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Article

The Effects of Extreme Weather Conditions on Hong Kong and Shenzhen Stock Market Returns

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Abstract: We investigate the impact of extreme weather conditions on the stock market returns of the Hong Kong Stock Exchange and Shenzhen Exchange. For the weather conditions, we apply dummy variables generated by applying a moving average and moving standard deviation. Our study provides two interesting results. First, extreme weather conditions have a significant impact on the stock returns of the Shenzhen Exchange, indicating that the Shenzhen market is inefficient. Second, during the pre-QFII period, extreme weather conditions have a strong impact on the returns of the Shenzhen stock market, but the impact is significantly weaker in the period after QFII. This means that the efficiency of the Shenzhen stock market has significantly increased since the QFII program due to the market openness to foreign institutional investors. We emphasize the role of foreign investors not affected by local weather conditions by observing how market opening affects extreme weather impacts on stock market returns.

Keywords: behavioral finance; extreme weather; financial market openness; investment sentiment; MA-MSD method; QFII plan

JEL Classification: C32; F36; G11; G14

1. Introduction

A psychological state, such as mood, feelings, emotion and sentiment, is known to play an important role in people's decision making and judgment (Wright and Bower 1992; Bagozzi et al. 1999; Nofsinger 2002). It is also known that the weather has a significant influence on the people's mood and sentiment, and in turn, people's decision and behavior, called the weather effect (Rind 1996; Bassi et al. 2013).

If so, do weather conditions really affect stock market returns? The literature of market anomaly has suggested that weather conditions initially affect individuals' emotional mood and sentiment and in turn influence investors' rational decision makings. In this case, if investors' decisions have significant weather effects, a variety of extreme weather conditions can affect stock returns.

The efficient market hypothesis (EMH) entails that stock prices are determined by firms' fundamental values. If this theory is right, then it is not expected that any weather conditions can affect firms' value. However, the literature of behavioral finance suggests that, to a certain extent,

anomalies in stock markets can be occurred from various weather factors.[1] This view challenges the validity of the EMH.

With regard to behavioral finance, Chinese stock markets are interested in examining weather effect on stock returns. There are two main stock indices in China: One is the domestic board (A-shares) and the other is the foreign board (B-shares). At the beginning, foreign investors were restricted to hold A-shares,[2] and domestic investors were restricted for holding B-shares. However, since 9 July 2003, foreign investors have been allowed to trade A-shares on a limited basis.

In case of domestic investors, investment decisions can be affected by local weather conditions in China and, thus, the effect of weather conditions may be existed in Chinese stock markets. However, in recent years, the expansion of market opening and globalization has increased the level of participation of foreign stocks in the local stock market, which may have weakened the weather effects of the stock market. Using electronic trading systems and modern communication technologies, arbitrageurs can establish international portfolio strategies based on program transactions. This development can reduce the weather impact on stock returns and increase the efficiency of the Chinese stock market. This unique market nature allows us to investigate the impact of stock returns on foreign investors before and after the opening of the stock market.

In this paper, we examine the effect of weather conditions on stock returns using two typical stock market indices of the Hong Kong Stock Exchange and the Shenzhen Stock Exchange: Hang Seng Index (HSI) and Shenzhen Component Index (SZI). For this, we consider the daily index of the weather index (temperature, humidity and sunshine period) from January 1999 to June 2016 with three weather proxies: Temperature, humidity, and sunshine duration. Additionally, we also investigate whether the activity of foreign investors in the state of Shenzhen A has reduced the degree of market impact since 9 July 2003. To analyze the possible impact of A-share openness on foreign investors, we divide the SZI index series into two sub-periods and compare the meteorological effects between the two sub-periods.

The rest of the paper is organized as follows. Section 2 discusses previous research on the impact of weather on the stock market. Section 3 outlines Hong Kong and Shenzhen stock market and statistical characteristics. Section 4 describes the measurement of extreme weather conditions and dummy variables based on 11 (31 days) moving averages and standard deviations. Section 5 examines the relationship between weather conditions and stock returns and compares the results for the two sub-periods, before and after 9 July 2003. Finally, Section 6 presents conclusions.

