



Functional currency and firm value in Mexico

Moneda funcional y valor de la empresa en México

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Abstract

In this paper, we analyze the effect of adopting a functional currency on tax collection and the value of the firm in Mexico. Our hypothesis is that, beyond the administrative benefits, it would reduce the exchange risk, and therefore increase the value of the companies. Using data from S&P Capital IQ we found that, at a rate of 30%, income tax collection increases slightly. By approximating the value of the firm with the present value of after-tax financial flows minus the payment of a risk premium, we find that functional currency tends to increase the value of the firm. With the utility theory method, the improvement can go from 19 to 30 percentage points of the value of the firm. This improvement in profitability is equivalent to a reduction of between 0.3 to 2 percentage points in the interest rate of operating in Mexico.

JEL Code: M48, H25, F23

Keywords: functional currency; value of the firm; multinational firms; exchange rate volatility

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Resumen

En este artículo analizamos el efecto fiscal y sobre el valor de las empresas de adoptar un esquema de moneda funcional en México. Nuestra hipótesis es que, más allá de los beneficios administrativos, reduciría el riesgo cambiario, y por tanto aumentaría el valor de las empresas. Utilizando datos de S&P Capital IQ encontramos que, con una tasa impositiva del 30%, aumenta ligeramente la recaudación del impuesto sobre la renta. Aproximando el valor de la empresa con el valor presente de los flujos financieros después de impuestos menos el pago de una prima de riesgo, encontramos que la moneda funcional tiende a incrementar el valor de la empresa. Con el método de la teoría de utilidad, la mejora puede ir de 19 a 30 puntos porcentuales del valor de la empresa. Esta mejora en la rentabilidad equivale a una reducción de entre 0.3 a 2 puntos porcentuales en la tasa de interés de operar en México.

Código JEL: M48, H25, F23

Palabras clave: moneda funcional; valor de la empresa; empresas multinacionales; volatilidad cambiaria

Introduction

Through the Functional Currency (FC) model, companies can report their financial statements and perform tax calculations in foreign currency. The accounting application seems to be more frequently found worldwide than the fiscal one. The openness of a country to foreign trade and operations and companies' exposure to the external sector should be the factors that determine the use of a FC in accounting. In the United States of America (USA) and Canada, Mexico's main trading partners, FC is used in accounting. Geoffrey (2008) notes that taxes can also be calculated in FC in Canada, although payment must be made in Canadian dollars, applying the corresponding exchange rate.

Similarly, in the Netherlands, taxes can also be calculated in FC. In this regime, the tax is converted annually into euros using an average exchange rate for the financial year.¹ In Latin America, financial statements can be prepared in FC in Chile, Peru, Argentina, Mexico, Brazil, Colombia, and Uruguay (Fernandez et al., 2020; Baptista et al., 2012).

In an FC-based tax regime, a company whose bulk of operations are made in a currency other than the country's currency may opt for an alternative. In this alternative, it could calculate and pay income tax in FC without translating income statement and balance sheet items into the local currency. This process eliminates the application of exchange gains or losses and the inflationary effects of the local currency.

¹ <https://taxsummaries.pwc.com/netherlands/corporate/tax-administration>

This paper evaluates the effect of introducing an FC-based tax model in Mexico on income tax collection and the value of companies that operate mainly with an FC other than the Mexican peso. The exercise consists of constructing a counterfactual where a representative company using a FC could calculate and pay income tax entirely in its relevant currency without having to include, therefore, foreign exchange or inflationary gains or losses, but maintaining the 30% tax rate established by current legislation.

To this end, the available international evidence and the accounting and financial literature on FC were documented first. It was then considered whether adopting it in Mexico implies any fiscal sacrifice by the federal government, i.e., a reduction in corporate income tax collection. A simulation of the current tax burden versus the one that would have occurred under a foreign FC regime was conducted for a sample of the country's main companies.

Once it is demonstrated that the model does not require any tax sacrifice, the increase in the company's value that could occur by eliminating the source of uncertainty involved in the foreign exchange risk was explored. These gains are equivalent to a reduction in the interest rate at which the value of the companies is discounted.

The main contribution of this paper is to approximate the fiscal effect of the FC regime, which can potentially reduce the foreign exchange risk of Mexican companies. The implications of corporate tax collection are something that, despite the importance it deserves, has not been addressed in the literature on the subject. Moreover, the related literature has studied, among other issues, the effect of an FC model on the value of companies once that tax regime has been implemented. Unlike in those works, which approximate the value of a company with the present value of the certainty equivalent of the flows it expects to receive, in this paper, the effect that an FC regime in Mexico could have on the value of companies was simulated.

The study's main conclusion is that the standardization of the Mexican fiscal authority's tax conditions to companies that use a foreign FC has merits. It is a reform that can stimulate private investment without any fiscal sacrifice.

Related literature and international experiences

This article's authors are unaware of any studies on the fiscal effects of adopting an FC to pay taxes in countries that have experience with such a model. The FC studies analyze the impact of accounting reporting on multinational companies' financial performance and FC decisions.

The related literature has studied how modifications in financial accounting reporting associated with the adoption of FC have helped to characterize companies' foreign exchange risk exposure and thus

to identify how changes in the exchange rate influence the companies' value. Huan and Vlady (2012) have studied this relation for Australian companies, while Gao and Senteney (2009), Bartov (1997), Bartov and Bodman (1995), Jorion (1990), Amihud (1993), Bodnar and Gentry (1993), and Bartov and Bodnar (1994) have done so for US companies. The vast majority of the papers deal with FC in the USA.

Before 1976, there was no standard procedure in the USA to report the effect of exchange rate volatility on current assets and liabilities in the financial statements. In 1976-81, the accounting standard SFAS (Statement of Financial Accounting Standards) No. 8 was followed, which used the historical exchange rate to convert assets and liabilities to USD (Bartov & Doadnar, 1995). Around 1981, the FC concept was introduced with SFAS No. 52. The differences were twofold: 1) the method used to translate the foreign currency using the historical exchange rate or the current exchange rate; and 2) the recording of the gains and losses derived from the exchange rate adjustment in the income statement or balance sheet (Selling & Sorter, 1983).

Related to SFAS No. 8 and SFAS No. 52, other issues that have been addressed are the reaction of stock price and trading volume with SFAS No. 52 (Kim & Ziebart, 1991); whether the market valuation of foreign exchange gains and losses was different with SFAS No. 8 and SFAS No. 52 (Soo & Soo, 1994); the financial market reaction, approximated with the performance of multinational companies, with FC accounting standards (Ziebart & Kim, 1987); and the price behavior of financial instruments (Rezaee et al., 1993).

