that in nine emerging economies, the STR does not affect the ETR. Our first hypothesis is therefore as follows:

Hypothesis 1. *The statutory tax rate affects the effective tax rate.*

2.2.2. GDP growth

In this research, we consider it especially important to control for GDP growth, because emerging economies are usually characterized by a high annual growth in GDP. Therefore, we believe there may be important differences between the G7 and BRIC countries. Table 3 shows that GDP growth is fairly different between the two groups of countries, and the BRIC average for the period is higher than that of the G7. However, considerable differences are also found within each group, especially among the BRIC countries. Specifically, China and India have very high rates of growth, whereas in Brazil and Russia, especially after 2014, the rates were low and even negative in some years.

The prior literature presents inconclusive results regarding the effect of GDP on ETR. Fernández-Rodríguez and Martínez-Arias (2011, 2012) do not find a relationship between GDP growth and ETR. Fonseca-Díaz et al. (2019) show that major GDP per capita growth leads to higher ETR, and Zeng (2019) finds a negative relation between ETR and GDP per capita. Finally, Fernández-Rodríguez et al. (2021) conclude that in nine emerging economies no relationship exists between GDP growth and the tax burden. Therefore, in principle we do not propose the sign of the relationship between GDP growth and ETR, despite the differences between the developed and emerging countries. Therefore, we propose a second hypothesis:

Table 3
GDP growth in G7 and BRIC (2010–2018) (Annual percent change).

Location	2010	2011	2012	2013	2014	2015	2016	2017	2018
Canada	3.10	3.10	1.80	2.30	2.90	0.70	1.00	3.20	2.00
France	1.90	2.20	0.30	0.60	1.00	1.10	1.10	2.30	1.70
Germany	4.20	3.90	0.40	0.40	2.20	1.70	2.20	2.50	1.50
Italy	1.70	0.70	-3.00	-1.80	0.00	0.80	1.30	1.70	0.80
Japan	4.20	-0.10	1.50	2.00	0.40	1.20	0.50	2.20	0.30
United Kingdom	1.90	1.50	1.50	2.10	2.60	2.40	1.90	1.90	1.30
United States	2.60	1.60	2.20	1.80	2.50	2.90	1.60	2.40	2.90
G7 Average	2.80	1.84	0.67	1.06	1.66	1.54	1.37	2.31	1.50
Brazil	7.50	4.00	1.90	3.00	0.50	-3.60	-3.30	1.30	1.30
China	10.60	9.50	7.90	7.80	7.30	6.90	6.80	6.90	6.70
India	10.30	6.60	5.50	6.40	7.40	8.00	8.30	7.00	6.10
Russia	4.50	5.10	3.70	1.80	0.70	-2.00	0.30	1.80	2.50
BRIC Average	8.23	6.30	4.75	4.75	3.98	2.33	3.03	4.25	4.15

Source: IMF (2020) and own calculations.

Hypothesis 2. GDP growth affects the effective tax rate.

2.2.3. Institutional quality

In general, papers that consider institutional quality usually use the six Worldwide Governance Indicators developed by Kaufmann et al. (2011): voice and accountability, control of corruption, political stability and absence of violence/terrorism, rule of law, government effectiveness and regulatory quality. However, Fonseca-Díaz et al. (2019) and Fernández-Rodríguez et al. (2021) analyze only the last three of them because they believe that the rest are not directly related to ETR. Nevertheless, Zeng (2019) studies the last three plus control of corruption because these four factors are very important in relation to a country's legal and institutional conditions. In our research, we also use these four variables because we believe that control of corruption may be of special interest, as developing countries usually have higher levels of corruption. Fifteen years ago, Svensson (2005) show that all the countries with the highest levels of corruption were developing or transition countries. Also, the Corruption Perception Index published annually by International Transparency gives evidence of this every year.

The four variables vary from - 2.5 (weak) to + 2.5 (strong). Fig. 1 shows the mean value for the four variables analyzed for G7 and BRIC countries in 2010–2018: rule of law (RULE_LAW), government effectiveness (GOV_EFF), regulatory quality (REG_QUAL), and control of corruption (CTRL_CORR).