2. Literature Review

Psychologists have long been interested in the effects of sunshine on human behavior (see Allen and Fischer 1978; Bell and Baron 1976; Cunningham 1979; Howarth and Hoffman 1984). They argue that sunshine affects people's moods and emotions and can, in turn, affect their own attitudes toward certain behaviors. For example, Cunningham (1979) finds that mild sunshine has a positive effect on consumer behavior and encourages people to interview.

Such finding indicates that weather can affect individuals' emotional state or mood, which in turn interferes in their rational or optimal decision-makings. If this is the case, the weather effect on people's behavior may have a substantial impact on the decision-makings of stock investors.

Some research on weather impacts focuses on the impact of sunshine on stock returns. Saunders (1993) and Hirshleifer and Shumway (2003) report that cloud cover negatively affects daily stock returns. Recently, some studies consider various weather conditions. For example, Keef and Roush

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[1] For examples, Saunders (1993), Kamstra et al. (2000, 2003), Keef and Roush (2002, 2005, 2007), Hirshleifer and Shumway (2003), Cao and Wei (2005), Garrett et al. (2005), Dowling and Lucey (2005, 2008), Chang et al. (2006), Yoon and Kang (2009), Novy-Marx (2014), Kaplanski et al. (2015), Schmittmann et al. (2015), Kaustia and Rantapuska (2016), and Dong and Tremblay (2018).

[2] Since July 2003, foreign investors have started to trade A-shares on a limited basis as a part of the Qualified Foreign Institutional Investor (QFII) plan.

(2002, 2005) investigate the impact of weather conditions such as cloud cover, temperature, and wind on the returns of New Zealand securities. Dowling and Lucey (2005, 2008) also investigate the relationship between weather and stock returns using multi-weather proxy variables. Cao and Wei (2005) and Keef and Roush (2007) find a negative correlation between the returns and temperature of Australian stock market. Chang et al. (2006) report that cloud volumes and temperature had a negative impact on Taiwanese stock market returns. Similar results can be found in Yoon and Kang's (2009) study of the effects of weather on Korea's stock returns using humidity, temperature and cloud cover.

More recently, Novy-Marx (2014) finds that, the weather conditions of global warming and the El Niño phenomenon have a significant power in forecasting the performance of popular anomalies in stock markets, implying that these factors have predictability for the asset pricing.

Kaplanski et al. (2015) survey investors' subjective emotional factors, returns and risk expectations. They are non-economic factors that influence the systematic risk and return expectations and investment plans of people who suffer from seasonal affective disorder it is found that the winter blues while supporting the hypothesis that the expected return is lower in autumn than any other season.

Schmittmann et al. (2015) explore the impact of weather on investors' trading in German stock market and find strong evidence for the relationship between weather and overall trading volume. Kaustia and Rantapuska (2016) identify the weather effects in Finland and link stock returns with weather. They find that some weather-related mood variables are individually significant. Pizzutilo and Roncone (2017) use intraday stock data to examine the weather effects of the Italian stock market and conclude that there is no systematic relationship between weather and stock returns. Shim et al. (2017) uses a daily data to explore the meteorological effects of returns and volatility in the Korean stock and derivatives markets. Dong and Tremblay (2018) finds pervasive and systematic patterns of weather effects by examining weather (sunshine, rain, snow, wind, and temperature) and the stock index returns of 49 countries for the period from 1973 to 2012.

There are several empirical studies on the Chinese stock market. For example, Yi and Wang (2005) provide evidence of the weather effects (humidity and wind) on the Shanghai Composite Index. Han and Wang (2005) and Han (2005, 2006) find significant impacts of weather on the Shanghai and Shenzhen stock markets. Kang et al. (2010) consider the openness effect of Shanghai B-stock market to domestic investors and the effect of comparing the weather effects between two periods before and after the opening. They find a strong effect of weather on B-share returns only during the period after the opening, possibly indicating that the weather effect seems to be caused by the participation of domestic investors. Cao and Han (2015) also test the weather effects using DCCA cross-correlation coefficient and find that some weather variables affect the returns and volatilities of the Shanghai and Shenzhen stock markets.

