

Mercados y Negocios

1665-7039 printed

2594-0163 on line

Year 25, n. 51, January-April (2024)

FINANCIAL AND ECONOMIC INDICATORS

Sensitivity Analysis and Finances

<https://doi.org/10.32870/myn.vi51.7724>

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The financial projections used in decision-making are associated with a degree of uncertainty regarding the correct choice of the hypotheses used or the certainty of the value of the variables, which is why it is necessary to place ourselves in several scenarios, in which the hypotheses and the value of the variables over which we have less control and which in turn have the greatest impact on the results must be varied. expected results. The above process is known as Sensitivity Analysis.

Purpose of sensitivity analysis: it consists of improving the quality of the information used so that the decision maker has additional tools that allow them to achieve better results and generate greater competitive advantages.

Sensitivity Analysis, also called Post-Optimization Analysis, also consists of determining how sensitive the optimal solution is to the change of some of the data or parameters, keeping the rest fixed (John & Faulín, 2023).

Intangible and intangible financial modeling, sensitivity analysis consists of analyzing how the different economic values of a set of independent variables affect a specific dependent variable, as well as knowing how it will respond, among the different economic scenarios.

In finance, sensitivity analysis is used to model the performance outcome of changes in interest rates, and asset prices, as well as changes in demand, in the formation of investment portfolios and the mix of their assets. Also, changes in systemic or market risk, unsystematic risk, as well as the change in the variables associated with different investment strategies.

Sensitivity analysis is the procedure by which it is possible to determine how much the objective function (IRR or NPV) is affected or how sensitive it is to changes in certain variables of the investment, considering that the others do not change. (Baca, 2022; Morales & Morales, 2009).



Forms of study of sensitivity: according to research conducted by John and Faulín (2023).

The first is to solve the entire problem again every time some of the original data has been modified. This method can take a long time to determine all the variants when we are faced with a large set of possible changes.

The second way is that once a problem has been solved, we proceed to analyze how the optimal result obtained would be affected by the variation within a "tolerable" range, of the value of one of the variables, keeping the value of the remaining variables fixed.

If the effects of varying more than one parameter (or a parameter beyond the "tolerance range") are studied, the problem must be reprogrammed.

Methods to study sensitivity: to obtain a measure of the variability in the results according to the research of Tejada and others (2015) and Pérez and others (2012), the following methods can be mentioned:

Informal method: the analyst assesses the stability of the variables.

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Decision tree: Future decision points and possible uncertain events are displayed; in which case each alternative is presented as a branch of the tree.

Monte Carlo model: links sensitivities and probability distributions of input variables. An uncertainty analysis allows you to quantitatively assess the variability of the model components for a specific situation and deduce an uncertainty distribution for each state or output variable of the model (Monod et al., 2006). Generally, this analysis is carried out using Monte Carlo simulation (Saltelli et al., 2008).

Dupont Method: measures the company's profitability about sales, and total asset turnover, which indicates how efficiently assets have been used to generate sales.

Software and sensitivity: there are different software's on the market, among them we can mention the following: @RISK, Managerial Analyzer Delfos Pro, Oracle Crystal Ball, EasyPlanEx, RealiaSoft RENO, MultiPlanEx, these softwares perform financial analysis, investment projection, as well as the financial sensitivity analysis.

Economic and financial indicators are useful tools that benefit organizations by facilitating timely and appropriate decision-making in relation to their corporate and financial strategies.

Next, the evolution of some economic and financial indicators of the Mexican environment is described and shown to facilitate decision-making related to personal and business strategies in an integral manner.

1. National Consumer Price Index (INPC, Spanish)
2. The Price and Quotation Index of the Mexican Stock Exchange (IPC, Spanish)
3. Exchange rate
4. Equilibrium interbank interest rate (TIIE, Spanish)
5. CETES rate of return
6. Investment units (UDIS, Spanish)

1. NATIONAL CONSUMER PRICE INDEX (INPC)

Born in 1995 and reflecting changes in consumer prices, it measures the general increase in prices in the country. It is calculated fortnightly by the Bank of Mexico and INEGI (2021). INPC is published in the Official Gazette of the Federation on the 10th and 25th of each month. The reference period is the second half of December 2010.