Regarding the decisions of multinational companies, Deng (2020) studies what may be one of the motivations for multinational companies to adopt a functional currency, foreign exchange risk, finding that exposure to higher exchange rate volatility is associated with reporting revenues in foreign currencies, known as outbound income shifting. On the other hand, Hosseini and Shalchi (1992) conducted an empirical test on the predictive ability of the six economic indicators used under SFAS No. 52 to determine a company's FC. Hosseini and Rezaee (1988) study the determinants of multinational corporations' choice of functional currency under SFAS No. 52. Bartov and Bodnar (1996) examine the incentive for multinational companies to choose an accounting method that reduces information asymmetry and makes financial statements more informative to investors. Pinto (2002) applies game theory to analyze the decision of the foreign currency translation accounting method. Revsine (1984) explains the objectives associated with choosing FC using illustrative cases. Houston (1990) and Houston and Mueller (1988) study foreign exchange hedging decisions under SFAS No. 8 and SFAS No. 52. Selling and Sorter (1983) study the implications for financial statement analysis of the choice of functional currency for multinational companies based in the USA.

The case of the United States of America

As mentioned, the USA's accounting standard for reporting foreign exchange volatility in formulating financial statements changed. Indeed, in 1981, the SFAS No. 8 was upgraded to SFAS No. 52. The evidence that has been documented proves a negative market reaction to the implementation of SFAS No. 8 and a positive reaction to SFAS No. 52. This is explained by the fact that under the former, companies were obligated to report their foreign exchange gains and losses in their revenues, which were severely affected by this volatility, leading them to take out foreign exchange hedges, incurring very high costs; on the other hand, the latter did not require reporting the foreign exchange adjustment in their revenues, but in the capital account of the balance sheet, so it was not necessary to take out foreign exchange hedges (Ziebart & Kim, 1987).

There may be different factors that influence the selection of the FC. Hosseini and Rezace's (1988) study shows that 82% of companies selected the local currency as the FC (i.e., the currency belonging to the country where the subsidiary is located). On the other hand, 15% of companies designated the USD as their FC, mainly subsidiaries located in Japan, France, and Great Britain. These subsidiaries operate as foreign branches and are conducted in USD. Multinationals with subsidiaries in countries with high inflation also selected the USD as their FC. The resulting analyses indicate that cash flow and sales are the most important variables for companies when selecting the FC of their subsidiaries, while financing and inter-company transactions are the least important variables.

Another factor that has been studied concerns foreign exchange hedging. Houston (1990) investigates the reason why the majority of a group of companies did not eliminate foreign exchange hedging when they were expected to do so after the adoption of SFAS No. 52. It is found that the geographic dispersion of foreign subsidiaries, as well as the ratio of a company's net foreign assets, differed significantly between companies that stopped hedging and those that continued hedging. The results show that, contrary to expectations, those companies with a lower ratio of foreign assets continued with exchange rate hedging.

It has also been interesting to find out whether a multinational company's exposure to exchange rate movements influences the value of the company. The results show that there is a meaningful relation between the lagged USD exchange rate and stock value in companies that continued under SFAS No. 8. This result indicates that those companies that continued to use the USD as the FC in their accounting reports introduced much volatility in their reported income in the financial statements (derived from the translation of the foreign currency to USD), and that this volatility made it difficult to determine the value of their shares accurately. In contrast, for the group of multinational companies that adopted foreign currency as FC in their accounting reports (i.e., that used SFAS No. 52), the exchange rate did not

influence the company's value. In other words, this group of companies' accounting and financial reports provide better economic information so the market can determine their value more accurately (Bartov & Bodnar, 1995).

The variability of earnings reported by subsidiaries, depending on the foreign currency translation methodology, has also been studied. The results indicate that the foreign currency translation method using the current exchange rate is the one that presents the greatest variation in earnings reported by subsidiaries. There is evidence that methodologies that allow for deferral of profits and losses generate lower volatility of reported earnings. Nevertheless, it is also important to consider the characteristics of each company (Holt, 2004).

Regarding the effectiveness of the selection of an FC (SFAS No. 52) as an indicator of the impact of exchange rate on the cash flows of multinational companies based in the USA, Gao and Senteney (2009) test the existence of systematic differences in the stock price response to accounting policy events related to foreign currency translation (SFAS No. 8, SFAS No. 52). Their results suggest that those companies that adopted USD as their FC were negatively affected (negative portfolio returns) by the issuance of the SFAS No. 8 preparatory document, while those companies that adopted foreign currency as their FC (or for some foreign subsidiaries adopted foreign currency and for other subsidiaries adopted USD) did not have the same effect. They conclude that the selection of the FC is an effective indicator of the impact of exchange rate variation on a multinational company's cash flow.

Functional currency in other countries

International Accounting Standard 21 in Italy states that multinational companies must adopt an FC for accounting reporting. Adopting an FC (IAS 21), the company's earnings are unaffected since the difference derived from the exchange rate variation at the time of currency translation is not recorded in the income statement but in the net equity account. On the other hand, if the company presents the income statement in euros, the exchange difference is recorded as a gain or loss in the income statement, providing information that does not correspond to reality since this exchange adjustment is not related to the company's operation. With the FC, the effect of the exchange rate variation is eliminated (Marsico, 2016).

In Peru, tax laws require financial statements to be presented in local currency. Some multinational companies in the mining and hydrocarbon sectors may enter into agreements with the government to keep their accounts in USD for presentation to their shareholders, customers, and suppliers, but not for tax purposes. Given that 1) the conversion to local currency is based on a fluctuating exchange rate and generates an unreal tax base, and 2) the tax laws include imprecise concepts and no uniformity on the exchange rate to be used in the currency conversion, it is recommended to establish legally the

determination of income tax based on the financial statements in USD and to review the Peruvian tax laws to standardize, clarify and simplify the currency conversion process (Gómez, 2019).

There have been two translation methods for multinational companies in Australia's oil and gas industry: Australian Accounting Standards Board 1012, AASB 1012, and Australian Accounting Standards Board 121, AASB 121. Before 2005, the AASB 1012 regulation was in force. In 2005, a new regulation, AASB 121, was established in Australia, under which a subsidiary company may adopt more than one currency to present its financial results. The exchange adjustments arising from translation are reported in the equity account without affecting the company's profit and loss statement. It has been found that under the translation method established in the new regulation AASB 121, there is a positive relation between the exchange adjustment derived from translation and the enterprise value. In contrast, during the period in which the previous regulation (AASB 1012) was in effect, the resulting relation was negative. This effect can be explained by the new rule allowing subsidiaries greater flexibility in the translation process of their accounting results (Huang & Vlady, 2012).