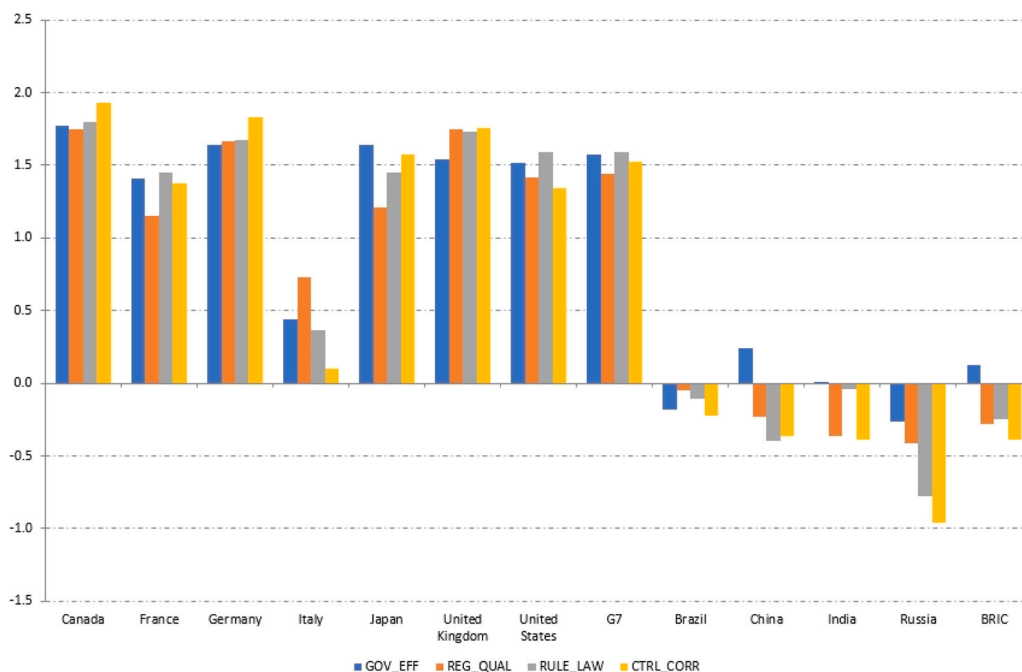


Fig. 1. Institutional quality in G7 and BRIC countries (2010–2018).

Source: World Bank (2020).

Fig. 1 shows that the BRIC countries have negative values for all the variables, except government effectiveness, which shows a low average value, 0.12, because of China's positive value. By country, Russia has the worst institutional quality according to all the indicators, especially for control of corruption and rule of law. By contrast, the G7 countries have high average values for institutional quality in all four indicators, although Italy stands out for its low values, especially for control of corruption. These important differences may well affect the ETR for companies.

According to Sáenz González and García-Meca (2014), corruption, government ineffectiveness, and weak rule of law, as well as other weaknesses in country infrastructure, increase opportunistic behavior by firms. In contrast, control of corruption, strong rule of law, and effective government (which has a high index value) reduce such opportunistic behavior. Picur and Riahi-Belkaoui (2006) find that international tax compliance is positively related to successful control of corruption. Therefore, when control of corruption is greater, firms' tax compliance is greater, so they should bear higher have ETRs.

For all these reasons, a positive relationship can be expected between the variables that represent institutional quality and firms' tax burden. However, the results reported in the prior literature are conclusive only for government effectiveness and control of corruption, as all the studies find a positive relationship with tax pressure. In contrast, for rule of law and regulatory quality, the results vary. Fonseca-Díaz et al. (2019) find a negative relation for rule of law and a lack of relation for regulatory quality. Fernández-Rodríguez et al. (2021) find a negative relation between the ETR and both variables. Finally, Zeng (2019) show a positive relation between tax burden and both institutional factors.

In conclusion, we believe that these four variables may affect the ETRs by companies. Government effectiveness and control of corruption have a positive sign, but for rule of law and regulatory quality, the sign is not clear. For these reasons, we propose our third hypothesis:

Hypothesis 3. *Institutional quality affects the effective tax rate.*

2.2.4. Deficit and gross debt

Public debt, deficit, and taxation are related, so they are usually studied together. Beqiraj et al. (2018) study government reactions to the accumulation of debt via fiscal policies. According to Cerniglia et al. (2018), the ability to finance expected or likely future spending, deficits, or debt is a sufficient condition for testing fiscal sustainability.

The relation between these three parameters is also observed in the new variable included in 2017 by the Heritage Foundation: "fiscal health." As stated by Miller and Kim (2017), it was possible to include this in the index of economic freedom because of the increased reliability and availability of worldwide data from a variety of sources. The score for the fiscal health component is based on two subfactors—deficits and debt—so it will be of interest to analyze it in a few years.

According to Müller et al. (2020), high debt can have numerous negative impacts, such as raising interest rates, crowding out private investment, and limiting governments' flexibility in responding to economic crises. Mounting public debt driven by persistent budget deficits often undermines overall productivity growth and ultimately leads to economic stagnation, rather than growth.

Table 4 shows the gross debt and average deficit of the world's largest economies. The BRIC countries have less debt than the G7, among which Russia has a particularly low level. Among the G7, Japan has debt that is more than twice the group average.

There are no great differences between the two groups with respect to deficits, with important variations by country. Germany is the only country with a surplus, and, at the other extreme, India has the largest average deficit.

Examining China, Tang et al. (2017) see deficits as a determinant of the corporate tax burden. They show that tax avoidance by local government-controlled firms is associated with local fiscal deficits over our sample period. Regarding countries' gross debt, to our knowledge this has not been used before as a determinant of the ETR. However, we consider that deficits and public debt may both have affect the ETR, so we propose the following hypotheses:

Hypothesis 4. *Deficits affect the effective tax rate.*

Hypothesis 5. *Gross debt affects the effective tax rate.*

Table 4
Average gross debt and deficit in the G7 and BRIC countries (2010–2018).