Table 1

Accumulated inflation in the year (Base: 2nd. Fortnight of December 2010 = 100 with data provided by *Banco de México*)

Periodo	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Enero	1.48	0.77	0.98	0.79	0.90	-0.09	0.38	1.70	0.53	0.09	0.48	0.86	0.59	0.76
Febrero	2.15	1.42	1.47	1.46	1.15	0.09	0.82	2.29	0.91	0.06	0.90	1.50	1.43	1.24
Marzo	2.52	1.84	1.55	1.99	1.43	0.51	0.97	2.92	1.24	0.44	0.85	2.34	2.43	1.51
Abril	1.98	0.72	0.69	1.81	1.24	0.25	0.65	3.04	0.90	0.50	-0.17	2.67	2.98	1.47
Mayo	0.60	-0.70	-0.65	0.95	0.91	-0.26	0.20	2.92	0.73	0.21	0.22	2.88	3.17	1.27
Junio	0.49	-0.41	-0.41	1.12	1.09	-0.09	0.31	3.18	1.12	0.27	0.76	3.43	4.04	1.37
Julio	0.56	-0.04	0.32	1.14	1.42	0.06	0.57	3.57	1.66	0.65	1.43	4.04	4.81	1.86
Agosto	0.91	0.30	0.92	1.31	1.73	0.27	0.86	4.08	2.26	0.63	1.82	4.24	5.54	2.42
Septiembre	1.27	0.73	1.12	1.61	2.18	0.27	1.47	4.41	2.69	0.89	2.06	4.88	6.19	2.88
Octubre	2.35	2.33	2.12	2.77	2.74	1.16	2.09	5.06	3.22	1.44	2.68	5.76	6.79	3.27
Noviembre	3.89	4.87	3.86	4.57	3.57	1.71	2.89	6.15	4.10	2.26	2.76	6.97	7.41	3.93
Diciembre	4.19	5.81	3.97	5.21	4.08	2.13	3.36	6.77	4.83	2.83	3.15	7.35	7.82	4.66

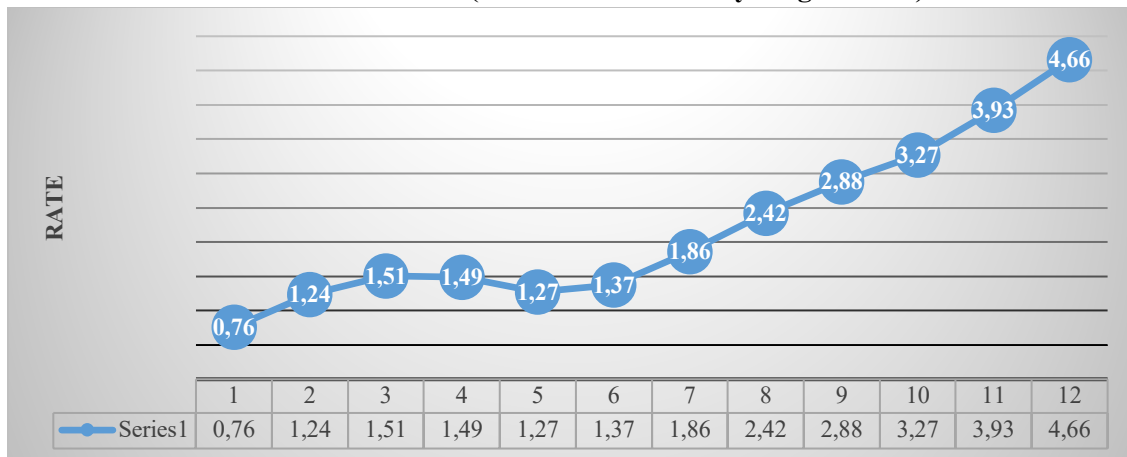
Source: Own elaboration (INEGI, 2024). Route: Indicadores económicos de coyuntura > Índices de precios > Índice nacional de precios al consumidor. Base segunda quincena de julio de 2018=100 > Mensual > Índice > Índice general

Graph 1
Inflation in Mexico (2010-2023 accumulated at the end of the year)



Source: Own elaboration (INEGI, 2024). Route: Indicadores económicos de coyuntura > Índices de precios > Índice nacional de precios al consumidor. Base segunda quincena de julio de 2018=100 > Mensual > Índice > Índice general

Graph 2
Inflation in Mexico (accumulated January-August 2023)



Source: Own elaboration (INEGI, 2024). Route: Indicadores económicos de coyuntura > Índices de precios > Índice nacional de precios al consumidor. Base segunda quincena de julio de 2018=100 > Mensual > Índice > Índice general

2. THE PRICE AND QUOTATION INDEX OF THE MEXICAN STOCK EXCHANGE (IPC)

Represents the change in the values traded on the Mexican Stock Exchange concerning the previous day to determine the percentage of rising or falling of the most representative shares of the companies listed therein.