All the above findings generally cast doubt on the validity of the EMH in Chinese stock markets. However, no study has analyzed the efficiency of the mainland Chinese stock market (Shenzhen stock market) by comparing it with the Greater Chinese stock market (Hong Kong stock market) from the perspective of behavioral finance. We think the two stock markets, Shenzhen and Hong Kong stock markets, are the best object of empirical study for exploring the weather effect and the origin and nature of market efficiency from the perspective of behavioral finance, because the two markets are very closely located to each other and in the same weather conditions, but different from the investor composition.

3. Hong Kong and Shenzhen Stock Markets

3.1. Overviews of Hong Kong and Shenzhen Stock Markets

This study considers Hong Kong and Shenzhen stock markets. There are two reasons why we focus on these two markets. First, because Shenzhen is the most important commerce gateway between the mainland China and Hong Kong, many blue chips in the southern part of China are listed in this market. To our knowledge, however, there is little study that investigates this market. Second,

both stock markets are geographically very close to each other with the same climate zone, but the proportion of local investors (or that of foreign investors) is very different between the two markets. This is the main reason why we choose these two stock markets to investigate the effect of weather conditions on stock returns.

Table 1 briefly summarizes the key statistics of Hong Kong and Shenzhen stock markets. The Hong Kong Exchange is one of international financial centers, and its exchanges and clearing houses provide a wide range of financial service to private companies, investors, and financial intermediaries. Since the takeover from the UK, the Hong Kong Exchange has reinforced its financial transactions with mainland stock markets. As shown in Table 1, the Hong Kong Exchange has two major markets: the Main Board and the Growth Enterprise Market (GEM).[3] As of 31 December 2016, the Hong Kong Stock Exchange has 1713 listed companies with a combined market capitalization of HK$24,450 billion in Main Board market.

Table 1. Overview of the statistics for Hong Kong and Shenzhen Exchanges (December 2016).

	Hong Kong Exchange		Shenzhen Stock Exchange	
	Main Board	**GEM**	**A-Share**	**B-Share**
No. of listed companies	1713	260	1859	49
No. of listed H-shares	218	23	n.a.	n.a.
No. of listed red-chips stocks	147	6	n.a.	n.a.
No. of listed securities	8330	261	n.a.	n.a.
Market capitalization (Billion)	HK$24,450	HK$311	RMB 22,222	RMB 86
Average P/E ratio (Times)	10.53	71.31	41.62	11.15
Turnover volume (average daily) (Million shares)	129,733	1419	13,085	17
Turnover value (average daily) (Million)	HK$54,775	HK$582	RMB 193,984	RMB 131

Source: Website of Hong Kong Exchange (http://www.hkex.com.hk), and Shenzhen Stock Exchange (http://www.szse.cn/main/en).

The Shenzhen stock exchange, which is a relatively immature market, was launched on July 1991. Many companies on the Shenzhen stock market are subsidiaries of the state companies controlled by the Chinese government. As shown in Table 1, the market is segmented with two types of shares. One is consisted of A-shares that are the ordinary shares issued by the mainland Chinese companies. The shares intended for domestic investors are denominated and traded in RMB Yuan. The other is made up of the B-shares also issued by the mainland Chinese companies. However, the shares are denominated with RMB Yuan and traded with foreign currencies in buying and selling. In 2002, the Chinese government allowed foreign investors to buy and sell Yuan-denominated A-shares by the implementation of the Qualified Foreign Institutional Investor (QFII) program.

Chinese companies can be listed on H-Shares in the Hong Kong market and on A-Shares in the mainland market through IPOs. Meanwhile, investors in both regions can trade in both markets. Hong Kong is the gateway to mainland China and has close business relationships with other Asian economies. Therefore, the Hong Kong stock market is strategically positioned as a regional financial center to finance many Asian and multinational corporations.

3.2. Investors in Hong Kong and Shenzhen Stock Markets

In the Hong Kong Exchange (Table 2), foreign investors represent about more than 40% of total investors. In the Shenzhen stock market (Table 3), local individual investors dominate more than 80%

[3] The Growth Enterprise Market (GEM) caters to companies which cannot satisfy some profit track records necessary to be listed on the Main Board of the Stock Exchange.

of the market. The number of foreign investors is relatively very small, although it has been increased after the launch of the QFII program in 2003.

