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Sticky Costs and Expenses are not Alike: Mexican Reality

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Abstract

The purpose of this paper is to further the discussion between the sticky costs and expenses effects. For this reason, it is important to highlight their differences; a cost represents an investment on an asset to be sold, while expenses are assets to consume. Therefore, sticky costs and expenses must be measured and analyzed separately and differently. Business leaders must understand that costs and expenses will not mirror each other, nor will they mirror income changes. This is in addition to the stickiness effects that represent the management's inability to effectively reduce the expenses, potentially endangering the firms' financial health. Furthermore, stickiness rates are significantly more pronounced in income decrease years as compared to income increase years. This is especially risky for administrators during a financial crisis. It is important to note that correctly managing sticky costs and expenses is contingent on businesses remaining competitive. Our multivariable analysis, with a 17-year database, encompasses 60 issuers; it was used to analyze cost and expense stickiness within industrial and publicly traded corporations in Mexico. Understanding the cost-stickiness theory will enable corporations to adequately manage their operations.

Keywords: cost stickiness, expense stickiness, financial vulnerability, financial crises, income increase, and income decrease.

I. INTRODUCTION

1.1. The Significant Differences between Sticky Costs and Expenses

Costs represent investments on assets that will be sold, even when value will be added. These assets will not be consumed until sold. Expenses, on the other hand, are assets to be consumed. Expenses are required to provide the needed substructure to efficiently operate the enterprise (White et al., 2003).

When a company's income goes up, its costs and/or expenses may advantageously grow at a lower rate; however, when income falls below the forecasted expectations, it is possible that the costs and expenses would not be reduced at the same rate, because of the excess assets acquired (Aboody et al., 2018), or because of

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previously acquired commitments (Balakrishnan et al., 2014). In fact, this is the real base of stickiness - a situation that might turn into a cash flow problem (Hilary et al., 2016). Yet, it is also important to note that in extreme circumstances, it can lead to the company's bankruptcy (Altman, 1984). Business leaders must understand that costs and expenses will not mirror each other, nor will they always reflect income changes. This reality endangers a firm's financial well-being which depicts the importance of understanding the implications of the differences between sticky costs and expenses inside any business organization. Furthermore, it is also crucial to pinpoint how this manifest in terms of their competitiveness.

Cattaneo and Bassani (2020) conducted a recent literature review, analyzing a final sample of 60 papers and concluded that the sticky costs are a global phenomenon that intersect countries and increase during macro-economic crisis. According to theses authors, costs could be classified as sticky, anti-sticky, and/or super sticky.

1.2. Scope of Problem

The real problem arises when income is lower than forecasted and the expense substructure is significantly larger that needed, without an efficient financial solution to resolve it. This particular error is extremely chaotic as cutting expenses reduces the capacity of the support departments (Balakrishnan & Gruca, 2010). Thus, the situation can potentially become a negative net income and negative cash flow situation. Due to this potential situation, managers are often misled and can come to the conclusion that the out-payments are fixed; not realizing that this only happens for a certain level of activity. As activity levels increase the so the called "fixed payments" increase also. Annex 1 presents the GDP Growth Rate (history and their relationship with the costs systems).

1.3. Research Purposes

Considering the importance of adequately managing costs and expenses, especially in times of high volatility, and considering that literature has done little to differentiate the respective behavior between sticky costs and sticky expenses studies (Cattaneo & Bassani, 2020), the purpose of this research is to verify whether or not the behavior of the sticky costs and the sticky expenses of Mexican corporations are the same during both income increasing and income decreasing years.

1.4. Benefits of this Research

The study of cost and expense stickiness is relevant to the present research because it must be controlled in order to create a competitive edge; especially during the present challenging, competitive, and dynamic status quo (Pamplona et al., 2016). In particular, Mexican companies are vulnerable to the stickiness effect because of their potential negative financial impact. Yet, a crisis is an anomaly that does not behave as a normal distribution because it is a manmade circumstance. "In the upper and lower ends of the distribution (, there) would be many more outlying events than statisticians … would have imagined (Gladwell, 2009, p. 72)". For this reason, an economic crisis has effects on local corporations (Milesi-Ferretti & Tille, 2011). An example would be the 2007-2009 financial crises which rapidly reached most of the world due to financial interconnectivity (Reinhart & Rogoff, 2008).

The renegotiation of The North American free trade agreement (NAFTA) is another source of Mexican vulnerability due to Mexico's dependency on the American market; a circumstance which eventually might become a crisis because at this time, approximately 80% of the Mexican exports go to the United States. This eventuality could come back in the form of trade barriers; unfair competition; lost investment

opportunities, protection and enforcement of intellectual property rights, and procedures for the resolution of commercial disputes (Ray et al., 2004; Porter, 2011).

