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RESEARCH ARTICLE



THE PHASES OF COVID-19 CRISIS MANAGEMENT BY THE DIRECTORATES OF COMMERCE IN ALGERIA AND ITS EFFECT ON THE CONSUMER BEHAVIOR

SABRI MEKIMAH*

Abstract *This study aims to identify the effect the phases of Covid-19 crisis management by the directorates of commerce in Algeria on the consumer behavior, whereby the descriptive analytical approach has been relied with the use of the form as a main tool for data collection which was distributed to a sample of consumers of 1537 persons. An electronic questionnaire was distributed to them, 1356 analyzable forms were retrieved, with a response rate estimated at 88.22%, to test the study hypotheses, the SPSS statistical program was used, which includes a set of statistical methods to analyze the answers and test the study hypotheses. We reached significant results indicating that the influence of the Covid 19 crisis management by commerce directorates on the Algerian consumer behavior is average. Where 52.7% of the changes in the level of consumer behavior are caused by the change in the level of control of the stages of Covid 19 crisis management, this requires that the Algerian trade directorates to pay more attention to the strict application of the Covid 19 crisis management phases.*

Keywords: *Crisis Management, Covid-19 Crisis, Consumer Behavior, The directorates of commerce*

JEL Classification: *H55, M38, I18*

1. INTRODUCTION

The world is now facing an unprecedented situation in terms of continuous challenges and rapid changes that lead to various crises of all types and their effects on countries economically and financially, and its abilities to cope and adapt to the prevailing conditions that may lead to unprecedented disasters.

Particularly, we find the Covid-19 crisis, as an unprecedented global pandemic in modern times, as it includes all the economic, social, psychological and geopolitical angles, it will also be the subject of research, studies and scientific symposiums for research centers and leaders of strategic thinking at the universal

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level, It particularly affects the economies of countries and their foreign and domestic trade.

Algeria is also one of the countries of the world that was afflicted by this pandemic, it directly and quickly affected its economy and its commercial activity, which will be affected negatively by the quarantine measures, likewise, this pandemic affects also unless , it is controlled and organized well,, this leads to the epidemic more and more. That is why the government is trying, through the Ministry of Commerce and its directorates spread across the country, to adopt scientific and practical ideas in crisis management. Considering the latter as decisions making body and setting the appropriate decision for every executive work, so that commerce directorates will be able to deal with this crisis that it is going through, under these environmental and health conditions, it must have well-defined strategies that help it to manage the crisis successfully. It is affected by numerous factors, which makes it an accurate topic that many researchers have dealt with in various fields. The consumer also has a behavior characterized by a lot of complexity, which led to the diversity of theories that knew it and the factors affected by it directly or indirectly. It is therefore considered one of the difficult, complex, and vital tasks that confront Algeria in general, as it did not receive a sufficient attention until late in comparison to studies related to the human behavior of the individual which needs a lot of development and study.

From the foregoing, the present study aims to reach to know the effect of the management of the Covid-19 crisis by the Directorate of Commerce in Algeria on consumer behavior, we can systematically present the problematic of the study as follows:

- To what extent do the phases of Covid-19 crisis management by the directorates of commerce in Algeria affect consumer behavior?
- To clarify the subject of the study more, we ask the following questions:
- To what extent does the avoidance phase of Covid-19 crisis by the commerce directorates affect the behavior of the Algerian consumer?
- To what extant does the preparation and the recognition of the existence phase of Covid 19 crisis by the commerce directorates affect the behavior of the Algerian consumer?
- To what extant does the containment and settlement phase of Covid 19 crisis by commerce directorates affect the behavior of the Algerian consumer?
- To what extant does the benefiting phase of Covid 19 crisis by commerce directorates affect the behavior of the Algerian consumer?

The importance of the study is that the concept of crises, particularly Covid 19 crisis, has become a widespread concept in our contemporary societies, but more complex in its application. As crises afflict a person with different demographic diversity, this requires the need for constant readiness to address them, due to the concern of the importance of the Algerian consumer behavior which is staying safe and sound.

The research aims to achieve the following objectives:

- The clarification of the most important concepts related to crisis management and consumer purchasing behavior.
- Highlight the effect of Covid 19 crisis management phases by commerce directorates on the Algerian consumer purchasing behavior.

There are many previous studies that are related to the subject of this research, especially studies that combine crisis management and consumer behavior, as well as studies that address the effects of the Covid crisis-19, the most important and most recent of the following studies:

- Study entitled: *Consumers behavior in crisis situations. Research on the effects of covid-19 in Romania.*

The article aims at analyzing the behavior of the Romanian consumer in the context of Covid 19 emergence, The performed research has highlighted the particularities of the emergence of this sanitary crisis at the local economy level. Although the Romanian population's infection degree has been more, advocate of traditional commerce, has been forced to appeal to modern trade methods based on online shopping, and provide the maintenance of the trade behavior. (stanciu & others, 2020)

- Study entitled: *The influence of crisis management on customer purchase intention, International conference on business sustainability and innovation.*

The purpose of this paper is to review about the influence of crisis management on customer purchase, The number of product-harm crisis in Malaysia in the present market is rising due to factors like the increasingly complex products, An organization should prepare with operative and effective crisis management and crisis communication plans that can support their execution of crisis management (Shaizatulaqma & others, 2019).

- Study entitled: *Evaluation of consumer purchasing behaviors in the covid-19 pandemic period in the context of Maslow's Hierarchy of needs.*

This study aims to analyze the purchasing behavior of consumers based on Maslow's hierarchy of needs theory, In the study firstly Maslow's theory of needs

hierarchy is given, then important researches and reports in the world and in turkey during the Covid 19 pandemic were mentioned (Erdal, 2020).

- Study entitled: *The Changing grocery shopping behavior of Chinese consumers at the outset of the covid-19 outbreak.*

This study aims on the embryonic stage of the covid-19 pandemic in china, this resulted in major disruptions to one of the most common market processes in retail, this study suggests avenues for further scholarly research and policy making related to the impact this behavior may be having around the world on society's more vulnerable groups, particularly the elderly (Junxiong & others, 2020).

- Study entitled: *Coronavirus crisis and its effects on the economy.*

This study aims to know the impact of the corona virus on the economy, the current economic turmoil turns to be more severe and lasting being aggravated by the epidemiological uncertainties, including technological shift varying the direction and volume of trade flows adjustments of structural proportions and relative prices (Buklemishev, 2020).

Through a review of these studies that dealt with the subject of our research, we find that they are diverse and inclusive for all aspects of the subject. So that it focused on both variables, however, this study differs from previous studies in that the current study studies the economic and commercial side of the implications of the Covid-19 crisis on consumer behavior and purchasing habits in Algeria, and the extent to which commerce directorates control the good implementation of the phases of crisis management.

Through study questions and previous studies, we can formulate the following hypotheses:

Main hypothesis:

- There is a statistically significant effect at the level of the 0.05 for the phases of managing Covid 19 crisis by commerce directorates on the behavior of the Algerian consumer.

Sub-hypotheses:

- There is a statistically significant effect at the level of the 0.05 for the phase of managing Covid 19 crisis by trade directorates on the behavior of the Algerian consumer.
- There is a statistically significant effect at the level of the 0.05 for the preparation and the recognition of the existence phase of Covid 19 crisis by commerce directorates affect the behavior of the Algerian consumer.

- There is a statistically significant effect at the level of the 0.05 the containment and settlement phase of Covid 19 crisis by commerce directorates affect the behavior of the Algerian consumer.
- There is a statistically significant effect at the level of the 0.05 for the benefiting phase of Covid 19 crisis by commerce directorates affect the behavior of the Algerian consumer.

The analytical descriptive approach was used through introducing the study variables from the theoretical point of view represented in each of the crisis management variable and consumer behavior. Whereas for the application side is used for the purpose of data collection, a form was designed and distributed to a sample of customers, in order to treat and test study hypotheses. The SPSS 20 program was used.

2. THEORETICAL BACKGROUND

The theoretical side deals with a general Introduction to crisis management and consumer buying behavior, we will address them through the following:

2.1. Introduction to crisis management

The crisis is an unusual situation that has a decisive impact on the course of normal affairs, as it is a turning point in unstable situations that can lead to undesirable outcomes if the parties concerned are unwilling or unable to contain them and ward off their dangers (Bieber, 1998, p. 25). So that the reason for its emergence was due to the external environmental factors represented by competitors, prevailing principles and values in addition to the internal environmental factors such as weak material, technological and human capabilities and lack of confidence (Umit & gungen, 2019, p. 67). It is characterized as a turning point in which the growing need for action increases in emergency circumstances, in which conditions of uncertainty, lack of information, time pressure and the need to make correct decisions prevail. It also helps in the emergence of satisfactory behavioral symptoms such as anxiety, loss of social relations and indifference (Shaizatulaqma & others, 2019, p. 155).

In particular, we find the Covid 19 crisis, which is a global health crisis that already has a devastating impact on the global economy. It first appeared in China and later spread to Europe, Russia and Asia, and it may spread mainly among animals, but it can develop and infect humans, as in the case of acute pneumonia (stanciu & others, 2020, p. 6). The outbreak of this epidemic had a strong impact on

global financial markets as it led to radical changes in the lifestyle of citizens and the business (Rajagopal, 2020, p. 163).

Crisis management is a distinctive administrative process, as it is exposed to a sudden event and needs quick decisive actions in accordance with the developments of the crisis. Therefore, crisis management has the initiative in leading events, influencing them and directing them according to the requirements of (Apuke & Tunca, 2019, p. 203). The latter is based on four phases, including the phase of avoiding the crisis, and it means confidentiality, caution and speed in dealing with the situation by avoiding the complexity of the procedures, creating public awareness, effective coordination, good planning and careful diagnosis, in addition to implementing the practical plan and following the developments and reducing risks (Huid, Aimee, & zharg, 2020, p. 100) The phase of preparation and recognition of the existence of a crisis is the willingness to face the circumstances in which the crisis cannot occur and rely on trust and open understanding in dealing with customers, as we cannot expect to know the form and size of the crisis and the reasons for its occurrence in order to prepare for it so that it is considered a more realistic and powerful tool for its management (Oliver & others, 2020, p. 3).

Furthermore, the stage of containment and settlement of the crisis by making difficult and quick decisions at this stage to quickly correct the situation. If the crisis occurs and it does not deal with it properly, the directorates may face severe problems and losses such as financial loss, accidents and reputation as they affect the consumer's buying behavior and at this stage also the crisis will not wait and the speed is extremely important by following new effective strategies (Shaizatulaqma & others, 2019, p. 217). Finally, the phase of benefiting from the crisis. At this stage, crises provide a tremendous amount of experience that has a deep impact in the directorates. It proposes preventive measures and procedures to limit the spread of infection because of its significant impact on sectors of activity such as tourism, transport and agriculture (Roggeveen & sethurman, 2020, p. 300).

2.2 Consumer buying behavior

The consumer's buying behavior is the action which was realized by the individual in the purchase, use, or benefit from of a product or service that includes a number of mental and social processes that lead to the achievement of that (Rajyalakshmi, 2015, p. 40)As it is involved in phases including the consumer decision-making process and identifying the problem and searching for information to solve the problem in addition to identifying products... etc. (Sander le leeuw & Dullaert, 2018, p. 256). It is one of the most important subjects studied in the

directorate, it acquires greater significance from one person to another as studies of consumer behavior benefit the individual by providing him with all the information and data that constitute a basic repertoire that helps him in making successful purchasing decisions that satisfy his needs and are compatible with his purchasing capabilities, inclinations and tastes (Bucko, Kakalejczik, & Ferencova, 2018, p. 6).

It also helps the state in drawing up its commercial and regulatory policy to guide the various commercial and economic institutions in defining its pricing and promotional strategies as well as determining the supply and distribution outlets to provide various goods and services. (Chandra & Musumdar, 2018, p. 24), Consumer behavior is characterized by being unstable, changeable at any moment, which makes the possibility of generalizing the study of his behavior limited in limited periods or for some goods and services, and it is also distinguished by being constantly affected by cognitive, psychological and external environment (Bressolles, Senecal, & Durrieu, 2014, pp. 889-896)

Social and cultural features, such as culture, social class, beliefs and attitudes also influence consumer behavior, as it deals with products, brands, and the type of stores (Koyluoglu, 2018, p. 317). As for the effects of the external environment today, due to the global health pandemic Covid-19, it has led to the development of trade and online shopping very quickly, and in a very small time period, due to recommendations to maintain social distance and domestic quarantine, as it is one of the main solutions that limit the spread of the epidemic and the growing uses of technology in the business environment, which in turn leads to economic recovery (Park, 2019, p. 56).

The aim of studying consumer behavior is to enable the state as an organizer of economic and commercial activity, to understand what the consumer makes daily purchasing decisions, and to enable researchers to understand factors or personal influences and external or environmental factors and influences that affect consumer behavior and satisfaction (See Maddox, 1981, p. 54). It also enables economic, commercial and service institutions to know the behavior of current and potential buyers and to find out how to allow them to cope with them and get them to act in a manner consistent with their goals (Tuzzahrah & others, 2018, p. 53).

Crisis management is also an important topic that plays a major role in influencing consumer behavior, as the primary goal of crisis management is to search and obtain appropriate information for decision-making, and that the primary goal of a study of consumer behavior is to enable it to understand what it makes daily purchasing decisions which is determined by some internal and external factors as it depends on the effects of marketing variables and emphasizes the external

influences of consumer trends and behavior through intense competition, this is what made consumers change their purchasing behavior by being a challenge to the behavior and promotes harmful ideas and behaviors in the consumer as crisis management (Ebrahimabad & mirab, 2018, p. 1068).

3. THE EMPIRICAL STUDY

In order to test the study hypotheses and arrive at conclusions about the effect the phases of Covid-19 crisis management by the directorates of commerce in Algeria on the consumer behavior, the case of the Algerian consumer was studied during the time period from March 2020 to July 2020, through a random sample.

3.1. Population and sample of study

The research community is represented by all Algerian consumers, as the population of Algeria is estimated, according to January 2020 statistics, to be 43 million, 66.60% of whom are within the age group of the respondents, who are between 15 years of age to 75 (Population Algerienne, 2020), which is equivalent to approximately 28 million people. It is the size of the survey population for this study.

A random sample was selected according to the formula: it is used for these calculations (Morgan, 1970, pp. 607-610):

$$n = \frac{X^2 * N * P * (1-P)}{(ME^2 * (N-1)) + (X^2 * P * (1-P))}$$

Where :

n = sample size

X² = Chi – square for the specified confidence level at 1 degree of freedom

N = Population Size

P = population proportion (.50 in this table)

ME = desired Margin of Error (expressed as a proportion)

With the use of the sample size determination table at 95% confidence, and Margin of Error of 2.5%, (Advisors, 2020), the sample was estimated at 1537 individuals, and the electronic questionnaire was distributed to them, 1356 analyzable forms were retrieved, means a response rate of 88.22.%

3.2. Consistency and Stability coefficients

In order to test the validity of the internal consistency, we used the correlation coefficient for Pearson, and to measure and test the reliability of the questionnaire, we used the Alpha Cronbach coefficient as follows:

Table 1: *Internal consistency*

The axes	Correlation coefficient	significance level
The phase of avoiding the crisis	0,817**	0,000
Preparation and recognition phase	0,866**	0,000
The containment and settlement phase	0,887**	0,000
The phase of benefiting from the crisis	0,868**	0,000
consumer's behavior	0,673**	0,000

Source: *Own calculations based on the output of the program SPSS*

The table shows the correlation coefficients of Pearson between each axis of the study in the total degree, where the correlation coefficients ranged between (0,673-0,887), which is positive and statistically function at a significance level of 0.01, thus the axes are considered true to what they were designed to measure.

Table 2: *Alpha Cronbach coefficient for each axis*

The axes	Number of terms	Alpha Cronbach coefficient
The phase of avoiding the crisis	04	0,645
Preparation and recognition phase	04	0,661
The containment and settlement phase	07	0,897
The phase of benefiting from the crisis	04	0,719
consumer's behavior	12	0,792
All the axes of study	31	0,921

Source: *Own calculations based on the output of the program SPSS*

Based on the results obtained This table indicates that the value of the Alpha Cronbach coefficient for the various axes exceeded 60%, which ranges between 0.645 and 0,897, which is a high value, while the total value of the Alpha Cronbach coefficient is 0.921, which is also a high value, and this indicates the stability of the measuring instrument from The area of the statements included in the questionnaire.

3.3. Normal distribution test

The Kolmogorov-Smirnov test was used to find out whether the study model was subject to a normal or free distribution, with the purpose of determining the nature of the tests used in the hypothesis test. The results were as follows:

Table 3: *The normal distribution of the study axes*

Kolmogorov-smirnov			
Axes	Value Z	Sig*	
All axes of the study	1,94	0,001	

*The distribution is normal if the significance level is > 0.05

Source: *Own calculations based on the output of the program SPSS*

Through looking at the table and at the level of significance (0.05), it is clear that all axes do not follow the normal distribution, as the rates of the natural distribution of all axes were smaller than (0.05), which is the method adopted in the statistical treatment of this study, ultimately, it is not possible to perform parameter tests on it. This is what requires relying on nonparametric tests to answer the established hypotheses

3.4. Descriptive Statistics of axes

According to the outputs of the SPSS program, by calculating the arithmetic average and standard deviation of the various questionnaire statements in order to analyze the respondents' answers, the results are shown in the following table according to each axis of the study:

Table 4: *Descriptive Statistics of axes*

Axes	The arithmetic mean	standard deviation	Arrangement
Crisis prevention	2,8258	0,81923	average
preparation and recognition	3,0916	0,80080	average
Containment and settlement	3,3496	0,75959	average
Take advantage of the crisis	3,2334	0,87619	average
consumer's behavior	3,3072	0,62109	average

Source: *Own calculations based on the output of the program spss*

Table 4 indicates the study sample answers about the expressions related to the level of importance of the phases of Covid-19 crisis management and consumer behavior, which came as follows:

- the arithmetic mean of Crisis prevention, is estimated at 2,8258 and a standard deviation of 0,81923, and this shows an average degree of approval on the part of the study sample, which indicates that the Trade Directorate did not care well about the crisis avoidance phase.
- the arithmetic mean for preparation and recognition, is 3,0916 and a deviation of 0,80080, and this indicates an average degree of approval by members of the study sample, which indicates that the Directorate of Commerce did not take care well of the preparation and recognition stage of a crisis.
- the arithmetic mean for Containment and settlement, is estimated at 3,3496 and a deviation of 0.75959, and this shows an average degree of approval by the members of the study sample, which indicates that the Directorate of Trade did not take a good attention in the stage of containing and settling the crisis.
- the arithmetic mean for Take advantage of the crisis, is estimated at 3,2334 and a deviation of 0,87619, and this shows an average degree of approval by the members of the study sample, which indicates that the Directorate of Commerce did not care about the stage of benefiting from the crisis.
- the arithmetic mean of consumer's behavior, is estimated at 3,3072 and the deviation is 0.62109, and this shows an average degree of approval on the part of the study sample, which indicates that the Trade Directorate did not take good care of consumer behavior.

3.5 Testing Study Hypotheses

To test the hypothesis of study, the anova T-test was used, the results of which in the following table:

The first hypothesis: There is a statistically significant effect at the 0.05 level of significance for the stage of avoiding the Covid 19 crisis by the Commerce Directorate on the Algerian consumer behavior.

Table 5: *The result of a simple regression analysis to test the effect of the Covid-19 crisis avoidance phase by the Trade Directorate on Algerian consumer behavior*

Axis	B value	T value	F value	R	R ²	Sig
The first hypothesis	0,350	19,125	365,775	0,461	0,213	0,000

Source: *Own calculations based on the output of the program SPSS*

Table 5 shows the impact of the phase of avoiding the Covid 19 crisis by Commerce directorates on the behavior of the Algerian consumer. The correlation coefficient reached (0.461) at the level of significance of 0,000 less than 0.05 and the determination coefficient (0,213), means its value (21,3%) of changes in the level of Algerian consumer behavior resulting from the change in the level of importance of the phase of avoiding the Covid 19 crisis, The value of the impact degree was (0.350), this reflects that the increase in the phase of avoiding the Covid 19 crisis leads to an increase in the level of Algerian consumer behavior, which shows the significance of this relationship is the value of F (365,775) and the value of T (19,125), This confirms the validity of the first sub-hypothesis, which says: There is a statistically significant effect at the 0.05 level of significance for the stage of avoiding the Covid 19 crisis by the Commerce directorates on the behavior of the Algerian consumer.

The second hypothesis: There is a statistically significant effect at the 0.05 level of significance of the preparation stage and the recognition of the existence of the Covid 19 crisis by the directorates of commerce on the behavior of the Algerian consumer.

Table 6: *The result of the simple regression analysis to test the effect of the preparation stage and the recognition of the presence of Covid 19 by trade directorates on the behavior of the Algerian consumer.*

Axis	B value	T value	F value	R	R ²	Sig
The second hypothesis	0,386	21,134	446,649	0,498	0,248	0,000

Source: *Own calculations based on the output of the program spss*

Table No. 6 shows the effect of the preparation and the recognition phase of the existence of Covid 19 crisis by the trade directorates on the behavior of the Algerian consumer, as the results showed the presence of the effect of the preparation and the recognition phase of the existence of Covid 19 crisis on the behavior of the Algerian consumer. The correlation coefficient reached (0,498) at the level of significance of 0,000 less than 0.05 and the determination coefficient (0,248), means its value (24,8%) of changes in the level of Algerian consumer behavior resulting from the change in the level of importance of the preparation and the recognition phase of the existence of the Covid 19 crisis. The value of the effect degree was (0.386), and this reflects that the increase in the stage of avoiding the Covid 19 crisis leads to an increase in the level of the Algerian consumer behavior, and what shows the significance of this relationship is the value of F (446,649) and the value of T

(21,134), This confirms the validity of the first sub-hypothesis, which says: There is a statistically significant effect at the 0.05 level of significance for the preparation and the recognition phase of the existence of the Covid 19 crisis by trade directorates on the behavior of the Algerian consumer.

The third hypothesis: There is a statistically significant effect at the 0.05 level of significance of the stage of containment and settlement of the Covid 19 crisis by the directorates of Commerce on the behavior of the Algerian consumer.

Table 7: *The result of a simple regression analysis to test the effect of the containment and settlement of the Covid 19 crisis by the directorates of Commerce on the behavior of the Algerian consumer*

Axis	B value	T value	F value	R	R ²	Sig
The third hypothesis	0,456	24,744	612,290	0,558	0,311	0,000

Source: *Own calculations based on the output of the program SPSS*

Table No. 7 shows the effect of the phase of containing and settling the Covid 19 crisis by the Commerce directorates on the behavior of the Algerian consumer, as the results showed the presence of the effect of the phase of containment and settlement of the Covid 19 crisis on the behavior of the Algerian consumer, the correlation coefficient reached (0,5588) at a significance level of 0,000 less than 0,05 and the determination coefficient (0,311), means its value of (31,1%) of changes in the level of Algerian consumer behavior resulting from the change in the level of importance of the stage of containment and settlement of the Covid 19 crisis. The value of the degree of effect was (0.456), this reflects that the increase in the phase of containment and settlement of Covid 19 leads to an increase in the level of Algerian consumer behavior, which shows the significance of this relationship is the value of F (612,290) and the value of T (24,744), This confirms the validity of the first sub-hypothesis, which says: There is a statistically significant effect at the 0.05 level of significance for the containment and settlement of the Covid 19 crisis by the Commerce directorates on the behavior of the Algerian consumer.