Country	Average gross debt	Average deficit
Canada	87.10	1.45
France	93.59	4.16
Germany	73.92	-0.07
Italy	126.95	2.94
Japan	229.72	6.11
United Kingdom	84.67	5.03
United States	103.25	6.15
Brazil	70.21	5.80
China	40.14	1.97
India	67.61	7.37
Russia	13.97	1.02

Source: Own calculations based on World Bank (2020) data.

Table 5
Fraser index score in the G7 and BRIC countries (2000–2017).

Location	2010	2011	2012	2013	2014	2015	2016	2017	Quartile
Canada	8.08	8.00	8.07	8.10	8.27	8.03	8.08	8.08	Most free (Q1)
France	7.53	7.41	7.35	7.31	7.44	7.42	7.32	7.35	Q2 (Q1 in 2010–2011)
Germany	7.73	7.82	7.78	7.84	7.85	7.85	7.87	7.82	Most free (Q1)
Italy	7.36	7.40	7.38	7.35	7.42	7.48	7.43	7.41	Q2 (Q1 in 2015)
Japan	7.73	7.63	7.70	7.77	7.75	7.85	7.83	7.86	Most free (Q1)
United Kingdom	8.02	7.99	8.02	8.00	7.97	8.07	8.06	8.09	Most free (Q1)
United States	7.96	7.89	8.00	7.89	7.95	8.07	8.17	8.19	Most free (Q1)
Brazil	6.47	6.47	6.29	6.12	6.00	5.83	6.11	6.23	Q3 (Q4 in 2013 and 2016)
China	6.22	6.23	6.29	6.31	6.30	6.33	6.40	6.42	Q3 (Q4 in 2011)
India	6.53	6.66	6.63	6.44	6.32	6.69	6.72	6.91	Q3 (Q2 in 2017)
Russia	6.44	6.47	6.56	6.53	6.49	6.52	6.71	6.78	Q3

Source: Fraser Institute (2020).

2.2.5. Economic freedom

Fonseca-Díaz et al. (2019) and Fernández-Rodríguez et al. (2021) consider economic freedom a determinant of corporate ETR using the Index of Economic Freedom (IEF), created by the Heritage Foundation and the *Wall Street Journal* in 1995. However, neither of these studies reaches conclusive results. Against this background, and taking into account that the Fraser index is the indicator that is best known and most widely used by researchers (Balliew et al., 2020), we use this index.

The Fraser index measures the degree of economic freedom in five major areas: size of government, legal system and security of property rights, sound money, freedom to trade internationally and regulation. Each component uses a scale from 0 to 10, and the Fraser Institute gives classification by quartiles (Q), with the first quartile (Q1) corresponding to the “most free” countries, and the fourth (Q4) to the “least free.” The score for each country analyzed is in Table 5. The data for 2018 are not yet available.

According to the Fraser index, throughout the study period, the BRIC countries were mostly in the third quartile, with the following exceptions: China in 2011 and Brazil between 2013 and 2016 appear in the fourth quartile (“least free”), and India in 2017 in the second quartile. Most of the G7 countries are considered the “most free,” except for France and Italy, which fell within the second quartile during almost all the periods.

In sum, there are clear differences between the BRIC and G7 countries, and emerging countries have less economic freedom than developed countries. This might have an effect on firms’ tax burden as, in an analysis of 30 countries, Riahi-Belkaoui (2004) show that tax compliance internationally is positively related to the level of economic freedom. In the same vein, Molina-Morales et al. (2011) find a positive relation between the economic freedom index and countries’ tax burden.

However, as stated above, the only studies that consider economic freedom a possible determinant of corporate ETR are inconclusive. Fonseca-Díaz et al. (2019) obtain a positive relation for 63 countries but only in one of the regressions performed, and Fernández-Rodríguez et al. (2021) do not find that economic freedom is a determinant of firms’ ETR in the BRICS and MINT countries.

For these reasons, we believe that economic freedom may have an effect on the ETR, but that this may differ between the G7 and BRIC countries because of their different conditions. Thus, our sixth hypothesis is as follows:

Hypothesis 6. *Economic freedom affects the effective tax rate.*

2.2.6. Open markets

The last variable complements the previous one, because the IEF of the Heritage Foundation has four components, one of which is open markets. This variable comprises three categories—trade freedom, investment freedom, and financial freedom—which may be relevant to business taxation.

Trade freedom measures the scope of the tariff and nontariff barriers that affect the imports and exports of goods and services. Investment freedom evaluates a variety of restrictions that are usually imposed on investment. Financial freedom is an indicator of bank efficiency and is a measure of independence from government control and interference in the financial sector.