Besides the circumstances within local communities in Mexico, vulnerability is based on potential currency devaluations; resulting from financial crisis, which would raise stickiness factor due to the assets value increase since devaluations increase the value of the expensed substructure. Moreover, the rupture, from traditional trade policy, "could affect businesses and consumers worldwide" allowing the U.S. "to renegotiate or pull back from multinational trade agreements and seek bilateral trade deals" (Paletta & Swanson, 2017, p. 1), by arguing a disadvantage. Furthermore, other vulnerability sources are: 1) Brexit's uncertain effect; 2) China threatening not to refinance American's financial deficit if the commercial war continues; and 3) lower tax rates are an incentive to invest in the U.S. rather than in Canada and México. These circumstances alter the medium- and long-term perspectives of the Mexican economy. Corporations will reevaluate their competitive strategy and verify that their perspective is in balance with their substructure and cost/expense structure. This would be the case because managers look at medium- and long-term perspectives too; especially at publicly traded companies; otherwise, their shares would be downgraded (Stímolo & Luquez, 2015). In this sense, other Mexican vulnerability is the substructure that describes the relevance of the stickiness effect. According to Oppenheimer (2018), half of the current jobs will disappear within the next 20 years due to technological advances, and if México does not develop its substructure serving capabilities, it will represent new sticky expense source.

II. LITERATURE REVIEW

2.1. Sticky Cost Literature

Articles about sticky costs can be abundantly found in specialized literature. Among the most cited papers are the works of Anderson et al. (2003), Banker et al. (2016), Subramaniam and Watson (2016), and Cohen et al. (2017). Cost stickiness became defined as the "asymmetric response of costs to a sales variation (both positive and negative)". This comparison is a widely documented phenomenon within the available research (Anderson et al., 2003, p. 49). In other words, this analysis offered a different perspective by demonstrating that costs do not change as income does.

Recently, Ibrahim and Ezat (2017) indicated that asymmetric cost behavior is common among Egyptian-listed firms as their selling, general, and administrative cost (SG&A), cost of goods sold (CGS), and total costs (TC) were found to be sticky during the study period. Han et al. (2019), proposed that cost stickiness is influenced by management's strategic choices. When management is optimistic about future performance it tends to increase the stickiness cost. Fourati et al. (2020) provided notable evidence of the existence of cost stickiness and conditional conservatism in the international context. They conclude that the association between cost stickiness and accounting conservatism changes across country groups and industries.

Calleja et al. (2006), is using a different international sample, corroborated Anderson's findings. Since the obtained results were different from Anderson's, it was concluded that such a difference resulted from differences in corporate governance systems and managerial supervision styles. Moreover, the authors were able to deduce that total operating costs are sticky. Yet, costs are less sticky over longer terms and stickier with severe income decreases. Cannon (2014) states that in the airline industry, costs decrease at a slower rate than at the rate they increase. This is because management retains unused capacity in anticipation of future demand resurgence,

signaling a low offer to travelers. However, this adds capacity as demand surges. For the author, sticky costs are associated with price and capacity changes (lowering prices to push unused capacity). Sticky costs increase when adding capacity, as demand grows at a greater rate. The opposite is true when reducing capacity because demand shrinks.

Dalla-Via and Perego (2014) included in their sample small and medium sized corporations that describe cost stickiness in regard to labor costs. Yet, they failed to account for other costs like the cost of goods sold, expenses, and operating costs. Venieris et al. (2015), differentiates between good and bad stickiness. The bad stickiness relates to necessary investments required to grow and compete, including agency costs or hiring "agents" to act on the company's behalf. Good stickiness relates to optimal resource planning. Companies with a high organizational capital exhibit cost stickiness. Comparatively speaking, there are other organizations with lower capital that do not show such behavior. Subramaniam and Watson (2016), investigated whether the determinants of sticky cost behavior vary by industry. Their results suggest that costs in the manufacturing industry are the stickiest, while costs in the marketing industry are less sticky, and the financial and service industries show some level of rigid cost behavior.

Finally, in the 21st century, analyses of sticky costs offered a different insight because of their ability to prove that costs do not change as income does (Anderson et al., 2003).

2.2. Sticky Expenses Literature

Articles about sticky expenses are extremely limited in specialized literature. These articles include: Venieris et al. (2015), which considers that corporations with a higher ratio of intangible assets would be more willing to carry the stickiness effect than those with a lower ratio. This circumstance is based on their high expectations about the future. A potentially higher perspective about the future income will allow the company to "recover" from what was expensed but unutilized, an intangible investment, during income increase years.

Anderson et al. (2003) was the first to openly question the assumption that income and expenses behave in a symmetrical fashion. This research proved that this is not the case. In fact, they were successful in quantifying the slopes of expenses during income increase and income decrease years; thus, proving that expenses grow less than income during income increase years. Yet, during income decrease years, expenses can be cut less than the income decrease years (this is what constitutes cost stickiness).

Balakrishnan et al. (2004) adds that the magnitude of change is influenced by the proportionality of the response; in other words, the stickiness disappears if the magnitude of the changes in activity is long, which is defined as greater than 3%.

Marudas et al. (2016), studied nonprofit organizations (NPOs), focusing on fundraising and administrative expenses. This research pinpoints that in some ways the fundraising and administrative expenses are equivalent to selling, general, and administrative (SG&A) expenses of companies. In their opinion, NPO's expenses are stickier than the SG&A expenses of companies.

Lastly, Jamkarani and Banafi (2017), suggest that there is a relationship between the economic value added (EVA), market value added (MVA), and the expense stickiness; the higher the EVA and MVA, the larger the stickiness.