Table 2. Composition of investors in the Hong Kong market (Year-end, %).

Year	Local Individual Investors	Local Institutional Investors	Foreign Institutional Investors	Foreign Individual Investors	The Exchange
2006	28	25	39	4	4
2009	25	24	38	4	8
2012	17	21	42	4	15
2015	19	19	31	8	22

Source: HKEX Fact Book (http://www.hkex.com.hk).

Table 3. Composition of investors in the Shenzhen market (Year-end, 10,000).

Year	No. of PersonalInvestors	No. of Company Investors	Total
2009	8542.60	28.15	8570.75
2012	10,537.82	35.48	10,573.30
2016	20,841.00	56.12	20,897.13

Source: Shenzhen Stock Exchange Fact Book (2016, p. 9).

This study raises the following three hypotheses on the effect of weather on returns in these markets:

(1) Since the proportion of local individual investors in the Shenzhen stock market is high, the market is expected to be sensitive to local weather conditions;

(2) Since the QFII program, the Shenzhen stock market increasingly has a number of foreign investors who are less affected by local weather conditions, it is expected that the program mitigates the existence of weather effects on the Shenzhen stock market;

(3) Since the proportion of foreign investors is high in the Hong Kong Exchange, no weather effect on stock returns is expected in this market.

3.3. Descriptive Statistics of Stock Returns

This study uses two daily stock indices for the period from January 1999 to June 2016: The Hang Seng Index (HSI) of Hong Kong Exchange and the SZSE Component Index (SZI) of Shenzhen Exchange.[4] A-shares on the Shenzhen Exchange were initially launched for domestic investors and B-shares for foreign investors. However, since 9 July 2003, A-shares are available to foreign investors on a limited basis. To examine the openness of the A-share market to foreign investors, the data were divided into two sub-samples using 9 July 2003, as a cut-off date.

Daily returns were calculated as $r_t = 100 \times \ln(P_t/P_{t-1})$, where P_t is the current index and P_{t-1} is the previous day's index. Figures 1 and 2 show dynamics of daily price and return series of HSI and SZI, respectively. Both return series show variability clustering. The dynamics of SZI are more volatile than HSI during that period and indicate that the Shenzhen Stock Exchange is less stable than the Hong Kong Stock Exchange.

Table 4 summarizes the descriptive statistics of stock returns. As shown in the table, the results of the *Jarque-Bera test* to check normality show that none of the sample returns is normally distributed.

[4] All of the data were obtained from the RESSET Financial Research Database.

Table 4. Descriptive statistics of sample returns.

Variables	Obs.	Mean	Max.	Min.	Std. Dev.	Skew.	Kurt.	Jarque-Bera
HSI	4350	0.02	13.41	−13.58	1.54	−0.06	10.19	9378.8 ***
SZI	4228	0.03	9.53	−9.75	1.86	−0.25	6.19	1841.2 ***

Notes: The Std. Dev., Skew., and Kurt. denote the standard deviation, skewness, and kurtosis of sample returns, respectively. The Jarque-Bera test statistics are to check the normality of sample returns. *** indicates the rejection of the null hypothesis of normality at the 1% significance level.