The fourth hypothesis: There is a statistically significant effect at the 0.05 level of significance for the stage of benefiting from the Covid 19 crisis by the directorates of commerce on the behavior of the Algerian consumer.

Table 8: *The result of a simple regression analysis to test the effect of the benefit stage of the Covid 19 crisis by the Commerce Directorate on the Algerian consumer behavior*

Axis	B value	T value	F value	R	R ²	Sig
The fourth hypothesis	0,276	15,573	242,509	0,390	0,152	0,000

Source: *Own calculations based on the output of the program SPSS*

Table No. 8 shows the effect of the phase of benefiting from the Covid 19 crisis by the Commerce directorates on the behavior of the Algerian consumer, as the results showed the presence of the effect of the phase of benefiting from the Covid 19 crisis on the behavior of the Algerian consumer, as the correlation coefficient reached (0.390) at a significance level of 0,000 less than 0.05 and the determination coefficient (0,152) means its value (15.2%) of changes in the level of Algerian consumer behavior resulting from the change in the level of importance of the stage of benefiting from the Covid 19 crisis. The value of the degree of effect was (0.276), and this indicates that the increase in the phase of benefiting from the Covid 19 crisis leads to an increase in the level of Algerian consumer behavior, which shows the significance of this relationship is the value of F (242,509) and the value of T (15,573), this confirms the validity of the first sub-hypothesis, which says: There is a statistically significant effect at the level of significance 0,05 for the stage of benefiting from the Covid 19 crisis by the trade directorates on the behavior of the Algerian consumer.

Fifth hypothesis: There are statistically significant differences at the level of 0.05 in the answers of the sample members regarding the impact of crisis management on the behavior of the Algerian consumer due to personality variables.

Table 9: *Mann-Whitney and Kruskal Wallis test for the significance of the differences in the respondents' attitudes about the impact of managing the Covid 19 crisis by Commerce directorates on the Algerian consumer behavior due to personal variables*

sample	variable		U de Mann-withney	Sig
	male	female	Gender	139852
	variable		Khi-deux	sig
	year 15-35	age	3,942	0,139
	year 35-55			
	year 55-75			
	Without income	salary	5,910	0,206
	45000-15000			
	75000-45000			

95000-75000				
95000 and more				
secondary	Educational	4,731	0,094	
university	level			
postgraduate				
internet	The source of	2,631	0,452	
television	receiving the			
From friends and	information			
acquaintances				
All previous means				

Source: Own calculations based on the output of the program spss

Through the above table, we notice that the level of significance for the means of the respondents' ranks in relation to the variables of age and educational level, income and the source of receiving information is not statistically significant because it is bigger than the level of significance approved in the study (0.05). Consequently, there are no statistically significant differences in the respondents' answers about the effect of managing the Covid 19 crisis by the Commerce directorates on the behavior of the Algerian consumer due to variables of age, income, educational level and source of information. However, we notice that the level of significance for the mean of the respondents' ranks for the variable of gender was estimated at 0,000, thus it is statistically significant at the level of significance 0.05, therefore we accept the first hypothesis, which states that there are statistically significant differences in the respondents' answers due to the gender variable.

Main hypothesis: There is a statistically significant effect at the 0.05 level of significance for the phases of managing the Covid 19 crisis by the Commerce Directorate on the behavior of the Algerian consumer.

Table 10: The result of a multiple regression analysis to test the effect of the stages of Covid-19 crisis management by the Commerce Directorate on the Algerian consumer behavior

axis	R	R ²	F value	sig
main hypothesis	0,726	0,527	376,055	0,000

Source: Own calculations based on the output of the program SPSS

Table No. 10 shows the effect of the stages of managing the Covid 19 crisis by the Commerce Directorate on the behavior of the Algerian consumer. We notice that there is an effect of the phases of managing the Covid 19 crisis on the behavior of the Algerian consumer, as the correlation coefficient reached (0.726) at a level of

significance of 0,000 less than 0.05, while the determination coefficient reached (0.527), means its value (52.7%) of changes in the level of Algerian consumer behavior resulting from the change in the level of control of the phases of managing the Covid crisis 19. The significance of this effect confirms the value of F (376,055), which is a function at a level less than 0.05, and this confirms the validity of the main sub-hypothesis, which says: There is a statistically significant effect at the level of 0.05 significance for the phases of Covid-19 crisis management by the directorates of commerce in Algeria on the consumer behavior.

4. CONCLUSION

In this study we demonstrated the importance of crisis management according to its various phases and its effect on consumer behavior, which is followed by the various directorates of Commerce in Algeria, as it is a distinct and complex administrative process. Because it is exposed to a sudden event and needs rapid decisive actions consistent with the developments of the Covid-19 crisis, and this was from the first phases of crisis management until controlling it and restoring the nature of a sound commercial activity. And the extent of its contribution to organizing and planning processes for managing crises effectively and professionally, and accordingly, the following conclusions can be drawn:

The Directorates of commerce was not fully aware of the seriousness of the crisis Covid 19. Furthermore, it has taken all preventive measures to avoid falling into this crisis but on average. It also made early warning before the crisis occurred, but not in a good way. In addition to this, it did not plan tightly to provide all the needs of the consumer before Falling into crisis. Besides that, the Directorates of Commerce has not laid down completely clear instructions for commercial activity specifying how to deal with the crisis. Moreover, it did not handle well effectively and efficiently with the crisis once it occurred. And then, it worked to cooperate with the relevant ministries to solve the crisis (Health and Interior) But not so well. Next, it did not work well to avoid all obstacles during the crisis (speculation and monopoly, scarcity of consumer and medical supplies). Apart from that, it did not deal with this crisis in a manner consistent with its serious nature. Further, it did not work well to prevent the occurrence of Sub-crises that may result from the Covid 19 crisis. What is more, the Directorates of Commerce did not perform the required efforts well which is represented in the control, distribution and regulation of commercial work to help contain the effects of the Covid 19 crisis. Another conclusion is that the Directorates of Commerce did not do well to control the factors Causing scarcity of consumables and preventive medical materials in a short period of time. And It did not take appropriate decisions to contain

the negative effects The resulting from this crisis in time. Also, it did not take appropriate decisions to contain the effects The negative resulting from this crisis in time. And, It is working to improve crisis management programs and plans. Finally, it has gained experience from facing this crisis that will take advantage of it to face of potential crises but not properly.

In other part, the decisions taken by the Directorates were not improved well over time to face this crisis. As, this crisis affected the daily consumer behavior. It also made the consumer more cautious in making purchase decisions. Furthermore, it made the consumer more cautious in making purchase decisions. Moreover, it made the consumer to switch from buying luxury to necessary goods. Besides that, the consumer purchases durable and avoids perishable products. Ultimately, the crisis made the consumer to switch from purchasing expensive to consumer goods and preventive and health products.

Concerning the conclusions about the consumer are as follows: the consumer is buying in medium quantities, to reduce the number of shopping times, furthermore, he buys local products and avoids buying imported products but not properly. Also, he is helped by social media to make a purchase decision but not well and properly. Another conclusion is that the consumer is taking precautions and preparing for storage and supply, but not properly. Then, the websites and social media did not provide well for the consumer All the information about the products he's looking for. The consumer uses the Internet and social media, in a moderate degree, in order to search for the products and services he needs. Finally, he will continue to carry out the electronic purchase process until the end of the crisis, but not significantly.

4.1 Results

The study found that there is little interest by commerce directorates in the phases of crisis management; this is what differs from the study of (stanciu & others, 2020) and (Erdal, 2020). The results also showed that there are different effects of the phases of crisis management by the commerce directorates in Algeria on consumer behavior. The most important is the weak effect of the crisis benefiting phase on consumer behavior this is by 15.2% , and a weak impact of the crisis settlement and containment phase on consumer behavior, at a rate of 31.1%, the study also found that there is a weak effect of the crisis avoidance phase on consumer behavior, with a rate of 21.3% , in addition, there is also a weak effect of the preparation stage and the recognition of the existence of a crisis on the behavior of the Algerian consumer, at a rate of 24.8%, this is in agreement with the study of (Buklemishev, 2020), and (Shaizatulaqma & others, 2019). the study found a strong

positive effect and relationship between the management of the Covid 19 crisis and the behavior of the Algerian consumer at a significance level of 0.05 of 72.6%, and this is in agreement with the study of (Junxiong & others, 2020), the results also showed that there are no statistically significant differences on the effect of Covid 19 crisis management on Algerian consumer behavior according to age and income, educational level and the source of information received, and the presence of statistically significant differences about the effect of Covid 19 crisis management on the behavior of the Algerian consumer according to gender.

4.2 Recommendations

Through previous results, a set of recommendations will be formulated regarding the Covid 19 crisis and its effect on the Algerian consumer behavior, the most important of them are:

- The necessity for the directorates of Commerce to pay attention to managing the crisis, Because of its great importance in influencing the behavior of the Algerian consumer.
- The necessity for the directorates of Commerce to pay attention to the preparation stage and to acknowledge the existence of the crisis, To avoid all obstacles when they occur.
- The necessity for the directorates of Commerce to pay attention to the stage of settling and containing the crisis, to prevent sub-crises that may result from the Covid-19 crisis.
- The necessity for the directorates of Commerce to pay attention to the phase of benefiting from the crisis, In order to gain experience from facing this crisis, which will benefit them to face potential crises in the future.
- Prior strategic plans must be made on which commerce directorates rely to face crises and get out of them with the least possible damage.
- The necessity to learn and take lessons learned from the Covid 19 crisis, in order to obtain field experience in crisis management.
- Directorates of Commerce are keen to carry out all preventive measures to avoid falling into crises.
- Developing a flexible plan in order to respond to consumer requirements during future crises that trade directorates cannot limit, but rather can avoid.
- Attention should be given to complaints made by consumers.
- Working on consumer awareness and education of the concept of crisis management and its phases.

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GOLD & STOCK RELATION: INVESTORS' REACTION DURING COVID-19 OUTBREAK

SUBRATA ROY*

Abstract: *The present study tries to examine the relationship between stock and gold during COVID-19 pandemic along with investors' investment preference during COVID-19 lockdown by considering three macroeconomic variables (BSE, NSE & Gold) with their daily data over a period from 30 January 2019 to 31 July 2020 under VAR environment. The time series data are normally distributed and stationary after first difference with same order of integration without co-integrated equations with optimum lag length one. The long run equilibrium relationship is absent during COVID-19 outbreak but short run association is found when lagged gold price influences gold itself. Bi-directional Granger causality exists between BSE and NSE only. The investors prefer stock investment as compared to gold during COVID-19 lockdown. Finally, the VAR models are valid and stable based on various residuals tests.*

Keywords: *Co-integration, VAR, COVID-19, Gold, BSE, NSE*

JEL Classification: *C12, C15, C32*

1. INTRODUCTION

It is true that water is life. Life without water is impossible. But in economic sense, it has almost no value. Oppositely, the yellow metal (gold) that has no need in livelihood as compared to water but its monetary value has already been touched the sky during this COVID-19 pandemic. So, a stable and healthy financial system depends on economic development of a country. If an economy has efficient and well functioning financial systems then the nation can flourish and may improve the standard of living of its countrymen. Presently, the activities of financial markets and their associations with the real sector have assumed significant importance (Tripathy,

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2016). According to Smith (2011), during the time of market crisis, stock market generally comes down but the gold's at the same time price reacts oppositely. Currently, the investors are more tending to keep a portion of their investments in the form of gold with the expectation of higher prices and that can also hedge against inflationary situation. Sometimes, when an economy goes through political uncertainty, economic boom, emergency, war or when dollars weakens etc. then the investors have a tendency to buy gold as a store of value for economic safety and to protect their portfolios from uncertain economic shocks as a tool of diversification (Kiohos & Sariannidis, 2010). In India, due to its high domestic demand, the gold price is sharply increasing because of its high security, liquidity, risk diversification tool, a safe haven investment and an asset of last resort (Gaur & Bansal, 2010). According to the Webster's dictionary "haven" means a harbor or a port; a place of safety or a destination that offers favorable opportunities and conditions (Baur & Lucey, 2006). In India, the capital market is not the first preference of investment till date because the investors believe that gold as a safe haven and an attractive investment tool for the Indian investors (Narang & Singh, 2012) and it depends on individual sentiment on gold holding and the habit of gold investment of Indians strongly ingrained in Indian social psyche because gold is held for years and passed hands of many generations without loss of its prime importance as a hedge against loss of wealth in time of market failure (Mishra & Mishra, 2010; Paul, 2012). The increasing demand of gold is not only due to the reasons of investment and uses only rather there are some other reasons which influence the demand for gold in Indian domestic market. The literature shows that the demand for gold may be having a causal association with the other investment options and stock market behavior. The market volatility creates panic to the investors and makes the investment decisions difficult and risky. So, deep uncertainty in stock market may have causal relation for movement in gold price and which might be influencing the demand for gold (Bhuyan & Dash, 2018). During this COVID-19 pandemic the world economy is in a turbulence situation. There is a deep uncertainty when the world economy will come out from this crisis period. The stock markets around the globe have lost investors' faith due to COVID-19 pandemic shock. The global stock markets are under in volatile situations and very difficult to predict the movement of stock prices during this pandemic situation. Oppositely, it is found that the gold price is moving in upward direction sharply and touched a record high during this pandemic situation. The investors shift their investments from stock markets to gold because for safety, liquidity and it helps to hedge against this pandemic shock. Nationwide lockdown makes the economic activities more disruptive but on the other hand this

lockdown helps to control the spreading of this deadly corona virus into population. During this uncertain pandemic situation whether lockdown and investors preferences on gold influence the gold prices to move high? Some are arguing that gold prices are a good proxy for other macroeconomic variables. So it is a preferred indicator of global economic performances. The price of gold is viewed by some analysts as a leading indicator of inflation because gold is extensively held as a store of value. Many studies suggested that gold is one of the best investment instruments for diversification. Since gold is frequently traded, its price and relationship with stock market assumed significant importance from the investor, traders, policy makers, and academicians' point of view. From the policy perspective, gold's price rise has raised a concern as to whether a future crash in Gold prices would have financial stability implications. Therefore gold has become the main focus of research in the field of finance today (Tripathy, 2016).

Finally, the study is designed as follows: in section 2 literature survey is described. Section 3 deals with objective. Hypothesis is given in section 4. Section 5 describes data and study period. Section 6 provides methodology. Section 7 analyses the result. Conclusion and recommendation are given in section 8.

2. LITERATURE REVIEW

The relationship between socio-economic variables under the VAR environment is discussed very little. The economic impact due to COVID-19 pandemic is a recent phenomenon. The life and livelihood are now uncertain due to COVID-19. The human civilization is stood at risk for survival. The whole world is jointly working when we will get released from this deadly virus. Research in various fields is conducting around the globe for the way out. Few papers have already been published and considered for developing this research. The researchers around the globe are working on this issue critically and trying to establish the relationship between the socio-economic variables.

Truly, the concept of co-integration is first introduced by Granger (1981) and then extended further by Engle and Granger (1987); Eagle and Yoo (1987, 1991); Phillips and Ouliaris (1990); Stock and Watson (1988); Phillips (1991); Johansen and Juselius (1990); and Johansen (1988, 1991, 1994) and after that empirical studies have been conducted by the researchers around the globe. In 1986, Roll and Ross inspect the underlying association among the stock market and macroeconomic variables during the period from 1953 to 1983 and observe that stock market is significantly affected by the macroeconomic shocks (see Kim 2003).

It is evident from the above studies that the relationships between stock market performance and macroeconomic variables are well established. But the literature on socio-economic variables with pandemic effect is very scanty around the globe. In this situation, this study tries to investigate the long and short run equilibrium relationships among the socio-economic variables in Indian context under the VAR environment and along with the analysing of how a positive innovation or shock (impulse) can changes the behaviour of the socio-economic variables under the VAR framework and here is the identity of this study being considered.

In 2001, Smith Graham examines the relationship between gold price and stock price indices in the United States. Therefore, he considers daily prices over a period from 1991 to 2001 by considering four gold prices and six stock prices indices. He observes that the short-run correlation coefficient between gold return and stock return is very small and negative. But gold prices and stock prices are integrated at same order but they are not co-integrated. However, he observes that short-run uni-directional causality runs from US stock returns to gold returns. On the other hand, Baur & Lucey (2006) seek to examine two issues (a) whether gold may be used as a hedge against stocks and /or bonds and (b) whether gold is a safe haven for investors when market falls. Therefore, they consider time series data over ten years' periods from 30th November 1995 to 30th November 2005. So, to examine the above two objectives they use various volatility forecasting measures like DCC, GARCH etc. They observe that gold can be used as a hedge against stocks and may be considered as a safe haven against stocks during trading days after an extreme stock market crash. In 2010, Kiohos and Sariannidis seek to examine the short effect of crude oil and financial markets on gold market by considering US market over a period from 1st January 1999 to 31st August 2009 using daily data and thus they apply GARCH type models. They opine that gold market acts as a mobilization factor of hedge against various portfolios and geopolitical risks. They also observe that US dollar exchange rate significantly influences gold markets' volatility and observe presence of volatility persistence. Finally, they suggest that gold can be used as a safe haven during the time of high volatility in the market and this evidence is similar to the result of Baur and Lucey (2006). In the same light, Mishra et. al., (2010) examine the co-integration and causal relationship between the gold prices and stock market over a period from 1991 to 2009 by considering daily data by applying Johansen co-integration test along with Granger causality analysis. According to the Johansen co-integration test there are two co-integrated equations with same order. Finally, the Granger causality test discovers bi-directional short-run relationship between gold prices and BSE. Toraman et. al., (2011) seek to examine the probable

macro-economic factors that affect the gold prices in USA. To examine the above objective they consider many macro-economic factors like oil prices, USA exchange rate, inflation rate, real interest rate and gold price over a period from June, 1992 to March, 2010. Therefore, they apply MGARCH and CCC models. The study shows that ARCH effect exists on some variables but few variables follow non-stationarity. Finally, they observe that gold prices and exchange rate are negatively correlated but oil prices and gold prices are positively correlated. In 2012, Narang and Singh examine the causal relationship between gold prices and Bombay Stock Exchange by considering daily data over a period from 2002 to 2012 by applying Johansen co-integration test and Granger causality test. But their study shows that there is no co-integration relationship between the variables and also absence of causality association between gold and BSE at any direction. Similarly, in 2012, Omag examines the relationship between gold prices and some macro-economic variables over a period from January 2002 to December 2011 by considering daily data in Turkey. Thus, he applies multiple regression technique to examine the above objectives. He observes that there is a positive relationship between gold prices and exchange rate and also positive relationship is found between Istanbul stock exchange and exchange rate. Finally, he opines that gold may be used as a substitute for other securities. Likewise, in 2013, Baig et. al., tries to examine the causal relationship between gold prices and macro-economic variables over a period from 2000 to 2010 by applying co-integration and causality techniques by considering monthly data in Pakistan. They find absence of significant correlation between the macro-economic variables. They observe that the data are stationary after first difference and co-integrated at same order but there is no existence of co-integrated equation and thus long-run equilibrium relationship is absent. Moreover, they also exhibit absence of short-run Granger causality relationship. In 2013, Mukhuti et. al., investigates the association between Indian stock market and gold prices over a period from 2nd January 1991 to 10th August 2012 by considering daily time series data. Therefore, they use bi-variate and multivariate Johansen co-integration approach to study the above objective. First they observe that the data are stationary at 1st difference (see, Baig et. al., 2013) and integrated at same order. Then, they observe that there is absence of co-integrated relationship at any significance level (see, Baig et. al., 2013) based on bi-variate co-integration test but multivariate co-integration test signifies presence of long-run equilibrium relationship between stock markets and gold prices (see, Mishra et. al., 2010). In 2013, Sindhu tries to examine the impact of macro-economic variables on gold prices over a period from November 2006 to December 2011 by taking into consideration the daily prices in India. The

study applies simple correlation and regression analysis technique to examine the research questions. Finally, the study shows that gold prices and exchange rates are inversely related but energy prices positively influence gold prices. Moreover, inflation rates and gold prices are positively correlated but gold prices and repo rates are independent. Similarly, in 2013, Contuk et. al., examines the effect of fluctuations in gold prices on ISE100 index over a period from 2009 to 2012 by considering daily data in Turkey and thus they apply GARCH type models to investigate the effect. They observe that the time series data are suffered from ARCH effect and thus they apply GARCH models. Finally, they observe that gold and stock prices are influenced by their own shocks and shock by each other. On the other hand, Tripathi et. al., (2014) seeks to examine the causal association between gold prices and global macro-economic variables by considering nine years monthly time series data in India. To examine the above objectives they apply various statistical and econometrics measures like unit root test, Johansen co-integration test and Granger causality test. They observe that there are co-integrated equations that means long run equilibrium relationship exists among the co-integrated variables. They also observe that short-run causality runs from gold prices to exchange rate and energy prices. Again in 2015, Khan examines the impact of energy prices and gold prices on economic growth in Pakistan over a period from 1997 to 2014 by using monthly time series data. Thus, he applies OLS regression analysis to examine the above objective. He observes that Karachi stock exchange and GDP have negative correlation with gold prices. According to the regression analysis, it is found that economic growth has strong relationship with stock market and gold prices in Pakistan. In the same fashion, Gokmenoglu et. al., (2015) investigates the impact of gold price, gold price volatility, energy price and energy price volatility on S&P 500 index by taking into account daily time series data over a period from January 2013 to 2014 by applying ARDL and error correction mechanism. Their study report that long run equilibrium relationship exists among the macro-economic variables. They also observe that short run bi-directional causality exists between oil price volatility and stock market. Similarly, in 2015, Akgulet et. al., tries to explore the non-linear relationship between gold prices and S&P 500 stock prices over a period from 1986 to 2013 by considering daily data. Thus, they apply Markov-Switching Bayesian VAR measures to examine the above research questions. They consider gold prices and stock market as the dependent variables and energy price as the independent variable. First they confirm the number of regime (3 regimes) by applying LR test statistic and then employed to estimate the MS-BVAR model. Finally, they observe that energy prices affect the gold prices and stock prices and the effects are varied

according to the regimes. According to impulse response function, the effect is diverse. In 2015, Tiwari and Gupta try to examine the causal association between gold prices and stock market return in India during a period from July 2005 to August 2014 with daily time series data. They apply unit root test and Granger causality test to examine their objectives. They observe that data are stationary after first difference and there is evidence of short run causal relationship between gold prices and stock market index in India (see. Narang 2012 & Baig 2013). A popular study by Tripathi in 2016, who examines co-integrated relationship between gold price and stock price in India by considering daily time series data over a period from July 1990 to April 2016. She applies various statistical tests to examine the above objective. She finds that the data are stationary after first difference with same order of co-integration. According to Johansen co-integration test gold price and stock price are related in the long run but there is no short run equilibrium relationship between them. She also observes that stock price can be used to forecast gold price. Similarly, in 2016, Raza et. al., investigates various asymmetric impact of gold price and energy price on stock markets by considering top ten emerging economies around the globe over a period from January 2008 to June 2015 of the daily time series data. They apply ARDL approach to study this relationship. They find that all the markets are positively correlated with gold and energy prices except China. The time series data are stationary after first difference and there is a presence of long run asymmetric equilibrium relationship among the macro-economic variables based on bound testing approach. They observe that energy prices negatively impact on all the stock markets. Finally, they argue that emerging markets are more prone to negative shocks. In 2017, Kaur and Kaur examine the effect of gold prices on Indian stock market by taking monthly time series data over a period from April 2007 to March 2016. They apply various statistical measures like J-B statistic, unit root test, correlation and regression and observe that gold price and BSE are positively correlated. Moreover, gold price can influence stock price significantly. In the same year (2017), Hlupo investigates the relationship between gold prices and stock market in Zimbabwe by considering daily data. Therefore, he uses various statistical and econometric tools like ADF test, multi-variate regression analysis and Granger causality test to examine the objectives. He finds that the daily time series data are stationary at first difference with positive correlation between gold prices and mining. He also observes that there is no Granger causality between the macro-economic variables which is also supported by the regression result. Similarly, in 2017, Seifoddini et. al., conducts a comparative study between gold prices and stock markets in the developed (US) and developing (Iran) markets over a period from