In Chile, Fernandez et al. (2020) identify common factors among countries that help explain why multinational companies adopt the USD as FC in countries with a different official currency. The results show that these companies concentrate assets in export-oriented economic sectors in countries where the corporate sector is highly dollarized (Canada, Norway, Israel, Australia, and Peru). In the case of Chile, many companies prefer to report their financial results in USD, as it eliminates the exposure to foreign exchange risk (Fernandez et al., 2020).

The likely effect of a functional currency regime on corporate tax burdens

This section estimates the effect on income tax collection of the reform of the FC regime in Mexico. To this end, the taxable base and taxes resulting from the proposal were estimated and compared with the taxes paid by 268 companies in the country between 2015 and 2019. It was concluded that adopting the proposed reform, at least for this sample of companies and this analysis period, slightly increases income tax collection. Apart from whether the increase is significant, the evidence presented eliminates the possibility that the FC represents a fiscal sacrifice for the federal government.

Methodology

The exercise consists of comparing different indicators of the tax burden of corporate income tax under current legislation with the hypothetical situation of the burden they would have if an FC were adopted.

The S&P Capital IQ, a financial information database, was used to obtain the basic financial records of various companies in Mexico. This database contains the entities' income statements, cash flow statements, and balance sheets. Information is included for 268 companies in Mexico from 2015 to 2019. Of these, 110 are state-owned productive entities or financial sector companies, and 158 are private non-financial companies. Of the private companies in the database, 138 are public because they list their shares on the main stock markets.²

Table 1 presents distribution and descriptive statistics of revenues in USD for all companies in the database and for private non-financial companies. The mean is in the order of USD 2 billion, and the median is just over USD 200 million for the entire sample, while the private non-financials have a mean size slightly above USD 2 billion, and the median is USD 400 million over the entire period. The smallest quarter of the sample has sizes of less than USD 125 million, while the largest quarter has sizes of USD 1.4 billion and above.

The tax burden estimates produced with these data can only represent companies of these sizes and cannot be extended to the millions of Mexican companies with lower sales. Nevertheless, it was felt that companies that might adopt foreign FC regimes fit more closely into the type of companies that can be found in the S&P Capital IQ database, so the exclusion of small revenue companies does not disqualify the merits of the exercise on the tax burden effects of the proposal.

Three indicators of tax burden were used. The tax burden on revenue (CFI) is the ratio of tax paid (T) to company income (I):

$$CFI_{kit} = \frac{T_{kit}}{I_{it}} \quad (1)$$

The tax burden on gross profit (CFUB) is obtained by dividing the tax by the gross profit (UB):

$$CFUB_{kit} = \frac{T_{kit}}{UB_{it}}; \quad (2)$$

and the tax burden measured through the implicit income tax rate that would have existed under a tax regime with FC (CFTI), which is calculated with the ratio of the tax paid and the taxable base under the FC regime (BGP):

$$CFTI_{kit} = \frac{T_{kit}}{BGP_{it}}. \quad (3)$$

² For a more detailed description of the database: <https://www.spglobal.com/marketintelligence/es/sp-capital-iq-pro>, https://www.spglobal.com/marketintelligence/en/documents/mi_nfc_426340_ciq_8.5x11_spa_fd.pdf

The subscript i denotes the company ($i = 1, 2, \dots, 268$), t the year ($t = 2015, 2016 \dots 2019$), and the subscript $k = A, P$, where A stands for Actual, i.e., under current law, while P stands for Proposal, or what would result from adopting the reform under study.

The tax burden in Equation 1 is simply the income tax paid by company i in year t in proportion to the company's revenue in that year. Indicator (2) shows the weight of taxes in the company's gross profit, and (3) estimates the ratio of taxes currently paid in proportion to the taxable income tax base if the proposal evaluated in this paper is adopted.

Tax burden indicators in the form of ratios are considered for several reasons. Both in the literature and in statistical expansions based on a sample, it is more advisable to estimate relative indicators of tax burden than absolute ones, i.e., a burden of a certain amount of millions of USD is difficult to interpret in contexts beyond the sample with which it was constructed, a disadvantage that does not occur if ratios to critical variables of the companies are used.

In addition, the most widely used indicator in public finance to estimate the tax burden of a tax is the tax collection as a ratio of Gross Domestic Product (GDP). To this end, CFI_{kit} shows the tax burden as a ratio to a proxy of total production, while $CFUB_{kit}$ does so relative to the closest approximation to value added (revenue minus intermediate consumption) obtained from company income statements. Since GDP represents aggregate values, then $CFUB_{kit}$ provides a rough estimate of the tax burden in terms of GDP.

Table 1
Distribution of revenues of companies in the S&P Capital IQ database (millions of USD)

	Percentile					Standard deviation
Year	25	50	75	100	Mean	
All companies						
2015	44.2	194.3	925.7	67 432.5	1 624.1	5 876.0
2016	44.0	198.2	851.1	52 141.7	1 515.1	5 068.8
2017	64.3	226.0	1 152.1	71 166.3	1 807.0	6 242.5
2018	66.6	252.1	1 243.5	85 551.0	2 013.9	7 044.9
2019	63.5	256.3	1 167.4	74 330.6	2 040.2	6 714.7
2015-2019	59.4	232.6	1 042.0	85 551.0	1 800.0	6 221.7
Non-financial private companies						
2015	101.4	342.3	1 352.1	51 875.5	1 878.3	5 270.0
2016	117.5	356.4	1 287.2	47 351.3	1 808.5	4 934.6
2017	125.6	428.7	1 462.0	52 043.2	2 068.5	5 493.6
2018	146.9	512.8	1 547.1	52 833.7	2 271.9	5 759.1
2019	154.4	515.6	1 752.2	53 408.2	2 365.0	5 979.6
2015-2019	126.7	433.9	1 473.7	53 408.2	2 078.4	5 489.8

Source: created by the authors based on S&P Capital IQ

The exercise will contrast the tax burdens concerning current revenue and gross profit and those occurring if the reform is adopted. $CFTI_{kit}$, on the other hand, measures the tax burden of the proposal differently. Here, the implicit tax rate is estimated, representing the tax payment in each period, but with the taxable base that would be obtained if the reform were adopted.