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Table 2
The Price and Quotation Index of the Mexican Stock Exchange (Base: October 1978, 0.78=100)

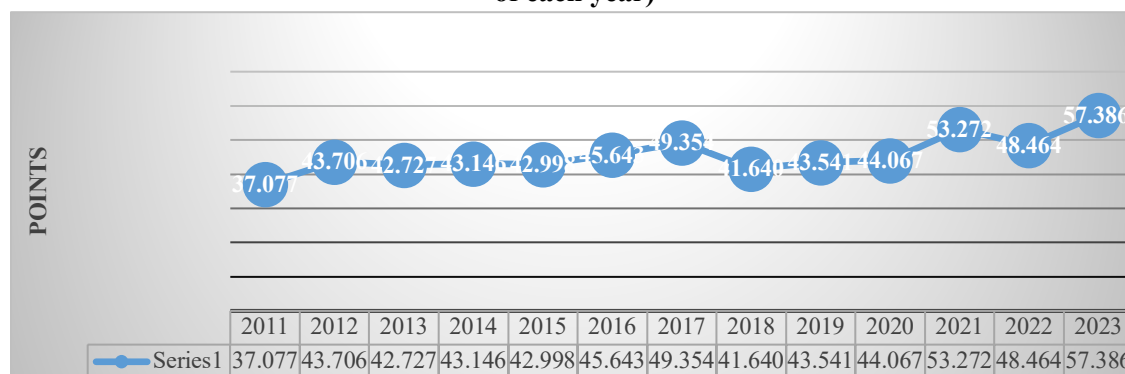
2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
36,982	37,422	45,278	40,879	40,951	43,631	47,001	50,456	43,988	44,862	42,986	51,331	54,564
37,020	37,816	44,121	38,783	44,190	43,715	46,857	47,438	42,824	41,324	44,593	53,401	52,758
37,441	39,521	44,077	40,462	43,725	45,881	48,542	46,125	43,281	34,554	47,246	56,537	53,904
36,963	39,461	42,263	40,712	44,582	45,785	49,261	48,354	44,597	36,470	48,010	51,418	55,121
35,833	37,872	41,588	41,363	44,704	45,459	48,788	44,663	42,749	36,122	50,886	51,753	52,736
36,558	40,199	40,623	42,737	45,054	45,966	49,857	47,663	43,161	37,716	50,290	47,524	53,526
35,999	40,704	40,838	43,818	44,753	46,661	51,012	49,698	40,863	37,020	50,868	48,144	54,819
35,721	39,422	39,492	45,628	43,722	47,541	51,210	49,548	42,623	36,841	53,305	44,919	53,021
33,503	40,867	40,185	44,986	42,633	47,246	50,346	49,504	43,011	37,459	51,386	44,627	50,875
36,160	41,620	41,039	45,028	44,543	48,009	48,626	43,943	43,337	36,988	51,310	49,922	49,062
36,829	41,834	42,499	44,190	43,419	45,286	47,092	41,733	42,820	41,779	49,699	51,685	54,060
37,077	43,706	42,727	43,146	42,998	45,643	49,354	41,640	43,541	44,067	53,272	48,464	57,386

Source: Own elaboration (BANXICO, 2024).

<https://www.banxico.org.mx/SieInternet/consultarDirectorioInternetAction.do?sector=7&accion=consultarCuadro&idCuadro=CF57&locale=es>

Graph 3

The Price and Quotation Index of the Mexican Stock Exchange, 2011 - 2023 (Score at the end of each year)

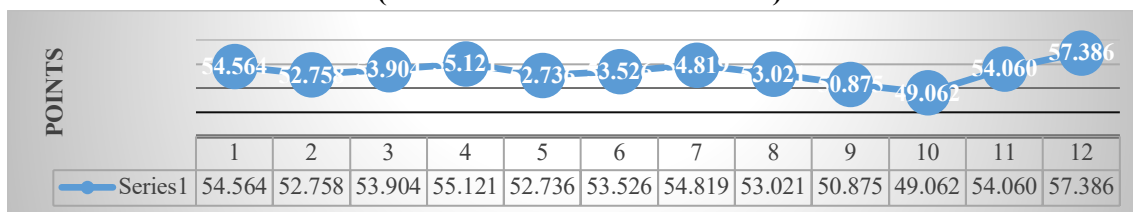


Source: Own elaboration (BANXICO, 2024).

<https://www.banxico.org.mx/SieInternet/consultarDirectorioInternetAction.do?sector=7&accion=consultarCuadro&idCuadro=CF57&locale=es>

Graph 4

The Price and Quotation Index of the Mexican Stock Exchange, January-December 2023 (Score at the end of each month)



Source: Own elaboration (BANXICO, 2024).

<https://www.banxico.org.mx/SieInternet/consultarDirectorioInternetAction.do?sector=7&accion=consultarCuadro&idCuadro=CF57&locale=es>

3. EXCHANGE RATE

It is the value of the Mexican peso concerning the dollar calculated with the daily average of the five most important banks in the country, which reflects the spot price (cash), negotiated between banks. It is highly related to Inflation, the interest rate, and the Mexican Stock Exchange.