December 2013 to December 2016 by considering daily time series data on gold spot prices and stock prices. To examine the above objective they apply Threshold regime switching model. Finally, they observe that stock prices and gold prices don't follow any specific regimes but this association may change in short as well as long terms between the two economies. In 2017, Mittal examines whether the gold price is affected by macro-economic conditions. Therefore, he examines various macro-economic variables like gold supply, mine production, net central bank sales, interest rates, recycled gold, demand of gold, inflation, US dollar, economic strength, world instability, jewellery market and other investment alternatives to examine the above issues. Finally, he observes that all those macro-economic factors directly or indirectly influence gold prices. In the same year (2017), Shobha seeks to examine whether gold is a safer and attractive investment avenue to the investors in terms of its risk and return as compared to the stock and bond. The study uses daily data of gold, bond and Nifty 50 index over a period from 2012 to 2017 by applying volatility forecasting modelling. She observes that volatility of risk is lower than the stock and bond. The study also says about gold is a good investment avenue for the educated people as compared to others. Similarly, in 2017, Seshiah et. al., seek to examine the influence of energy prices, exchange rate, trade deficit and fiscal deficit on gold prices over a period from 1994-1995 to 2014-2015 with monthly observations in India. They apply various statistical and econometrical tools and techniques. They observe that the time series data are stationary after first difference with same order of integration. According to the Johansen co-integration test there are two co-integrated equations and the variables have long run relationships. They also observe bi-directional causality between trade and fiscal deficit as well as trade deficit and exchange rate similarly, uni-directional short run causality exists between gold and exchange rate; gold and fiscal deficit; trade deficit and gold; and also trade deficit and energy prices. In 2018, Balaji and Mahalingam seek to examine the impact of macro-economic variables on gold prices in India by considering secondary data. Thus, they use various statistical tools like correlation, regression and coefficient of variation to explore various influences of the macro-economic variables. They observe that gold prices are more volatile as compared to other variables. They also find that gold price is strongly correlated with BSE, NSE, energy price, euro, Yen and foreign institutional investment. According to the regression result they point out that BSE, NSE and crude oil prices can influence the gold prices. Similarly, in 2018, Bhuyan and Dash examine the relationship between gold prices and National Stock Exchange (NSE) over a period from January 2001 to December 2017 by considering monthly time series data. Thus, they apply Johansen

co-integration and Granger's causality tests. They observe that the time series data are stationary after first difference with co-integrated equations that means presence of long run equilibrium relationship between gold prices and NSE. But, there is absence of short run causal relationship between them. Once again in 2018, Ameer et. al., examines the relationship between gold prices and stock prices in Germany over a period from 2004 to 2016 by considering monthly data obtained from Bloomberg data base. They consider Frankfurt stock exchange and divide the entire time period in three parts (pre, post and during recession). Therefore, they use Johansen co-integration and Granger causality tests. They show that the correlation between gold prices and stock prices is positive and some time it is negative across the sub periods. According to the co-integrated test there is a long run equilibrium relationship among the variables. But Granger causality test indicates absence of short run causal relationship between the variables. Similarly, in 2018, Moreman and Bonga seek to examine the impact of gold and oil price shocks on South African stock market and its component indices over a period from 3 January 2006 to 31 December 2015 by considering daily data. To examine this issue, they use asymmetric dynamic conditional correlation (ADCC), generalised autoregressive conditional heteroskedasticity (GARCH) approaches. They also examine the magnitude of the optimal portfolio weight, hedge ratio and hedge effectiveness for portfolios. They observe that there is significant volatility spill over between the gold price and stock market and also energy price and stock market. In the same year in 2018, Mukhuti tries to examine the impact of volatility of domestic gold prices on stock prices in India over a period from 2008 to 2018. To examine this he applies various statistical and econometric tools and techniques like correlation, regression and Granger causality test. The study shows that BSE and NSE are positively correlated with the gold prices but there is no significant impact on gold prices as presented by the regression equation. Finally, Granger causality shows bi-directional relationship between gold prices and BSE's return and also NSE's return. Similarly, in 2018, Sharma et. al., seek to examine the determinants of gold prices over a period from 1991 to 2000 in India. Thus, they consider many macro-economic variables to examine this. Therefore, he applies simple and multiple regression techniques and also applies various statistical tests. They observe that the macro-economic variables have positive impact on gold prices. But, individual impact of inflation and interest rates on gold prices is negative and insignificant. In 2019, Sun tries to examine the relationship between the macro-economic variables in China over a period from 2008 to 2016 by taking into account the daily data collected from various secondary sources. Thus, he considers oil prices, gold prices, stock prices and foreign exchange

in China and applies correlation measure which is based on Vine Coupla technique. He observes that energy market captures the dominant position in other markets.

In the developed countries a lot of research works have shown the relationship between gold and the macro-economic variables. However, there is few research works are conducted in the developing countries like India. But, in pandemic situation, study on gold is scanty. The present study tries to address this research gap and add value to the existing literature. There is lot of evidences on financial disaster but global economic slowdown due to COVID-19 is totally new in financial literature. More specifically, the study focuses on to examine the equilibrium relationship between the stock prices and gold prices and also to examine the investors' preferences on investment regarding gold and stock during COVID-19 in India

Objective of the study:

The study is designed to achieve the following objectives:

- i. To examine the long-run equilibrium relationship
- ii. To establish the short-run causal relationship and direction of causality
- iii. To establish whether gold is more preferable by the investors as compared to stock during COVID-19 lockdown

Data & Study Period:

The study considers daily time series data over a period from 30th January 2019 to 31st July 2020. The daily closing value of BSE and NSE are obtained from their official websites. The daily gold prices of ten grams (22 carat) in Indian rupee is collected from multi commodity exchange and cross checked with prices provided by world gold council.

Hypothesis formulation:

The study is designed to examine the causal relationship between the gold prices and stock prices by using dummy variable under VAR environment during COVID-19 pandemic and thus the following hypotheses are formulated:

Hypothesis 1:

H0: The time series data are non-stationary

H1: The time series data are stationary

Hypothesis 2:

H0: There is no long run equilibrium association between the variables

H1: There is a long run equilibrium association between the variables

Hypothesis 3:

H0: There is no short run causal association between the variables

H1: There is a short run causal association between the variables

Hypothesis 4:

H0: Investors don't like to prefer gold investment during COVID-19 lockdown

H1: Investors like to prefer stock investment during COVID-19 lockdown

3. METHODOLOGY

The study considers the closing prices of the time series data of the macroeconomic variables and then converted the data series into logarithm time series. When time series data is considered for empirical research then it is assumed that the time series data are normally distributed. The study uses Jarque-Bera (1981) test statistics to examine normality of the time series data based on sample skewness and kurtosis and thus, the following testable hypothesis is formulated as under:

H₀: the distribution is normal

H_a: the distribution is not normal

The J-B test statistic can be defined as below:

$$JB = (n - k) \left(\frac{s^2}{6} + \frac{(k - 3)^2}{24} \right) \quad (1)$$

Where, *s* and *k* measures sample skewness and kurtosis respectively, *n* represents number of observation. It is assumed that if the value of skewness and kurtosis is 0 and 3 respectively then the distribution follows normality and vice-versa. Here, the result of normality test of the time series data is presented in table 1. It is observed that the skewness and kurtosis of the time series data is less than 0 and 3 respectively that means data are normally distributed. Here, the probabilities values of the JB statistics are higher than 5% level in all cases indicating acceptance of the null hypotheses.

Table 1: *Test of normality*

Variable	Observation	Skewness	Kurtosis	JB	P-value
logBSE	125	-0.050278	2.109197	4.185631	0.123339
logNSE	125	-0.096592	2.110137	4.318628	0.115404

logGold	162	-0.074307	2.303051	3.427811	0.180161
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The non-stationarity is one of the significant problem when deals with time series data in modelling economic relationship. In case of non-stationary data, OLS regression procedures produce incorrect estimates of the parameters (spurious regression). So, non-stationarity must be tested and corrected for time series economic modelling. Here, Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests are applied to check non-stationarity. Therefore, the study considers the following random walk model

$$Y_t = \alpha + \rho Y_{t-1} + e_t \quad (2)$$

Where, Y_t is a series of observation at time t . It is evident that when $|\rho|=1$ then Y_t faces unit root problem (non-stationary) and then the variances grow exponentially as t increases (Dickey & Fuller 1979). After taking first difference, the series looks like $\Delta Y_t = Y_t - Y_{t-1} = e_t$ that becomes stationary (white noise) and then run regression ΔY_t on ΔX_t instead of Y_t on X_t . Dickey and Fuller extend the test procedure by inserting an extra lagged terms of the dependent variable in the right hand side of the regression in order to eliminate the autocorrelation problem. The optimum lag length may be determined by using various criterions (AIC, SBIC & HQIC). The ADF test may be written as under:

$$\Delta Y_t = \alpha + \delta Y_{t-1} + \sum_{i=1}^k \beta_i \Delta Y_{t-i} + e_t \quad (3)$$

Similarly, Phillips and Perron (1988) widen a generalization of the ADF test technique and consider the following equation:

$$\Delta Y_t = \alpha + \delta Y_{t-1} + e_t \quad (4)$$

Here, the PP test makes a correction to the t statistic of the coefficient δ from the AR(1) process to explain the serial correlation in e_t . So, PP test is the modification of the ADF test that takes into consideration the less restrictive nature of the error process.

The outcome of the unit root test is presented in table 2. It is observed that in level form the time series data are non-stationary or in other words have unit root problem based on both the test statistics. But the time series data become stationary after taking first differences because the probabilities values are less than 5% levels in all cases and thus, null hypotheses can be rejected here.

Table 2: *Unit root test*

Variable	ADF				Phillips-Perron				Order of Integration
	Level		1 st Difference		Level		1 st Difference		
	t-stat.	Prob.	t-stat.	Prob.	t-stat.	Prob.	t-stat.	Prob.	
<i>logBSE</i>	-1.6451	0.4566	-12.8639*	0.0000	-1.6128	0.4730	-12.7267*	0.0000	I(1)
<i>logNSE</i>	-1.6091	0.4749	-12.9000*	0.0000	-1.5926	0.4833	-12.7520*	0.0000	I(1)
<i>logGold</i>	-0.0855	0.9480	-12.6836*	0.0000	-0.1627	0.9393	-12.6969*	0.0000	I(1)

* Significant at 5 percent level.

Note: Author's own calculation

Order of integration is one of the important criteria for co-integration analysis. According to the Ganger theorem if Y_t and X_t are $I(d)$ then there exists a linear combination between them that is integrated of order "b", where $b < d$ that tells about that both Y_t and X_t are $I(1)$ but the linear combination of them must be $I(0)$ and thus, spurious regression can be eliminated. Here, the above series are stationary at their first differences and thus, the order of integration is $I(1)$.

Then choosing of optimum lag length is another important criterion for co-integration and VAR modelling. It is assumed that the lag length will be optimum when the loss function will be minimized and thus, the study uses AIC, SBIC and HQIC criterions.

Table 3 highlights the result of choosing optimum lag length criterion. It is found that the optimum lag length based on SBIC and HQIC is one but AIC tells about four. The study uses, one lag because out of three criterions, two criterions indicate to choose one lag for co-integration and VAR modelling.

Table 3: *Selection of optimum lag length*

Lag order	AIC	SBIC	HQIC
0	-18.15645	-18.08562	-18.12769
1	-25.23725	-24.95395*	-2.12223*
2	-25.16149	-24.66572	-24.96021
3	-25.14268	-24.43443	-24.85514
4	-25.36830*	-24.44757	-24.99449

* Indicates lag order selection, AIC: Akaike Information Criterion; SBIC: Schwarz Bayesian Information Criterion & HQIC: Hannan Quinn Information criterion

Note: Author's own calculation

After satisfying the preconditions of VAR modelling, now co-integration relationship can be examined among the macro-economic variables. Granger (1981) is the pioneer to introduce co-integration and thereafter it is extended by Engle and

Granger (1987), Engle and Yoo (1987), Phillips and Ouliaris (1990), Stock and Watson (1988), Phillips (1986 & 1987), Johansen and Juselius (1990) and Johansen (1988, 1991 & 1995). According to Harris (1995), co-integration means presence of stable relationship in the long-run from which an economic system converges in due course. In accordance with, Asteriou (2007) observes that in bi-variate regression model, there may be facts of more than one co-integrating vector with many equilibrium relationships and thus, Johansen (1991) propose maximum-likelihood co-integration technique under VAR environment as below:

$$Z_t = n + k_1 \Delta z_{t-1} + \dots + k_p \Delta z_{t-p} + \Pi z_{t-p} + e_t \quad (5)$$

Where, Z_t is a k vector of non-stationary series of order $I(1)$, ' n ' is a k vector of parameters to be estimated and e_t is a k vector of innovations. Now we can express the above VAR(p) model in a Vector Error Correction Model (VECM) as below:

$$\Delta Z_t = n + \sum_{i=1}^{p-1} \Gamma_i \Delta Z_{t-i} + \Pi Z_{t-1} + e_t \quad (6)$$

$$\text{Where, } \Pi = \sum_{i=1}^p k_{i-1} \quad \text{and} \quad \Gamma_i = - \sum_{j=i+1}^p k_j$$

Where, matrix Π represents long-run relationships ($p \times p$ matrixes of parameters) and matrix Γ_i provides short run coefficients to be estimated ($p \times p$ matrixes of coefficients). Although, Π can be decomposed as follows:

$$\Pi = \alpha \beta;$$

Where, α denotes the speed of adjustment and β represents the long-run matrix of coefficients which is equivalent to the error correction term.

Johansen test is divided into two types that uses maximum likelihood statistics namely trace test and maximum Eigen value test.

The trace test can be represented as under:

$$\lambda_{trace} = -T \sum_{i=r+1}^n \ln(1 - \bar{\lambda}_i) \quad (7)$$

Here, T stands for number of observations, $\hat{\lambda}$ is the eigen value and n is the number of separate series to be analysed. The hypothesis can be formulated as under:

H_0 : number of co-integrating vector is $\leq r$ ($r = 0, 1, \text{ or } 2$)

Ha: number of co-integrating vector is r

Likewise, the max eigen value test can be written as under:

$$\lambda_{\max} = -T \ln(1 - \hat{\lambda}_{r+1}) \quad (8)$$

The testable hypothesis can be formulated as below:

H0: number of co-integrating vector is r

Ha: number of co-integrating vector is r + 1

Where, the null hypothesis r = 0 is tested against r = 1 and also tested against r = 2.

Sims (1980) says that, if there is simultaneity among a number of variables then distinction between dependent and independent variables is worthless that means they are treated as endogenous and therefore, each equation has the same set of regressors for developing VAR model. It is found from the beginning that the variables are stationary at their first differences and order of integration is I(1) with optimum lag length one. The outcome of Johansen co-integration test is presented in table 4. It is found from the table that the trace statistic and max eigen statistic are insignificant based on both tests as the probabilities values are higher than five percent level of significance that means there is no evidence of co-integrating equations or long-term equilibrium relationship between the gold and stock prices during COVID-19 pandemic in India and therefore null hypothesis is accepted here and so, we can proceed for VAR modelling for examining short-run relationship.

Table 4: Johansen Co-integration test

Hypothesis ed no. of CEs	Eigen value	Rank test (Trace)			Rank test (Max-Eigen value)		
		Trace Stat.	Critical Value (0.05)	P- value* *	Max- Eigen Stat.	Critical Value (0.05)	P- value* *
None	0.10505 7	21.3021 2	29.7970 7	0.3391	13.3193 8	21.1316 2	0.4233
At most 1	0.05984 6	7.98273 2	15.4947 1	0.4673	7.40533 7	14.2646 0	0.4424
At most 2	0.00480 0	0.57739 5	3.84146 5	0.4473	0.57739 5	3.84146 5	0.4473

*Trace & Max-Eigen value tests indicate no co-integrating equations at 5% significance level;

*denotes rejection of the hypothesis at 5 percent level; **denotes MacKinnon-Haug-Michelis p-values

Note: Author's own calculation

After testing co-integration it is observed absence of co-integrating equations among the gold and stock prices during COVID pandemic and thus we can proceed to develop unrestricted VAR modelling to check short run relationship among the macroeconomic variables. The VAR is an un-restricted model.

Under VAR modelling it is assumed that the macro-economic variables are treated as independent and there is simultaneity of relationship between them. In this study, three macroeconomic variables are considered (BSE, NSE and Gold). But the study also considers dummy variable that puts into the VAR modelling to examine whether the investors like to prefer gold investment during COVID-19 lockdown as compared to stock investment? Dummy variable generally takes two numerical values 1 and 0. It can be shown as below:

$D = 1$, when investors prefer to invest in gold during COVID-19 lock-down

$D = 0$, otherwise

So the above situation can be specified under VAR environment as under:

$$\Delta \log Gold_t = \alpha_1 + \sum_{j=1}^p \beta_j \Delta \log Gold_{t-j} + \sum_{j=1}^p \gamma_j \Delta \log BSE_{t-j} + \sum_{j=1}^p \lambda \Delta \log NSE_{t-j} + \delta Dummy_t + e_{1t} \quad (9)$$

$$\Delta \log BSE_t = \alpha_2 + \sum_{j=1}^p \beta_j \Delta \log BSE_{t-j} + \sum_{j=1}^p \gamma_j \Delta \log NSE_{t-j} + \sum_{j=1}^p \lambda \Delta \log Gold_{t-j} + \delta Dummy_t + e_{2t} \quad (10)$$

$$\Delta \log NSE_t = \alpha_3 + \sum_{j=1}^p \beta_j \Delta \log NSE_{t-j} + \sum_{j=1}^p \gamma_j \Delta \log BSE_{t-j} + \sum_{j=1}^p \lambda \Delta \log Gold_{t-j} + \delta Dummy_t + e_{3t} \quad (11)$$

Here, it is assumed that each equation in the VAR system contains p lag of the macroeconomic variables with an error term that indicates shocks or impulses under VAR(p) framework.

To estimate the above VAR model, stationary of the variables must be checked and it is observed that the variables are stationarity after first difference i.e. I(1) and the optimum lag length is one under SBIC and HQIC criterion.

Now, we can estimate the VAR(1) model as below:

$$\Delta \log \hat{Gold}_t = \hat{\alpha}_1 + \hat{\beta}_1 \Delta \log Gold_{t-1} + \hat{\lambda}_1 \Delta \log BSE_{t-1} + \hat{\gamma}_1 \Delta \log NSE_{t-1} + \delta Dummy_t + e_{1t} \quad (12)$$

$$\Delta \log \hat{BSE}_t = \hat{\alpha}_2 + \hat{\beta}_2 \Delta \log BSE_{t-1} + \hat{\lambda}_2 \Delta \log Gold_{t-1} + \hat{\gamma}_2 \Delta \log NSE_{t-1} + \delta Dummy_t + e_{2t} \quad (13)$$

$$\Delta \log \hat{NSE}_t = \hat{\alpha}_3 + \hat{\beta}_3 \Delta \log NSE_{t-1} + \hat{\lambda}_3 \Delta \log BSE_{t-1} + \hat{\gamma}_3 \Delta \log Gold_{t-1} + \delta Dummy_t + e_{3t} \quad (14)$$

Where, α indicates constant term. β , λ and γ are the slope coefficients to be estimated. δ is the slope coefficient of the dummy variable that measures investors' preference towards gold investment during COVID-19 lockdown if the

slope coefficient is positive and statistically significant or vice-versa. Δ is the difference operator.

The study also uses Granger causality test to find out the direction of causality between the variables under VAR environment.

The goodness or suitability of the VAR model is checked by using some well known statistical measures like serial correlation, heteroskedasticity and normality by considering the residuals.

Finally, the CUSUM test is applied for parameter stabilization by considering the recursive residuals:

$$\theta_t = \sum_{j=k+1}^T \frac{\theta_j}{\hat{\sigma}_t}, \quad j = k + 1, \dots, T \quad (15)$$

$$\text{with, } \hat{\sigma}^2 = \frac{\sum_{j=k+1}^T (\theta_j - \bar{\theta})^2}{T - K - 1} \quad \text{and} \quad \bar{\theta} = \frac{\sum_{j=k+1}^T w_j}{T - k}$$

Where, θ denotes the recursive residuals. σ is the standard error of the regression fitted to T sample points and k is the number of coefficients to be estimated.

Result & Analysis:

The estimated short-run coefficients of the VAR models (Equation 12, 13 & 14) are presented in table 5. It is observed from the table (Equation 12) that the slope coefficients of BSE and NSE are statistically insignificant to influence the gold price during Corona virus outbreak in the short run. But the one period lag slope coefficient of gold is statistically significant and influences its own price significantly during COVID-19. Similarly, the slope coefficients for equations 13 and 14 are found to be insignificant meaning that the exogenous variables in the VAR equations have failed to influence the endogenous variables during the crisis period respectively. Although, the constant terms of all the VAR models are statistically significant. But, the slope coefficients of the dummy variables under the VAR models are insignificant that means that the investors don't like to prefer gold investment during the time of COVID-19 lockdown in India or oppositely the investors like to invest in stock markets (BSE and NSE) during the specified period of COVID-19 lockdown. The macro-economic time series data are good fit into the VAR models as shown by the R^2 values and the models are free from autocorrelation problems as suggested by the Durbin-Watson test statistics.

Table 5: Estimation of coefficient under VAR

Dependent Variable	Const.	Coefficients				R ²	D-W
		$\beta_1 \log \text{Gold}_{t-1}$	$\lambda_1 \log \text{Bse}_{t-1}$	$\gamma_1 \log \text{Nse}_{t-1}$	$\delta_1 \text{Dummy}_{t-1}$		
$\Delta \log \text{Gold}_t$ (Equation 12)	0.8533** (2.7024)	0.9113** (9.5287)	-0.1034 (-0.1424)	0.0630 (0.0850)	-0.0021 (-0.5424)	0.9535	2.0492
$\Delta \log \text{BSE}_t$ (Equation 13)	1.6876** (2.4720)	$\beta_2 \log \text{Bse}_{t-1}$	$\lambda_2 \log \text{Gold}_{t-1}$	$\gamma_2 \log \text{Nse}_{t-1}$	$\delta_2 \text{Dummy}_{t-1}$	0.9494	1.9494
		2.4094 (1.5517)	-0.2579 (-1.2626)	-1.6868 (-1.0641)	0.0065 (0.7735)		
$\Delta \log \text{NSE}_t$ (Equation 14)	3.5930** (2.3809)	$\beta_2 \log \text{Nse}_{t-1}$	$\lambda_2 \log \text{Bse}_{t-1}$	$\gamma_2 \log \text{Gold}_{t-1}$	$\delta_3 \text{Dummy}_{t-1}$	0.9524	1.9460
		-0.8169 (-0.5258)	1.5451 (1.0153)	-0.2606 (-1.3019)	0.0066 (0.7026)		

** significant at 5 percent level

Note: Author's own calculation

The direction of Granger causality is presented in table 6. From the below table, it is observed that two-way or bi-directional causality is found between Bombay Stock Exchange (BSE) and National Stock Exchange (NSE) during COVID-19. But in other cases the evidences of direction of causalities are absent.