Table 6 presents the open markets score for the eleven countries studied, calculated from the average of the three components mentioned above. It shows that emerging economies are in the last category, except for Brazil, which is “mostly unfree.” The countries’ markets are considered far from “open,” with obvious drawbacks for firms. However, in 2017 and 2018 India’s score was over 50, which moves it to the second category (“Mostly free”). According to Miller et al. (2018), India’s economic freedom score increased significantly in 2018, propelling the country along the path to becoming an open-market economy. Yet traces of its prior autarkic policies linger. Conversely, and with the exception of Japan, which is “moderately free,” the G7 countries are “free” or “mostly free,” and the United Kingdom and Canada have the highest scores.

Although there is no prior research on this, we believe that this variable may affect the ETR and will probably affect the BRIC and G7 countries differently, based on the large differences between the two groups. We therefore propose our seventh hypothesis:

Hypothesis 7. *Open markets affect the effective tax rate.*

Table 6
Open markets score in the G7 and BRIC countries.

Location	2010	2011	2012	2013	2014	2015	2016	2017	2018	Category
Canada	81.0	81.0	81.0	81.1	82.8	82.8	82.3	82.8	82.7	Free
France	67.5	69.2	69.0	72.3	74.3	74.3	74.3	74.0	75.6	Mostly free
Germany	77.5	77.5	77.4	80.6	82.6	82.7	82.7	79.0	79.0	Mostly free (2013–2016 free)
Italy	74.2	74.2	74.0	75.6	77.6	77.7	77.7	74.0	74.0	Mostly free
Japan	64.1	64.2	63.9	63.9	67.5	67.5	70.9	70.9	70.8	Moderately free
United Kingdom	85.8	85.9	85.7	85.6	85.9	86.0	86.0	85.7	85.6	Free
United States	77.3	77.1	75.5	75.5	75.6	75.7	75.7	79.0	83.9	Mostly free
Brazil	54.7	56.6	59.9	59.9	61.4	59.9	58.1	56.5	56.2	Mostly unfree
China	40.7	42.2	42.2	42.3	43.9	42.3	44.3	37.9	39.4	Repressed
India	47.6	46.4	46.4	46.2	46.9	46.5	48.7	50.9	50.8	Repressed
Russia	44.5	44.4	44.4	44.1	43.2	43.3	42.5	45.1	46.5	Repressed

Source: Heritage Foundation (2020).

2.3. Econometric specification and description of variables

To test whether it is more appropriate to use ordinary least squares or panel data, we carried out various statistical tests. The F test and the Breusch and Pagan multiplier test indicate that it is appropriate to consider individual effects and to work with panel data. We also checked whether we could use a dynamic model, including the lagged dependent variable in it, but this lagged variable was not significant, and, moreover, the Sargan test indicates that the dynamic model is not appropriate. Therefore, the estimations are performed using static panel data. Then, we carried out the Hausman test to determine whether the individual effects were correlated with the explanatory variables, and the results indicate that it is more appropriate to use fixed effects.

In addition, the Wooldridge test indicates the presence of autocorrelation, and the Wald test demonstrates heteroskedasticity problems. Two possible estimators exist for correcting these problems: feasible generalized least squares (FGLS) and panel-corrected standard errors (PCSE). Beck and Katz (1995) show that standard errors with PCSE are more precise than those with FGLS, so in this research we use the PCSE estimator.

We use the following model to test the seven hypotheses proposed in the previous subsection:

$$ETR_{i,t} = \beta_0 + \beta_1 STR_t + \beta_2 GDP_GROWTH_t + \beta_3 GOV_EFF_t + \beta_4 REG_QUAL_t + \beta_5 RULE_LAW_t + \beta_6 CTRL_CORR_t + \beta_7 DEFICIT_t + \beta_8 GROSS_DEBT_t + \beta_9 FRASER_INDEX_t + \beta_{10} OPEN_MARKETS_t + \text{dummies SECTOR} + \text{dummies YEAR} + \text{dummies COUNTRY} + \varepsilon_{i,t} \quad (1)$$

where ETR is the dependent variable indicating firms' tax burden, which we define in three different ways:

- CASH_ETR: this is cash taxes paid on the pretax income of firm i in year t . All observations with negative values in cash taxes paid or in pretax income were eliminated. Also, the variable was limited to between 0 and 1, as is the norm in prior studies.
- R_ETR: this is the ratio between CASH_ETR of firm i in year t , and the STR current in each year and country. This modified measure of tax burden, called the ETR Ratio, was proposed by Amiram et al. (2013) but has only been used by Tang et al. (2017), Fernández-Rodríguez et al. (2021), and Jiang et al. (2020). When the value of R_ETR is one, the ETR and the STR tax rate are the same. If it is over one, the effective rate is greater than the statutory rate, which is unusual. If it is under one, then firms pay lower taxes than is established by STR. Thus, when R_ETR is higher, a firm's tax burden is greater—that is, it can be interpreted in a similar way to CASH_ETR.
- D_ETR: this is the difference between the STR current in each year and country and the CASH_ETR of firm i in year t . This second modified measure of the tax burden, called ETR Difference, is fairly new, although it has been used by Amiram et al. (2013), Majeed and Yan (2019), and Zeng (2019). The gap between STR and ETR show the tax avoidance employed by firms. Low values of D_ETR indicate a high tax burden and vice versa. Thus, D_ETR is interpreted as the opposite of ETR and R_ETR.