However, literature is not as readily available in terms of sticky-expenses, and practically non-existent in terms of analyses that encompass the differences between

sticky costs and expenses. Presenting such well-developed research on this topic is crucial since it is vital to know the difference between such concepts.

2.3. Differences between Stickiness of Cost and Expenses

Accounting literature does elaborate on the differences between costs and expenses. In general, outflows are labeled as expenses and include the delivery and production of goods or services and performing all of the necessary operations (White et al., 2003). This situation is an issue because this description never actually describes what an outflow is. From this definition, costs and expenses have similar outflows which are necessary for operational business.

Direct costs are associated with products, departments, and projects, such as raw materials, direct labor, and packaging, among others. Costs include acquired assets to be sold, or those assets that add value to the products to be sold. Therefore, costs are mainly associated with the manufacture or service levels and include both variable, or direct, and semi-fixed inputs. Costs increase, decrease, or are maintained relative to sales, but their effect is financially noticed during the selling/consumption time. Its effect is not permanent; even though it might include the temporary effect of the carried inventory (White et al., 2003).

On the other hand, expenses are acquired assets or services that are not for sale and began to be consumed totally or partially immediately after its purchase (White et al., 2003). Because of this, their acquisition and behavior is completely different from that of costs. Costs can be portrayed as a line increasing at the same rate through time and volume (unitary cost * volume), generating a graph that resembles a "traditional pyramid". On the other hand, expenses behave as a "step pyramid": where each step represents a different level of production. For these reasons, a detailed understanding of costs and expenses is required to adequately and competitively manage these concepts and price both products and services sold. This understanding is also useful for calculating the indirect cost rate, or overhead, to allot expenses among departments or programs. In an attempt to better understand cost stickiness, the research differentiates costs from expenses, due to its nature and operational use. This is true even though the relevant literature considers both as one in the same and calls their combined effects "cost stickiness".

2.4. Review of Stickiness Literature in Mexico

Currently, there is not much information about the history of Mexican industrial sticky costs. However, the article had access to a 12-year (2002-2013) study of the 50 largest Brazilian, Chilean, and Mexican publicly traded corporations (Pamplona et al., 2016). The researchers performed various steps: 1) a qualitative and quantitative analysis of the companies; 2) an analysis of the total costs to net sales ratio; 3) confirmed the sticky cost behavior; and 4) an analysis of the macroeconomic factors, inflation and GDP growth rates, that determined a cost's asymmetric behavior relative to income changes.

The relevant findings were the total cost to net sales ratio, the notion that each country's macroeconomic factors caused different cost stickiness rates, the asymmetry of stickiness, as described by the previously mentioned paper, and the fact that the relation varies depending on income increase and decrease years.

2.5. Framework and Hypotheses

First, considering the asymmetric and theoretical sticky cost literature reviewed, the first research question would be: are the effects of the sticky cost presented in the

Mexican companies selected both in years with an upward income and in the years with downward income?

The paper offers the following hypotheses:

$H_{A.1}$: costs of goods sold present smaller variations than the income's variations during income increase years.

$H_{A.2}$: costs of goods sold present smaller variations than the income's variations during income decrease years.

A detailed understanding of the costs that is obtained separately from the expenses, is required. Considering the Mexican market situation, the next questions arise: are there sticky effects on the expenses in both years with upward income and years with downward income?

For this research question, (theoretically speaking, cost stickiness conceptualizes the effect on administrating, general, selling, and transportation expenses due to income changes), the article identified the following hypothesis:

$H_{B.1}$: the expenses have smaller variations than sales variations in income increase years.

$H_{B.2}$: the expenses have smaller variations than sales variations in income decrease years.

This means that: 1) when income increases expenses follow (Bradbury & Scott, 2018); 2) when income decreases, expenses grow at a lower rate or decrease but are not totally offset (Bradbury & Scott, 2018), in these cases, both Anderson et al. (2003) and Calleja et al. (2005) concur that this phenomena leaves businesses with a reduced flow of cash, a competitive edge, and a reduced or negative profit; and 3) when income dramatically decreases because of a regional or global crisis expenses actually decrease (Vela-Beltrán-del-Río & Reynoso, 2018).

Finally, to verify whether or not the behavior of the sticky costs and the sticky expenses of Mexican corporations are the same or are different during both income increase and income decrease years, and to study this phenomenon, the research paper elaborated the next couple of hypotheses:

$H_{C.1}$: the sticky costs (cost of goods sold) behave differently in income increase years than in income de decrease years.

$H_{C.2}$: the sticky expenses behave differently in income increase years than in income de decrease years.

III. RESEARCH SAMPLE AND METHODOLOGY

3.1. Outliers and How the Missing Data was Treated

The annual financial information not reported by the selected companies was given the "missing data" treatment, as theoretically allowed, without statistically estimating them because for the first database analysis, according to the Grubbs' Test methodology, the paper discovered that some of the numbers were outliers. In terms of financial indicators, the unusually large values in the denominator make financial ratios tend to zero and vice versa, the small denominators, make the indicators tend to infinity (Lev & Sunder, 1979; Frecka & Hopwood, 1983). This is why financial analysts use some robust transformation as indicated (Osborne & Overbay, 2004).