Table 6: Granger causality test

Null Hypothesis (H ₀)	F-Statistic	Prob.	Decision
BSE doesn't Granger cause Gold	0.02113	0.8847	Don't Reject H ₀
Gold doesn't Granger cause BSE	0.47451	0.4922	Don't Reject H ₀
NSE doesn't Granger cause Gold	0.04219	0.8376	Don't Reject H ₀
Gold doesn't Granger cause NSE	0.55755	0.4567	Don't Reject H ₀
Dummy Variable doesn't Granger cause Gold	2.38707	0.1250	Don't Reject H ₀
Gold doesn't Granger cause Dummy Variable	0.30445	0.5821	Don't Reject H ₀
NSE doesn't Granger cause BSE	4.83995**	0.0297	Reject H ₀
BSE doesn't Granger cause NSE	4.61574**	0.0337	Reject H ₀
Dummy Variable doesn't Granger cause BSE	2.36595	0.1266	Don't Reject H ₀
BSE doesn't Granger cause Dummy Variable	2.08454	0.1514	Don't Reject H ₀
Dummy Variable doesn't Granger cause NSE	2.66545	0.1051	Don't Reject H ₀
NSE doesn't Granger cause Dummy Variable	2.00268	0.1596	Don't Reject H ₀

**significant at 5 percent level

Note: Author's own calculation

The validity of the VAR models is checked and the outcomes are presented in table 7. It is found that the observed R² values of the residuals of all the VAR models based on Breusch-Godfrey test are statistically insignificant that means absence of

autocorrelation problem in the VAR models which is desirable. The heteroskedasticity test tells about rejection of null hypothesis in all the cases which is not enviable. Although, the J-B statistics of the residuals of the VAR models are found to be insignificant for rejecting the null hypothesis regarding normality which is acceptable. Finally, it may be said that the VAR models are valid based on two criterions out of three.

Table 7: Test for checking validity of the VAR

Dependent Variable	B-G LM test		B-P-G Het. Test		Normality Test	
	Obs* R ²	Prob.	Obs* R ²	Prob.	J-B Stat.	Prob.
Residuals of $\Delta \log \text{Gold}_t$	0.87880	0.2872	32.10889	0.0001	1.8325	0.3216
Residuals of $\Delta \log \text{BSE}_t$	0.89317	0.3446	36.56945	0.0000	2.5127	0.2784
Residuals of $\Delta \log \text{nNSE}_t$	0.97139	0.3243	95.76630	0.0000	2.1247	0.4578

Note: Author's own calculation

The parameter stabilization of the VAR models is checked by applying CUSUM test and the graphs are presented in three figures. It is found that the cumulative sums of scaled recursive residuals in all the cases are inside in five percent critical lines that indicate parameter stability and absence of structural break which is acceptable.

Stability diagnostic

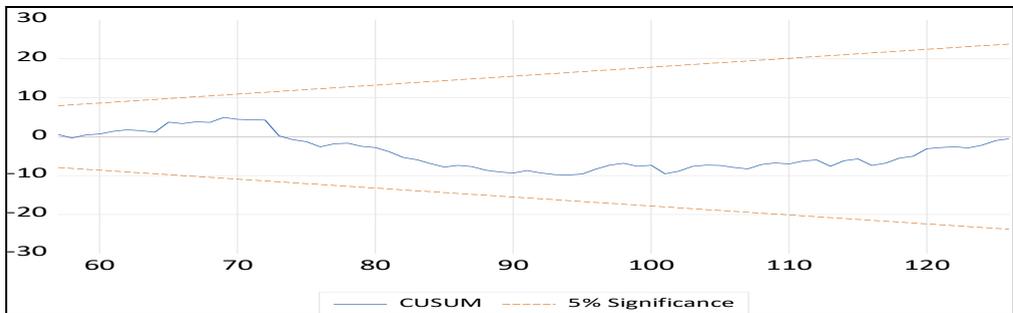
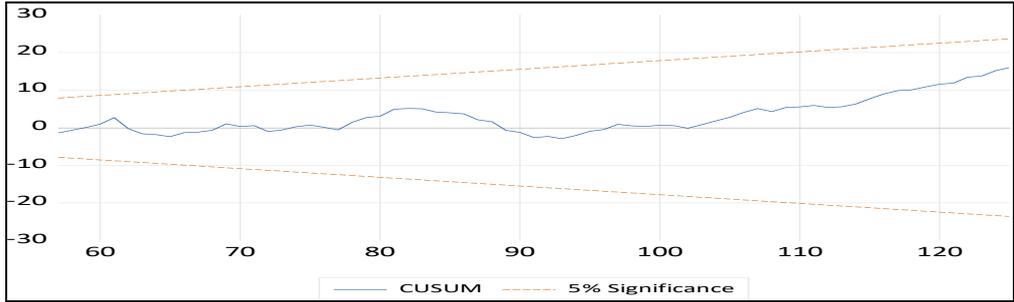
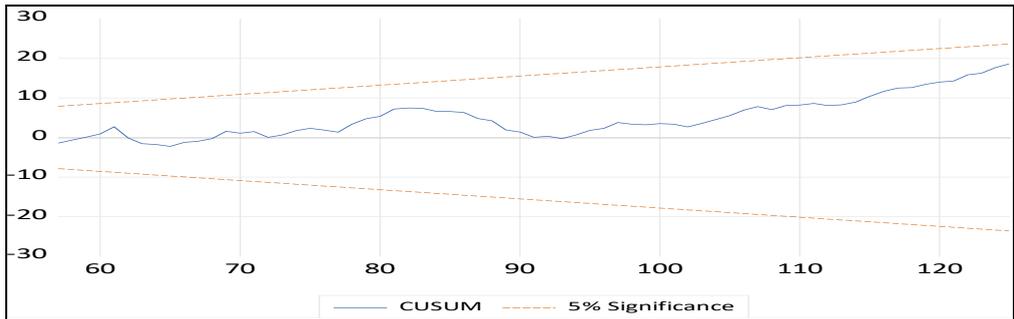


Figure 1: Gold

Figure 2: *BSE*Figure 3: *NSE*

4. CONCLUSION

The present study seeks to examine the association between stock and gold investment during COVID-19 pandemic in India. Here, the macroeconomic time series variables (BSE, NSE and Gold) are normal and stationary at their first difference with same order of integration [I(1)] with optimum lag length of one without any co-integrated equations. So, there is no evidence of long run equilibrium relationship among the macroeconomic variables during COVID-19 pandemic. In the short-run it is observed that only one period lagged gold price significantly influence the gold price under VAR model (Equation 12). During COVID-19 lockdown, the investors like to prefer to make investment in stock as compared to gold as suggested by the dummy variable coefficients. The bi-directional causality is seen between BSE and NSE only. Various residuals tests enlighten about VAR model validity and stability.

The VAR modelling may be applied extensively in the emerging and underdeveloped countries for better understanding of the macroeconomic variables. Furthermore, this study may be helpful to the researchers, social thinkers, investors,

investment managers and policy makers to rethink again about the association between stock and gold by contributing more knowledge in this field.

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MARKET-SENSING CAPABILITIES, PROFITABILITY WITHIN STAGNANT INDUSTRIES AND CRAFTING OF CUSTOMER VALUE PROPOSITIONS

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Abstract: *From the perspective of market competition, this paper investigates the impact of market-sensing capability on a company, and sources profits within a slow growth industry. As an example, our results are applied to demonstrate how effective customer value propositions can be formulated. Among others, it is shown that market-sensing capability empowers a company to categorize customers, lower its operational costs while increase expected profits; that when an industry experiences slow growth, its member company's profit can grow only through a combination of raising unit price and lowering unit cost; and how market knowledge and innovative understanding of market invitations potentially lead to effective CVPs. Instead of employing either a statistics-based approach or an anecdotal analysis, this work relies on the rigor of game theory so that all results established are generally true unless given conditions are violated. Managerial recommendations for decision makers and potential questions for future research are provided.*

Keywords: *customer relation; market invitation; market knowledge; market-level growth; Nash equilibrium; profit portfolio*

JEL Classification: *M10, M31*

1. INTRODUCTION

Market-sensing, meaning innovative understanding of market signals and invitations, has been recognized as an important capability for a company that desires to survive and succeed in increasingly fast-changing markets (Day, 1994; Forrest et

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al., 2017; McGrath, 2013). However, the literature reports inconsistent findings. For example, Ardyan (2016) does not find any positive effect of market-sensing capability on companies' profitability. Although such capability does show some positive effect on companies' profitability, Lindblom et al. (2008) confirms that the effect is not significant. However, in terms of positive findings, Sugiyarti and Ardyan (2017) confirm a positive effect of such capability on the quality of market entries; and Alshanty and Emeagwali (2019) demonstrate a significant impact on knowledge creation for small- and medium-sized enterprises. If these studies, either negative or positive, are seen holistically (Forrest, 2018), these empirically confirmed results are really obvious. For example, a company's ability to see a market trend does not mean that it is capable of actually taking appropriate actions to follow the trend. That is, between seeing and materializing what is seen there is a large room for many other things to occur (McGrath, 2013). As for the listed positive empirical findings, each market entry decision is generally made based on prior market sensing, while knowledge creation takes place after learning from the market. So, of course the capability of market sensing impacts market entry and knowledge creation positively. Although we can provide such holistic explanations for the inconsistency of the literature, an important general question still arises as follows: are there key factors that drive these inconsistent empirical findings?

The answer to this question is both theoretically and practically important, because whether it is for a market leader or a follower, knowing the evolving direction of future market demand and being able to actually take corresponding actions are crucial for managers to plan strategically and to make necessary adjustments, especially within the current era of transient competitive advantages (McGrath, 2013).

The primary contributions of the present research are threefold. First, to arrive at an answer to the present question, we have to methodologically go beyond the limitations of all statistics- and anecdote-based approaches. The literature is mostly empirical, which is why inconsistent results as listed above appear. And, it has been noted that in many situations, inconsistencies and difficult issues are simply consequences of the tools employed in studies (Einstein, 1997). Hence, instead of using statistics-based empirical studies or anecdote-based qualitative research, this paper utilizes game theory and the logical reasoning that is widely used in mathematics (Kline 1972). Second, by using game theory, we are able to conceptualize a company's potential for achieving and sustaining profitability in industries that experience stagnant market growth. Third, we offer a novel

application of market knowledge and an innovative understanding of market signals to help companies formulate effective customer value propositions (CVPs).

The rest of this paper is organized as follows: Section 2 reviews relevant literature Section 3 shows the vital importance of market-sensing capabilities for companies that endeavor to succeed in the marketplace. Section 4 investigates profitability in industries that experience stagnant market growth. As applications of established results, Section 5 considers the association between customer relationship management capability & profitability, and conditions under which effective CVPs can be drafted. This presentation concludes in Section 6 with managerial recommendations and appropriate questions for future research.

2. LITERATURE REVIEW

This work contributes to three areas of the literature: market-sensing capabilities, profitability in stagnant industries and formulation of CVPs. Studies on market-sensing capabilities have been mostly empirical and revealed inconsistent findings. For example, Bharadwaj and Dong (2014) show that market learning needs to cover all customers in order for a company to synchronize with market change and to deliver superior value. Ardyan (2016) and Lindblom et al. (2008) find respectively that market-sensing capability has no positive or significant effect on profitability. Sugiyarti and Ardyan (2017) demonstrate that market-sense capability positively and significantly affects the quality of market entry. Bayighomog Likoum et al. (2018) propose an empirical research agenda that links market-sensing capability and firm performance. Alshanty and Emeagwali (2019) confirm market-sensing capability's positive effect on knowledge creation for small and medium sized enterprises. The present research enriches the extant literature, while avoiding all constraints of statistics- and anecdote-based approaches, and reveals that market-sensing capability enables a company to identify target customers, to lower its average costs and to increase expected profits.

There is a paucity of literature concerning profitability in stagnant industries, all of which examine a particular industry or market. For instance, Ferber and Schlappa (2016) use good practices and a model to investigate how brownfield land can be managed more effectively and sustainably in stagnant European urban land markets. Tournois (2016) reveals how BB cream, a breakthrough product in the cosmetics market, brought about successful growth. Porse and Rudolph (2017) review the geography of the seaweed hydrocolloid industry and provide industry-wide suggestions. Clements et al. (2019) address challenges faced by small-scale furniture productions in Jepara, Indonesia, by assessing a regional producers

association. Le et al. (2020) investigate financial development and productivity growth in stagnant or low-productivity-growth U.S. industries. Contrary to these studies on specific industries and markets, this work has broad applicability to many industries lacking market growth.

Most of the literature on formulation of CVPs is oriented towards applications. For example, Osterwalder et al. (2014) list processes and tools that help produce and generate sales of companies' products that sell. By adapting this work to financial planners, Lecours (2017) provides a framework of CVP development. Wouters et al. (2018) recommend startups construct two sequential value propositions – the innovative offering and leveraging assistance value proposition – with the former demonstrating the superior value created for customer firms and the latter value captured by customer firms. Using what he terms the “service-dominant logic,” Kowalkowski (2011) codifies four principles from the literature to guide a company as it designs its market opportunities. In comparison, using game theory the current research develops how market knowledge can help create effective CVPs and why innovative understanding of market invitations plays a key role in the creation of effective CVPs.

In sum, this work contributes to the literature in three different ways by: clarifying inconsistent empirical findings, deriving results that are broadly applicable to markets that satisfy given conditions, and establishing the importance of knowledge and innovative understanding of markets in the formulation of CVPs.

3. VITAL IMPORTANCE OF MARKET-SENSING CAPABILITIES

To theoretically see why market-sensing capabilities are vitally important for companies, let us consider an oligopoly market, that is perfectly complete and served by n incumbent companies, for $n = 1, 2, 3, \dots$. Assume that the operation of the market is only affected by market forces, such as demand and supply, which are influenced by consumers' forever evolving preferences and tastes. Implicitly, this assumption means that although technological advances affect the equilibrium between market demand and supply, the competition among rival companies is not influenced in any way by any other market. Assume that the n incumbent companies serve the said market with their horizontally differentiated offers, $n = 1, 2, 3, \dots$. Although consumers' forever-evolving preferences and tastes tend to turn once loyal customers into switchers who make purchase decisions depending on which company's offer is valued more highly, assume that each incumbent company enjoys the support of its loyal customers as long as the prices are not more than their reservation prices. The existence of switchers means that there are customers in the

marketplace who are not totally satisfied with any of the available market offers. For these switchers, assume that for whatever reason they make their purchases only from the company that offers the best price. Collectively, the totality of these switchers will be referred to as the consumer surplus in the marketplace. So, other than trying to keep their corresponding loyal customers, the incumbent companies compete with each other over the consumer surplus by using pricing strategies.

As for the managerial decision-making of the incumbent companies, assume that the companies' managers are well aware of competitors' pricing strategies so that they set prices that result in a Nash equilibrium to advance their best responses through untainted self-analyses. Then, the dynamics of competition in this market is of the following property:

Theorem 1. When the afore-mentioned market is in Nash equilibrium, if the percentage scale of consumer surplus is greater than that of the loyal-customer base of at least one incumbent company, then an opportunity appears for other companies to profitably enter the market with their versions of substitute offers so that the aggregate expected profit of all entrants can be potentially larger than that of at least one incumbent company.

Proof: Without loss of generality, assume that all boundary conditions are normalized as follows: for each company involved, its cost of production is 0, customer's reservation price is 1, its price P satisfies $0 \leq P \leq 1$, its (percentage) magnitude of loyal customers is u (same for all incumbent companies), and $v = 1 - nu$ stands for the percentage magnitude of the consumer surplus. Also without loss of generality, assume that only one new company enters into the described market by randomizing its price between production cost 0 and reservation price 1.

To protect their established territories and to exercise mutual forbearance (Bernheim and Whinston, 1990), each incumbent company sets its price by considering the entrant and other incumbents. If the entrant randomizes its price between its cost and customer reservation price, then the equilibrium indifference condition of incumbent Company k is

$$u \times P + v \times P \prod_{j \neq k}^n (1 - P)[1 - F_j(P)] = u \times 1 \quad (1)$$

where $F_j(P)$ represents the price distribution of company j , and in Nash equilibrium, the incumbent companies do not have any pure pricing strategy (Forrest et al., 2017). So, for the incumbent companies, their symmetric equilibrium pricing is

$$F(P) = 1 - \left(\frac{1-v}{vnP} \right)^{\frac{1}{n-1}} \quad (2)$$

The assumption that the consumer surplus $v \geq u$ (= the magnitude of the loyal-customer base of at least one incumbent company) implies that equation (2) defines a mixed strategy for each incumbent company for P satisfying $(1-v)/(vn) \leq P \leq 1$. Since $F(P)$ is discontinuous at $P = 1$ with a jump $[(1-v)/(vn)]^{\frac{1}{n-1}}$, the expected profits of the entrant are:

$$E_e(\Pi) = \int_0^{(1-v)/(vn)} vPdP + \int_{(1-v)/(vn)}^{+\infty} vP[1-F(P)]^n dP \quad (3)$$

$$= \begin{cases} \frac{(1-v)^2}{2vn^2} - \frac{(1-v)^2}{vn^2} \ln \frac{1-v}{vn} + v \left(\frac{1-v}{vn} \right)^{\frac{n}{n-1}}, & \text{if } n = 2 \\ \frac{-(1-v)^2}{2vn(n-2)} + \frac{n-1}{(n-2)} \left[\frac{(1-v)^n}{vn^n} \right]^{\frac{1}{n-1}} + v \left(\frac{1-v}{vn} \right)^{\frac{n}{n-1}}, & \text{if } n \geq 3 \end{cases} \quad (4)$$

The first term on right-hand side of equation (3) is equal to the entrant's expected profits when it charges a price lower than the incumbents and captures all switchers, and the second term is the entrant's expected profits when it directly competes with the incumbent companies. Additionally, the expected profits of an incumbent are

$$E_m(\Pi) = \int_{(1-v)/(vn)}^1 \left\{ \frac{1-v}{n} P + vP(1-P) \prod_{j \neq i}^n [1-F(P)] \right\} dF(P) + \frac{1-v}{n} \left(\frac{1-v}{vn} \right)^{\frac{1}{n-1}} = \frac{1-v}{n}. \quad (5)$$

Because $\frac{\partial}{\partial u} [E_e(\Pi) - E_m(\Pi)] > 0$, and when $u = 1/(n+1) = v$, $E_e(\Pi) - E_m(\Pi) > 0$, there is $u^* \in (0, 1/(n+1))$ satisfying that when $u = (1-v)/n \geq u^*$, $E_e(\Pi) > E_m(\Pi)$. That is, the entrant can actually expect to make more profits in the said market than at least one incumbent, if the assumed normalizations are not applied.

By market-sensing capability, it means such an aptitude that a company can employ to acquire an innovative understanding of market invitations. In other words, such capability represents a company's ability to shed creative light on its knowledge about its customers, competitors, members of its supply-chain ecosystem and the broader market environment in which it operates. This definition generalizes that introduced by Day (1994) and is different from Lindstrom et al (2008) in terms of that other than sensing the market our definition has nothing to do with using the innovative understanding of the market invitation to guide subsequent actions. Now, by examining this concept in the context of Theorem 1, the following result follows. Note: in the rest of this paper, the word “proposition” means one of two unrelated concepts: (1) a statement that is arguably true; or (2) a particular selling point, as well studied in the area of marketing, for example, the unique selling proposition (Reeves 1961), the emotional selling proposition (Lindstrom 2005), or customer value proposition (Payne et al. 2017). The meaning of “proposition” in (1) points to the methodological novelty of this paper: any hypothesis testing, as widely employed in economics and business studies, is a statistics-based approach that helps uncover potential facts, but not any arguably true fact.

Proposition 1. With a superb market-sensing capability, a company is able to

- (1) Identify the market segments of customers who are not adequately served and customers who are unsatisfied with currently existing market offers; and
- (2) Learn market insights that enable the company to lower its average costs through introducing appropriate technologies, acquiring and deploying adequate resources, etc., to meet evolving customer demands and prospective opportunities.

In fact, item (1) is a direct consequence of Theorem 1, where both underserved and unsatisfied customers jointly constitute the market segment of switchers. Because of customers' constantly evolving preferences and needs, currently satisfied customers can still become either unsatisfied or underserved, and become a switcher. So, a superb market-sensing capability helps a company to identify potential switchers. Theorem 1 implies that if there are switchers to target, new competitions will appear.

As for item (2), the appearance of new entrants into the market with the potential of making as much profit as some of the incumbent companies (Theorem 1) means particularly that if v – the magnitude of the market segment of switchers – is greater than that of the loyal-customer base of an incumbent company, then collectively the new entrants can potentially make more profits than some of the incumbent companies. For this outcome to happen realistically, it must be the case

that the new entrants have acquired something, such as knowledge, technology, or managerial routine, that greatly lowers their average costs of production. Examples of this ‘something’ are a disruptive technology, a newly found breakthrough in managerial efficiency, or a more effective production capability. In sum, a superb market-sensing capability enables a company to acquire at least one of these resources to lower its average unit cost.

In terms of the literature, a more narrowly formulated conclusion than item (1) is given by Slater and Narver (2000); and a special case of item (2) is provided by Hult (1998) and Morgan et al (2009a).

Proposition 2. The stronger market-sensing capability a company possesses, the more profit the company can expect to earn.

To see why this result holds true in general, let us consider two scenarios: (1) the focal company operates in a munificent environment, where the demand is greater than the supply; and (2) the focal company conducts its business in an environment that lacks market growth, where the demand is less than or equal to the supply.

When scenario (1) holds true, the market provides the potential of simultaneous growth in both sales and margins; therefore, the company can expect to earn additional profits in these two dimensions. In this case, the market-sensing capability of the company helps it pinpoint where high demand is located, such as underserved market segments, and how its offers can be tailored to satisfy particular consumer needs that are not fulfilled by rivals’ offers. Furthermore, this market knowledge enables the company to conduct a logistically effective sales efforts (Proposition 1 (1)) and fine tune its offers to reach a wider range of customers through either more focused CVPs or adjusting the features and/or functionalities of its offers accordingly (Proposition 1 (2)).

When scenario (2) is the case, the company can grow its profits in two ways (for more details, see Proposition 3 below): (i) expand its market territory through increasing unit sales to current customers, or acquiring new customers, or a combination of these two methods; and (ii) raise margins by either increasing the price for each unit of output sold, or lowering costs, or a combination of both. Under this scenario, a strong market-sensing capability will help the company to realize the exact situation within which it is situated, i.e., market growth is absent, so that appropriate actions can be taken to remedy the situation by possibly adjusting its offers to potentially attract additional customers from the current market or from other markets and by making its production more efficient than before (Morgan et al., 2009b). That is, stronger market-sensing capability leads to more profit potential.