We use these three measures of the tax burden because CASH_ETR is one of the measures of the tax burden that is most widely used in the extensive prior literature. Also, when several countries are studied over time, it is appropriate to use measures of the ETR corrected by the STR (Fernández-Rodríguez et al., 2021). For these reasons, it is of interest to use R_ETR and D_ETR as alternative measures of CASH_ETR.

The explanatory variables considered are as follows:

- STR: statutory tax rate.
- GDP_GROWTH: GDP growth.
- GOV_EFF: government effectiveness, which ranges from -2.5 (weak) to $+2.5$ (strong).
- REG_QUAL: regulatory quality, which ranges from -2.5 (weak) to $+2.5$ (strong).
- RULE_LAW: rule of law, which ranges from -2.5 (weak) to $+2.5$ (strong).
- CTRL_CORR: control of corruption, which ranges from -2.5 (weak) to $+2.5$ (strong).

- DEFICIT: deficit, measured as the difference between total government expenditure and total government revenue, as a percentage of GDP.
- GROSS_DEBT: gross debt, measured as the ratio of all liabilities that require future payment of interest or principal by the debtor to the creditor to GDP.
- FRASER_INDEX: Fraser Institute's Economic Freedom of the World index, which ranges from 0 to 10.
- OPEN_MARKETS: open markets, measured as the average of trade freedom, investment freedom and financial freedom, which ranges from 0 to 100, with countries divided into the five categories listed in Subsection 2.2.

Finally, SECTOR, YEAR, and COUNTRY are dummies for each sector, year, and country.

Appendix A provides a complete list of variable definitions.

3. Sample and results

3.1. Sample and descriptive statistics

For this research, firm data were obtained from the SP Capital IQ database, using the financial information on listed firms in the G7 and BRIC countries for the period 2010–2018. As is usual in other research, only nonfinancial firms are considered, yielding a total of 25,878 firms—17,146 in the G7 and 8732 in the BRIC countries. Table 7 gives the composition of the sample and the descriptive statistics for the variables used in Model 1 and the means test.

As shown in Table 7, for all the variables considered, both dependent and independent, there are statistically significant differences between the G7 and BRIC countries. As stated in Subsection 2.2, average STR in the G7 exceeds that of the BRIC countries; however, the lowest average CASH_ETR is for the G7. Therefore, the STR gives information that is closer to the tax burden of firms in the BRIC countries than for those in the G7, and the gap between STR and CASH_ETR is very large. This fact is corroborated by mean D_ETR, which is slightly above two points in the BRIC countries and 18 points in the G7. Similarly, the R_ETR of emerging countries is more than twice that of developed countries.

For the remaining explanatory variables, the data for each of the years considered are presented and discussed in Subsection 2.2, and the averages for the study period are given together with the means testing. The statistically significant difference in GDP growth is clear, because growth in the BRIC countries is more than three times that in the G7. There are also very large differences between the two groups of countries with respect to the variables for institutional quality. It has already been found that the BRIC countries have negative values in three of the variables—regulatory quality, rule of law and control of corruption—and a low value for government effectiveness. However, the G7 has high, positive values for all four components. So, institutional quality is much better in the G7 countries than in the BRIC countries.

However, for deficits and gross debt, the scores are more adverse in for the G7, much higher than for emerging countries. The scores for deficits do not seem to be very different, but the test of means confirms that the differences are significant.

Finally, the G7 countries have greater economic freedom, in particular, more open markets than the emerging countries. In both cases, the statistical tests corroborate that the differences are statistically significant.

3.2. Institutional determinants of ETR in the biggest economies

To test our hypotheses, we separate our sample into two groups, G7 and BRIC countries, and run six regressions, using the three different dependent variables. When R_ETR and D_ETR are used as the dependent variable, the STR variable is excluded because it is already included in the calculation of these dependent variables. Table 8 shows the six estimates, distinguishing them by the tax burden measure used. We consider that a variable is relevant for explaining the ETR when it is significant in at least two of the three estimates for each group. Thus, if a variable is significant in only one estimation, we believe that this result is not robust.

First, the results in Table 8 show that institutional factors have greater explanatory power for ETRs in the BRIC countries than in the G7, as shown by the adjusted R^2 values, which are much higher for emerging countries than for developed countries.

The results show that, of the ten institutional variables considered, half (STR, government effectiveness, regulatory quality, rule of law, and open markets) affect all the countries. Control of corruption and economic freedom affect only the BRIC countries, and GDP growth, deficits, and gross debt affect only the G7.

According to the results, STR has a greater effect in the BRIC countries than in the G7, as shown by the value of the coefficient and its significance. More specifically, the legal tax rate creates a greater tax burden for firms, but the effect is greater in the BRIC countries than in the G7, because the value of the coefficient is larger (1.0549 as opposed to 0.1512), as is the significance. These results tally with most of the prior literature, which also finds a positive relationship between legal and effective rates (Lee and Swenson, 2012; Delgado et al., 2014; Jaafar and Thornton, 2015). However, they differ from Fernández-Rodríguez et al. (2021), who did not find a significant relationship between the ETR and the STR in nine emerging economies.