In order to correct the outlier effect of the sample, Barnes (1987) proposed trimming the remote data by switching the outlier for other nearby data. However, the research present will use the criteria established by Cihák and Hesse (2010) who recommend the exclusion of any data outside of the 1st and 99th percentile distribution. Taking all of this into consideration we chose to use the following annual variables to identify and eliminate outliers: assets variation, income variation, costs of goods sold

variation, and expenses variation. The 1st and 99th percentiles identified limits to refine data set and are included in Table 1.

Table 1
Median and Extreme Annual Variation Limits to Identify Outliers

Indicator	Assets Variation	Income Variation	Costs Variation	Expenses Variation
Median	1.073	1.098	1.098	1.086
Percentile 99%	1.759	1.875	2.019	2.051
Percentile 1%	0.738	0.645	0.506	0.467

Source: authors.

Following the criteria established by Cihák and Hesse (2010), the research paper excluded the outliers outside the 1st and 99th distribution percentiles; 58 (5.74%) of the 1010 were eliminated, leaving the sample with n= 952 useful data entries. The list of the 60 used issuers, number of data entries, and their business sector are presented in Annex A1. For now, the companies' situations are what produced the outliers' cases, as can be reviewed in Annex A2.

3.2. Definitions of Operational Variables

The selected variables from the financial reported database were year, issuer, total assets (assets), income (income); cost of goods sold (cost of goods sold or cost); expenses (selling and administrative); and the issuer's operational sector. The analysis required following calculations: equations (1) to (7), from the original obtained database (where t is the annual required date).

$$\text{Income variation}_t = \text{Income}_t / \text{Income}_{t-1} \dots\dots\dots\dots\dots\dots \quad (1)$$
$$\text{Cost variation}_t = \text{Cost}_t / \text{Cost}_{t-1} \dots\dots\dots\dots\dots\dots\dots\dots \quad (2)$$
$$\text{Expenses variation}_t = \text{Expenses}_t / \text{Expenses}_{t-1} \dots\dots\dots\dots \quad (3)$$
$$\text{Sticky cost to} = \text{Cost Variation}_t / \text{Income Variation}_t \dots\dots\dots \quad (4)$$
$$\text{Sticky expenses}_t = \text{Expenses Variation}_t / \text{Income variation}_t \dots\dots \quad (5)$$
$$\text{Income trend}_t \text{ (dummy var.)} = 1, \text{ during income increase years} \dots\dots \quad (6)$$
$$\text{Income trend}_t \text{ (dummy var.)} = 0, \text{ during income decrease years} \dots\dots \quad (7)$$

The formulas (1), (2), and (3) selected to calculate the income, cost of goods sold, and expenses variations, respectively, are established in relative terms, in order to avoid working with negative values. Interpretations of stickiness variation: 1) when the Sticky factor is greater than 1, during income decrease years, it means that cost of goods sold and/or expenses decreased less than income did (for example, if income decreases 10%, the income variation$_t$= 0.90, and cost of goods sold decrease 5%, cost variation$_t$= 0.95, the cost of goods sold sticky factor$_t$= 0.95/0.90= 1.06). In other words, the cost of goods sold and or expenses cannot be reduced as much as income falls, therefore potentially reducing net income because the expenses, for instance, are excessive for the new and reduced income level. On the other hand, during income increase years, when the Sticky factor is smaller than 1, it means that cost of goods sold and/or expenses increased less than income did (for example, if income increases 10%, the income variation$_t$= 1.10, and the cost of goods sold increased 5%, cost variation$_t$= 1.05, the cost of goods sold sticky factor$_t$= 1.05/1.10= 0.95). In other words, the cost of goods sold and/or expenses increased less than income did, meaning for instance that expenses are insufficient for the new and increased income level. With the gathered information, this research paper additionally calculated the following financial ratios: income/assets and expenses/income.

IV. EMPIRICAL RESULTS

4.1. Sampler Financial Rates

From the financial perspective (Besley & Brigham, 2016), the most representative ratios of the Mexican companies related to their financial statements are: 1) an income to assets ratio (income/assets) of 0.828, which means that each asset investment peso produced less than a peso worth of sales. Furthermore, corporations could have a larger than needed substructure which produces stickiness in income decrease years. The international ratio (Macrotrends, 2018) is 0.703; proving that the Mexican ratio is a little larger. 2) An asset profitability rate (net income/assets) of 8.3%. This percentage also proves positive versus the international standard of 5.65%. Finally, 3) a sales profitability rate (net income/sales) of 12.4%, means that each peso sold yielded over a 12% return. This yield is very attractive, relative to the international standards of 8.03%.

4.2. Descriptive Costs and Expenses Analysis

During the research period, the average annual income grew 10.1%, cost grew 10.3%, and the expenses grew 9.2%. The summary of the eighteen-year financial information of 60 Mexican issuers (N= 952) is presented in Table 2.