4. PROFITABILITY WITHIN MARKETS THAT LACK MARKET GROWTH

For the purpose of growing profit, a company can generally increase sales revenue, margins or both. Other than the rare circumstances when demands exceed supplies (Dickson, 1992; Keats and Hitt, 1988), such as the cases of expanding markets, say, the personal computer market in the 1970s (Sobel, 1999), the general profit picture of a company is portrayed by the following proposition:

Proposition 3. If a focal company operates within an industry with no market growth, then it can grow its profit only by raising margins through some combination of the following strategies: raise the price for each unit sold or lower the cost of each unit sold.

To show this result, it suffices to demonstrate that under the given assumption about the industry (or market) within which the focal company operates, the company cannot effectively increase its sales revenue. In general, the goal of increasing sales revenue can be accomplished by either increasing unit sales to current customers or acquiring new customers or both.

Assume that the industry (or market) in which the focal company operates is occupied by n incumbent companies, $n = 1, 2, \dots$. They provide substitutable offers to their respective bases of loyal customers, if the price is not more than their reservation price. For the most general situation, the demands of these loyal customers are already satisfied by their respective companies. Thus, increasing sales of additional units of the same market offers to these customers is nearly impossible unless the price per unit value is lowered substantially and/or the demand increases from these loyal customers. In terms of increases in unit sales, enticing a loyal customer to make additional purchases is equivalent to the increase from acquiring a new customer. To acquire new customers, these incumbent companies have to compete against each other by using the strategy of adjusting their per unit-value prices, because it is assumed that they all serve the market with their mutually substitutable offers. The reality that the current business world is in the era of transient competitive advantages (McGrath, 2013) and customers become less patient than ever before (Forrest and Tallapally, 2018) implies that the market surely contains an increasing number of discontent customers with their quickly evolving preferences. Therefore, these customers, no matter whether they were previously loyal to their particular companies or not, become ready targets for the focal company to potentially acquire as new customers. Evidently, when adjustable per unit-value prices are employed to attract potential new customers, the same prices have to be applied to loyal customers also in order to maintain their loyalty through fair treatment. Without loss of generality, assume that the forever improving efficiency of modern technology implies that the pricing strategies of the incumbent companies are

known to each other. Then, to possibly acquire new customers, the incumbent companies play the Nash equilibrium through pure self-analyses.

The following game-theoretical analysis, which is a continuation of the proof of Theorem 1, shows that the expected profit of each incumbent company stays constant and is equal to how much it expects to earn from its base of loyal customers, although the incumbent companies try to attract as many new customers as possible. In other words, what is implied jointly by this analysis and the discussion above is that our focal company cannot effectively raise its sales revenue by increasing unit sales to current customers or acquiring new customers or both. To reach this conclusion of the argument for Proposition 3, let us look at some game-theoretic details below.

In the set-up given in the previous paragraphs, all incumbent companies are identical, as so normalized in the proof of Theorem 1. Hence, there is no pure strategy Nash equilibrium (Narasimhan, 1988; Forrest et al, 2017). To find a symmetric mixed strategy Nash equilibrium, assume that the price distribution of company i , $i \in \{1, 2, \dots, n\}$, is $F_i(P)$. Then, this company's objective function is

$$\begin{aligned} \max_{F_i} E(\Pi_i) &= \int_{-\infty}^{\infty} \left\{ uP + \prod_{j \neq i}^m [1 - F_k(P)] vP \right\} d F_i(P) \\ &= \int_0^1 \left\{ uP + \prod_{j \neq i}^m [1 - F_k(P)] vP \right\} d F_i(P) \end{aligned} \quad (6)$$

where $E(\Pi_i)$ is the expected profit of company i for all possible prices, and all other symbols are the same as those defined and normalized in the proof of Theorem 1. The company's objective is to maximize its expected profit by choosing its particular price distribution $F_i(P)$. The reason why the upper and lower limits of the integral are changed respectively from $+\infty$ and $-\infty$ to 1 and 0 is that when $P < 0$ (= the cost of production) or when $P > 1$ (= reservation price), the profits are zero.

Company i can readily earn u from its loyal customers by charging them the reservation price 1. However, to potentially maximize profits and to protect its market territory (Theorem 1), each incumbent company likes to adjust price P to attract new customers and to potentially exhaust the consumer surplus. At the same time each company does not have any incentive to price its product below $u/(u + v)$. If so, the price below $u/(u + v)$ will yield profit less than u despite of attracting all discontent customers, because $uP + vP \geq u \rightarrow P \geq u/(u + v)$. From the equilibrium indifference condition for company i

$$\begin{aligned}
 u \times P + \prod_{j \neq i}^n [1 - F_k(P)] v \times P = u \times 1, \frac{u}{u+v} \leq P \leq 1, i \\
 = 1, 2, \dots, n,
 \end{aligned} \tag{7}$$

one obtains the symmetric equilibrium price distribution as follows

$$F(P) = F_i(P) = F_j(P) = 1 - \left[\frac{(1-P)u}{P(1-nu)} \right]^{\frac{1}{n-1}}, \frac{u}{u+v} \leq P \leq 1 \tag{8}$$

satisfying $F(u/(u+v)) = 0$ and $F(1) = 1$. Hence, each incumbent company's expected profit is

$$\begin{aligned}
 E(\Pi) &= \int_{-\infty}^{+\infty} \left\{ uP + \prod_{j \neq i}^m [1 - F_k(P)] vP \right\} dF(P) \\
 &= \int_{\frac{x}{x+y}}^1 u dF(P) = uF(P) \Big|_{\frac{x}{x+y}}^1 = u
 \end{aligned} \tag{9}$$

That is, in the symmetric mixed strategy Nash equilibrium, each incumbent company's expected profit does not change and is equal to how much it expects to earn from its base of loyal customers, even though it tries to acquire as many new customers as possible.

Proposition 4. If a focal company operates within an industry with no market growth, then profit growth from expanded sales revenue and that from margins, two components driving the company's profit, do not generally occur simultaneously.

To see why this result holds true in general, let us first look at the concept of resources. Specifically, by resource, it means a company's asset, either tangible or not (Harmancioglu et al., 2009), that can be employed to achieve its strategies (Barney and Arikan, 2001). In other words, a resource represents anything that a company can mobilize to achieve its corporate objectives through its adopted strategies. Assets can be physical, financial, informational, intellectual, or organizational.

Now, let us identify each company with its unique system of resources (Barney and Hesterly, 2012; Peteraf and Barney, 2003), where, for instance, among others each company has its own unique set of human resources and particular ways to utilize these human resources. Hence, the given assumption implies that:

- (1) In order to maintain or improve its sales revenue, a company has to grow its market share through increasing the number of units sold to existing customers and acquiring new customers, see the argument of Proposition 3.
And
- (2) In order to improve its margins, the company has to raise prices realized for each unit sold, lower costs, or use some combination of these two options.

To accomplish item (1), where Proposition 3 indicates that instead of improving sales revenue, it will be more likely a maintenance of sales revenue, the company needs to allocate a specific set of resources to exploit the market value of its existing offers; and to accomplish item (2), the company has to dedicate a different set of resources to either explore incremental improvements on the existing offers or produce completely new offers that feature more use values to customers than existing ones. However, resources, purposefully developed to accomplish (1) above and those for (2), generally do not work well together (McGrath, 2013) because these two business goals are inconsistent with each other. Of course, there are resources, such as relationships that lead to information sharing, risk taking, and adoption of innovations (Dutta et al., 1999), that can be easily deployed to realize different business goals.

Let X and Y be mutually exclusive sets of resources such that resources in X lead to the realization of item (1) and those in Y help with that of item (2). Then interactions between resources in X and those in Y tend to produce undesirable effects or outcomes. That is, profit in sales revenue and profit in margins do not generally increase simultaneously, because the effects of resources in X and those in Y tend to neutralize each other. The situation discussed here is depicted in Figure 1, where the sets of resources exclusively developed for business goals (1) and (2), respectively, do not overlap. Furthermore, the general-purpose resources can be deployed and redeployed readily to serve different, even opposing goals.

Preliminarily, different specific versions of the general conclusion in Proposition 4 were confirmed by various scholars, such as Markman and Gartner (2002) and Steffens et al. (2009).

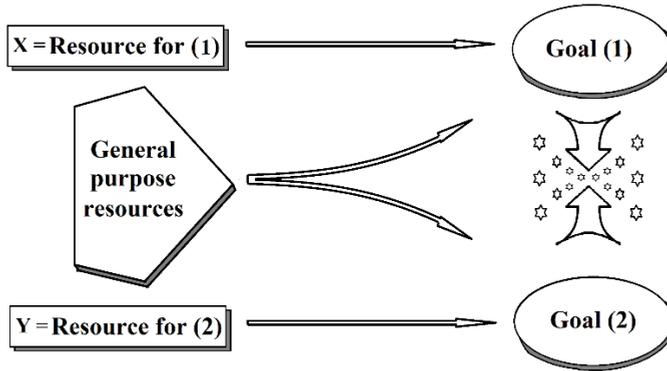


Figure 1: *Separation of available resources*

Proposition 4 leads to the following issues for managers: what should they do when it becomes clear (to them while not necessarily to others) that a competitive advantage is eroding? How should they restructure their organizations to concurrently disengage from the current advantage in use and mobilize resources, be they existing or newly acquired for the planned strategic move, into the next perceived advantage?

To illustrate, let us look at the case of Netflix, an American media-services provider and production company. In mid-2000s, Wilmot Reed Hastings, a co-founder, chairman and CEO of Netflix, was convinced by YouTube that streaming is going to be the preferred vehicle for users to access content, no matter what device they use, and that the DVD business will no longer be the core of Netflix's future. Following this innovative realization of the market trend, which was advanced in time among all its rivals, a spinoff, named Qwickster, was created to continue Netflix's established successful operation of DVD services with the goal of maximizing cash flow during the declining stage of its service life cycle. As Netflix leadership looked to the future, their job was to manage rapid growth and access to digital content. To avoid any potential of adverse effects between exploiting the DVD services and exploring new opportunities, the operation of Netflix was intelligently divided into two independent business branches. From the point of view of Proposition 4, it makes practical sense in terms of business operating processes. However, many customers were infuriated by the switch and by the idea that they would need to double their effort if they wanted to access movies and other content in both formats, and search for what they wanted in two different places, because choices in the DVD arena were vastly richer than those available to stream. Additionally, content providers, such as cable television and satellite dish services,

were wary of the disruptive nature of Netflix's new move. For more details on this case, see McGrath (2013).

5. CUSTOMER RELATIONS AND CRAFT OF CUSTOMER VALUE PROPOSITIONS: CASES OF APPLICATION

All the propositions established above are derived by using the rigor of game theory and then by employing logical reasoning that is parallel to that widely used in mathematics (Kline, 1972). That is why these are generally true results unless the assumptions stated in these propositions are violated, although no hypothesis is formulated and empirically tested. As a matter of fact, hypothesis testing is simply a statistics-based approach that can be applied to uncover potential facts instead of proving any fact (Forrest et al., 2020).

As an application, this section looks at how the propositions above can be employed to establish results about the association between customer relationship management capability & profitability, and the formulation of effective CVPs. By customer relationship management (CRM) capability, it means such a capability with that a company is able to leverage customer-level profits through:

- 1) Identifying the different echelons of profit potential of customers and prospects,
- 2) Initiating and establishing relationships with customers and prospects, and
- 3) Maintaining customer relations in such a way that is optimal based on the assessed profit potential of each customer echelon.

This definition of CRM capabilities embodies the recognition of the facts that beyond discrete transactions, relationships lead to profitable outcomes for companies and great satisfaction for customers (Verhoef, 2003) and that not all customers and prospects are equally attractive for a company to profitably meet their demands (Niraj et al., 2001).

Proposition 5. The more a company is capable of managing customer relationships, the more profits the company can expect to generate from both sales' revenue and margin growth.

To see why this conclusion holds true, we analyze the scenario from two angles: (1) sales revenue growth, and (2) margin growth. As for revenue growth, a company's CRM capability directs the company's attention to an understanding of how prospects and existing customers can contribute to its profitability differently (Reinartz et al., 2005), before any of them become a switcher (Theorem 1). So, the more a company is capable of managing customer relationships, the more adequately

it can (a) classify prospects and existing customers into echelons of attractiveness, and (b) initiate and manage relationships with them according to their individual levels of attractiveness. In particular, at one extreme on the spectrum of attractiveness, companies can devote valuable resources on the initiation and maintenance of relationships with those high-potential prospects and existing high-revenue-producing customers. At the other extreme, without putting in any additional effort companies can simply employ pricing strategies to expand its market territory by attracting switchers that wander around the market (Theorem 1). Therefore, more CRM capable companies can expect to generate more profits or at least maintain their profitability with respect to customers of all different echelons of attractiveness. To this end, one caveat is the attempts of some companies (Ryals, 2005) that only pay attention to high-potential prospects and highly profitable customers. Such attempts generally result in fewer customers (Reinartz et al., 2005). One good case that vividly demonstrates what disasters such narrow-minded attempts might lead to is that of Pan American World Airways (Sobel, 1999), where the company focused on lucrative international air traffic without putting in any effort to develop the domestic market so that it could not stand skyrocketing energy prices and terrorist attacks. The reason behind such disastrous failures is that maintaining relationships with high profile prospects and customers of forever changing needs over a relatively long periods of time is extremely difficult, if not impossible.

As for (2) – margin growth, strong CRM capabilities help companies refine their strategies on how to deploy resources on the initiation and maintenance of relationships with prospects and existing customers respectively based on their potential and level of attractiveness. With increasing knowledge and experience on how to deal with prospects and existing customers of different attractiveness, companies are able to reduce their service costs over time (Reinartz and Kumar 2000), while increasing customer retention and more experienced users of their market offers. That helps lower companies' service costs over time (Ryals 2005). Hence, companies with strong CRM capabilities are generally able to increase their margins by continually reducing their service costs through allocating resources appropriate to the attractiveness levels of prospects and existing customer; such appropriate resource allocation in turn raises the level of satisfaction of customers in different attractiveness echelons. When appropriate relationships are maintained with those customers whose purchase decisions are not driven merely by prices, a strongly CRM-capable company will be able to realize better prices for its offers (Cao and Gruca, 2005). Therefore, Proposition 5 follows.

This proposition is inconsistent with what is hypothesized and empirically confirmed by Morgan et al. (2009b). In particular, these scholars claim that a company's revenue growth rate is a decreasing function of CRM capability and its margin growth rate is an increasing function of CRM capability.

A concept that is closely related to that of CRM capabilities is market knowledge, which refers to knowledge about market demand regarding: (1) who customers and prospects are; (2) what their life needs and problems are; (3) who competitors are; and (4) what features their offers possess. A CVP is said to be effective to a company, if it can actually lead to additional profit for the company that is beyond the case without the CVP, after subtracting the costs for developing and implementing the CVP.

Proposition 6. Market knowledge is a market-based resource that can be employed to craft effective CVPs.

First, market knowledge is clearly a market-based resource, because it would not exist without a market. Second, let us see how effective CVPs can be formulated by using **this** knowledge. To do this, let us treat a focal company and its customers, both existing and potential, as input-output systems so that the company's mission represents its CVP and customers' demands as their desired inputs. Then, the communicated CVP helps associate the company's input-output flows with those of targeted customers in the market. In this systemic thinking, resource sharing is reflected in the aligned input-output flows of the company and the targeted customers. The idea of superior value is shown by the harmonious alignment of these specific input-output flows, for details, see Figure 2.

This systemic thinking indicates that for an adopted CVP to be effective, the company's input-output flows have to align with those of a sufficient number of customers. Now, the so-called market knowledge of the company can be systemically seen as the company's understanding of how the input-output flows of its rivals relate to the market and how the input-output flows of customers in the market react to the marketing activities of these companies.

Intuitively, if input-output flows R_1 , R_2 and R_3 in Figure 2 represent three of the rivals of the focal company, then R_1 's territory includes B_1 , B_2 and B_3 , R_2 's territory includes C_1 , C_2 and C_3 , while R_3 's territory includes D_1 , D_2 and D_3 . In this case, the market knowledge of the focal company will be about the associations between R_1 and B_s , R_2 and C_s , and R_3 and D_s . Generally, when the focal company has market knowledge, it means that it knows how its rivals interact with their customers and where these interactions fall short of customer expectations. Such knowledge can help the focal company to locate its market niche(s) based on which

customers are not adequately served by its rivals, to assess how large such consumer surplus (Theorem 1) is, and to discover what the dissatisfied customers are looking for in order to be satisfied.

These discussions above jointly explain why market knowledge is a market-based resource the focal company can use to craft its effective CVP(s).

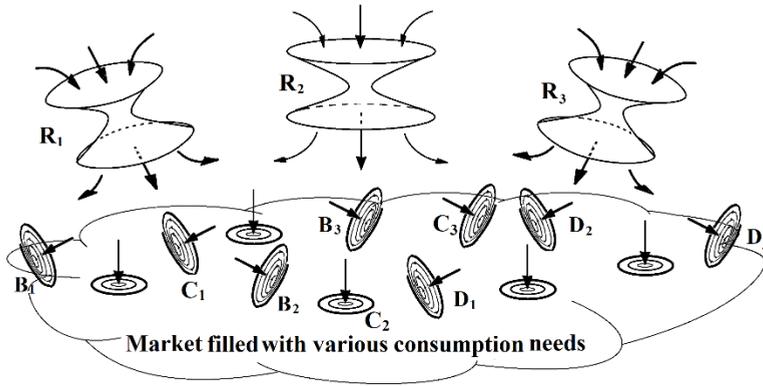


Figure 2: *Rivals and their market territories*

Note: Proposition 6 is different from that confirmed by Kozlenkova et al. (2014). It is also dissimilar to Payne et al. (2017), who state that market knowledge is a resource for crafting CVPs. As a matter of fact, without considering effectiveness of CVPs, one can craft a CVP without employing any market information. Even with all these key differences, we like to honor these scholars for their pioneering work related to the development of this proposition.

Proposition 7. Innovative understanding of market invitations is the key element in crafting an effective CVP.

This conclusion follows directly from Theorem 1, which implies that the market generally signals the opportunity for additional competition and innovation by showing the existence of a large consumer surplus. When the market is monopolistic, that is, in Theorem 1, $n = 1$, instead of switchers, the severity of customer dissatisfaction and the scale of dissatisfied customers will be used as signals of market invitation. In such a case, a surplus of producers might appear to answer the market call, depending on what a profit potential is presented, because sensing the call, entrepreneurs with different knowledge structures and background experiences will produce different versions of offers to potentially satisfy the customer demand. So, another way to sense a market invitation for innovation is the

appearance of producer surplus. That is, an effective CVP has to be the offspring of an innovative and comprehensive understanding of market invitations.

To illustrate this proposition, let us examine a real-life example from Ye et al. (2012). Located in the northern part of the United States is a state university of over 29,000 students. Most of them are unmarried undergraduates living on tight budgets. Because of the characteristic behaviors of young and active undergraduate students, most rental properties that serve the university students do not offer easily-damaged laundry facilities. Hence, many stand-alone laundromats near the campus compete for students' business by providing self-servicing, coin-operated laundry machines. In addition, because of the long and cold winters of the region, indoor tanning is another successful business that attracts appearance-conscious college women.

Although the laundromats are different from each other in various ways, such as locations, students usually do not have particular preference of one over another, while indoor tanning salons compete for business by providing competitive prices. In other words, laundromats and indoor tanning salons respectively serve their individually different markets. In either case, customers flow from one service installment to another quite freely or depending on whose offer is more competitive.

Seeing the market invitation, as indicated by consumer surplus (Theorem 1), two entrepreneurs understood the invitation innovatively and started their independent, single-location business by jointly offering coin-operated self-service laundry facility and indoor tanning service. The innovativeness inherent to this business establishment is reflected in the following two ways: (1) it helps students save their unproductive and costly waiting time by simultaneously accomplishing two tasks – clothes washing and skin tanning, and (2) it provides male and female students with a potential opportunity to establish relationships. In particular, the greater participation of women in the tanning service, as caused by savings of time from doing two unrelated errands simultaneously, attracts to the laundry service a larger number of men who are indifferent in terms of which laundromat they go to. As a consequence of this innovative understanding of the market invitation, the combined business is able to collect higher fees from the laundry service than other standalone stores; and it sustains competitive prices for the demand of the tanning service. In particular, the demand for the tanning service is also much increased due to the heavy flow of male users of the laundromats.

6. CONCLUSION

Although the importance of market-sensing has been widely recognized in terms of improving companies' economic performance (Day, 1994; Forrest et al.,

2017; McGrath, 2013), the literature consists of inconsistent conclusions. To resolve this inconsistency, this paper goes beyond the methodology commonly used in the literature by employing game theory and the logical reasoning that is widely used in mathematics (Kline 1972). After positively achieving this said objective, this work then turns its attention to look at two closely related topics: a company's profit sources within an industry that lacks market growth, and formulation of effective CVPs. Due to the specific chosen method, established conclusions herein are free from the constraints of data and anecdotal analyses widely used in the literature. In particular, among others this work establishes the following generally-true theoretical results:

- If a company possesses a superb market-sensing capability, then it is able to create vitally important market knowledge and increase its expected profits through introducing appropriate technologies, and acquiring and deploying adequate resources (Propositions 1 and 3).
- If a company learns that its industry is lacking market growth, then its possession of a superb market-sensing capability will help grow its profit by raising margins (Proposition 3). And
- Both market knowledge, which includes market invitations, and what to make out of the knowledge are important resources a company can employ to draft an effective CVPs (Propositions 6 and 7).

Due to apparent reasons and methodological validities, implementing best practices and making statistics- or anecdote-driven decisions, as commonly employed in managerial exercises (Duan et al., 2019; McGrath, 2013), have led to widely different outcomes, some of which can be quite unexpected (Forrest et al., 2020). This fact vividly demonstrates the practical significance of this work, because our established results produce general recommendations instead of suggestions for managers and entrepreneurs. In particular, the generally-true conclusions established above lead to the following recommendations for general managerial purpose.

- To improve performance, each company needs to purposefully acquire and improve its market-sensing capability by learning which customers are underserved, why some others are dissatisfied with available market offers, and what technology can be employed to improve productivity (Propositions 1 and 2);
- When a company does not see any potential of market growth, it needs to focus on either raising the price or lowering the cost of each sold unit, or a combination of these efforts (Proposition 3), without devoting much effort on improving the sales revenue (Proposition 4);
- Any company that desires to succeed in the marketplace needs to manage its customer relationships by employing its market-sensing capability with

resources allocated appropriately corresponding to the attractiveness levels of customers and prospects (Proposition 5); and

- Companies need to focus on formulating their CVPs by making use of their acquired market knowledge and by innovatively understanding what the knowledge implies in order to make their adopted CVPs effective (Propositions 6 and 7).

One implicit assumption behind all results established in this paper is that each company stays financially solvent through positive cash flows from the marketplace by fulfilling market demand(s) with corresponding offer(s). But in today's business landscape, this assumption is not generally true. So, for future research, one can consider developing results parallel to those developed here for companies established for other purposes, such as producing promising futures, expanding market territories, or others (Li and Ma, 2015). Although it is known that implementing best practices and making statistics- or anecdote-driven decisions cannot assuredly lead to desired outcomes (Lin and OuYang, 2010), an increasing number of contemporary decisions are driven by data (Duan et al., 2019; McGrath, 2013). Hence, it is very important both theoretically and practically to develop ways to demonstrate recognized best practices and statistics- or anecdote-patterns can be recommended for applications beyond the origins from which the practices and patterns are initially revealed.