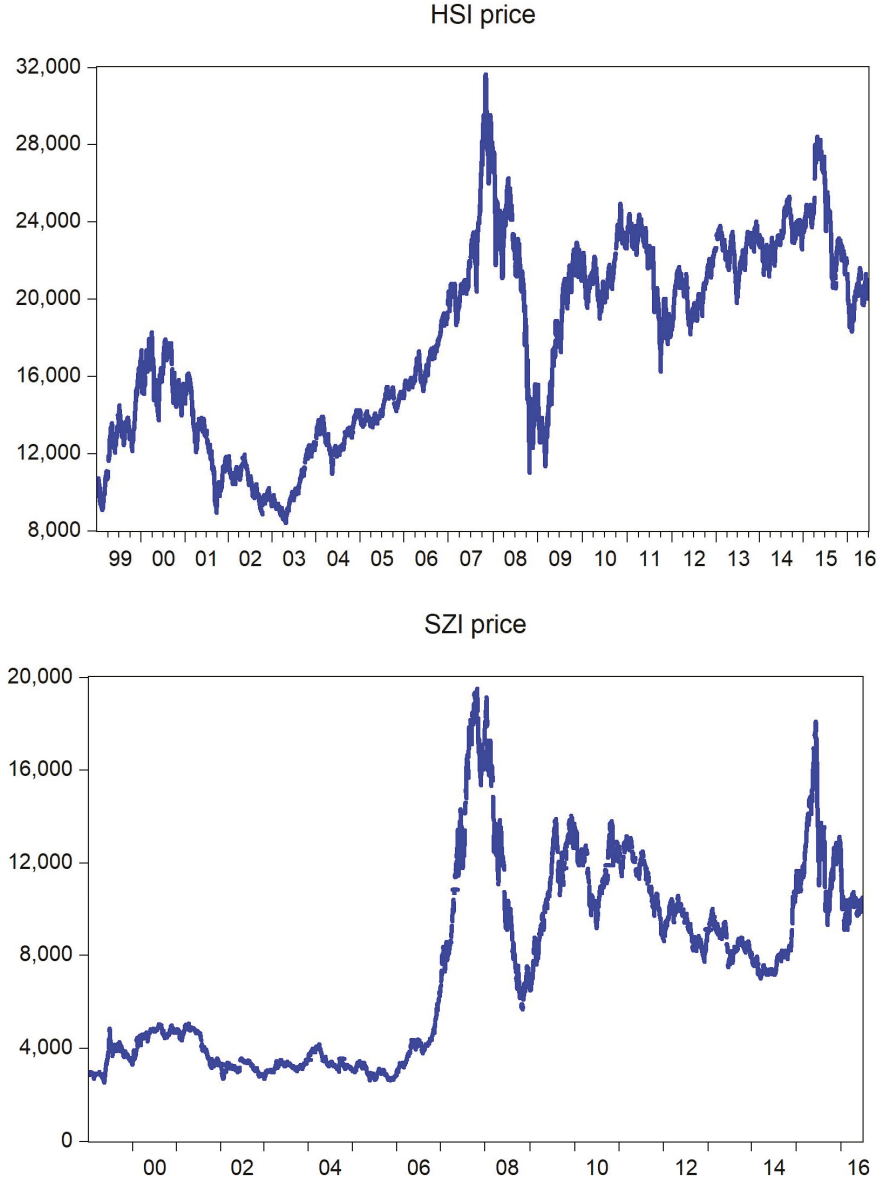

Figure 1. Dynamics of daily price: HSI and SZI prices.