Table 2

Mean, SEMean, Standard Deviation, and Min/Max of the Annual Variables and Financial Ratios of the 60 Issuer Dample (N= 952)

Variable	Mean	SEMean	StDev	Min	Max
Income variation	1.101	0.005	0.140	0.646	1.769
Cost of goods sold variation	1.103	0.005	0.147	0.529	1.831
Expense variation	1.092	0.005	0.152	0.557	1.982
Sticky cost factor	1.004	0.002	0.068	0.725	1.632
Sticky expenses factor	0.998	0.004	0.121	0.562	1.742
Income trend (1= gain, 0= loss)	0.829	0.012	0.377	0	1
Financial ratios:					
Income/Assets	0.828	0.015	0.467	0.105	2.789
Expenses/Income	0.217	0.004	0.131	0.004	0.755

Source: authors.

As previously mentioned, the way in which the formulas (1), (2), and (3) are structured, makes it impossible for the sticky cost and sticky expense factor formulas, (4) and (5), to produce negative values. Additionally, in relation to statistical information, regarding the variability of these distributions, the incremented rates have similar standard deviations (from 14.0% to 15.2%). It is also observed from the behavior of the dummy variable, that in 82.9% of the analyzed cases, the companies experienced an annual income increase; while 17.1% of the time the companies presented income decreases. Annex A3 presents the variables' histograms.

Moreover, from the Kurtosis statistical analysis, we obtained the following values: K (sticky cost of goods sold) = 21.34; and K (sticky expenses) = 4.72; these values suggest an important concentration of the sample over its core values, since the results present values higher than 3, which mean these variables have a "sharply peaked data" distribution (while the normal distribution has a K= 0).

The research paper also compares the relevance of cost and expense statistics in order to determine which variable carries a larger stickiness effect. With respect to the sticky cost (cost of goods sold) variable distribution, there is an average confidence interval (P-value= 0.05) between (0.999 and 1.008). On the other hand, the sticky

expense variable has an average confidence interval (P-value= 0.05) between (0.990 and 1.006). There was not enough conclusive statistical evidence to determine that the means of these two indexes are statistically different (P-value= 0.197). Yet, the results of the standard deviations resulted in a distinctive comparison (P-value < 0.001). The sticky cost variable has a standard deviation confidence interval (P-value= 0.05) between (0.058 and 0.079). This interval is smaller than the sticky expense variable standard deviation, which results in a confidence interval (P-value=0.05) between (0.111 and 0.132).

Finally, Table 3 describes the basic statistics for the income, cost of goods sold, and expenses variations at different income trend values (1= income increase years, and 0= income decrease years).

Table 3
Descriptive Basic Statistics for Income, Cost of Goods Sold, and Expenses Variation

Income Trend	Variable Variation	N	Mean	Equivalent (%)	SE Mean	CI at 95%
1	Income		1.140	+14.0	0.004	1.132 to 1.148
	Cost	789	1.141	+14.1	0.004	1.132 to 1.149
	Expense		1.116	+11.6	0.005	1.106 to 1.126
0	Income		0.909	-9.1	0.006	0.896 to 0.921
	Cost	163	0.923	-7.7	0.009	0.907 to 0.940
	Expense		0.977	-2.3	0.011	0.957 to 0.998

Source: authors.

From the previous table, it is important to highlight the following: Table 3 shows that during income increase years (income increase trend= 1), the average income increase variation (+14.0%) is larger than the average expenses variation (+11.6%). During income decrease years (income decrease trend= 0), a similar situation happens, income is reduced in a larger proportion (-9.1%) than the expenses decrease (-2.3%). This finding corroborates the international understanding of the sticky expense behavior and public corporations operating in México, during the analyzed period, are not an expectation.

4.3. The Correlation Matrix

The following correlation matrix is showing the relationship (correlation coefficients) between the selected sets of variables and some interesting facts are presented in Table 4.

Table 4
Correlation Matrix

#	Variable	1	2	3	4
1	**Income Variation**				
2	**Cost Variation**	0.869 0.000			
3	**Expenses Variation**	0.578 0.000	0.435 0.000		
4	**Sticky Cost**	-0.150 0.000	0.349 0.000	-0.220 0.000	
5	**Sticky Expenses**	-0.370 0.000	-0.402 0.000	0.530 0.000	-0.097 0.003

Source: authors (Pearson correlation in the upper values and P-value in lower values).

Theoretically speaking, a correlation is significant if the P-value is below 0.05 and it is strong if r value is greater than 0.7, moderate if it is between 0.69 and 0.5, and weak when is less than 0.5 (Nieves & Dominguez, 2010). Because of this theoretical framework, the cost to income correlation r= 0.869 (P-value < 0.001) is significant, positive, and strong; the expense to income correlation r= 0.578 (P-value < 0.001) is significant, positive, and moderate. With respect to the correlation between income and sticky cost (cost of goods sold) r= -0.15 (P-value < 0.001) and between income and sticky expense r= -0.37 (P-value < 0.001). Both are significant, weak, but depict a negative relationship; it is apparently a logical outcome based on the theoretical equations (4) and (5). This is because if the denominator of the ratio is increased (when there is an income increase), then the sticky cost value is reduced.