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IMPROVING EARNINGS PREDICTIONS WITH NEURAL NETWORK MODELS

RĂZVAN POPA*

Abstract: *In this paper we develop a generalized deep neural network model to predict quarterly earnings. Using a diverse range of predictors consisting of fundamental, technical and sentiment data the resulting model outperforms existing timeseries models such as the Fama-French 2006 regression model and comes close in prediction accuracy to sales analysts' estimates. This is achieved by handling some known issues in time series models such as seasonality and non-linearity of the earnings while improving predictions with additional explanatory variables that reflect the expectations of the market. Thus, we add to the existing literature a comprehensive and innovative neural network model that provides solutions to known challenges in forecasting and closes the gap between statistical models and sales analysts.*

Keywords: *Comparative analysis, earnings forecasting methods, Fama French profitability model, deep neural network*

1. INTRODUCTION

Whether it is academic researchers that require reliable predictions for future profitability in their research studies or investors that base their resource allocation on earnings expectations, the importance of accurate earnings forecasts cannot be overlooked. This challenge is mostly prevalent in the field of valuation (academic and professional) where profitability forecasting plays an important role in deciding the present value of a company based on its future cash flows.

The difficulty that lies in predicting earnings is closely related to their nature. First, earnings and profitability as a whole tend to be persistent (Fama and French 2006). This is related to the continuity and durability of the current earnings that allows companies to present quality earnings for long periods of time. Another two characteristics that are

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amplified at quarterly reporting frequency are that earnings are seasonal (Kang 1991, Hill, et al. 1994) and non-linear (Donaldson, Kamstra and Kim 1993). This means that earnings are difficult to predict from one quarter to another since seasons, consumer behavior and other macro-economic conditions produce variability. This variability is then translated into their non-linear nature which makes it difficult for linear models to fit a function between them.

Looking into existing solutions, two main groups of earnings predictions sources arise: time series models (TS) and sales analysts' (SA) estimates. These two groups closely go into a debate of which one is superior with certain studies showing that SA significantly outperform TS models forecasts (Brown and Rozeff 1978, Collins and Hopwood 1980, Fried and Givoly 1982, Wiedman 1996) while others state that SA estimates are not significantly more accurate than TS models (Cragg and Malkiel 1968, Elton and Gruber 1972, Imhoff and Pare 1982).

From an outside perspective certain advantages and disadvantages can be observed for both approaches. First, there is significant evidence that SA predictions tend to be biased upwards (O'Brien 1988, Mendenhall 1991, L. Brown 1993, Das, Levine and Sivarmakrishnan 1998) while overlooking information when forecasting earnings (Fama and French 2006). Second, TS models are prone to some short-comings when compared to SA when it comes to the timing advantage and contemporaneous advantage (Brown, Richardson and Schwager 1987). These translate into the time period from the last earnings report to the current one being predicted and a better utilization of the information on the date of the announcement.

Taking into consideration the short-comings of TS models we decided to add several explanatory variables to tackle the issue of the market expectations and timing advantage of the SA. Variables such as the news and Twitter sentiment taken one day before can provide an overview of the mood of the market and its expectations right before earnings. Another area that provides insight can be the options market where a ratio such as the put/call ratio can also show how bearish or bullish the market is at that time. Furthermore, information can also be found in peers or correlated companies that reported before the one in question.

To address the issues discussed above such as non-linear relations, seasonality but also model the great amount of data available we chose to tackle this problem using neural network models. Whether used for classification or regressions, neural network (NN) models have been around for quite a while, but it's in the last decade that it's been picking up steam due to hardware advancements and the financial field is no exception.

Specifically, predicting quarterly earnings using neural networks has been tried before with various degrees of success, thus the ongoing debate if NN models provide superior results to TS. One aspect that is brought into discussion a lot of the times is that NN models tend to be context sensitive (Chatfield 1993, Hill, et al. 1994, J.L., P.C.Y. and Y. 1996). This translates into the fact that NN models tend to behave differently from one company to another. One reason is that the amount of data required by NN models is quite large and earnings announcements come in relatively small amounts. We target this issue in our model by not making it company specific, rather a general model where all companies and earnings

events are pooled together and analyzed as a whole. Thus, our model is built on the whole dataset available consisting of all companies and earnings events. In abstract terms, we can think of the developed NN model as a general formula for predicting earnings for any company that is part of the US stock market.

On the other hand, more recently we find studies which state that NN can better model the non-linear structure of the earnings than linear, time series models both for the univariate and multivariate case (Zhang, Cao and Schniederjans 2004). This is one of the main reasons we chose to proceed using NN models instead of existing regression-based models.

Considering the ongoing debates, we aimed to provide a comparative analysis between sales analysts, time series models and neural network models forecasts. Also, we add to the existing literature a generalized NN model with an expanded set of explanatory variables that go beyond the theoretical, financial information that we are used to in financial studies.

Starting with the analysts' estimations we chose the IBES (Institutional Brokers' Estimate System) data for its sufficient timeframe and consistency with existing research papers. These predictions come in the form of the mean of the SA estimates and usually rely on an average of 10 analysts.

Choosing a TS model for our study however required more thought as it needed to be multivariate and employ as much explanatory information as possible in order to be a fair comparison to the neural network model. For this reason, but also due to the large timespan between the moment of writing this paper and the release of those models we chose to not employ some estimation techniques used commonly in the existing literature such as Brown and Rozeff (1979), Foster (1977) or Griffin-Wats (1977). Instead, we selected a more comprehensive and recent model developed by Fama and French (2006), further referred to as FF06 model to forecast profitability using a set of financial ratios, stock prices, returns, a variable that denotes the probability of default (Ohlson 1980) and a composite measure of the firm's strength (Piotroski 2000). This model addresses a lot of the characteristics of earnings including persistence (Fama and French 1995), the prices and returns as leading indicators (Weiss, Naik and Tsai 2008) and accruals as a mean of earnings generation. One modification that we add to the model is predicting quarterly earnings instead of annual earnings as in the original paper, alteration that has been suggested before in literature (Harris, F., & Wang, 2013).

For our model, we chose to employ one of the most recent fields in machine learning, mainly, deep learning. This type of learning structures algorithms into layers creating an artificial neural network that is able to learn and make decisions on its own. We took this decision to address the non-linearity, seasonality and complex structure of earnings and to simulate the way the sales analysts make predictions by replicating the structure of the human brain. An immediate debate that appears in literature is on the training algorithm used to train the neural network or how to help it learn from existing data. There are several studies that are in favor of using a genetic algorithm instead of the backward propagation algorithm. Backward propagation involves an iterative adjustment of a single parameter vector that has

the objective to minimize a certain cost function. In a genetic algorithm a new generation of parameter vectors is developed by changing the parameter vectors in the current generation (Dorsey and Mayer 1995, Sexton, Dorsey and Johnson 1999). This technique should increase the probability of finding a global minimum by simultaneously exploring different parts of the parameter space (Dorsey and Mayer 1995). As previously stated, conflicting results appear in the existing literature with those that favor genetic algorithm (Cao and Parry 2009) when mean squared error is used as a cost function while for the same cost function and the mean absolute error backward propagation seems to behave better in other studies (Sarchami and Eftekhari 2012). In our model we decided to use the backward propagation algorithm since we have seen no signs of local optimum issues thanks to the efficiency of the Xavier initialization method used (Glorot and Bengio 2010). Also, the superior execution speed compared to the genetic algorithms played an important role in making this decision too.

2. RESEARCH OBJECTIVE

The purpose of this paper is to conduct research based on the expectation that the deep neural network model developed is superior to the FF06 model for profitability (in both cases: using the same variables and the added sentiment and correlation variables) and whether it is a reliable alternative to the SA estimates. Thus, we come up with the following hypotheses that we want to test:

H1. *The DNN is superior to the linear regression when using the FF06 profitability model's explanatory variables.*

H2. *The DNN model is superior to the FF06 profitability model when using the added, developed explanatory variables.*

H3. *The DNN model is superior to the SA estimates when using the added, developed explanatory variables.*

3. METHODOLOGY

3.1. Fama French profitability model

The Fama French model for profitability employs a diverse range of predictors to estimate profitability which is defined as earnings (Y) divided by the book equity (B). Some caveats inferred from existing literature on which the model is based include the following: profitability is persistent, current investment is related to future profitability, accruals forecast profitability, dividend paying firms tend to be more profitable and smaller firms tend to be more profitable. Thus, the following regression (equation 1) is estimated:

$$Y_{t+1} = Int + \beta_1 \times \ln(B_t/M_t) + \beta_2 \times \ln(MC_t) + \beta_3 \times \text{Neg } Y_t + \beta_4 \times (Y_t/B_t) + \beta_5 \times (-AC_t/B_t) + \beta_6 \times (+AC_t/B_t) + \beta_7 \times (dA_t/A_t) + \beta_8 \times NoD_t + \beta_9 \times (D_t/B_t) + \beta_{10} \times 1Y_{r_t} + \beta_{11} \times 2 - 3Y_{r_t} + \beta_{12} \times OH_t + \beta_{12} \times PT_t + \beta_{12} \times (I_t/B_t) \quad (1)$$

where,

$B_t = \text{book value per share}$

M_t = market price of one share
 MC_t = market capitalization
 Y_t = earnings per share
 $Neg(Y_t)$ = dummy variable that is 1 if $Y_t < 0$
 AC_t = accruals per share
 A_t = total assets
 dA_t/A_t = assets growth
 $1Y_{rq}$ = 1 quarter return
 $2 - 3 Y_{rq}$ = return between quarter - 3 and - 1
 OH_t = Ohlson's probability of default on debt
 PT_t = Piotroski's composite index of firm strength
 I_t = IEBS analysts' estimate for quarter t

Valuation theory says that expected stock returns are related to three variables: the book-to-market equity ratio (B_t/M_t), expected profitability, and expected investment. Given B_t/M_t and expected profitability, higher expected rates of investment imply lower expected returns. But controlling for the other two variables, more profitable firms have higher expected returns, as do firms with higher B_t/M_t . These predictions are confirmed in our tests.

The data source used in our reproduction is the same data used in the original model: financial data from Compustat, Price data from CSRP and analyst estimates from IBES. We employ the same filtering method for the stocks as in the original paper: Stocks with total assets greater than 25 million USD and book equity greater than 12.5 million at each point in time. Companies with values outside the 0.5 and 99.5 percentile are also excluded. All variables used are per share.

To adapt the model for quarterly earnings forecasting and provide a fair comparison with the NN model and analysts' estimates we generalized as well instead of keeping it company specific. This is also an outcome of the fact that the amount of data remaining per company after filtering that contains sentiment information is reduced in size. Thus, we do one regression for all data instead of one regression for each company. Lastly, we remove the final explanatory variable from the model (I_t/B_t) since we want to compare the models as if there was no analyst estimates available. Also, for an apple to apple comparison, the dependent/forecasted variable becomes earnings per share instead of earnings divided by book equity per share. This is done with the background knowledge that the explanatory power of the model remains the same since the removed variable (B_t) is already present in the explanatory variables in multiple ratios used to scale the inputs for companies of different sizes.

The model is estimated using the Ordinary Least Squares (OLS) method on the 80% of the dataset (or the training dataset as referred later) pooling together all the companies. Thus, even though the model is not company specific anymore, the large amount of data provided allows for a comparable performance to the original model.

Table 1: OLS estimation for the FF06 profitability model

Variable	FF06 model for profitability
Constant	-1.045*** (0.034)
$\ln(B_t/M_t)$	-0.312*** (0.007)
$\ln(MC_t)$	-0.023*** (0.008)
$\text{Neg}(Y_t)$	-0.265*** (0.016)
Y_t/B_t	0.495*** (0.028)
$-AC_t/B_t$	-0.350*** (0.041)
AC_t/B_t	0.063 (0.059)
dA_t/A	-0.036 (0.039)
$\text{No}(D_t)$	-0.097*** (0.010)
D_t/B_t	-0.001*** (0.000)
$1Qr_t$	-0.081*** (0.018)
$2-3Qr_t$	-.054*** (0.014)
OH_t	-0.100*** (0.003)
PT_t	0.007*** (0.003)
Observations	16177
Adjusted R-squared	0.442

Standard errors in parentheses; *** p<0.01

We can immediately observe that the coefficients are in line with the original model, with an F-statistic that supports the significance of the explanatory variables. Looking at the coefficients we confirm the fact that the Ohlson's default profitability has a negative effect on earnings and the Piotroski's strength score adds to the overall earnings value (in a small amount though). Past profitability (Y_t/B_t) seems to carry the most amount of predictive power followed by the negative accruals and the book equity to price ratio.

3.2. Deep neural network

Neural networks were inspired from the studies on the information processing capabilities of the human brain. Some characteristics of the human brain that were replicated in the neural networks include its nonlinear and parallel structure and dense connections between neurons / nodes (figure 1).

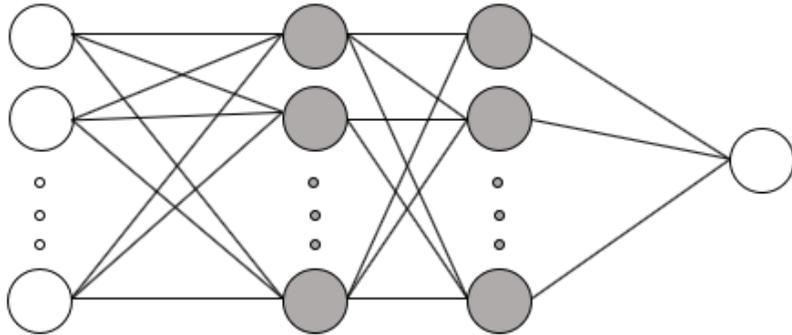


Figure 1: Schematic overview of a deep neural network with two hidden layers. The input layer (first layer) has n neurons representing the n explanatory variables used and the output layer (last layer) consists of one neuron representing the forecasted earnings per share. The layers in grey are the two hidden layers employed and each have m nodes.

Neural network (NN) models reproduce the inner workings of the human brain by linking layers of input and output variables with processing units called hidden nodes. Our model employs an input layer with seventy nodes (the number of explanatory variables/features), two hidden layers with eight nodes each and an output layer consisting of one node (the earnings per share prediction).

Each explanatory variable (feature) has a weighted connection to each node in the first hidden layer, with the latter being connected in the same way to the second hidden layer and finally to the output node/layer.

The value of a neuron is calculated as a weighted sum of the input variables plus a bias (constant) for each input as in equation (2):

$$Y = \sum(\text{weight} * \text{input}) + \text{bias} \quad (2)$$

Similar to the brain, we must decide when these neurons fire (activate) or not. This is done via activation functions like the most basic one called the step activation. This activates the neuron when a certain value (threshold) is exceeded by Y .

One important aspect when setting up a neural network is how each weight is initialized. The way the weights are assigned initially can make the difference between a model that finds the global optimum and a model that gets stuck in a local one. One common practice is to initialize these weights randomly each time the model is trained.

The last aspect that has to be considered when working with neural networks is how the model learns. This is done via an algorithm called backpropagation which represents how the weights are adjusted after each training example. After an estimation is done on a training example the resulting error is calculated and the weights are adjusted from the output to the input accordingly. Using differential calculus, the instantaneous rate of change is calculated

using partial derivatives for each parameter and the model is adjusted using a chain rule of calculus.

As mentioned earlier, we refer at the estimation step as the training and validation part. Training represents the data that is given as example to the model to learn and validation is the data used to check the behavior of the model. Both are chosen randomly each time the model is trained. The training procedure is repeated as long as the model continues to learn (improve its estimates) for a number of iterations, also known as epochs. After an acceptable model is achieved it is tested against a testing dataset which represents new data that the model has never seen before, such that a real-world performance indication can be provided.

3.2.1. Implementation

To develop and test our neural network model we chose to use the TensorFlow package due to its robustness, high performance C++ implementation and Python specific usability. For productivity purposes we chose the high-level API built on top of it, Keras.

We chose Keras since we were aiming for a deep-neural-network (DNN) implementation that allowed us to model the complex non-linear relations between our large and diverse set of input variables. This architecture is represented by a feed forward neural network with multiple hidden layers capabilities where the information flows from the input to the output and adjusts the weights of each after each epoch.

3.2.2. Methodology

A first recommended step when training neural network models is to normalize the data. This is required as a great variability in the ranges of the data can make the gradient descent algorithm run slow (Ioffe and Szegedy 2015). We did this in two steps. First all financial data were transformed into per share data, in this way standardizing across all companies. Next, all variables were normalized using a Gaussian normalization method that replaces each value with its z-score. (demeaned value divided by the standard deviation).

When setting up the model, one of the first decisions we have to make is how many nodes and hidden layers to use. In case of multi-layer neural networks, a belief is that in order for the model to achieve full generality a number of two hidden layers is necessary (Sontag 1992). We thus arrive at a configuration of 4 dense layers (one input, two hidden and one output).

Closely following after deciding on the number of layers is how many nodes per hidden layer to use. An indication that we considered when started training the model is that we need to specify as many hidden nodes as principal components needed to capture 70-90% of the variance of the input data (Boger and Guterman 1997). In our case this proved to be around 6-14 nodes and after a few validations runs of the model we set our hidden layers at a number of 8 nodes.

For the activation function we went with a non-linear function, namely the leaky rectified linear unit (Maas, Hannun and Ng 2013) that increases the range of the classic

rectified linear unit which is one the most used activation functions in deep neural networks and proved to be a good fit for the nonlinearity of our data.

We then chose our initialization function, which in combination with the number of epochs parameter allows our model to learn smoothly throughout time. For the initialization function we chose the Adadelta initialization (Zeiler 2012) which adapts the learning rates based on a moving window of gradient updates, instead of accumulating all past gradients. This allows it to continue learning even when many updates have been done. After running the model a few times, we arrived at a number of 300 epochs in combination with a learning rate of 0.1 that allowed our model to learn in a steady and improving way over time.

As a loss function we chose the mean absolute error (MAE) since other loss functions like mean square error (MSE) tends to not necessarily increase with the variance of the errors as the MAE does. Also, MAE bears the most meaning when comparing models.

3.2.3. Feature selection

To train the model we fed two types of variables: lagged financials and forward-looking variables. The lagged financials included variables such as total assets, liabilities, cost of goods sold, sales and past earnings.

The forward-looking variables included: past-quarter next-day return and volume change to provide information regarding guidance for this quarter; previous day information like put/call open interest, news and twitter sentiment, average surprise produced by peers, price correlation weighted average of past earnings surprise of other companies and changes in price and volume in the last days before the announcement

We decided to use the past 4 quarters lagged variables to overcome seasonality effects and also include the earnings trend over quarters. The next step in building our model consisted in selecting only the features that added explanatory power to our model. For this task we used a procedure called Sequential Floating Backward Selection (Somol, Novovičová and Pudil 2010) which starts with an empty set of features and builds upon it as long as the objective function is increased for k variables.

1. Start with the empty set $Y = \{\emptyset\}$
2. Select the best feature
 $x^+ = \operatorname{argmax}[J(Y_k + x)]$
 $Y_k = Y_k + x^+; \quad k = k + 1;$
3. Select the worst feature
 $x^- = \operatorname{argmax}[J(Y_k - x)]$
4. If $J(Y_k - x^-) > J(Y_k)$ then
 $Y_{k+1} = Y_k - x^-; \quad k = k + 1;$
 go to step 3
 else
 go to step 4

Algorithm 1: Pseudocode representation of the variable selection algorithm (BFBS).

3.2.4. Validation

With the DNN model set up we train the model and validate it for a number of 300 epochs (learning cycles) where at each iteration the learning and validation sets are randomly created. In figure 2 we observe a correct behavior of the gradient descent algorithm that descends fast into an acceptable solution in a few dozen iterations and then slowly decreases to the global optimum. As expected, the validation error is slightly higher than the training error which suggests no signs of overfitting or underfitting.

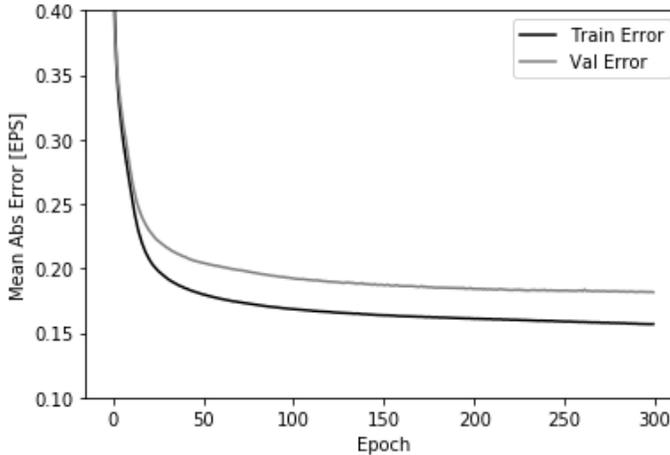


Figure 2: DNN model training and validation error across epochs

3.3. Comparison of methods

All models are run and compared on the testing dataset, which, in our view represents the future, unknown earnings events, thus proving a good proxy for how the models would behave in a real-world application. Throughout the testing procedure we employed three metrics: mean absolute error (MAE), mean absolute percentage error and mean squared error (MSE). Also, R-squared is used to show the explanatory power of the models, again on the testing dataset.

4. DATA

The financial instruments used throughout this paper are North American, US listed companies that are part of the Russel3000 Index. We choose this index for its broad spread, financial data availability and overall consistency reasons.

There are 25 fundamental variables and one technical as required by the Fama French profitability model. For the neural network model another 7 variables are fetched/derived: Twitter and News Sentiment data, Put/Call Open Interest, Price and Volume (with lags), average subsector surprise and composite earnings score of price correlated companies. Other variables are present with identification/descriptive roles. We begin with data within the timeframe 1979-2019, with most of it laying in the 2013-2019 area after filtering the entries that do not have sentiment and options data.

4.1. Data collection

The index constituents alongside with their sector and sub-sector are fetched using Bloomberg and then filtered to match the requirements of the Fama French model for profitability (No companies from the Financial or Real Estate Sectors). This results in a total of 2124 stocks. The data used comes from two main providers and five different sources with a timeframe between 1992 and 2019 (table 2).

Table 2: *Data providers and sources used*

Provider	Source	Description
Wharton Research Data Services	The Center for Research in Security Prices (CRSP)	Daily Stock File: Price, Volume and Share Factor
Wharton Research Data Services	Compustat-North America Daily - Fundamentals Quarterly	The fundamental data that is used throughout this paper
Wharton Research Data Services	IBES from Thomson Reuters - Summary History - Surprise History	EPS actual value, estimate and announcement date
Bloomberg	Historical	News Sentiment, Twitter Sentiment, Put/Call Open Interest
Bloomberg	Bulk Historical	Earnings Announcement Time (before/after the bell)

4.2. Data processing

The data are processed and merged using the CUSIP codes and tickers alongside the announcement dates and their corresponding financial quarters. Then the lagged prices, volumes and sentiment data are added using the announcement date and announcement time to derive which is the last trading day before the earnings report. For each company we look into its peers (sub-industry) and compute the average surprise produced by the ones who reported before it. For the composite earnings score based on price correlation a correlation weighted average of the earnings surprise is computed from the companies that reported before the current announcement date.

4.3. Data filtering

An initial prefilter is made to ensure that all mandatory variables required by the Fama French model are present and not null with the missing optional variables set to 0. As required by the profitability model, we ensure that each company has total assets greater than 25 million USD at each point in time.