Conversely, open markets have a greater effect on the G7 than on the BRIC countries. Thus, the results show that a more open market implies a greater tax burden on all firms. However, this is the explanatory variable with the lowest coefficient in all the estimations, indicating that of all the institutional factors considered, open markets have the least influence on the ETR. Because of the absence of prior studies, comparisons are not possible.

Regulatory quality, rule of law, and government effectiveness are the institutional characteristics with the most weight in both the BRIC and G7 countries. This is clear because the values of the coefficients for these variables are the highest. However, in the BRIC

Table 7
Descriptive statistics and means testing.

	G7						BRIC						Means Test	
	Mean	Median	St. Dev.	Min.	Max.		Mean	Median	St. Dev.	Min.	Max.		Diff.	T Value
CASHLETR	0.1589	0.0752	0.1936	0.0000	1.0000		0.2586	0.1952	0.2732	0.0000	1.0000		-0.0997	-63.88 ***
R_LETR	0.4833	0.2199	0.6038	0.0000	5.2252		1.0325	0.7757	1.0945	0.0000	4.9489		-0.5492	-92.94 ***
D_LETR	0.1809	0.2557	0.1999	-0.8028	0.4069		0.0229	0.0566	0.3038	-0.7898	0.3500		0.1580	92.82 ***
STR	0.3394	0.3564	0.0640	0.1900	0.4069		0.2879	0.2500	0.0464	0.2000	0.3500		0.0515	221.85 ***
GDP_GROWTH	1.9610	1.9494	0.9108	-2.8190	4.1917		7.1554	7.1679	1.9299	-3.5458	10.6361		-5.1944	-720.00 ***
GOV_EFF	1.5753	1.5500	0.2014	0.3700	1.8500		0.1215	0.0900	0.2171	-0.4700	0.4800		1.4538	1600.00 ***
REG_QUAL	1.4442	1.4500	0.2513	0.6400	1.8900		-0.2829	-0.2800	0.1093	-0.5400	0.1700		1.7271	2300.00 ***
RULE_LAW	1.5890	1.6100	0.2158	0.2500	1.8900		-0.2508	-0.2600	0.2065	-0.8200	0.0400		1.8398	2000.00 ***
CTRL_CORR	1.5274	1.4200	0.3082	-0.0300	2.0700		-0.3845	-0.3600	0.1509	-1.0900	0.1700		1.9119	2000.00 ***
DEFICIT	4.8088	4.2690	3.1189	-1.8666	11.0244		4.2485	3.9000	3.0347	-2.9229	10.2539		0.5603	41.73 ***
GROSS_DEBT	123.8310	104.2571	54.8105	61.6909	237.1295		51.5835	46.7867	15.4530	10.9093	87.8942		72.2475	481.58 ***
FRASER_INDEX	7.9368	7.9600	0.1963	7.3100	8.2700		6.4356	6.4000	0.1969	5.8300	6.9100		1.5012	1600.00 ***
OPEN_MARKETS	76.5143	75.6667	6.0490	63.9333	86.0000		44.7265	44.2667	4.2253	37.8667	61.4333		31.7878	1500.00 ***
Number of companies	17,146	17,146	17,146	17,146	17,146		8732	8732	8732	8732	8732		25,878	25,878

Note: *** significant at the 1% level.

Table 8
Institutional determinants of the ETR in G7 and BRIC countries.

	CASH_ETR		R_ETR		D_ETR	
	G7	BRIC	G7	BRIC	G7	BRIC
STR	0.1512 (1.82)* **	1.0549 (3.44)* **	—	—	—	—
GDP_GROWTH	0.0081 (7.46)* **	-0.0006 (-0.37)	0.0210 (6.40)* **	0.0082 (1.37)	-0.0126 (-12.43)* **	0.0005 (0.34)
GOV_EFF	0.0940 (7.31)* **	0.0947 (5.76)* **	0.2584 (6.25)* **	0.4325 (6.33)* **	-0.1183 (-9.24)* **	-0.0953 (-6.09)* **
REG_QUAL	-0.1556 (-10.71)* **	-0.1248 (-3.00)* **	-0.3319 (-7.16)* **	-0.3504 (-1.90)*	0.1095 (7.90)* **	0.1232 (3.03)* **
RULE_LAW	-0.0977 (-5.58)* **	-0.1909 (-6.31)* **	-0.3318 (-6.12)* **	-0.7576 (-5.99)* **	0.0681 (3.95)* **	0.1910 (6.31)* **
CTRL_CORR	0.0051 (0.29)	0.1056 (5.15)* **	0.1381 (2.18)* *	0.4394 (5.75)* **	0.0137 (0.76)	-0.1056 (-5.15)* **
DEFICIT	-0.0050 (-4.16)* **	0.0039 (1.57)	-0.0161 (-4.94)* **	0.0111 (1.09)	0.0109 (10.41)* **	0.0038 (1.58)
GROSS_DEBT	-0.0061 (-18.41)* **	0.0012 (1.20)	-0.0147 (-14.83)* **	0.0062 (1.66)*	0.0046 (15.31)* **	-0.0012 (-1.23)
FRASER_INDEX	0.0305 (1.75)*	-0.0341 (-1.95)* *	-0.0118 (-0.21)	-0.2573 (-4.65)* **	0.0153 (0.91)	0.0356 (2.48)* **
OPEN_MARKETS	0.0049 (5.89)* **	0.0012 (1.38)	0.0105 (4.05)* **	0.0105 (3.19)* **	-0.0058 (-7.10)* **	-0.0013 (-1.66)*
Country dummies	Included	Included	Included	Included	Included	Included
Year dummies	Included	Included	Included	Included	Included	Included
Sector dummies	Included	Included	Included	Included	Included	Included
Adjusted R ²	10.93%	31.68%	9.58%	32.22%	14.47%	36.84%
Observations	50,239	37,301	50,239	37,301	50,239	37,301