By construction, the taxes paid concerning the taxable base under the FC reform would always be 30%, the tax rate provided for by current tax legislation. In contrast, if $CFTI_{kit}$ is less than 30%, then the taxes currently paid represent a lower ratio to the taxable base envisioned by the reform, and, therefore, corporate income tax collections would be higher under the reform than under current conditions. If $CFTI_{kit}$ were greater than 30%, then adopting the FC reform implies a fiscal sacrifice for the tax authority.

The taxable basis with FC (BGP) is operating profit plus net interest and other net operating or extraordinary revenues. In the particular case of the S&P Capital IQ database income statement presentation, the best approximation is:

$$BGP_{it} = UOP_{it} + INTN_{it} + OIOP_{it} + CARE_{it} + VACT_{it} + OTIN_{it} + IOPD_{it} + EXAR_{it} \quad (4)$$

where UOP is the operating profit, INTN is net interest (if paid exceeds received, it is negative income), OIOP is other operating income, CARE is restructuring charges, VACT is sales of assets, OTIN is other unusual income, IOPD is income from discontinued operations, and EXAR is extraordinary items.³

The tax calculation with FC, to be denominated at a rate of 30%, is obtained by:

$$TP_{it} = 0.3 * BGP_{it}. \quad (5)$$

Results

Given the marked skewness in the distributions of the tax burden indicators, medians were used to describe the revenue collection results. The median represents the centrality of the distribution using the 50th percentile, and unlike the mean, it has the advantage of being insensitive to outliers.

Tables 2 to 4 present the three tax burden indicators described in the previous section. Estimates are presented for the entire sample (268 companies), for those private companies that are public (138), those that, according to S&P Capital IQ, report their financial statements in USD (11), private non-

³ The financial statements in the database are shown in English. The terms are: operating income (UOP), net interest expense (INTN), other operating income (OIOP), restructuring charges (CARE), sales of assets (VACT), other unusual items (OTIN), earnings of discontinued operations (IOPD) and extraordinary items and accounting change (EXAR).

financial companies (158), and within these those with revenues over USD 100 million (from 100 to 126 companies depending on the year).

None of the tax burden indicators show any specific evolution over time; they tend to be stationary. Tax burdens under current legislation average 3.7%, measured on total revenue, and 9.1% on gross profit. The implicit tax rate, measured on the taxable base with FC, is 24.5%.

A quick inspection of Tables 2, 3, and 4 shows that the reform does not reduce the tax burden of the companies in the sample, regardless of the type of company. The reform increases the tax burden measured in terms of revenue between 0.2% to 0.8% in the average of all years, increases the burden measured in terms of gross profit between 0.3% to 2.3% depending on the sub-segment of companies considered, and represents an increase in the implicit tax rate of between 3.2 to 5.5 percentage points (pp).

Table 2
Median tax burden in terms of revenue (CFI_{kit})

Year	All		Public		Reported dollars		Non-financial private			
							All		Revenues greater than USD 100 million	
	Current	Proposal	Current	Proposal	Current	Proposal	Current	Proposal	Current	Proposal
2015	3.6%	4.5%	3.3%	3.5%	1.9%	1.8%	2.9%	3.1%	3.1%	3.4%
2016	4.0%	5.0%	3.6%	4.3%	2.4%	4.1%	3.0%	3.4%	3.0%	3.7%
2017	3.6%	4.8%	3.1%	4.5%	3.0%	4.0%	2.9%	3.5%	2.8%	3.6%
2018	3.4%	4.4%	2.9%	3.3%	2.7%	2.9%	2.5%	2.6%	2.7%	3.0%
2019	4.1%	3.8%	3.2%	3.1%	1.2%	1.3%	2.7%	2.1%	2.9%	2.1%
2015-2019	3.7%	4.5%	3.2%	3.6%	2.5%	2.6%	2.8%	3.0%	2.9%	3.2%

Source: created by the authors based on S&P Capital IQ

Table 3
Median tax burden in terms of gross profit ($CFUB_{kit}$)

Year	All		Public		Reported dollars		Non-financial private			
							All		Revenues greater than USD 100 million	
	Current	Proposal	Current	Proposal	Current	Proposal	Current	Proposal	Current	Proposal
2015	9.7%	10.5%	9.6%	10.4%	6.7%	8.9%	8.9%	8.9%	9.3%	9.7%
2016	10.0%	12.0%	9.7%	13.4%	8.4%	11.6%	9.1%	9.2%	9.1%	9.4%
2017	8.7%	10.9%	9.5%	12.6%	10.9%	14.0%	8.6%	9.5%	9.0%	9.7%
2018	8.0%	9.5%	8.4%	9.3%	9.9%	10.4%	7.5%	8.4%	8.4%	9.2%
2019	8.9%	9.0%	8.8%	7.9%	7.4%	6.7%	7.5%	6.2%	8.1%	6.7%
2015-2019	9.1%	10.1%	9.3%	10.2%	8.1%	10.4%	8.3%	8.8%	8.9%	9.2%

Source: created by the authors based on S&P Capital IQ

Table 4
Median tax burden in terms of implicit tax rate ($CFTI_{kit}$)

Year	All	Public	Reported dollars	Non-financial private	
				All	Revenues greater than USD 100 million
2015	24.1%	27.0%	42.9%	26.5%	27.7%
2016	23.9%	24.5%	20.8%	24.1%	25.1%
2017	21.6%	23.3%	25.4%	24.8%	26.2%
2018	24.8%	26.6%	27.8%	26.2%	27.8%
2019	26.4%	27.8%	20.8%	26.4%	27.3%
2015-2019	24.5%	26.2%	26.4%	25.8%	26.8%

Source. created by the authors based on S&P Capital IQ

Sensitivity analysis

The estimates of the tax burden indicate that adopting an FC model does not reduce the income tax burden for the medium-sized company in the S&P Capital IQ database compared to the current legislation. This implies that a reform of this type does not involve a fiscal sacrifice for the tax authority.

Nonetheless, it is difficult to compare the taxes paid by the companies in the database in the 2015-2019 period with those that would have resulted if the FC model had been adopted in these years, mainly because there was no access to all the tax reconciliations necessary to make a more accurate calculation of the tax. Companies may have paid less in the period considered because they posted losses from previous years.

In order to weigh the sensitivity of the tax burden estimates to this possibility, two additional exercises were carried out. In the first one, companies that paid lower taxes were eliminated; for this purpose, only companies with a $CFTI_{kit}$ greater than the 10th percentile (P10), the 20th percentile (P20), and the 30th percentile (P30) were included. The idea is to “shave” the observations that could be qualified as abnormally low in relation to taxes paid.