4.4. Testing of the Hypotheses

Proving the hypotheses is equivalent to:

For income increase years,

$H_{A.1}$: cost variation mean $\leq$ income variation mean, when income trend$_t$= 1.

$H_{B.1}$: expenses variation mean $\leq$ income variation mean, when income trend$_t$= 1.

For Income decrease years,

$H_{A.2}$: cost variation mean $\geq$ income variation mean, when income trend$_t$= 0.

$H_{B.2}$: expenses variation mean $\geq$ income variation mean, when income trend$_t$= 0.

In relation to the first hypothesis, $H_{A.1}$, there is not enough evidence to conclude that the income variation mean (1.140) is statically larger than the cost variation (1.141) (at P-value= 0.521), during income increase trend years (t= 1). In relation to the second hypothesis, $H_{A.2}$, there is neither enough evidence to conclude that the income variation mean (0.909) is statistically smaller than cost variation (0.923) (at P-value= 0.081), during the income decrease trend years (t= 0). The following cost variations are presented in Figure 2.

Figure 2

**Scatter Plot of Cost Variation vs. Income Variation**
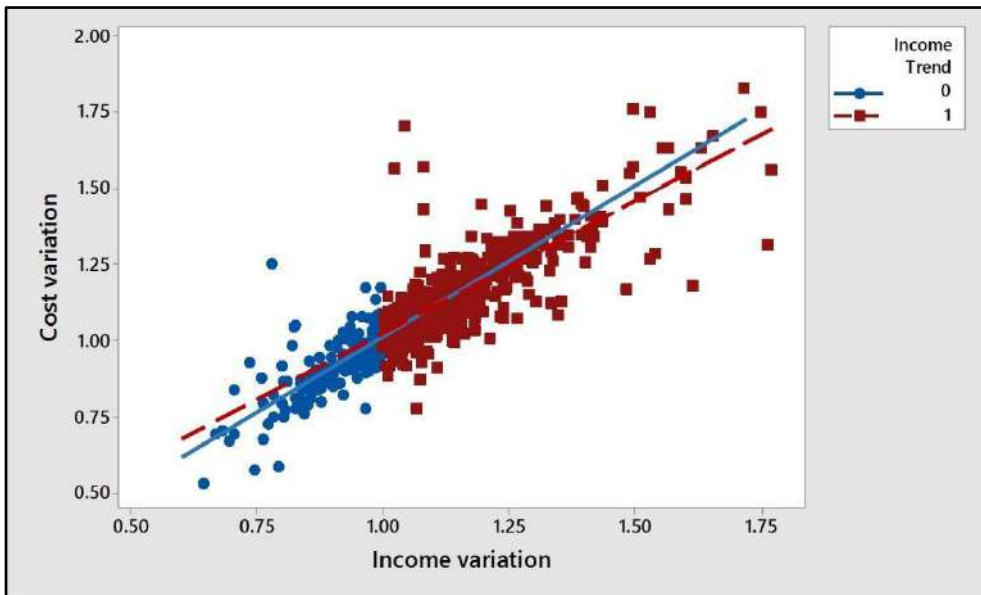
Source: authors.

In relation to the third hypothesis, $H_{B.1}$, it can be reasoned that the income variation mean (1.141) is statistically larger than the average expenses variation (1.116) at the P-value < 0.001 of significance, during the income increase trend years (t= 1). This is the confirmation that the sticky cost effect exists, for the analyzed companies, during the income increase trend years.

In relation to the $H_{B.2}$ hypothesis, income variation mean (0.909, or -9.1% variation equivalent) is larger than the expenses variation (0.977, or -2.3% variation equivalent) at the P-value < 0.001 of significance during the income decrease trend years (t= 0). In other words, expenses decreased less than income did. This is the research confirmation that the sticky expenses effect exists during the income decrease trend years. The following expense variations are presented in Figure 3.

Figure 3
Scatter Plot of Expenses Variation vs. Income Variation
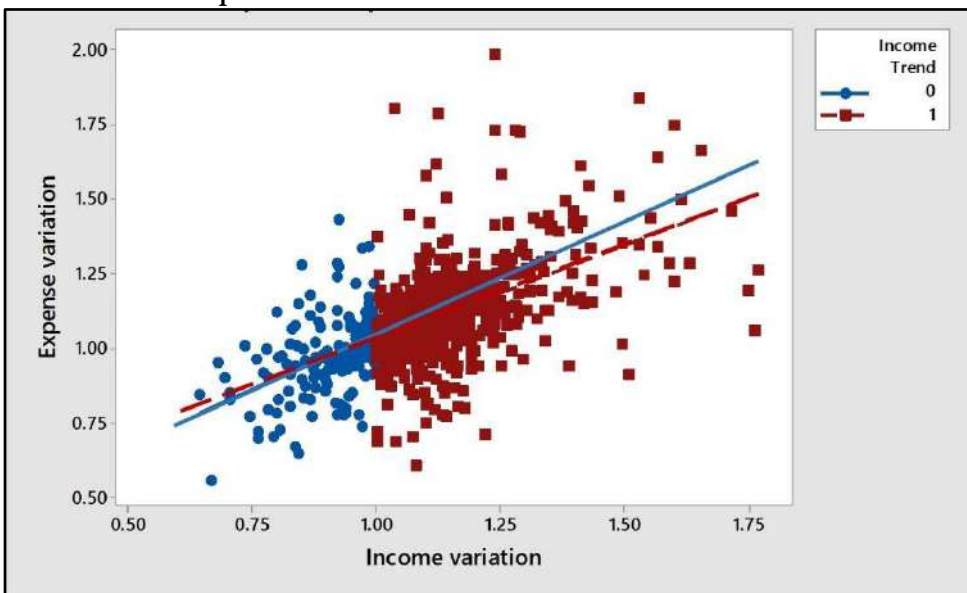
Source: authors.