Table 3
Exchange rate (National currency per US dollar, parity at the end of each period)

Period	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
January	12.02	12.95	12.71	13.37	14.69	18.45	21.02	18.62	19.04	18.91	20.22	20.74	18.79
February	12.17	12.87	12.87	13.30	14.92	18.17	19.83	18.65	19.26	19.78	20.94	20.65	18.40
March	11.97	12.80	12.36	13.08	15.15	17.40	18.81	18.33	19.38	23.48	20.44	19.99	18.11
April	11.59	13.20	12.16	13.14	15.22	19.40	19.11	18.86	19.01	23.93	20.18	20.57	18.07
May	11.63	13.91	12.63	12.87	15.36	18.45	18.51	19.75	19.64	22.18	19.92	19.69	17.56
June	11.84	13.66	13.19	13.03	15.57	18.91	17.90	20.06	19.21	23.09	19.91	20.13	17.07
July	11.65	13.28	12.73	13.06	16.21	18.86	17.69	18.55	19.99	22.20	19.85	20.34	16.73
August	12.41	13.27	13.25	13.08	16.89	18.58	17.88	19.07	20.07	21.89	20.06	20.09	16.84
September	13.42	12.92	13.01	13.45	17.01	19.50	18.13	18.90	19.68	22.14	20.56	20.09	17.62
October	13.20	13.09	12.89	13.42	16.45	18.84	19.15	19.80	19.16	21.25	20.53	19.82	18.08
November	14.03	13.04	13.09	13.72	16.55	20.55	18.58	20.41	19.61	20.14	21.45	19.40	17.14
December	13.99	13.01	13.08	14.72	17.21	20.73	19.79	19.68	18.87	19.91	20.47	19.47	16.89

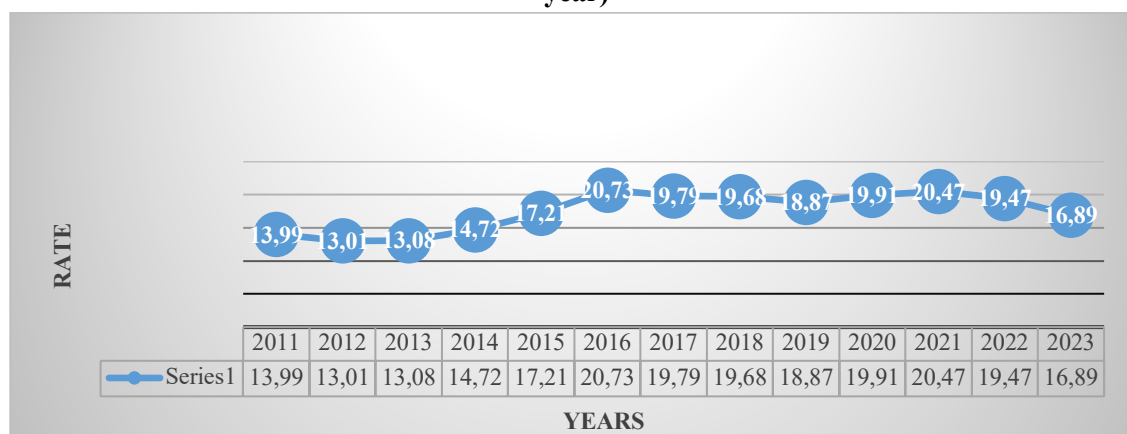
NOTE: Exchange rate FIX by The Banco de México, used for settling obligations denominated in foreign currency. Quote at the end

Source: Own elaboration (BANXICO, 2024).

<https://www.banxico.org.mx/SieInternet/consultarDirectorioInternetAction.do?sector=6&accion=consultarCuadro&idCuadro=CF102&locale=es>

Graph 5

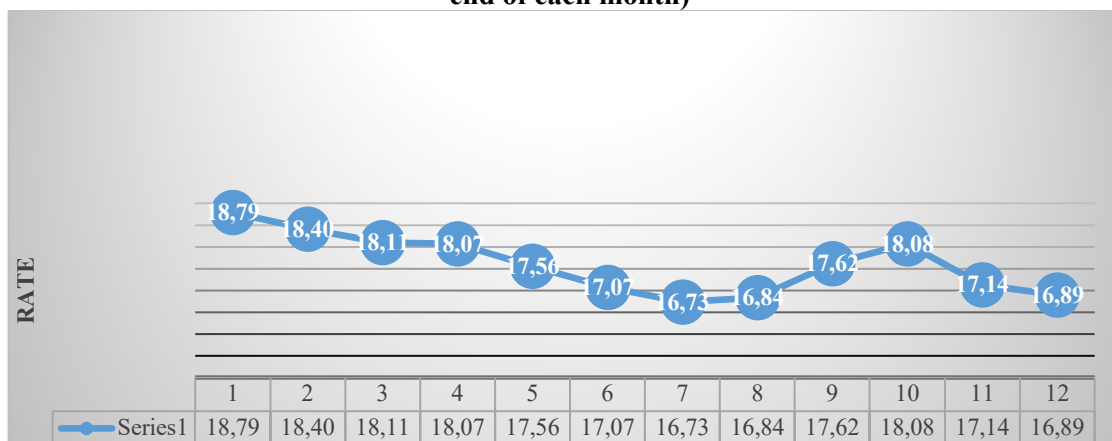
Exchange rate (National currency per US dollar, 2011-2023, FIX parity at the end of each year)



Source: Own elaboration (BANXICO, 2024).