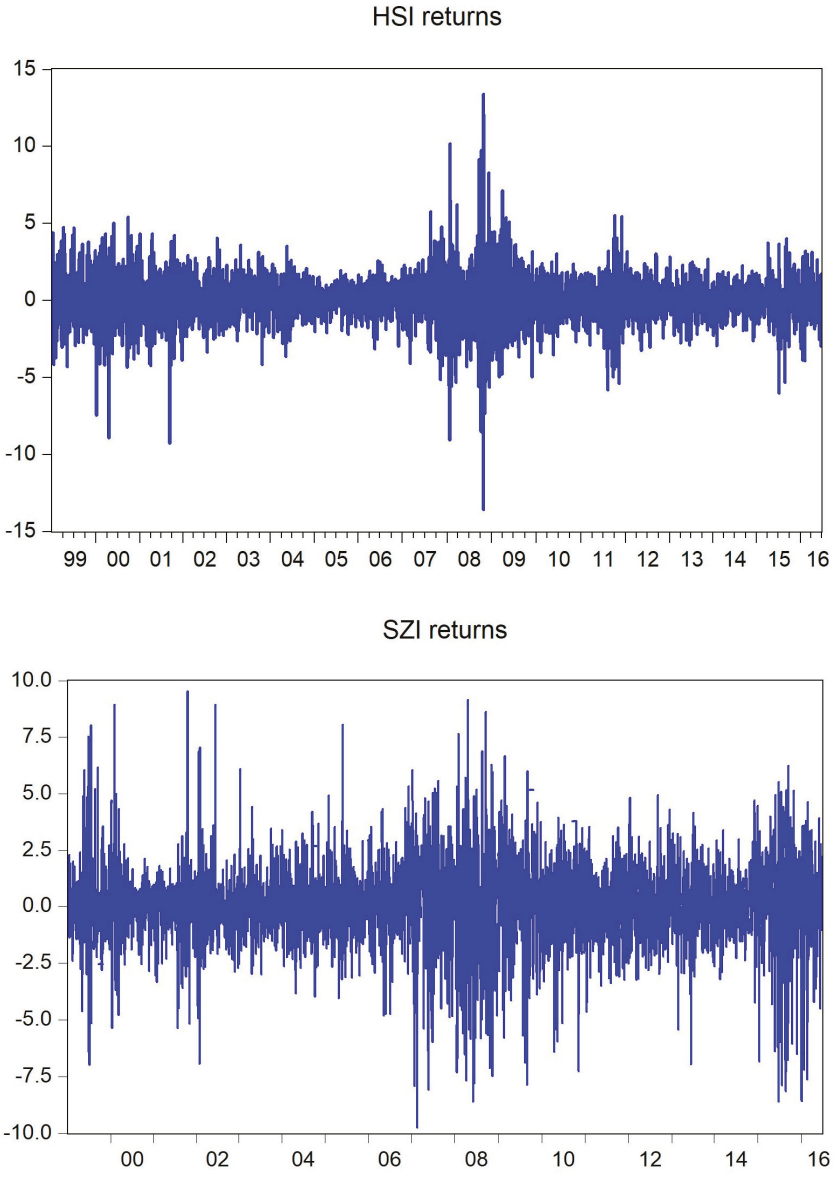

Figure 2. Dynamics of daily returns: HSI and SZI returns.

Daily weather data were used from January 1999 to June 2016: Sunshine (SUNSH), temperature (TEMP), and humidity (HUMI).[5] The data series were obtained from the Hong Kong Observatory.[6] Sunshine is measured in terms of the number of hours of sunshine duration; temperature in terms of

[5] We also analyzed using cloud cover instead of sunshine duration and found similar results. As the two variables are very highly correlated each other, both variables should not be included in the regression equation due to multicollinearity problem.

[6] http://www.weather.gov.hk/.

Celsius degrees; humidity in terms of relative humidity (the percentage of moisture contained in the air). Table 5 summarizes the descriptive statistics of the sample data used. As shown in this table, the weather conditions in Hong Kong and Shenzhen are very similar, because the two regions are in fact the same area. In this region, it is very hot, humid and rainy in summer, but relative mild and humid in winter.

Table 5. Descriptive statistics of weather variables for Hong Kong and Shenzhen.

Variables	Obs.	Mean	Max.	Min.	Std. Dev.	Skew.	Kurt.	Jarque-Bera
Panel A: Hong Kong								
TEMP	4350	23.5	31.8	7.4	5.12	−0.53	2.27	304.3 ***
HUMI	4350	78.2	99.0	27.0	10.29	−0.99	4.89	1350.8 ***
SUNSH	4350	5.0	12.4	0.0	3.89	0.04	1.52	398.7 ***
Panel B: Shenzhen								
TEMP	4228	23.6	31.8	7.4	5.09	−0.52	2.25	291.8 ***
HUMI	4228	78.3	99.0	27.0	10.28	−1.00	4.95	1380.1 ***
SUNSH	4228	5.1	12.4	0.0	3.89	0.03	1.52	387.4 ***

Note: See the note of Table 4.