Notes: Regressions are estimated using the panel-corrected standard errors (PCSE) estimator, controlling for both heteroskedasticity and autocorrelation. All the variables are defined in Appendix A. The regressions are estimated with annual data for the period 2010–2018. Dummy variables are included for every year, sector, and country in all estimations, though their coefficients are not shown due to space limitations. ***, **, and * significant at the 1%, 5%, and 10% levels, respectively.

countries, the coefficient for control of corruption is also high, showing that it has a great impact on the BRIC countries but no impact on the G7 countries. This result may stem from the large differences between the two groups of countries: emerging economies have much greater corruption, so controlling it can be expected to raise tax burdens on firms and therefore bring in more revenue for governments.

In short, among the institutional characteristics, regulatory quality, rule of law, and government effectiveness have the greatest influence on firms' tax pressure in the eleven largest economies. These variables have already been shown to be significant in prior research. Specifically, [Fernández-Rodríguez et al. \(2021\)](#) obtain similar results for nine emerging economies, and [Fonseca-Díaz et al. \(2019\)](#) achieve the same results for government effectiveness and rule of law in research covering 63 countries. [Zeng \(2019\)](#) find a positive relationship between these three institutional quality variables and tax burden in 32 countries.

Corruption control is very important in emerging countries but has no influence at all in developed countries. Greater control of corruption can be expected to entail higher taxation for firms in BRIC countries. [Zeng \(2019\)](#) also find a positive relationship between corruption control and tax pressure in 32 countries, making no distinction between developed and emerging countries. Our results seem reasonable because emerging countries have a lower level of corruption control, as stated in Subsection 2.2. Therefore, implementation of more controls by governments are rewarded with greater tax revenue, providing funding for the much-needed public services in emerging countries. Therefore, it is clearly necessary for emerging countries, with their higher levels of corruption and less corruption control, to devote resources to mitigating corruption in order to raise tax revenue.

Another variable that affects only the BRIC countries is economic freedom, so when the Fraser index is higher, the tax burden for firms is lower, probably because they can make business decisions considering their effect on taxation. As already stated, the economic freedom index is lower in the BRIC countries than in the G7, and the differences between the two are statistically significant ([Table 7](#)). These differences could explain why Fraser's index affects only developing countries. Therefore, when emerging economies improve their economic freedom, firms will be able to make decisions to reduce their tax burden. The prior literature on this is not conclusive, as [Fonseca-Díaz et al. \(2019\)](#) find a weak positive relationship, while [Fernández-Rodríguez et al. \(2021\)](#) see no link between economic freedom and tax pressure.

Finally, mention should be made of the three variables that affect only the G7 countries: GDP growth, gross debt, and deficits. The limited empirical evidence found shows that GDP growth, at an international level, is positively related to tax burdens ([Fonseca-Díaz et al., 2019](#)), in line with our results for the G7. [Fernández-Rodríguez et al. \(2021\)](#), however, find no link in nine emerging economies, which is similar to the results we obtained for the BRIC countries. A positive relationship implies a greater tax burden, which might

spark greater tax uncertainty in these developing countries because of their high growth rates. And, according to the IMF and the OECD (IMF/OECD, 2017), tax uncertainty is one of the main concerns of firms when they make decisions about location and investment.

The results for gross debt show that, in the G7 countries, firms have a lower tax burden when the country has higher debt. As noted above, average debt in the G7 countries is more than double that of the BRIC countries (Table 7), and this could explain their negative relationship with the corporate tax burden. Thus, firms in the G7 countries have a lower tax burden, but, in return, governments have to take on more debt in order to sustain public expenditure. Similarly, in developed economies, a higher deficit implies lower tax pressure, but this variable is not significant for the BRIC countries. Tang et al. (2017) also find a negative relationship between ETR and deficit for Chinese companies. In general, the results in Table 8 support our prediction that firms' ETRs are associated with deficits and gross debt. When firms pay less corporate tax, tax revenue declines. Thus, public revenue will be smaller than public expenditure, generating a deficit. And countries with a deficit need more public debt to fund public expenditure and investment.