<https://www.banxico.org.mx/SieInternet/consultarDirectorioInternetAction.do?sector=6&accion=consultarCuadro&idCuadro=CF102&locale=es>

Graph 6
Exchange rate (National currency per US dollar, January-December 2023, FIX parity at the end of each month)



Source: Own elaboration (BANXICO, 2024).

<https://www.banxico.org.mx/SieInternet/consultarDirectorioInternetAction.do?sector=6&accion=consultarCuadro&idCuadro=CF102&locale=es>

4. EQUILIBRIUM INTERBANK INTEREST RATE (TIE)

On March 23, 1995, the Bank of Mexico, to establish an interbank interest rate that better reflects market conditions, released the Interbank Equilibrium Interest Rate through the Official Gazette of the Federation.

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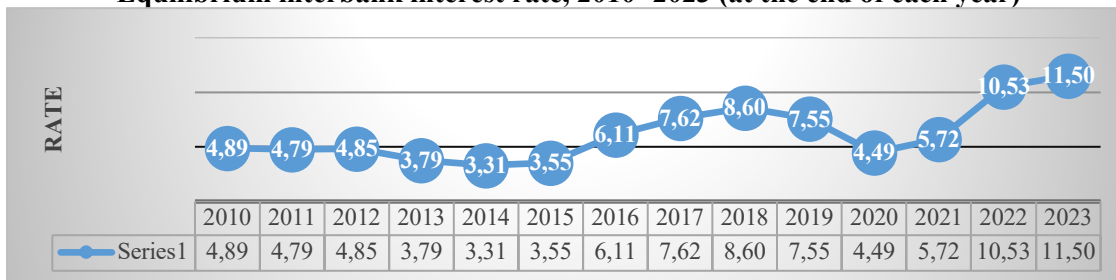
Table 4
Equilibrium interbank interest rate (28-day quote)

Periodo	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Enero	4.91	4.86	4.79	4.84	3.78	3.29	3.56	6.15	7.66	8.59	7.50	4.47	5.72	10.78
Febrero	4.92	4.84	4.78	4.80	3.79	3.29	4.05	6.61	7.83	8.54	7.29	4.36	6.02	11.10
Marzo	4.92	4.84	4.77	4.35	3.81	3.30	4.07	6.68	7.85	8.51	6.74	4.28	6.33	11.34
Abril	4.94	4.85	4.75	4.33	3.80	3.30	4.07	6.89	7.85	8.50	6.25	4.28	6.73	11.53
Mayo	4.94	4.85	4.76	4.30	3.79	3.30	4.10	7.15	7.86	8.51	5.74	4.29	7.01	11.54
Junio	4.94	4.85	4.77	4.31	3.31	3.30	4.11	7.36	8.10	8.49	5.28	4.32	7.42	11.50
Julio	4.92	4.82	4.78	4.32	3.31	3.31	4.59	7.38	8.11	8.47	5.19	4.52	8.04	11.50
Agosto	4.90	4.81	4.79	4.30	3.30	3.33	4.60	7.38	8.10	8.26	4.76	4.65	8.50	11.50
Septiembre	4.90	4.78	4.81	4.03	3.29	3.33	4.67	7.38	8.12	8.04	4.55	4.75	8.89	11.50
Octubre	4.87	4.79	4.83	3.78	3.28	3.30	5.11	7.38	8.15	7.97	4.51	4.98	9.56	11.50
Noviembre	4.87	4.80	4.85	3.80	3.31	3.32	5.57	7.39	8.34	7.78	4.48	5.13	10.00	11.50
Diciembre	4.89	4.79	4.85	3.79	3.31	3.55	6.11	7.62	8.60	7.55	4.49	5.72	10.53	11.50

Source: Own elaboration (BANXICO, 2024).