The second exercise aimed to eliminate from the sample companies that might have recurring losses. Accordingly, three cases were considered. In the first one, only companies with 3 or more years with positive operating profit were considered; in the second one, it was increased to 4 or more; in the strictest one, only those with 5 periods with positive operating profit were considered. It should be remembered that the database analyzed contains information for 5 years, from 2015 to 2019.

Table 5 presents the sensitivity analysis for the three tax burden estimators, the ratio of taxes to revenue (CFI_{kit}), to gross profit ($CFUB_{kit}$), and to taxable income with FC ($CFTI_{kit}$). The first column presents the median for each tax burden for all companies, both the current burden and the one found with FC. These estimates coincide with those reported in the first two columns and the last row of tables 2, 3, and 4 and are left out for comparison purposes. The rest of the columns present the companies considered:

in the first three columns, those above the 10th, 20th, and 30th percentiles, and in the last columns, those with 3 or more years with positive operating profit, 4 or more, or all 5 years.

The difference between the burden with FC and the current burden is reported for each subgroup of companies. If it is positive, then the burden derived from the reform is greater than the one reported in the databases, corresponding to the current tax legislation.

Table 5

Median tax burdens to revenue (CFI_{kit}), gross profit ($CFUB_{kit}$), and reform taxable base ($CFTI_{kit}$) for the period 2015-2019 for different groups of companies depending on the $CFTI_{kit}$ percentile and years with positive operating profit.

		Companies						
		With $CFTI$ greater than				With positive operating profit during		
		All	P10	P20	P30	3 or more years	4 or more years	5 years
Tax ratio at Revenue (CFI)								
	Current	3.7%	3.9%	4.3%	5.0%	3.8%	3.7%	3.6%
	Proposal	4.5%	5.5%	5.1%	4.9%	4.8%	5.2%	5.3%
	Difference	0.8%	1.6%	0.8%	-0.1%	1.1%	1.5%	1.7%
Gross profit ($CFUB$)								
	Current	9.1%	9.6%	9.9%	10.9%	9.3%	9.2%	8.7%
	Proposal	10.1%	12.5%	11.8%	10.9%	10.9%	10.9%	10.4%
	Difference	1.0%	2.9%	2.0%	0.1%	1.6%	1.7%	1.6%
The tax basis of the proposal ($CFTI$)								
	Current	24.5%	26.6%	27.3%	28.8%	24.7%	24.9%	25.4%
	Proposal	30.0%	30.0%	30.0%	30.0%	30.0%	30.0%	30.0%
	Difference	5.5%	3.4%	2.7%	1.2%	5.3%	5.1%	4.6%
Observations		1 340	936	856	710	1 225	1 115	920

Note: P10, P20, and P30 mean 10th, 20th, and 30th percentile respectively on the $CFTI$ scale

Source. created by the authors based on S&P Capital IQ

As seen in all cases, except for one, the tax burden with FC is higher than the current one. The burden is reduced, as expected when companies with lower $CFTI_{kit}$ are “shaved”. Nevertheless, when the 30th percentile is reached, the ratio to gross profit is still positive at 0.1%, and the implicit tax rate is still below 30% of the reform. The only exception is that measured relative to revenue, it is now slightly negative, -0.1%.

Tax burdens do not change appreciably when companies with 2 or more years of operating losses are eliminated. In all samples, the differences are always positive for all tax burden indicators considered.

To summarize, it may be confidently asserted that in the sample of companies considered in this analysis and based on their financial reports, the tax burden that can be inferred from a foreign FC model is not less than that of the current legislation, both for the entire universe of companies, even excluding up to 30% of the companies with lower $CFTI_{kit}$, and for those with negative profits for 2 or up to 5 fiscal years in the time considered.

Effect of the FC regime on company value and discount rates

The adoption of a foreign FC tax regime in Mexico can increase the value of a typical company that conducts all its operations in FC (e.g., USD) since such a regime eliminates the uncertainty caused by the volatility of the real exchange rate, which introduces volatility in the tax base or the effective tax rates paid under the current regime. As mentioned in the literature section, this notion that the use of an FC influences company value has been analyzed by, among others, Huan and Vlady (2012) for Australian companies and by Bartov and Bodman (1995), Jorion (1990), Amihud (1993), Bodnar and Gentry (1993), and Bartov and Bodnar (1994) for US companies.

The increase in company value is equivalent to a reduction in the interest rate at which the company's value is deducted. For this reason, adopting an FC model reduces the opportunity cost of funding the company.

Modeling the effects on company value

Under current income tax legislation, exchange rate volatility increases the uncertainty faced by those companies whose vast majority of operations and debt are in foreign currency. One implication of the FC regime is to eliminate the provisions for accruing or deducting foreign exchange and inflationary gains or losses for these companies, removing this source of uncertainty. By choosing to file and pay their taxes in foreign FC, net income flows become more predictable, which may increase their value or, in equivalent terms, reduce the rate at which they discount the flows to obtain the company's value.

In order to demonstrate this and get quantitative results, the value of a company was approximated by the present value of the certainty equivalent of the cash flows it expects to receive. It should be remembered that in situations of uncertainty, the flows are unknown *ex-ante*, and the greater the volatility, the greater the uncertainty faced by the shareholders, which penalizes the implicit value of the company.

Under risk conditions, the present value of an investment must consider the amount and valuation of the source of risk. This can be done by considering a risk premium faced by the shareholders, which must, therefore, be subtracted from the expected value of the flows, thus arriving at the certainty equivalent. If the flow produced by the investment in period t is denoted as F_t and its expected value as $E(F_t)$, then the certainty equivalent (EC) is:

$$EC(F_t) = E(F_t) - \text{Risk Premium} \quad (6)$$

The value of the company is therefore:

$$V = \sum_{t=1}^T \frac{EC(F_t)}{(1 + \delta)^t} \quad (7)$$

where δ is the relevant discount rate for the company. Initially, it was assumed that the only source of risk in the risk premium is the volatility of the real exchange rate, which must be included according to corporate income tax law. Nevertheless, this analysis permitted other sources of risk to be included in the discount rate, such as a premium above the USA Treasury bill rate depending on the company's credit rating or even a weighted average cost of capital (WACC) constructed with a factor model that includes systemic risks from other sources.