Proving the last two hypotheses is equivalent to:

$H_{C.1}$: sticky cost mean (when income trend t= 1) ≠ sticky cost mean (when income trend t= 0) and $H_{C.2}$: sticky expenses mean (when income trend t= 1) ≠ sticky expenses mean (when income trend t= 0). Table 5 portrays the basic descriptive statistics for sticky cost and sticky expense at both income increase and decrease trend years (1= increase years, and 0= decrease years).

Table 5
Basic Descriptive Statistics for Sticky Cost and Sticky Prime Cost

Income Trend	Variable	N	Mean	Variation Equivalent (%)	SE Mean	CI at 95%
1	**Sticky Cost**	789	1.001	+0.10	0.002	0.997 to 1.006
0		163	1.016	+1.60	0.007	1.003 to 1.030
1	**Sticky Expenses**	789	0.981	-1.90	0.004	0.974 to 0.989
0		163	1.079	+7.90	0.011	1.057 to 1.100

Source: authors.

These variables are larger (1.016 and 1.079) during income decrease years (Trend= 0) than during income increase years (1.001 and 0.981) (Trend= 1); meaning that during income decrease years, costs and expenses decrease slower than income which is a very dangerous situation for the financial health of corporations and the administrators must be aware of it. From our researcher's perspective, this demonstrates that the stickiness rate of cost of goods sold and expenses changes depending on whether there is an income increase or income decrease year. In other words, this effect is more dangerous during income decrease years.

To prove the hypothesis $H_{C.1}$, the research analysis concluded that the means of sticky cost (1.016) during income decrease years (t= 0) and (1.001) during increase years (t= 1), are statistically different (at P-value= 0.041). To prove the hypothesis $H_{C.2}$, the research paper's analysis concluded that the means of sticky expenses (1.079) during income decrease years (t= 0) and (0.981) during income increase years (t= 1), are statically different (at P-value < 0.001) as well.

The hypothesis' test result indicates that sticky costs and the sticky expenses do not behave the same in the income increase years as compared to income decrease years. It seems that Mexican companies' expense and cost variations in income increase years practically mirror the income variation. Yet, this would not be the case in the years of a crisis.

4.5. Discussion

From the established hypotheses about stickiness behavior, it can be inferred that in the long term, sticky expenses are part of the Mexican reality. These results coincide with the international theory (Anderson et al., 2003; Calleja et al., 2005; and Balakrishnan & Gruca, 2010). In income increase years (t= 1), the income variation (1.141) is statistically larger than the variation of expenses (1,116). Yet, in income decrease years the income decrease (0.909) is statistically larger than the expenses' decrease (0.977). The research has stated that it was unable to verify the hypothesis related to the cost of goods sold (sticky cost) because the variation does not statistically behave as the income variations do.

Moreover, the paper found that the correlation between costs to income is significant, positive, and strong. However, the correlation between expenses to income is significant, positive, but moderate. This means that; in general, administrators react quickly to income variations within their cost and expenditure policies (when income increases management raises expenses, and when income decreases management lowers expenses). This seems to coincide with the variable costs theory (Chen & Koebel, 2017). However, the same theory considers that income and expenses should be considered as independent.

Anderson et al. (2003), had already detected that income and costs do not have a symmetrical performance, and under normal conditions expenses grow less than income. Yet, during income decrease years expenses diminish less than income. However, Also, Calleja et al. (2005), discovered that costs in extreme situations (income decreasing years) cannot be reduced at the same income rate.

V. CONCLUSION, IMPLICATION, LIMITATION AND FURTHER RESEARCH

5.1. Conclusion

Businesses' driving force (the enormous social change seen in recent decades) is forcing organizations to review their accounting and financial business paradigms. In

the last 80 years the American GDP has increased 180 times, but business operations and the financial reporting system have not been updated as required. On the other hand, the current international volatility, including the Mexican one, suggests that companies will experience abrupt income increases and decreases, as well as costs and expenses variations; for these reasons, the analysis of sticky cost and expenses is extremely relevant for managers managing such tremendous output.

This trail of thought suggests the following questions: is the behavior of the sticky cost different from sticky expense behavior? Do both of these concepts have different behaviors during income increases or decreases years, in México?

With respect to the correlations found between income to sticky cost (r= -0.15) and income to sticky expenses (r= -0.37), the paper's analysis observed a negative, significant relationship. This result was to be expected because if income is lowered, costs and expenses will not be lowering at the same income rate; this is especially true in regard to expenses. This same situation could have escalated because under extreme circumstances it could have led to additional risk to the company. On the other hand, during income increase years, given an unusual income increase, costs, and expenses will not be increasing as fast as income, which makes this indicator a perverse and deceitful concept.