4. Methodology

4.1. Weather Variables

To examine the effect of weather on stock returns, the three weather variables we used in this study were converted into dummy variables because they are subject to seasonal factors. For example, in Hong Kong and SHENZHEN, 15 °C in winter is considered to be relatively warm, but the same weather in summer is felt relatively cold. Thus, directly using raw weather data may result in seasonal bias in the measurement of the effect of weather on stock market returns. For this reason, following Yoon and Kang (2009), we recalculated weather variables using moving averages (MA) and moving standard deviations (MSD). Specifically, we used the following 11-day MA and MSD:[7]

$$MA_t = \frac{1}{11}\sum_{i=-5}^{5} x_{t+i} \tag{1}$$

$$MSD_t = \sqrt{\frac{1}{10}\sum_{i=-5}^{5}\{x_{t+i} - MA_t\}^2} \tag{2}$$

where x_t is the daily values of three weather variables—SUNSH, TEMP, and HUMI—at day t. Since extreme weather conditions are expected to be more likely to substantially augment the weather effects on stock returns than normal conditions, two dummy variables were generated as follows:

$$\begin{array}{c} \text{If } x_t < (MA_t - MSD_t), \text{ then} WL = 1; \text{ otherwise, } WL = 0, \\ \text{If } x_t > (MA_t - MSD_t), \text{ then } WH = 1; \text{ otherwise, } WH = 0, \end{array} \tag{3}$$

where WL represents a dummy variable for extremely below-average weather and WH is a dummy variable for extremely above-average weather. The weather dummies used in the study are summarized in Table 6.

[7] The 31-day MA and MSD method can be similarly formalized to the case of 31-day. See Yoon and Kang (2009) for the case of 21-day.

Table 6. Description of extreme weather condition dummies.

Weather Dummies	Description
tmL	Extremely low temperature
tmH	Extremely high temperature
hmL	Extremely low humidity
hmH	Extremely high humidity
snL	Extremely short sunshine duration
snH	Extremely long sunshine duration

4.2. Model Framework

Using the weather dummy variables generated in the above section, we estimated the following model for analyzing the effect of weather on stock returns:

$$\begin{aligned} R_t = \quad & \mu + \theta Jan + \varphi Mon \\ & + \gamma_1 tmL + \gamma_2 tmH + \gamma_3 hmL + \gamma_4 hmH + \gamma_5 snL + \gamma_6 snH \\ & + \lambda_1 tmL * hmL + \lambda_2 tmL * hmH + \lambda_3 tmL * snL + \lambda_4 tmL * snH \\ & + \lambda_5 tmH * hmL + \lambda_6 tmH * hmH + \lambda_7 tmH * snL + \lambda_8 tmH * snH \\ & + \lambda_9 hmL * snL + \lambda_{10} hmL * snH + \lambda_{11} hmH * snL + \lambda_{12} hmH * snH + \varepsilon_t. \end{aligned} \tag{4}$$

In this equation, R_t denotes the daily returns of the Hong Kong Stock Exchange and the Shenzhen Stock Exchange; *Jan* and *Mon* denote the dummies for January and Monday effects, respectively; γ_i denotes the coefficients of weather dummies; and λ_i denotes the interaction effect of the three weather dummies used. Additionally, we considered the nonlinear problem of time varying heteroskedasticity in the model using the following GARCH (1,1) model:[8]

$$h_t = \omega + \alpha \varepsilon_{t-1}^2 + \beta h_{t-1},\ \varepsilon_t = z_t \sigma_t,\ z_t \sim N(0,1), \tag{5}$$

where ε_t is normally distributed but heteroskedastic and h_t denotes the conditional variance. All parameters (ω, α, and β) are expected to be positive, and the sum of $(\alpha + \beta)$ indicates the persistence of shocks to volatility.

5. Empirical Results

5.1. Effects of Weather on Hong Kong and Shenzhen Stock Returns

Table 7 shows the effects of extreme weather condition on the returns of the HSI and the SZI using 11-day MA-MSD method. As shown in the table, the estimated values of parameters (ω, α and β) in the GARCH model are positive and $(\alpha + \beta) < 1$. These results indicate that the non-negativity constraint and stationarity in the conditional variances are satisfied, respectively. Additionally, there is no seasonal effect such as January effect (Jan) on the HSI and SZI returns, indicating the absence of a market anomaly in these two markets.