Generally, if the expected value of the profit approach is adopted, the risk premium is directly proportional to the volatility of the source of risk and the degree of relative risk aversion of the company's shareholders.⁴

Based on Bernoulli's expected value theory, the profit function of an uncertain cash flow (x) was represented as $U = U(x)$. The EC can be approximated as (Milgrom & Roberts, 1992):

$$EC(x) = E(x) - \left(\frac{1}{2}\right) r \left[\frac{V(x)}{E(x)} \right] \quad (8)$$

The certainty equivalent represents the amount of money the individual would require to be indifferent about whether to participate in the random event where the payoff x is defined (e.g., a lottery) or to receive EC with certainty. The risk premium is the term $\left(\frac{1}{2}\right) r \left[\frac{V(x)}{E(x)} \right]$, r is the coefficient of relative risk aversion (Pratt, 1964), and $V(x)$ is the variance of the x -flow. Based on the economic theory of decision-making under uncertainty, estimates of risk premium and the associated certainty equivalent can be made. The only drawback is estimating the coefficient r , although experimental and behavioral economics provide sufficient evidence to address reasonable ranges of investors' relative risk aversion.

In this way, first, the cash flows produced by a company will be determined, then the expected value, and finally the variance of these flows will be estimated, assuming that the only source of risk is the real depreciation of the exchange rate. Under these conditions, the risk premium for typical values of r can be estimated, and the value of the company under current legislation can be compared, which has the advantage of specifying exchange rate and inflationary gains or losses but the disadvantage of introducing significant volatility to the flows compared to that produced with the proposed reform.

⁴ The other dominant theory of choices in uncertainty is Prospect Theory. Nevertheless, empirically the risk premium does not change substantially, if anything it tends to become larger due to the loss aversion effect, which occurs in addition to risk aversion. For this reason, it is considered that the estimates arrived at in this article can be considered as a lower limit of what would occur in a more general case.

The model was designed for companies that adopt the foreign FC model and operate under the following characteristics: The currency is USD; all revenues and operating expenses are in USD; they are financed with debt denominated in USD and repaid at international rates; current assets and liabilities, such as accounts receivable or payable, are denominated in USD, as are short-term investments.

The following notation was used:

R = All revenues received by the company in USD

G = All expenses, whether production or operating costs of the company in USD

i^* = International interest rate on debt in USD

T = Tax payment under current legislation

τ = Corporate income tax rate under current legislation

D = Company's debt in the international markets, denominated in USD

AC = Current assets in USD

PC = Current liabilities in USD

P = Current liabilities plus long-run debt in USD

E = Nominal exchange rate (MXN per USD)

e = Percentage depreciation of the nominal exchange rate

π = Inflation rate in Mexico

π^* = Inflation rate in the United States of America

Omitting time subscripts to simplify the expressions, the flow in one year of the company can be defined as:

$$F = [R - G - i^*D] - \tau[R - G - i^*D + e(AC - PC - D) + \pi(PC + D - AC)] \quad (9)$$

The first term in (9) is the net income after interest accrual but before taxes, and the second is the tax payment, which recognizes the exchange gain in the $e(AC - PC - D)$ term, as well as the inflationary gain in $\pi(PC + D - AC)$. Simplifying, expression (9) can be written as:

$$F = [R - G - i^*D] - \tau[R - G - i^*D + (e - \pi)(AC - PC - D)] \quad (10)$$

The variable $(e - \pi)$ in Equation 10 represents the real depreciation of the Mexican peso compared to the USD, an uncertain and highly volatile variable that introduces risk in the flows produced by the modeled company. Equation 10 can be rewritten by introducing the variable $\gamma = \frac{(AC - PC - D)}{(R - G - i^*D)}$, which represents net current assets minus debt in ratio to income before taxes. Using this variable, expression (10) can be written as:

$$F = [R - G - i^*D]\{1 - \tau(1 + (e - \pi)\gamma)\} \quad (11)$$

From (11), it is clear that the effective tax rate paid by the representative company operating in a dollar FC is:

$$\tau_{efe} = \tau(1 + (e - \pi)\gamma) \quad (12)$$

The rate τ is usually fixed by law (e.g., 30%), but if $\gamma < 0$, as expected in highly indebted companies, a real appreciation of the exchange rate increases it, and a real depreciation reduces it. The expected value of the company, assuming that real depreciation is the only source of risk, is:

$$E(F) = [R - G - i^*D]\{1 - \tau[1 + \gamma E(e - \pi)]\} \quad (13)$$

While the flow variance will be:

$$V(F) = \tau^2 \gamma^2 [R - G - i^*D]^2 V(e - \pi) \quad (14)$$

where $V(e - \pi)$ is the variance of the real exchange rate depreciation. Applying Equation 13 to the flow, its certainty equivalent can be defined as: $EC(F) = E(F) - \left(\frac{1}{2}\right)r \left[\frac{V(F)}{E(F)}\right]$, or:

$$EC(F) = [R - G - i^*D] \left\{ 1 - \tau[1 + \gamma E(e - \pi)] - \left(\frac{1}{2}\right)r \left[\frac{\tau^2 \gamma^2 V(e - \pi)}{\{1 - \tau[1 + \gamma E(e - \pi)]\}} \right] \right\} \quad (15)$$

Equation 15 is key to the argument as it shows that the certainty equivalent decreases sharply the greater the variance in the real depreciation of the peso, the higher the ratio of debt to pre-tax net revenue (γ), and the higher the tax rate (τ).

Under current law, the company's value to shareholders, referred to as V_A , will therefore be:

$$V_A = \sum_{t=1}^T \frac{[R - G - i^*D] \left\{ 1 - \tau[1 + \gamma E(e - \pi)] - \left(\frac{1}{2}\right)r \left[\frac{\tau^2 \gamma^2 V(e - \pi)}{\{1 - \tau[1 + \gamma E(e - \pi)]\}} \right] \right\}}{(1 + \delta)^t} \quad (16)$$

Assuming no change in time τ , γ , r , $E(e - \pi)$, and $V(e - \pi)$ can be expressed as:

$$V_A = \left\{ 1 - \tau[1 + \gamma E(e - \pi)] - \left(\frac{1}{2}\right)r \left[\frac{\tau^2 \gamma^2 V(e - \pi)}{\{1 - \tau[1 + \gamma E(e - \pi)]\}} \right] \right\} \sum_{t=1}^T \frac{[R - G - i^*D]}{(1 + \delta)^t} \quad (17)$$

which has an interesting interpretation. The value of the company is proportional to $\sum_{t=1}^T \frac{[R-G-i^*D]}{(1+\delta)^t}$, which is the value the company would have if there were no corporate income tax.

Under the tax proposal associated with the FC model in which companies pay taxes without considering exchange rate or inflationary gains, the value of the company, V_p , would be:

$$V_p = (1 - \tau) \sum_{t=1}^T \frac{[R - G - i^*D]}{(1 + \delta)^t} \quad (18)$$

The comparison of (17) and (18) is key to understanding the effect of the FC model on company value.