<https://www.banxico.org.mx/SieInternet/consultarDirectorioInternetAction.do?sector=18&accion=consultarCuadro&idCuadro=CF101&locale=es>

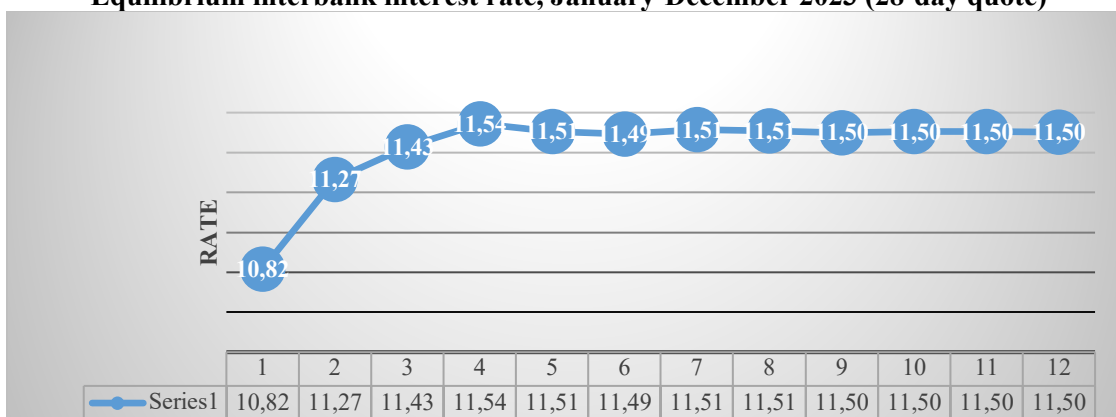
Graph 7
Equilibrium interbank interest rate, 2010- 2023 (at the end of each year)



Source: Own elaboration (BANXICO, 2024).

<https://www.banxico.org.mx/SieInternet/consultarDirectorioInternetAction.do?sector=18&accion=consultarCuadro&idCuadro=CF101&locale=es>

Graph 8
Equilibrium interbank interest rate, January-December 2023 (28-day quote)



Source: Own elaboration (BANXICO, 2024).

<https://www.banxico.org.mx/SieInternet/consultarDirectorioInternetAction.do?sector=18&accion=consultarCuadro&idCuadro=CF101&locale=es>

5. CETES RATE OF RETURN

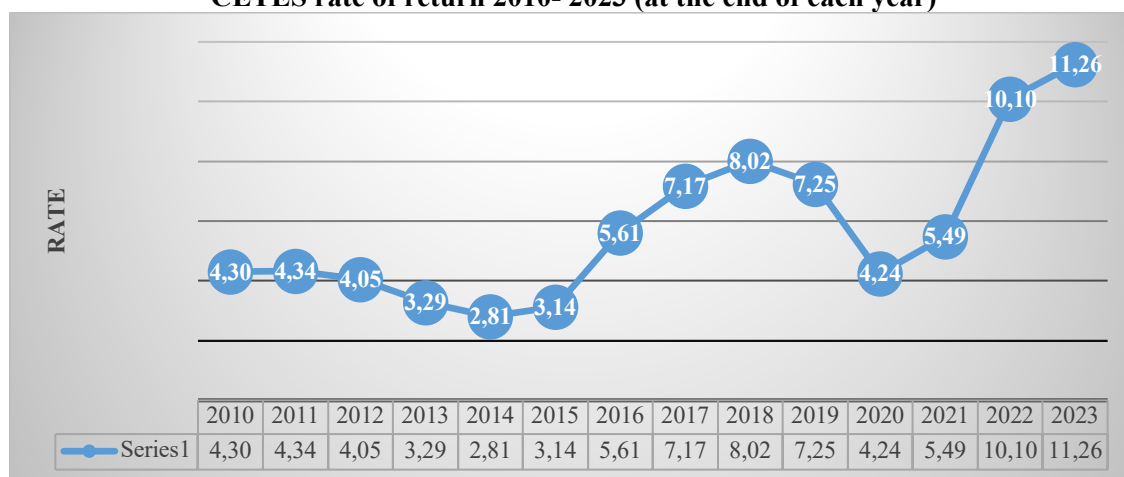
Table 5
CETES rate of return (28-day)

Period	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
January	4.49	4.14	4.27	4.15	3.14	2.67	3.08	5.83	7.25	7.95	7.04	4.22	5.50	10.80
February	4.49	4.04	4.32	4.19	3.16	2.81	3.36	6.06	7.40	7.93	6.91	4.02	5.94	11.04
March	4.45	4.27	4.24	3.98	3.17	3.04	3.80	6.32	7.47	8.02	6.59	4.08	6.52	11.34
April	4.44	4.28	4.29	3.82	3.23	2.97	3.74	6.50	7.46	7.78	5.84	4.06	6.68	11.27
May	4.52	4.31	4.39	3.72	3.28	2.98	3.81	6.56	7.51	8.07	5.38	4.07	6.90	11.25
June	4.59	4.37	4.34	3.78	3.02	2.96	3.81	6.82	7.64	8.18	4.85	4.03	7.56	11.02
July	4.60	4.14	4.15	3.85	2.83	2.99	4.21	6.99	7.73	8.15	4.63	4.35	8.05	11.09
August	4.52	4.05	4.13	3.84	2.77	3.04	4.24	6.94	7.73	7.87	4.50	4.49	8.35	11.07
Sep.	4.43	4.23	4.17	3.64	2.83	3.10	4.28	6.99	7.69	7.61	4.25	4.69	9.25	11.05
Oct.	4.03	4.36	4.21	3.39	2.90	3.02	4.69	7.03	7.69	7.62	4.22	4.93	9.00	11.26
Nov.	3.97	4.35	4.23	3.39	2.85	3.02	5.15	7.02	7.83	7.46	4.28	5.05	9.70	11.78
Dec.	4.30	4.34	4.05	3.29	2.81	3.14	5.61	7.17	8.02	7.25	4.24	5.49	10.10	11.26

Source: Own elaboration (BANXICO, 2024).