Next, we ensure that we provide the required number of lagged quarters (4) and split the data chronologically (80/20) into estimation and testing. The estimation is split again randomly this time into training and validation for the neural network model.

All data gathering, processing and filtering is done automatically with the help of several Python scripts/modules and apis from the data providers.

4.4. Data structuring

After the data have been gathered, processed and filtered, they are stored in a Python, Pandas Dataframe. This data structure is similar to a table where each row represents a separate input for our models. A row contains the current data (after the announcement date) that need to be forecasted, as well as the four preceding quarters. Using this type of structure, we encapsulate in one row all the current and historical information a model needs to forecast earnings.

5. RESULTS

Looking at earnings per share we immediately observe a skewness to the right which can be explained by the fact that highly unprofitable firms are not that common and usually result in bankruptcy as show by Ohlson (1980).

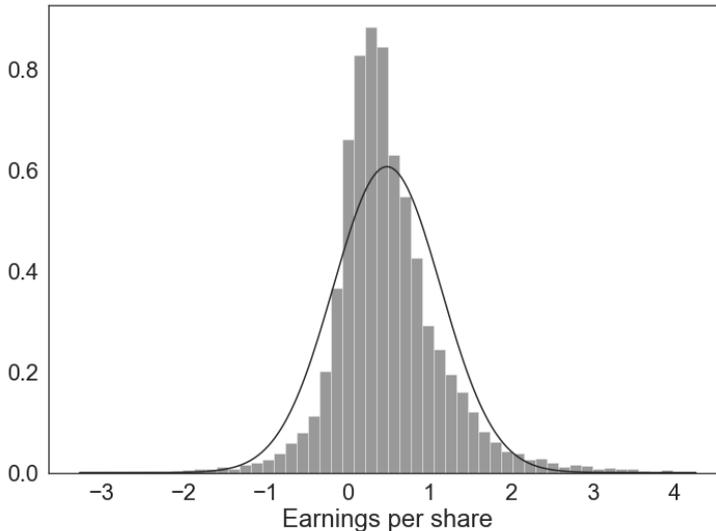


Figure 3: *Earnings per share in US dollars distribution*

Looking at the earnings surprise generated by the SA estimates we can observe the bias discussed in literature where SA tend to overestimate results thus resulting in an earnings surprise skewed to the left.

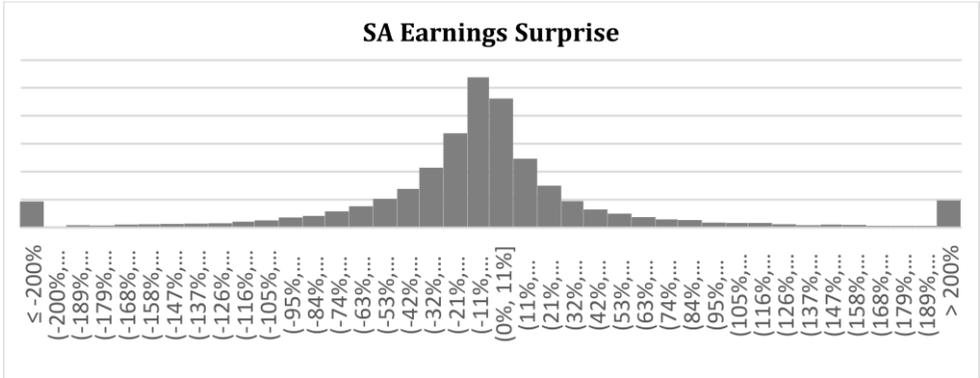


Figure 4: IEBS earnings surprise distribution calculated as $(estimate/actual)-1$

Looking into the explanatory power of past earnings we clearly see that a clear relationship can be observed, thus confirming the FF06 statement that past profitability forecast current profitability.

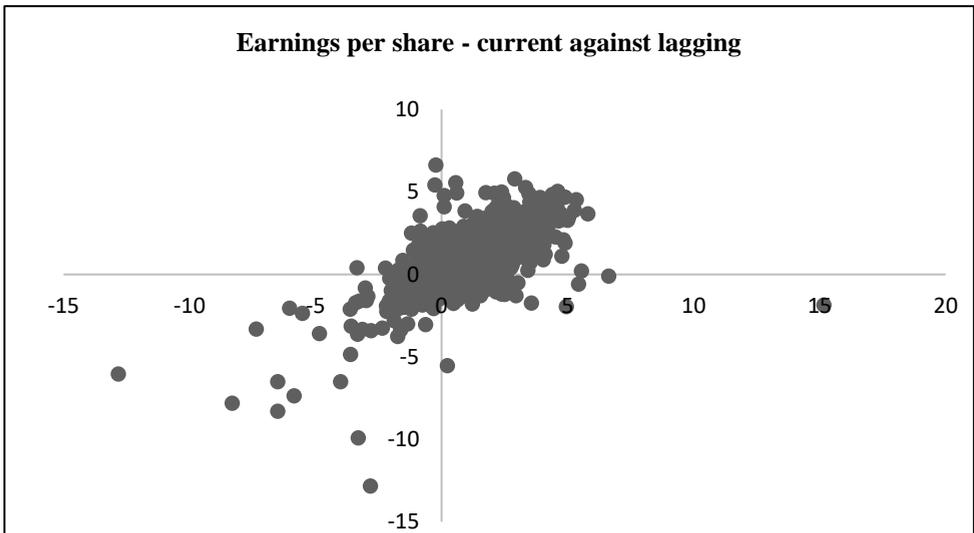


Figure 5: Current earnings per share (in US dollars) plotted against earnings per share one quarter before

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Appendix A. *DNN build procedure in Python*

```

1. def build_model():
2.     model = keras.Sequential([
3.         layers.Dense(8,
4.             activation = tf.nn.leaky_relu,
5.             input_shape = [len(estimation_dataset.keys())]
6.         ),
7.         layers.Dense(8, activation = tf.nn.leaky_relu),
8.         layers.Dense(1)
9.     ])
10.
11. optimizer = tf.keras.optimizers.Adadelta(lr = 0.1)
12.
13. model.compile(loss = 'mean_squared_error',
14.               optimizer = optimizer,
15.               metrics = ['mean_absolute_error', 'mean_squared_error'])
16. return model

```

Appendix B. *Data filtering procedure in Python*

```

1. FF_REQUIRED_COLUMNS = [
2.     'actq', # Current Assets - Total
3.     'atq', # Assets - Total
4.     'chcq', # Cash and Short-Term Investments
5.     'cogsq', # Cost of Goods Sold
6.     'cshoq', # Common Shares Outstanding
7.     'dlcq', # Debt In Current Liabilities
8.     'dlttq', # Long-Term Debt Total
9.     'dpq', # Depreciation and Amortization
10.    'ibq', # Income Before Extraordinary Items
11.    'lctq', # Current Liabilities - Total
12.    'niq', # Net Income (Loss)
13.    'saleq', # Sales/Turnover (Net)
14.    'dvpsxq', # Dividends per Share/Ex-Date
15.    'ltq', # Liabilities - Total
16.    'scfq', # Cash Flow Format
17.    'oancfy', # Operating Activities/Net Cash Flow
18.    ]
19.
20. FF_OPTIONAL_COLUMNS = [
21.    'ddlq', # Long-Term Debt Due In One Year
22.    'pstq', # Preferred/Preference Stock (Capital) - Total
23.    'txdiq', # Income Taxes - Deferred
24.    'txditq', # Deferred Taxes and Investment Tax Credit
25.    'wcapq', # Working Capital (Balance Sheet)

```

```

26.         'sstky', # Sale of Common and Preferred Stock
27.     ]
28.
29. NN_COLUMNS = [
30.     'cshtrq', # Common Shares Traded - Quarterly
31.     'prccq', # Price Close - Quarterly
32.     'prchq', # Price High - Quarterly
33.     'prclq', # Price Low - Quarterly
34. ]
35.
36.
37. def ff_filter(df):
38.     df.drop(df.columns[[0, 1, 2, 3, 4, 5, 6, 7, 10, 11, 13, 35]], axis=1, inplace=True)
39.
40.     df.dropna(subset=FF_REQUIRED_COLUMNS, inplace=True)
41.
42.     for optional_column in FF_OPTIONAL_COLUMNS:
43.         df[optional_column] = df[optional_column].fillna(0)
44.
45.     book_equity = []
46.     for i, row in df.iterrows():
47.         book_equity.append(row['atq'] - row['ltq'] + row['txditcq'] - row['pstkq'])
48.
49.     df['book_equity'] = book_equity
50.
51.     df = df[df['book_equity'] >= 12.5] # Remove companies with less than 12.5 mln
in book equity in year
52.
53.     df = df[df['atq'] >= 25] # Remove companies with less than 25 mln in total ass
ets in year t
54.
55.     return df
56.
57.
58. def eps_filter(df):
59.     df.drop(columns=['TICKER', 'MEASURE', 'FISCALP'], axis=1, inplace=True)
60.
61.     df.dropna(subset=['actual', 'surpmean'], inplace=True)
62.
63.     df['anndats'] = pd.to_datetime(df['anndats'], format='%Y%m%d')
64.
65.     dates = []
66.     quarters = []
67.     for i in range(len(df)):
68.         pyear = df.iloc[i]['PYEAR']
69.         pmonth = df.iloc[i]['PMON']

```

```

70.
71.     quarter = int((pmonth - 1)/3) + 1
72.
73.     dates.append('%dQ%d' % (pyear, quarter))
74.     quarters.append(quarter)
75.
76.     df['datacqtr'] = dates
77.     df['quarter'] = quarters
78.
79.     df.drop(columns=['PYEAR', 'PMON'], axis=1, inplace=True)
80.
81.     df.rename(index=str, columns={'OFTIC': 'tic'}, inplace=True)
82.
83.     return df
84.
85.
86. def technical_filter(df_t, df):
87.     df_t.drop(columns=['PERMNO', 'COMNAM', 'CUSIP'], inplace=True)
88.
89.     df_t['date'] = pd.to_datetime(df_t['date'], format='%Y%m%d')
90.
91.     new_data = {}
92.     for i in range(-5, 1):
93.         new_data['volume%s' % (str(i) if i != 0 else '')] = []
94.         new_data['price%s' % (str(i) if i != 0 else '')] = []
95.
96.     df = df_t.reset_index().merge(df,
97.                                   how="left",
98.                                   left_on=['TICKER', 'date'],
99.                                   right_on=['tic', 'anndats']
100.                                  ).set_index('index')
101.
102.     df.dropna(subset=['anndats'], inplace=True)
103.
104.     for j in range(len(df)):
105.         if j % 1000 == 0:
106.             print('Step: %d' % j)
107.
108.         rt_adj = 1 if df.iloc[j]['report_time'] == 'after' else 0
109.
110.         index = df.index[j]
111.
112.         for i in range(-5, 1):
113.             new_data['volume%s' % (str(i) if i != 0 else '')]
114.                 .append(df_t.iloc[index + i + rt_adj]['VOL'])
115.             new_data['price%s' % (str(i) if i != 0 else '')]
116.                 .append(df_t.iloc[index + i + rt_adj]['PRC'])

```

```
117.
118.     for key in new_data:
119.         df[key] = new_data[key]
120.
121.     df.drop(columns=['VOL', 'PRC', 'date', 'TICKER'], inplace=True)
122.     df.dropna(subset=['price', 'volume', 'price-1', 'volume-
123.     1'], inplace=True)
124.     df.sort_values(by=['tic', 'anndats'], inplace=True)
125.
126.     df.reset_index(inplace=True)
127.
128.     df.drop(columns=['index'], inplace=True)
129.
130.     return df
131.
132.
133.     def nearest(items, pivot):
134.         return min(items, key=lambda x: abs(x - pivot))
135.
136.
137.     def main():
138.         # Import fundamental data
139.         df_f = pd.read_csv(WRDS_FUNDAMENTAL_DATA_PATH)
140.
141.         df_f = ff_filter(df_f)
142.
143.         # Import eps values and estimates
144.         df_e = pd.read_csv(WRDS_EPS_DATA_PATH)
145.
146.         df_tc = pd.read_csv(WRDS_TICKER_CUSIP)
147.
148.         tickers = []
149.         for cusip in sorted(df_f['cusip'].unique().tolist()):
150.             rows = df_tc[df_tc['CUSIP'] == cusip[:8]]
151.
152.             if len(rows) > 0:
153.                 tickers.append(rows.iloc[0]['TICKER'])
154.
155.         df_e = df_e[df_e['TICKER'].isin(tickers)]
156.
157.         df_e = eps_filter(df_e)
158.
159.         df = df_f.merge(df_e, on=['tic', 'dataqtr'])
160.
161.         # Import earnings report times
162.         d_r = pd.read_pickle(BMBG_BEFORE_AFTER_MKT_PATH)
```

```
163.
164.     report_time = []
165.     for i in range(len(df)):
166.         bloomberg_ticker = df.iloc[i]['tic'] + ' US Equity'
167.
168.         anndats = df.iloc[i]['anndats']
169.         closest_date = nearest(d_r[bloomberg_ticker].keys(), anndats)
170.
171.         report_time.append(d_r[bloomberg_ticker][closest_date])
172.
173.     df['report_time'] = report_time
174.
175.     pd.to_pickle(df, 'wrds_partial.pkl')
176.
177.     # Import technical data
178.     df_t = pd.read_csv(WRDS_TECHNICAL_DATA_PATH, low_memory
y=False)
179.
180.     df = technical_filter(df_t, df)
181.
182.     pd.to_pickle(df, MERGED_DATA_PATH)
183.
184.     if __name__ == '__main__':
185.         main()
```

CASE STUDY



FACTORS INHIBITING FEMALE MANAGERS' ADVANCEMENT TO SENIOR POSITIONS

IRIS RON*

Abstract: *This literature review will examine the internal and external factors that hinder female managers' advancement to senior positions in the Israeli labor market. The cultural framework consists of several main elements that guide gender roles. During the COVID-19 period, women experienced more difficulties associated with the new constraints and guidelines than men in workplaces.*

The review is divided into internal and external factors in four main areas: sociology, economics, human capital, and legislation.

The glass ceiling for a female manager is created in an organization whose structure is not suitable for the inclusion of women and mothers. From an early age, boys and girls experience different attitudes according to gender, social expectations, perception of themselves, social disparities, economic dependence, and discrimination.

Changing the perception of gender roles in all areas of life may change workplace culture. Legislation and enforcement may create a gender balance in public and private sectors.

Keywords: *female management, senior positions, glass ceiling, career, professional pipeline, wage differences, economics, sociology, human capital, legislation, inhibiting factors, COVID-19*

JEL Classification:

1. INTRODUCTION

The background for the present paper is the data from the Israeli Central Bureau of Statistics (CBS) showing that women make up 47% of the labor force in the market according to 2014 survey results. Of all management positions, 32% are held by women. The proportion of women in senior management of companies listed in the Tel Aviv 100 Index is 19.4%, and the percentage of women among board members is only 18.2%. Of these board members, 6% are CEOs, and 4% are chairs of the board (Aharoni, 2015).

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Although women make up 47% of the workforce, which nears equality, most are not managers. Women have been shown to take on responsibilities and tasks associated with senior positions, such as vice president, but are ranked according to their middle management title, as are their salaries (Wall Street Journal, 2020).

According to these data, the situation in Israel with regard to the status of women in senior positions is still far from being in gender balance (Aharoni, 2015).

External factors begin at the macro level, in organizations' hierarchical military structure (Sasson-Levi 2017). Other external factors that prevent women's advancement are an organizational culture representing inherent perceptions of language, division of roles, relationships, and even the tone of speech. At the micro (individual) level, another external factor that prevents many women from advancing in their professional roles is that they are also current or future mothers (Bar Zuri et al., 1997).

This paper will address gender differences in the workplace and the limitations women face in reaching senior positions in Israel. Some of these limitations stem from the State of Israel's character since its independence, and some are international. In addition, the primary professional victims of COVID-19 constraints are women whose promotions have been halted, and whose ability to pursue a master's degree, which is the door to a senior position, was blocked for economic reasons (35% of students surveyed in Israel indicated that the corona crisis created economic difficulties for them, while 20% dropped their studies as a result) (Ilan, 2020). Another COVID-19-related reason for the lack of promotion is that women cannot continue to work when there are no educational solutions for children outside the home (Hasson and Ben Eliyahu, 2020).

2. METHODS

The paper's structure is based on the classification of inhibiting factors by external and internal influences on the promotion of female managers.

The main reasons women do not advance to senior positions are divided according to the main areas ranked from wide to narrow perspectives:

1. Sociology
2. Economics
3. Human capital, with an emphasis on female management.

The literature review is based on the following key concepts and their interpretations:

- Affirmative action (for women) – The process of getting women into work positions in order to create a gender balance (Kramar, 1998)

- Aspirations and expectations – A desire to hold or advance to a senior position (Herrbach and Mignonac, 2012)
- Board of Directors – Group of directors and consultants responsible for managing the corporation (Cambridge University, 2020)
- Career – The professional path of the person in the field(s) in which they work (Cambridge University, 2020)
- Female management – The typical management style for women that contrasts masculine management (Gabdreeva and Khalfieva, 2016)
- Female professions – Areas of practice that are in a gender imbalance that favors the female side
- Glass ceiling – The barrier that women reach in terms of wages, the share of senior positions, and occupational crossover (Oakley, 2000)
- Higher education – Academic studies beginning with a bachelor's degree; a condition for promotion is a master's degree or higher (Cambridge University, 2020)
- Mentoring – Accompanying an employee at the beginning of his or her career by a veteran in the field, with the provision of orientation and tips for success (Cambridge University, 2020)
- Middle management – Management with limited responsibility for employees or a specific issue (Gabdreeva and Khalfieva, 2016)
- Mothers in the workplace – Women who currently or may in the future take care of children, and who want to balance work and home life (Barry, 2019)
- Neocolonialism – Hierarchical structures created by military regimes that operated in countries that were conquered by empires; the State of Israel continued with these structures and methods for the independent management of an economy (Sasson-Levi and Misgav, 2017)
- Networking – Connections and relationships between people who are aware of the employee's abilities, and can influence professional development (Cambridge University, 2020)
- Professional pipeline – A person's career path from the beginning of school until reaching a target position (Schweitzer et al., 2011)
- Self-realization – Expression of abilities, and specialization in them to achieve personal goals (Olson, 2013)
- Senior – A position given to a manager with the rank of vice president and above (Cambridge University, 2020)

- Wage differences – A comparison between the pay given to men vs. women for the same hours of work in the same field with the same level of education and years of experience (Payscale, 2020)

3. RESULTS AND DISCUSSION

1.1. Inhibiting Factors in Sociological Aspects of Career Development of Female Managers Toward Senior Positions in Israel

1.1.1. External sociological aspects inhibiting advancement of women to senior positions

External factors that prevent women's promotion to senior positions are rooted in the following:

1. "Glass ceiling" – The glass ceiling is the barrier that women reach in terms of wages, the share of senior positions, and occupational crossover, relative to men (Oakley, 2000).
2. Organizations' hierarchical military structure is fundamentally masculine (Sasson-Levi and Misgav, 2017).
3. The influence of cultural perceptions in creating gender differences in the workplace creates situations in which women are often silenced (Reardon, 2015; Fisher, 1991).
4. Lack of networking and organizational politics for women: women often feel forced to maneuver between gender loyalty and the struggle to remain in their jobs (Duguid, 2011).
5. The responsibilities of motherhood outweigh the importance of economics and self-realization (Zainzinger, 2012).

The glass ceiling is a metaphor describing an invisible barrier to the advancement of careers – in this context, of high-achieving women. It reflects corporate policies and practices in training and career development (including promotion and compensation) which do not allow women to reach senior ranks. Glass ceiling culture dictates to women the perception of their status in society and the workplace (Flippin, 2017; Oakley, 2000).

Women need experience in areas such as operations, manufacturing, or marketing, which are generally not in the career track of female managers. Women rarely choose professions considered "only for males." The experience required as a necessary condition for the position of CEO dictates a specific line of professional development and other senior management positions. Often these policy difficulties are not addressed in the lower ranks of management. Subsequently, when women

rise to positions closer to the top later, they often find themselves excluded from upper management levels due to improper tracking earlier in their careers (Oakley, 2000; Morrison, 1992).

Oakley (2000) argued that there are several conditions for creating employment diversity in the workplace:

1. An understanding of the rationale behind occupational diversity at all levels of the organization.
2. Leadership training courses for women interested in taking part in the process of increasing employment diversity in their workplace, including promoting women to the ranks of upper management.

When women fully participate in the labor market, companies' profitability increases due to the following reasons (International Finance Corporation, 2013):

1. Women enable access to new markets and diverse sectors.
2. Women take fewer risks in management and strategic decision-making.
3. Women bring higher education levels, extensive areas of knowledge, resourcefulness, creativity, and multi-tasking.

For example, a case study: "E" is a female manager who became vice president at a factory. She was initially in a "female" profession, in the position of an educational consultant, and realized that her professional path would lead to being only a school principal. She decided to move to the industry and started her career from the bottom up. She already had a master's degree, so she progressed to become a human resources vice president at an industrial company where she worked (unpublished interview).

The neo-colonialism theory suggests that organizations' hierarchical military structure is fundamentally masculine, even though organizations have been defined as gender-neutral (Sasson-Levi and Misgav, 2017). Neo-colonial structures in Israel offer preservation of old hierarchical patterns, from the high commander's level to middle commander to soldier. Since the British Mandate era, officers in the rank of sergeant were the top managers of the entire state organization. This model is duplicated in the industry even today, e.g., the title of an individual responsible for the safety or security of workers in the industry is called "officer" ("katzin" in Hebrew), which carries a rank equivalent to that of sergeant (Sasson-Levi and Misgav, 2017).

Neo-colonialism is a barrier to women's professional advancement due to several reasons:

1. This hierarchical structure is generally not suitable for women, who tend to use other styles of handling projects. Rather than using authority as a way to manage workers, women tend to delegate tasks (Kanter, 1977).
2. From the early days of Israel, military and militancy are combined in society. The “militant agenda” reflects the male agenda that excludes women from the discourse. Although women take part in military service at the age of 18 (generally until 20), most are not a part of the combat arena. Therefore, men consider them to be not part of the primary military conversation – and by default, male – circle (Eiran-Yona, 2013).
3. Neo-colonialism separates Jewish and Arab women’s identities, and does not let their equality struggles join together. This situation is due to the tension between the two peoples for many generations (Sasson-Levi and Misgav, 2017).
4. The influence of cultural perceptions in creating gender differences in the workplace creates situations in which women are often silenced (Reardon, 2015; Fisher, 1991).

In many cases, when interpersonal discourse is held, it is conducted in a way that the male voice sometimes trumps the female voice, which tends to be more delicate (Reardon, 2015).

Even independently of their role, women’s voices often are not heard or are completely ignored. The results of a survey conducted by Fischer (1992) among men and women in senior positions in large corporations justify this statement about silencing women. Women in senior positions claim that opportunities to be heard are not given by their male counterparts, who do not listen to them. If this is senior executives’ experience, there is little chance that most women in the workplace will be heard. Under these conditions, it is not surprising that only 2% of CEOs answered in the affirmative when asked whether it is likely that their company will have a female CEO in the next decade (Fisher, 1992).