Parameter calibration and estimation of the impact of reform

In order to evaluate the effect of the proposed reform on the value of a company, it is necessary to estimate Equations 17 and 18. To this end, a reform impact variable was constructed as the difference in company values if the FC regime is adopted but in proportion to the value it would have in the absence of taxes. The estimated impact of the reform on company value was denoted as μ :

$$\mu = \frac{V_p - V_A}{\sum_{t=1}^T \frac{[R - G - i^*D]}{(1 + \delta)^t}} = (1 - \tau) - \left\{ 1 - \tau[1 + \gamma E(e - \pi)] - \left(\frac{1}{2} \right) r \left[\frac{\tau^2 \gamma^2 V(e - \pi)}{\{1 - \tau[1 + \gamma E(e - \pi)]\}} \right] \right\} \quad (19)$$

To estimate $E(e - \pi)$ and $V(e - \pi)$, annual real depreciations were used from January 2010 to August 2020, a period in which the exchange rate was flexible, and the Bank of Mexico used the reference rate as its main monetary policy instrument.

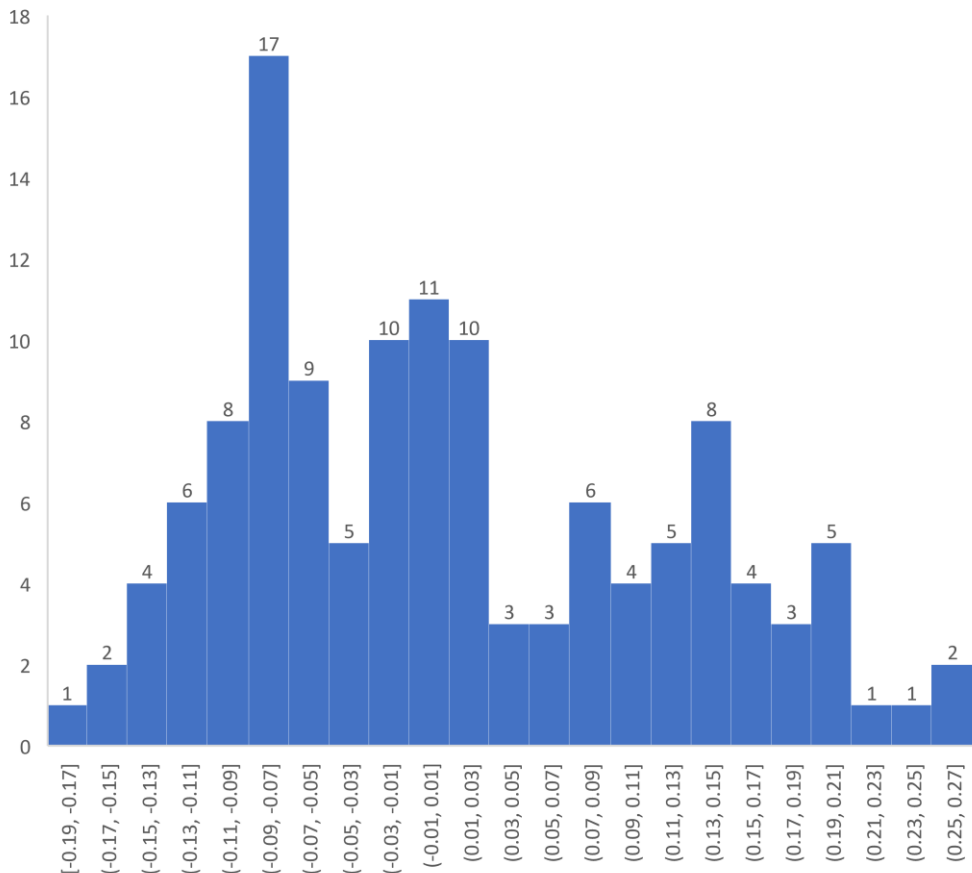


Figure 1. Real Depreciation Rate in Mexico (January 2010-August 2020)

Source: created by the authors based on information from INEGI and Banco de México

Each month, the growth rate of the exchange rate and the Consumer Price Index were calculated compared to their values twelve months earlier. Both rates were subtracted to estimate the real depreciation rate. Figure 1 shows the histogram of the real depreciation in that period.

The distribution is skewed and slightly more loaded to real appreciations, i.e., values in the negative range. The estimate of the mean of the data grouped in this way shows a real mean depreciation of 0.0082 and a standard deviation of 0.1059, thirteen times more than the mean. In other words, even though the expected value of real depreciation is not so far from zero, the high volatility in this variable introduces a high risk in the profitability of the companies after taxes.

Focusing on the part of the distribution where there are real appreciations, which lead to unexpected increases in the effective revenue tax rate paid by companies with $\gamma < 0$, it is found that 54% of the months examined show some real appreciation. The mean real depreciation, given that $(e - \pi) < 0$, is -0.0694.

An estimate of the relative risk aversion coefficient is also required. This is based on experimental estimates obtained with two methods, the first provided by Eckel and Grossman (2002, 2008), henceforth EG, and that proposed by Holt and Laurie (2002), or HL.

In the study by Eckel and Grossman (2008)⁵, the mode of the r coefficient in men ranges from 0.2 to 0.38, while in women it ranges from 0.38 to 0.67. In another study, Dave et al. (2010) found substantially higher r coefficients using the EG method in the range of 0.71 to 1.16. The HL method is more complete, although more difficult for subjects to understand. In their seminal experiment, Holt and Laurie (2002) place the coefficient in the rank of 0.41 to 0.68.

Thus, it cannot be affirmed that the literature reaches a consensus on a single risk aversion coefficient value for all individuals; the evidence points to important differences by gender, age, and possibly culture. Even so, from the investigations carried out with the EG and HL methods among risk-averse individuals, the coefficients most frequently reported in the literature range from 0.2 to 2.

As shown in the expression showing the impact of the reform (19), the higher the risk aversion coefficient, the greater the impact. For this reason, it was decided again to opt for the most conservative estimate of r according to the findings described above. It was preferable to bias the results downward and underestimate the potential of the reform, which is why $r = 0.2$ was selected.

Finally, an estimate of the parameter γ that is representative of the companies that could join the FC regime was required. Using the S&P Capital IQ database to assess the taxable impact, assets minus current liabilities and long-run debt were estimated and divided by the taxable base resulting from adopting the proposed reform, which in simple terms is the operating profit minus net interest. Table 6 presents the medians of the γ parameter for different groups of companies.