4. Conclusions

This study analyzes the institutional factors that affect the tax burden of listed companies in the eleven economies with the highest GDP, which comprise G7 and BRIC countries. This is the first paper to consider institutional factors the main variables for explaining the ETR. For this purpose, we use a database of 25,878 listed firms, of which 17,146 are in the G7 and 8732 in BRIC countries, over the period 2010–2018, and apply panel data methodology. Three variables are used to indicate the tax burden, CASH_ETR, which is commonly found in the prior literature, and two “modified” measures that weigh CASH_ETR by the STR in force (ETR ratio and ETR difference). As explanatory variables, we use ten institutional factors that determine the environment in each country and affect all firms equally, irrespective of their individual characteristics.

The world's largest economies are developed and emerging countries, and their characteristics differ considerably. We find that all the variables considered at the country level have statistically significant differences. More specifically, the average STR is higher in the G7 than in the BRIC countries, which contrasts with the lowest average CASH_ETR in the G7 countries. Therefore, in the BRIC countries, the STR gives information that is closer to the tax burden by firms than in the G7, where the gap between STR and CASH_ETR is very wide.

The results show that, of the ten institutional variables considered, half (STR, government effectiveness, regulatory quality, rule of law, and open markets) affect all countries. However, corruption control and economic freedom affect only the BRIC countries, and GDP growth, deficits, and gross debt affect only the G7. Moreover, the results show that institutional factors have greater explanatory power for ETRs in BRIC countries than in the G7.

Corruption control is very important in emerging countries but has no influence in developed countries. Specifically, greater control of corruption can be expected to lead firms in BRIC countries to pay more taxes. Therefore, implementation of more controls by governments would be rewarded with greater tax revenue, which can be used to fund public services that are especially necessary in emerging countries. As a result, it is clearly necessary for emerging countries, which have greater corruption and control it less, to devote resources to mitigating it in order to increase their public revenue.

The results for the G7 show that firms' tax burdens are smaller when the country's debt and deficits are higher. Average debt is found to be more than twice as high in G7 countries as in the BRIC countries, with larger deficits. Therefore, we can conclude that firms in G7 countries have a lower tax burden and their average ETR is lower than in the BRIC countries but, in exchange, governments have to take on more debt and a higher deficit in order to support public expenditure. Also, the gap between the STR and ETR is very large. So, G7 economies should reduce their public debt and deficits and increase their tax pressure on firms. Moreover, in this way, STRs could give firms better information about the effective tax burden, which is not the case at present.

In conclusion, this paper takes an important step forward in studying the ETR because it analyzes the effect of institutional factors on the tax burden for firms, whereas prior research focuses on business factors. More specifically, it shows the importance of the environment in which firms operate for their tax burden. We believe that these findings will be useful for firms in their investment and location decisions in these countries and for governments in designing public policies.

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Declaration of Competing Interest

The authors report no declarations of interest.

Appendix A. Variable definitions

Dependent Variables	
CASH_ETR	Cash effective tax rate, measured as total cash taxes paid divided by pretax income. Firms' denominator and numerator are required to be positive. The variable is winsorized at 0 and 1.
R_ETR	Effective tax rate ratio, measured as CASH_ETR divided by statutory tax rate.
D_ETR	Effective tax rate difference, measured as the difference between statutory tax rate and CASH_ETR.
Independent Variables	
STR	Statutory tax rate.
GDP_GROWTH	Gross domestic product growth.
GOV_EFF	Government effectiveness, which ranges from - 2.5 (weak) to + 2.5 (strong).
REG_QUAL	Regulatory quality, which ranges from - 2.5 (weak) to + 2.5 (strong).
RULE_LAW	Rule of law, which ranges from - 2.5 (weak) to + 2.5 (strong).
CTRL_CORR	Control of corruption, which ranges from - 2.5 (weak) to + 2.5 (strong).
DEFICIT	Deficit, measured as the difference between total government expenditure and total government revenue, as a percentage of GDP (IMF).
GROSS_DEBT	Gross debt, measured as the ratio to GDP of all liabilities that require future payment of interest and/or principal by the debtor to the creditor (IMF).
FRASER_INDEX	Fraser Institute's Economic Freedom of the World index, which ranges from 0 to 10. The Institute classification is by quartiles (Q), with the first quartile (Q1) corresponding to "Most free" countries, and the fourth (Q4) to "Least free" countries.
OPEN_MARKETS	Open markets, measured as the average of trade freedom, investment freedom, and financial freedom, which ranges from 0 to 100: free (90–100), mostly free (70–79.9), moderately free (60–69.9), mostly unfree (50–59.9), repressed (0–49.9).
Control Variables	
SECTOR	A dummy variable for each sector.
YEAR	A dummy variable for each year.
COUNTRY	A dummy variable for each country.

All continuous business variables are winsorized at 1% and 99% of the distribution.

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