<https://www.banxico.org.mx/SieInternet/consultarDirectorioInternetAction.do?sector=22&accion=consultarCuadro&idCuadro=CF107&locale=es>

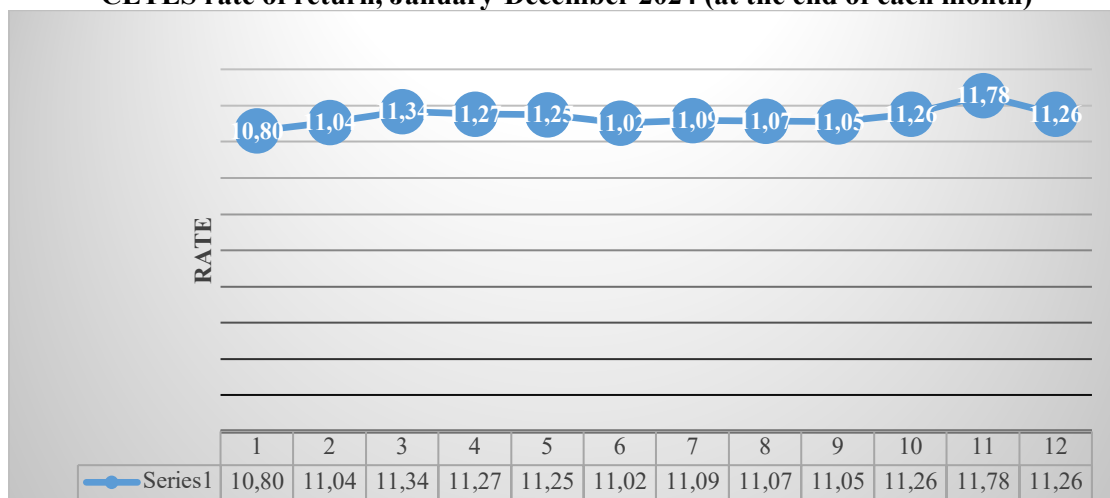
Graph 9
CETES rate of return 2010- 2023 (at the end of each year)



Source: Own elaboration (BANXICO, 2024).

<https://www.banxico.org.mx/SieInternet/consultarDirectorioInternetAction.do?sector=22&accion=consultarCuadro&idCuadro=CF107&locale=es>

Graph 10
CETES rate of return, January-December 2024 (at the end of each month)



Source: Own elaboration (BANXICO, 2024).

<https://www.banxico.org.mx/SieInternet/consultarDirectorioInternetAction.do?sector=22&accion=consultarCuadro&idCuadro=CF107&locale=es>

6. INVESTMENT UNITS (UDIS)

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The UDI is a unit of account of constant real value to denominate credit titles. It does not apply to checks, commercial contracts, or other acts of commerce.

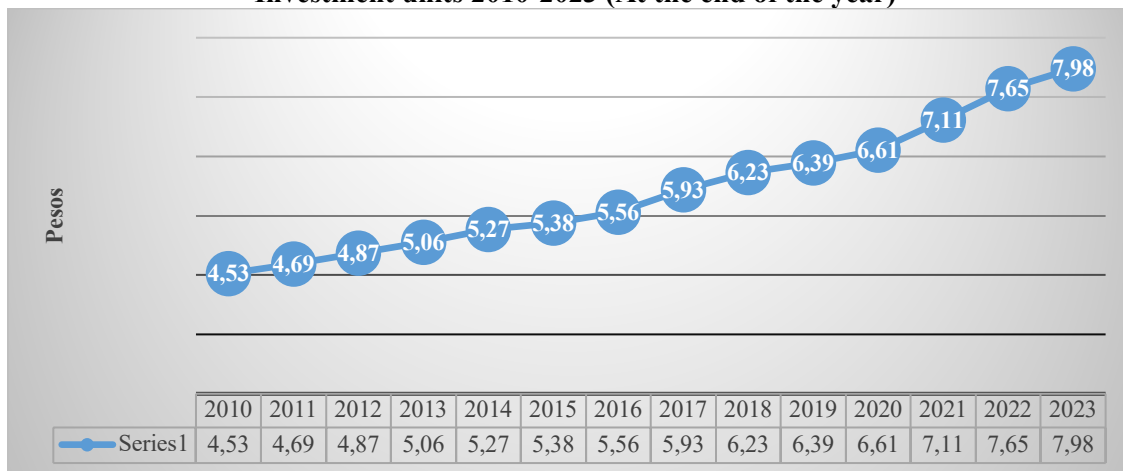
Table 6
Investment units (value concerning pesos)