As can be seen, depending on the year and the group of companies, the parameter γ oscillates between -2.1 and -6.2, which gives a class mark of -4.2. Additionally, during the period 2015 to 2019, the median for the group of companies that use the USD as filling currency is -4.8, which is why a $\gamma = -4.5$ was taken as the class mark in this exercise, evaluating the sensitivity of the results in the limits of the interval (-4, -5).

⁵ The profit function used establishes a relation of the type $U(x) = \frac{x^{1-r}}{1-r}$, which produces a coefficient of relative risk aversion of r , which is constant.

In order to measure the impact of the reform on the value of the company, the μ indicators expressed in Equation 19 were used; additionally, the equivalent reduction in the discount rate necessary to increase the value of the company under current legislation to the value that could be achieved with the proposed reform was estimated. That is, if the proposal increases the company's value, i.e., $\mu > 0$, then another way to achieve an increase of the same magnitude in the company's value is to reduce the discount rate. That is, if for example $\mu > 0$, the reduction in the discount rate can be sought by adjusting it by a factor $1 - \phi$ so that the present value under the reform is achieved. That is:

$$\left\{1 - \tau[1 + \gamma E(e - \pi)] - \left(\frac{1}{2}\right) r \left[\frac{\tau^2 \gamma^2 V(e - \pi)}{\{1 - \tau[1 + \gamma E(e - \pi)]\}} \right] \right\} \sum_{t=1}^T \frac{[R - G - i^* D]}{[(1 - \phi)(1 + \delta)]^t} = (1\tau) \sum_{t=1}^T \frac{[R - G - i^* D]}{(1 + \delta)^t}.$$

Table 6
Medians of the γ parameter in different groups of companies in Mexico (2015-2019)

Year	All	Public	Reported dollars	Non-financial private	
				All	Revenues greater than USD 100 million
2015	-2.9	-2.1	-4.1	-2.8	-3.2
2016	-2.6	-2.3	-6.2	-2.5	-2.6
2017	-3.2	-2.5	-4.0	-2.9	-3.2
2018	-3.6	-3.0	-4.8	-3.6	-3.6
2019	-2.8	-2.7	-6.2	-2.8	-2.8
2015-2019	-3.0	-2.5	-4.8	-2.8	-3.1

Source. created by the authors based on information from S&P Capital IQ

For the case where $[R - G - i^* D]$ is constant, then it is removed from the summation on both sides and eliminated. Assuming that T is a very large number of years (i.e., tends to infinity), one has:

$$\left\{1 - \tau[1 + \gamma E(e - \pi)] - \left(\frac{1}{2}\right) r \left[\frac{\tau^2 \gamma^2 V(e - \pi)}{\{1 - \tau[1 + \gamma E(e - \pi)]\}} \right] \right\} \left[\frac{1}{(1 - \phi)(1 + \delta) - 1} \right] = \frac{(1 - \tau)}{\delta}.$$

By subtracting for $1 - \phi$, the following factor is obtained:

$$1 - \phi = \left\{1 + \left[1 - \tau[1 + \gamma E(e - \pi)] - \left(\frac{1}{2}\right) r \left[\frac{\tau^2 \gamma^2 V(e - \pi)}{\{1 - \tau[1 + \gamma E(e - \pi)]\}} \right] \right] \frac{\delta}{(1 - \tau)} \right\} \left[\frac{1}{(1 + \delta)} \right]. \quad (20)$$

The change in percentage points is:

$$\Delta\delta = [(1 - \phi)(1 + \delta) - 1] - \delta \quad (21)$$

Table 7

Impact measures of the proposed tax reform: Increase in company value and reduction in discount rate

	-4	γ -4.5	-5
μ	0.193	0.245	0.304
$\Delta\delta$	-0.014	-0.018	-0.022

Source. created by the authors

Table 7 shows the impact on the value of the company and the change in the equivalent discount rate that an FC regime could produce based on an initial discount rate of 5%. Based on the parameters, the increase in the company's value is between 19 and 30 percentage points of the value it would have in the absence of taxes, equivalent to a reduction in the discount rates of 1 to 2 percentage points.

Final comments

The basic premise of this paper is that adopting a Foreign FC tax model in Mexico is an appropriate measure to improve the country's competitiveness for companies that, although established in Mexico, operate mostly with a currency other than the Mexican peso.

The literature provides concrete estimates that adhering to FC models reduces foreign exchange risk in companies that operate mainly in foreign currency and increases shareholder value. Also, there is evidence that investment tends to be higher when the exchange rate is less volatile.

This paper shows that, by maintaining a 30% income tax rate, the foreign FC regime would not reduce the tax burden in a sample of 268 of Mexico's largest companies. On the other hand, it could increase the value of companies by 19 to 30 percentage points, equivalent to a drop in the interest rate of 1 to 2 percentage points, which could significantly stimulate investment and consequent job creation.

The estimates in this paper are not free of limitations, given the nature of the database employed. For example, limiting the tax burden exercises to those companies most likely to ascribe to a voluntary tax regime in FC would be desirable. However, that would involve identifying the destination or origin or the currency in which sales, expenses, and debt contracting are made, which cannot be done with the financial information accessed.

The empirical exercises can be refined by using a random sample of companies' tax records that would fit an FC model, but this could only be done with information from the tax authorities. Similarly, the specification of the valuation model is quite stylized. Even so, the authors believe that the evidence analyzed in this paper is a very good approximation of the likely effects of adopting this measure and sufficient to motivate a broad discussion on different tax regimes that could stimulate companies' competitiveness and productive investment without implying fiscal sacrifices.

Other possible extensions of the study have to do with the income tax rate to be applied to companies that subscribe to the FC model proposed. In this research, the 30% rate currently in force was taken so as not to introduce different rates for companies that declare under FC and those that do not. The authors believe supporting the model would be politically complicated if it introduces possible discrimination between companies from the outset. Even so, it would be worthwhile to explore the sensitivity of the results to marginal changes in the tax rate analyzed here and estimate optimal rates according to some reasonable criterion. Two possibilities are to maximize the tax burden subject to no reduction in company value or to maximize company value subject to no reduction in the tax burden. The authors believe this exercise is more useful if it is carried out with tax information on the types of companies that are more likely to join the FC model rather than with the information available in this first approach, which is why it was not addressed in this research.

The introduction of the Foreign FC regime for tax purposes could be done following international best practices. For this purpose, it is convenient to make clear the conditions that companies must comply with to access the regime, and even though the affiliation is voluntary, it must be multiannual for an established period, with no option to change during this period.

In conclusion, it is an initiative with solid foundations, which can improve the country's business climate and potentially attract more productive investment.

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