One of the reasons women are not promoted is the lack of support or loyalty from their peers, due to power struggles for fear of their status and maintaining their place and roles in the organization (Duguid, 2011). There are several reasons for this:

1. The number of positions for women is relatively small, so the struggle to survive is challenging.
2. There are always power struggles between men, but it is not acceptable for women to fight.
3. The female manager may feel that her value is threatened by another woman who might be considered better and with more credentials.

The responsibilities of motherhood outweigh the importance of economics and self-realization. As the working class develops and more women join the workforce, women's ability to produce a balance between family and career will grow and help in successful and continuous employment (Rout and Rout, 2002). Now they are facing occupational stress.

Stress at work can adversely affect family life and vice versa (Rout and Rout, 2002). In society, the expectations of women and especially mothers have remained the same over the past decades. Therefore, motherhood still presents a barrier that affects women's professional advancement.

1. The career expectations stem from women's conscious decisions to pursue different career paths from men. It reflects their values (e.g., maintaining the family), and thus gender differences are created (Wang and Degol, 2017).
2. Human capital theory suggests that women tend to prefer employment conditions that enable work-life balance over salary and promotion. Further, women may consistently invest less in the education and work experience necessary for their advancement, and more in their children (Schweizer et al., 2011). For example, "I" preferred to study education to be a teacher so that she can finish her workday in the afternoon, rest, pick up her children from kindergarten, and spend holidays with the family (since there are no studies at those times) (unpublished research).

According to existing research, most women in management positions do not consider moving up the management ladder to senior positions (Brier-Garb et al., 2017). Society's expectation of women is caring for children as a primary priority, careers as a secondary priority.

1. Even when women are more talented and have higher education levels and aspirations for advancement than their male peers, their concerns may be in other areas: their relationships, their place in the family and home, and their duty to care for their children (Herrbach and Mignonac, 2012).
2. There is a stereotype about women and their place in the workplace that geography is a barrier, as it is expected that a woman would not work too far from home if she needs to take her child from school/kindergarten in the middle of the day (Dagblad, 2019). Kindertartens in Israel are sometimes located far from the workplace, due to the placement of children in state kindertartens by area of residence) (Ministry of Education, 1959).

3.1.2 Internal sociological aspects inhibiting advancement of women to senior positions

Women tend to have low expectations and aspirations regarding their success. A case study conducted by Axelrod (2017) indicates that a woman who was told as a child that she can reach any goal she wants is likely to advance to a higher level in the organization in the future, given that there is a match between her performance level and expectations.

The following are potential barriers:

1. Fear of running for senior positions: women are afraid to apply for a senior position if they think they do not have 100% of the job description qualifications. Even when women know they can do the job well, they assume they may not be able to pass the resume screening or interview stage due to the lack of some of the skills stated to be required for the job (Mohr, 2014).
2. The perception of the management position as too challenging, and the responsibility for the profit and loss is too heavy: women tend to not feel comfortable applying for a senior position. Further, there is a lack of awareness of the importance of mentoring and networking in the organization (Barry, 2019).
3. Women are satisfied with low wages and part-time jobs when working conditions are favorable: women more than men tend to gravitate towards low-level and low-paying part-time jobs that offer flexibility. At the senior level, they would be expected to work full-time, and work culture does not provide clear policies and procedures for balancing private life and work (Grant et al., 2006).
4. Women feel alienated in executive meetings characterized by masculine organizational culture: women describe the behaviors that seem disturbing to them. They say that their voices are not heard and that their words are interrupted or ignored altogether in meetings. Important working and networking meetings also often do not occur during the workday, but rather during male-dominated activities outside of the workplace (e.g., in pubs, at football games, or on the golf course) (Stocking, 2020).
5. Women tend to choose to remain silent so as not to provoke conflicts in the workplace: research by Milliken (2003) of New York University found types of concerns raised by the respondents indicating the influence of their decisions to remain silent. The most common concern was to appear negative or be labeled as a serial complainant (30%). Some thought that if they spoke out, they would not be seen as team players. "A person's strength comes when

people find them pleasant, reliable, and easy to work with” (Female, Investment Banking Firm). The second most commonly expressed fear was from hurting work-related relationships. Many survey participants (27.5%) said that talking about problems that bother them could hurt relationships with colleagues or bosses they rely on to get important information. They were afraid that they will no longer like them or will stop thinking they are trustworthy. The biggest fear is avoidance (Female, consulting firm). The third fear is that others will not listen or do anything anyway, so it is not worth the effort (25%). Some say, “why bother telling when nobody is listening?” and some say, “it probably won’t be worth taking the risk.” The last fear is from revenge or punishment (22.5%), including losing the job or promotion opportunities. “Managers value loyalty above all else ... If you were okay, and you never said anything controversial, you would advance in the organization” (Female Chemist, Biotechnology Company) (Milliken, 2003).

6. Women tend to have low self-confidence and be outwardly sensitive to criticism. In contrast, men tend to show more confidence. Male managers, who have been taught to move away from their emotions, are therefore perceived as having greater abilities (Fischer et al., 2018).
7. Women are sensitive and, therefore, more considerate, but tend to demonstrate high vulnerability. The related perceived lack of authority tends to undermine the trust of subordinates and their commitment to comply with directives (Fischer et al., 2018)

3.2 Inhibiting factors in economic aspects of women’s careers

3.2.1 External economic inhibiting factors in career development

Women’s career advancement track is different from that of men. One of the known reasons for their different trajectories is called “leaky pipeline syndrome.” While men’s advancement is described as a planned pipeline starting from the period of study until they are promoted to senior positions, in women, of those starting in the engineering, computer, mathematics, chemistry, etc. study track, only 10% will reach senior positions. The reasons for dropping out along the way are internal and external and are discussed elsewhere in this paper (Ministry of Economy and Industry, 2019).

There are fewer positions for a senior management rank in fields that tend to be considered “female.” According to a study using 1950-2000 data from the United States Census Bureau, when women dominated traditionally male professions in the same sector, wages decreased significantly, independently of education level, work experience, skills, race, and geography. Every decade, a 10% increase in the

proportion of women in that sector resulted in an up to 5% decrease in hourly wages (Levanon et al., 2009). A profession characterized as male tends to have more prestige and thus has a senior position reserved on the management team to which one can be promoted. Once an occupation starts to be feminized (i.e., takes on more females), the wages/salaries decrease, as do promotions, and as a result, there is rarely a senior place in the field (Hedreen, 2019).

The problem is that women agree to fulfill everything included in the VP's position but without the rank and salary commensurate with the size of the job and responsibilities. The basic premise is that a woman will perform the required work and even more to prove herself and demonstrate actual results (Hedreen, 2019).

In its early days, the computer industry was mainly used for accounting and programming, considered female professions. As the field evolved and the technology became more complex to operate, employees with higher STEM skills were required, and the field became male-dominated (Orbach, 2016). As a result, salaries increased, as did management roles. Today the technology industry is characterized by male culture (Hedreen, 2019).

According to a study, 30% of jobs in positions typically filled by women were filled by men from 2011 onward; 27% of all professions dominated by women, such as accountants, education managers, interior designers, human resources managers, pharmacists, and cooks, are currently held by male workers (Hedreen, 2019).

Flat wages accompany the growth rate of women's participation in the workforce. As wage levels rise, the growth curve of women's participation in labor flattens out. It is evident that in the higher grades, the increase in wages and participation of women stops (Galka, 2015).

Women's wages are lower than those of men in the same field and in the same position (Payscale, 2020). This phenomenon is seen in Israel and around the world, and cannot be explained by the stereotype of fewer working hours. In practice, a woman's hourly wage is lower than a man's hourly wage (e.g., \$0.70-\$0.92 for every \$1 a male makes) (Payscale, 2020). Further, women can generally give less overtime than men due to family and household obligations. Women gain less experience than men because the former are often forced to leave work due to childbirth and childcare. Women also participate less in courses than men because studying is a privilege for those who can spend many hours away from family and children and ultimately bring more money. Given the expense of advanced education, with the importance of degrees in career promotion, this creates a vicious cycle that prevents gender equality (Bar Zuri et al., 1997).

1.2.2. Internal economic inhibiting factors in career development

A crucial internal factor for women is to be significant and valuable and to contribute to the global economy; however, this need is often not expressed. When choosing a profession at the beginning of their careers, women indicate the importance of doing the work itself as best as possible and do not aim for management in their field. Therefore, they remain in their working roles and do not advance to management roles (Bar Zuri et al., 1997).

Women currently do not have egalitarian economic involvement. They make up two-thirds of the world's workforce, but receive only 10% of global income, and hold only 1% of global assets. Meanwhile, they make up about 70% of the world's poor. Further, women worldwide are often engaged in three roles simultaneously: raising children, household chores, and paid work to support the family (Jalbert, 2010).

Ironically, studies show that companies with women in senior management produce a higher profit line, especially when there is gender balance in management in general. The point of change in public companies is created when at least three women are present on the board of directors, generally meaning that at least 25% of all board members should be women (Deshe, 2020).

Women report a lack of knowledge in the areas of business and activity of the workplace (e.g., engineering, computers, chemistry, sales, and marketing). For example, the areas in which they have less experience include the industrial field where the company is engaged, sophisticated technical practices in high-tech, or business knowledge in sales and marketing. This lack of knowledge undermines their confidence and does not allow them to express their opinions at management meetings in making strategic decisions for the organization. In the intervention program for gender equality in the public sector, enrichment courses for female leadership in organizations will be budgeted, including learning areas relevant to their ministry's field of practice. The enrichment process for women must include business knowledge in the corporate arena, as detailed by the Israeli Ministry of Economy and Industry (Mizrahi Simon, 2015).

3.3 Inhibiting factors of female human capital in management and the integration of women at the senior level

3.3.1 External inhibiting factors in the integration of women at the senior level

Women are in managerial roles but not in senior positions. Even in sectors where the vast majority are women, most men will be found at the top level. As in the United States, the under-representation of women in senior positions is

characteristic of Israel. As of 2014, only 40% of the top managers and only 15% of CEOs were women. This situation is also prevalent in the public sector, though most employees therein are women. In 2015, only 16% of CEOs in the civil service were women (Hermon et al., 2018), even though female management has often been observed to be more effective than male management. For example, women can maintain relationships and speak at eye level, especially with Generation Y, which is a significant advantage (Gallup, 2015). The lack of social recognition of these benefits stems from the prejudices and personality shaping of men and women from childhood, along with other previously detailed barriers such as gender-based discrimination. This situation may change in the future, due to efforts against discrimination (Hermon et al., 2018).

3.3.2 **Internal inhibitory factors in the integration of women at the senior level**

Women usually do not use their authority in management, while men are required to express assertiveness in this context. If a woman uses authority, i.e., commands instructions to her subordinates, it is not well received, neither by men nor by women. Women also do not respond well to authoritative behavior from a female boss. Women are expected to be soft, explanatory, and motherly rather than forceful. Otherwise, they are attributed traits of those who cross the line of fair and equal relationships, especially by Generation Y. Many women believe that their focus on leading a process through a more personal and encouraging management style is not perceived as achieving the desired result when it comes to promoting them in the organizational hierarchy. On the other hand, men are expected to be strong, leading, determined, and authoritative; otherwise, they are characterized as weak, hesitant, and lacking in leadership skills, and tend to hide other sides of their character (Australian Government Department of Social Services, 2008).

Women's quiet and soft voice does not support their status in loud arguments and verbal confrontations; when there is an argument between people, the men's bass voice outweighs women's voice (Reardon, 2015). Women avoid raising their voices for the following two reasons: (1) politeness requires women to not raise their voices; and (2) women's voices tend to be distorted ("shrill") when raised, which can reveal vulnerability rather than intensity. The theme of the voice is rooted in cultural perceptions, which in turn, are rooted in the culture of discourse between people. The general tendency of men is to dominate mixed discussion groups. Beyond the need to be aware of this tendency, it is argued that businesses need to find ways to avoid such situations that cause gender bias (Reardon, 2015).

Perhaps in a managed discourse culture, everyone will be able to speak for a limited time by a facilitator. As it takes place in virtual encounters using video conference platforms, there will be almost no differences between women and men due to their voices. According to Krupnik's article on the discussion patterns of the various genders, female students tended to have equal exchanges during the discourse. In men's discussion groups, the conversation was more like a competition: most added personal stories and get more attention, or raised their voice to create superiority over others in the discussion (Krupnick,1985).

3.4 Legislation

In Israel, there is a "Civil Service Law," which deals with the field of "appointment to public positions" under section 02A (1958). Under this law, the government enforces women's representation in all departments and divisions, and in all ranks and professions of all government ministries. This law is about representation, not absolute equality, and is about relative equality (i.e., if women staff 45% of public service positions, then representation in senior positions will reflect this same proportion). The law demands to do as much as possible and even take "corrective action" already at the job acceptance stage, and of course, at the job promotion stage (Civil Service Commissioner, 2019).

The department responsible for human capital management in the public sector is the Civil Service Commission. Within this office is the Division for Gender Equality and the Advancement of Women (Wexelman, 2015).

The Stauber Committee to Examine Ways to Promote Women in the Civil Service was established in 2013. The committee's recommendations deal with pay, bidding, women in senior positions, work-life balance, leadership courses, etc.

Of the highest-ranking positions in the civil service, 1.0% is staffed by women. A plan has been drawn up according to which, within five years, 21% of women will be at least at the highest level and one level below it, in government ministries and sub-units.

The sanction given to ministries that do not meet this goal is that they will not be permitted to recruit employees without the Exceptions Committee's approval. The problem is that there is a significant gap between women who bid for positions in the civil service. Though women make up 61% of state workers, only 18% get to the bidding stage.

Appropriate representation in relation to the appointment of a director-general of a government ministry should be proportionate to women's percentage in the civil service. The percentage of women in government ministries (21%) does not

represent their proportion in the general population and in the civil service. (Wexelman, 2015).

Current executives in Germany think the goal of improving the number of women in operational management should be achieved through mentoring programs, internal target agreements, including aspects of gender equality in the company's mandatory report, and modern human resource management, which takes into account the following (Wipperman, 2010):

1. Differing needs and potential of women and men in management positions
2. Promotion of career change and penetration into sectors that were previously only male
3. Encouragement of women to take leaps in their careers

Managers in the business world in Germany, both men and women, think that a change in the number of female managers in at the senior level is unlikely to happen without assistance from the law and government decrees. According to these managers, it will not be possible to balance the number of women in senior positions without politicians and business leaders in the economy promoting legislative measures to support this change. It is a process of changing social perceptions and cultural thinking patterns that will enable mobility between different gender roles in the workplace (Wipperman, 2010).

As previously mentioned, Deshe's idea is that if there are no women on the board, there would be no public offering on the stock exchange. There should be at least three women on the board or at least 25% of women out of all participants on the board of directors (Deshe, 2020).

3.5 Worsening of Inhibiting Factors by the COVID-19 Crisis

Since the beginning of 2020, a large part of the population has been forced to work remotely or has been laid off in some professions and industries due to the COVID-19 epidemic. Women were at higher risk of suffering greater losses in profits, as today, many work in occupations in community and social services, education, library and training, office and administrative support, and personal services in larger percentages than men. In the female professions, many were suspended from work, laid off, or forced to work fewer hours. Some of the women even resigned from their positions in order to take care of children who were no longer in school, or elderly family members who were left without care (Payscale, 2020).

According to previous studies conducted by PayScale, some women's salaries dropped by 7% upon returning to work after an absence. Gender pay gaps for employees in positions with the same level of experience and training were

significantly affected by the situation. Women make up 90% of the nursing profession, but are paid less than their male counterparts, even though they face the same significant health risks (Payscale, 2020).

Measures taken to prevent the spread of the pandemic, such as shutdowns and the limiting of crowds, have led to the halting of women's careers and career advancement. It is now more challenging to return to the work cycle in the following respects (Hasson and Ben Eliyahu, 2020):

1. Many women have been laid off from their jobs or taken out of the workplace due to job cuts.
2. Children did not return to school or only partially returned, and the expectation is that women will stay home with the children.
3. The number of jobs in fields considered "female" (education systems, restaurants, catering, and secretarial positions) has declined due to a decrease in necessity secondary to reduced activity.
4. As a result of deterioration in families' economic situation, there was a halt in the advancement of women who stayed at work. In Israel, one of the conditions for promotion is a master's degree, even promotion to management at the intermediate level. (Gilrovich, 2018) Therefore in families where women's advanced degree studies were planned (usually later in life than men's), the plans were disrupted due to budgetary considerations (college and university studies cost a lot of money).

The COVID-19 pandemic, which led to a reduction in economic activity, was reflected, among other things, in social-gender and economic inequality. Before the crisis, there were differences between women and men in different economic and labor market positions: compared to men, women, on average, work more in less profitable occupational industries and are mainly in lower positions in the organizational hierarchy (Hasson and Ben Eliyahu, 2020).

In March-April, women's share among job seekers was high, especially in the young age group. Up to the age of 24, 39% of men were job seekers, compared to 61% of women. Between the ages of 25-64, the distribution of male job seekers was 45% compared to 55% of women. In general, among job seekers from all populations in Israel, 44% are men without a job, compared with 56% of women during this period (Hasson and Ben Eliyahu, 2020).

The COVID-19 crisis hit more those who had earned low wages even earlier. It is especially evident among women, who are more likely to receive low pay. Women's unemployment benefits were also lower than men's, in line with the initial salary. The median monthly wage of women whose work was stopped was 5,600

NIS per month, only slightly higher than the minimum wage of 5,300 NIS, while the median salary for men was 7,500 NIS (Hasson and Ben Eliyahu, 2020).

For self-employed men and women in the economy, the average unemployment benefit for women was 3,231 NIS, about 1,400 NIS lower than that for men. The difference in the amount of the benefit reflects gender gaps in income before the COVID-19 crisis, as the median difference in monthly payment is about 42% in favor of men: 5,880 NIS for women compared to 10,081 NIS for men (Hasson and Ben Eliyahu, 2020).

Women are the majority among employees of the public systems that are essential for dealing daily with the consequences of COVID-19. The epidemic has revealed unfairness in a segregated and polarized labor market: a significant proportion of women in essential positions are also those whose wages are very low, and these positions are characterized by part-time work (Hasson and Ben Eliyahu, 2020).

The following are findings from a survey of women versus men in the labor market during the COVID-19 period, taken in early April 2020 (Keidar, 2020):

1. Compared to 32% of men, 48% of previously employed women said that they went on unpaid leave or that their work was terminated due to reductions. The big gap between women and men was in unpaid leave, whereby 37% of women were affected, compared to 24% of men.
2. Compared to 54% of men, 39% of women work the same amount as before.
3. Of those who continued to work, 21% of women continued as usual in the workplace, and 28% worked from home. On the other hand, among men, 35% continued as usual in the workplace, compared to 32% who worked from home.
4. The level of education greatly influenced the continued work of employees, both among men and women. Among women without an academic degree, 60% were dismissed or put on unpaid leave, compared to 37% of women with an academic degree. Few women without an academic degree work from home – only 11% of women without a degree worked from home or in the workplace, compared to 43% of women with an academic degree who worked from home.
5. Continued employment of young women was interrupted: 61% went on unpaid leave or were dismissed. Only 27% of the women who remained in full employment were aged 25-34, whereas 45% of adults aged 35 plus stayed at work.
6. In the past, 36% of women were able to work from home more efficiently than in the workplace, compared with 46% of men. The inefficiency of working

from home is likely due to the presence of children in the home: 44% of women without children could work efficiently from home.

This survey focused on gender research, adapted to the ratio between men and women in the labor market before the crisis. The sample consisted of 412 men and 348 women, representing 54% men and 46% women in the sample. This sample represents the working population in Israel, which is currently divided into 53% men and 47% women (Keidar, 2020)

4. CONCLUSIONS

The current situation is a gender imbalance in the workforce in general and in senior management in particular. The article reviews the literature to date about factors that prevent female managers from getting promoted to senior positions. The inhibitory factors are divided into external and internal influences, and classified according to aspects of sociological, economic, and female management perceptions, specifically compared to male management.

At the general level in the field of sociology, the literature review explores broad perceptions about the role of women in human culture and the world of work.

At the second level in the field of economics are factors that hinder female promotion, such as gaps in women's knowledge in the business field and their focus on the professional side and less on the managerial aspects. In occupations defined as female, there are less often senior ranks in management such that of vice president; due to this, women's salaries tend to be consistently lower than those of their male colleagues.

At the more specific level, which deals with human capital, the article addresses aspects of female management. Although women's voices are softer – which does not play to their favor (Reardon, 2015) – allow this style to be more effective than authoritative male management.

In order to build the inclusion of additional women in business management systems, decisions must first be made to influence and take the necessary actions in legislation and enforcement (Wiperman, 2010).

At the political level, it has already been concluded that gender balance is an essential part of institutional organizational ethics. Thus was enacted the Gender Equality Act in Israeli government institutions, and procedures issued for its enforcement (Civil Service Commissioner, 2019).

Today, during the COVID-19 crisis, we are witnessing a worsening of women's situation in the workforce in general and in the promotion to senior positions in particular (Keidar, 2020). However, we do not yet know where this

crisis will lead us. Will it lead to aggravation of the situation or change for the better? We currently cannot predict the future in this matter. Presumably, along with the difficulty is also the opportunity for women to break forth in entrepreneurship or identify opportunities that did not exist before within the current economy's limited scope.

In order to change the situation, actions must be taken on several fronts: education, culture, the economy, and legislation (Wipperman, 2010).

In the field of education, the expectation is for equal treatment of females and males. There need to be proposals for further studies in the transition to technology majors and encouragement of women to study in subjects that are considered masculine; in the university setting especially, female researchers and lecturers should be encouraged to be an equal part of the academic staff (Wang and Degol, 2017).

In workplace culture, language needs to be based on gender-neutral terms for gender equality in opportunity (European Parliament, 2018).

In the field of economics, promoting gender equality in the workplace means to create equal opportunities for men and women for admission to positions in all areas and in promotion to management and senior positions (Civil Service Commissioner, 2019).

In the field of legislation, the model that comes from the public sector for gender balance in government ministries and affiliates (Civil Service Commissioner, 2019) should be copied to the private and business sector. In the corporation, especially if it is traded on the stock exchange (Deshe, 2020), a new law may be enacted to implement wage equality. A related bill passed the first stage of approval by the Ministerial Committee for Legislative Affairs in the Israeli Parliament (Israeli Knesset, 2020). Enforcement would include a requirement that companies divulge in annual reports their efforts toward gender equality, which will be published in the media. Penalties would result if the balance is not established within a specified time from the moment the law comes out.

In order for women to overcome inhibitory factors in reaching senior positions, the economic reality needs to change so that they will be able to fund help for the management of the home and thus will be free to realize their high abilities at work and reach senior ranks. To promote women who are mothers to young children, and in order for there to be a gender balance in the workplace that reflects the proportion of women in the population, tax reliefs and grants for mothers must be allowed. The monetary compensation for unpaid labor such as housework will allow them to enter the workforce fully. The additional resources they will receive will allow them to consume outside services such as cleaning, laundry, babysitting, and cooking. These

changes may help promote women to senior positions, prevent discrimination, make it easier for women to advance in their career paths, and allow women to apply their abilities and talents in all sectors of the economy (Amiran, 2017).

Changing the perception of different gender roles, combined with education expressed not only in institutions but also in other areas of life (such as art, advertisements, and social media), could also lead to change in women's status in the workplace. Future research will explore how management training and enrichment in business and engineering early in the education process can advance women to senior positions.

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