Period	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
January	4.37	4.56	4.73	4.89	5.10	5.29	5.41	5.62	5.97	6.25	6.44	6.64	7.12	7.69
February	4.41	4.57	4.75	4.92	5.13	5.29	5.43	5.69	6.00	6.25	6.46	6.70	7.18	7.74
March	4.44	4.59	4.75	4.94	5.15	5.30	5.44	5.71	6.02	6.26	6.49	6.75	7.24	7.77
April	4.46	4.59	4.75	4.97	5.15	5.32	5.45	5.75	6.03	6.28	6.43	6.79	7.31	7.78
May	4.43	4.58	4.71	4.96	5.13	5.29	5.42	5.75	6.01	6.27	6.42	6.81	7.33	7.78
June	4.41	4.55	4.74	4.95	5.13	5.28	5.42	5.75	6.01	6.26	6.44	6.83	7.36	7.77
July	4.42	4.57	4.77	4.95	5.14	5.28	5.42	5.76	6.04	6.27	6.49	6.87	7.43	7.79
August	4.43	4.58	4.78	4.95	5.16	5.29	5.44	5.79	6.07	6.29	6.52	6.90	7.47	7.83
September	4.44	4.59	4.80	4.97	5.18	5.31	5.45	5.82	6.11	6.29	6.55	6.92	7.53	7.87
October	4.47	4.61	4.83	4.99	5.20	5.33	5.49	5.84	6.13	6.31	6.57	6.97	7.57	7.90
November	4.50	4.64	4.85	5.02	5.23	5.36	5.53	5.89	6.17	6.35	6.60	7.04	7.62	7.94
December	4.53	4.69	4.87	5.06	5.27	5.38	5.56	5.93	6.23	6.39	6.61	7.11	7.65	7.98

Source: Own elaboration (BANXICO, 2024).

<https://www.banxico.org.mx/SieInternet/consultarDirectorioInternetAction.do?accion=consultarCuadro&idCuadro=CP150&locale=es>

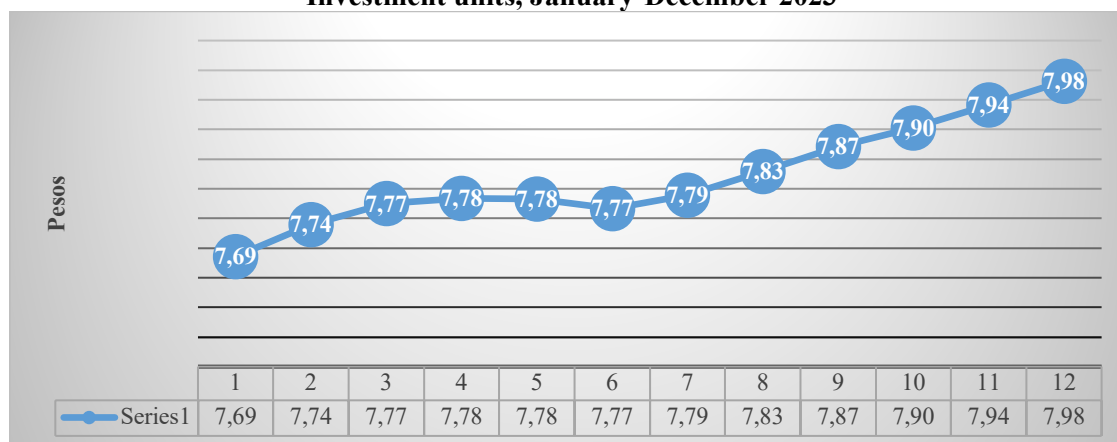
Graph 11
Investment units 2010-2023 (At the end of the year)



Source: Own elaboration (BANXICO, 2024).

<https://www.banxico.org.mx/SieInternet/consultarDirectorioInternetAction.do?accion=consultarCuadro&idCuadro=CP150&locale=es>

Graph 12
Investment units, January-December 2023



Source: Own elaboration (BANXICO, 2024).

<https://www.banxico.org.mx/SieInternet/consultarDirectorioInternetAction.do?accion=consultarCuadro&idCuadro=CP150&locale=es>

In these uncertain times, it is very important to apply the best mathematical models to carry out the appropriate analyzes that offer us the necessary information to make business decisions related, among others, to investment, opportunity costs, market share, sales forecasts, plans business, business valuation or risk assessment.

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