In relation to the cost vs. expense difference, the study described its main differences and how each behaves. Costs tend represent assets to sell while expenses are assets for internal consumption.

5.2. Implication

We found that stickiness rates are significantly larger during income decrease years. This scenario is very dangerous for management. The paper confirmed the respective assumptions about the stickiness factor. Additionally, the paper's research proved that the sticky cost standard deviation is smaller than the sticky expense standard deviation. This means that managers could have greater control over costs variations than over the expenses variation (yet, these cost and expense variations could concur).

5.3. Limitation and Further Research

A limitation of this paper is that we do not separate the medium and long terms. One potential possibility could be to separate companies buying additional substructure. This additional resource alters the costs and expense structures and will translate into additional sources of costs' and expenses' stickiness. Another potential limitation is that we failed to consider companies would acquire the required substructure through leases, instead of buying or temporarily hiring labor. This situation could result in a significant reduction of the assets acquired; thus, this translates into a cost and expense reduction relative to acquiring assets and resources and therefore the exposure to an excessive and potentially unneeded substructure. All of which lead to lowering the potential stickiness levels. As a result, a larger than needed substructure, that must be expensed, during lower than anticipated income years is the base of stickiness for costs and expenses.

For further research and studies, we believe that it is necessary to create papers that could review the relationship between stickiness and the quality of a companies' assets. This because it is possible that management is not negligent or tardy in its actions to correct cost and expense stickiness.

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Annex 1. The GDP Growth Rate and Analysis Throughout Recent History

The American gross domestic product (GDP) for 1940 was $102.9 and at the end of 2017 it was $19,390.6 billion dollars. This meteoric growth was based on the social changes between the 1950s and the 1990s that did not allow for mistakes or misunderstandings in managing either costs or expenses. Inflation was critically low during this period of time. The American GDP is portrayed in Figure 1.

Figure 1
GDP in Billions of Current Dollars (Annual Value)
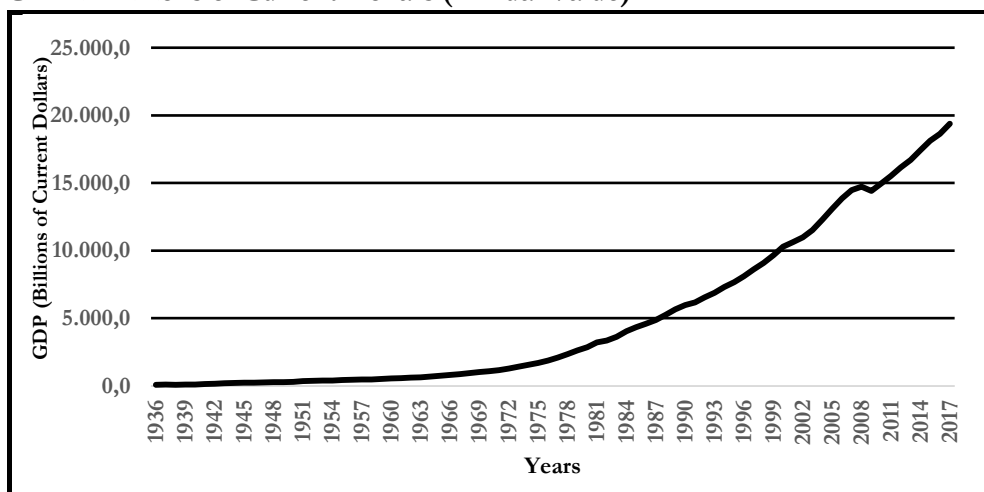
Source**:** Bureau of economic analysis (2019).

During the 80's and 90's, management realized that traditional cost systems were not appropriate for the challenge of managing extreme GDP growth. This is especially true for those that used volume-driven cost allocation systems that do not offer a whole, detailed picture when compared to assets/resources not related to the volume of production (Cooper & Kaplan, 1992). The variable vs. fixed cost approach was not appropriate either because the allocation criteria can be subjective as it is prone to vary since production and technology changes become increasingly commonplace. This explains why management developed systems, which described expense drivers, since many of the organization's expenses are not linked to production levels (Pamplona et al., 2016). Additionally, Activity Based Cost Systems (ABCs) calculated the cost of the resources used, including output and other processes, which provided the cost of idle capacity (Cooper & Kaplan, 1992), linking costs and expenses to products and processes. However, an additional problem arises when forecasts are not accurate and available. This introduces an additional risk to the primary business (Raman et al.,

1994). This is especially true in underdeveloped countries because of the lack of resources and financial opportunities there.

On the other hand, when production and competition have grown exponentially, financial accounting and analysis does not depict the true nature of selling and administrative expenses. This leads to inadequate decisions being made (Cooper & Kaplan, 1992). In fact, excess demand can sometimes be met in short term with additional outflow allocation that takes the form of additional resources that expedite the reaction time and/or the output offered (Chopra & Sodhi, 2004).