[8] The GARCH (generalized autoregressive conditional heteroscedasticity) model proposed by Bollerslev (1986) is a generalization of ARCH model of Engle (1982) to consider a volatility clustering. The standard GARCH model has been extended to the GJR-GARCH model (Glosten et al. 1993) and EGARCH model (Nelson 1991) to capture an asymmetry of volatility and FIGARCH model to capture a long memory feature of volatility. In the empirical study, we apply the standard and popular GARCH model to focus on the conditional mean equation of Equation (4).

Table 7. Effects of weather conditions on returns using 11-day MA-MSD method.

	HSI		SZI					
			Whole Period		Pre-QFII Period		Post-QFII Period	
	Coeff.	t-Value	Coeff.	t-Value	Coeff.	t-Value	Coeff.	t-Value
μ	0.0499	1.83	0.1701	2.13	0.1963	1.94	0.1748	1.34
Jan	−0.0265	−0.44	0.0158	0.20	0.2294	2.19	−0.2384	−1.84
Mon	0.0156	0.38	−0.0024	−2.31	−0.0029	−2.14	−0.0024	−1.42
tmL	0.0274	0.35	**0.1904**	**1.88**	**0.3161**	**2.46**	0.0479	0.30
tmH	−0.0610	−0.86	−0.0652	−0.75	0.0940	0.82	−0.1925	−1.41
hmL	−0.0670	−0.89	−0.1067	−1.12	−0.1045	−0.79	−0.0907	−0.62
hmH	0.0670	0.81	0.0875	0.88	0.0073	0.06	0.2002	1.27
snL	**0.1100**	**1.88**	0.0952	0.90	0.0267	0.21	0.1617	0.84
snH	**−0.1802**	**−1.98**	−0.0035	−0.04	0.0236	0.17	−0.0722	−0.58
$tmL * hmL$	−0.0259	−0.16	0.1025	0.56	−0.1060	−0.45	0.3027	1.03
$tmL * hmH$	−0.1837	−1.28	−0.2119	−1.18	−0.1502	−0.68	−0.3050	−1.04
$tmL * snL$	−0.1304	−0.52	−0.2328	−1.44	−0.3022	−1.60	−0.1277	−0.45
$hmL * snH$	0.2064	1.39	−0.3651	−1.37	−0.5177	−1.42	0.0659	0.14
$tmH * hmL$	0.1588	1.16	0.2601	1.39	0.2461	1.06	0.1750	0.57
$tmH * hmH$	−0.2212	−1.27	**0.3731**	**1.68**	0.3600	1.17	0.2812	0.82
$tmH * snL$	−0.1362	−1.00	−0.3089	−0.87	−0.3930	−0.78	−0.3076	−0.61
$tmH * snH$	0.0566	0.21	−0.1740	−0.97	**−0.5476**	**−2.30**	0.2854	1.04
$hmL * snL$	−0.0589	−0.50	−0.3764	−1.31	−0.3622	−1.19	−0.0322	−0.04
$hmL * snH$	0.3764	1.17	−0.0593	−0.40	−0.1708	−0.78	0.0758	0.34
$hmH * snL$	0.4496	0.94	0.1339	0.84	0.1222	0.59	0.1656	0.63
$hmH * snH$	0.1230	0.92	−0.5671	−1.26	−0.1634	−0.27	−1.1766	−1.41
ω	0.0152	5.07	0.0397	6.23	0.0722	4.95	0.0266	3.47
α	0.0627	12.68	0.0779	14.53	0.1159	10.88	0.0504	9.54
β	0.9307	164.29	0.9125	173.8	0.8574	69.13	0.9438	173.9
$\log L$	−7285.2039		−8123.7431		−3275.7723		−4815.9844	
AIC	14,618.4077		16,295.4862		6599.5446		9679.9687	

Notes: The bold indicates the rejection of the null hypothesis of no weather effect at the 10% significance level. $\log L$ denotes the calculated value of logarithmic likelihood in the maximum likelihood estimation. *AIC* denotes the calculated value of the Akaike information criterion.

As shown in Table 7, the significance of two weather variables (snL and snH) provide statistical evidence for the effect of weather on the HSI returns. This implies that sunshine duration is very important weather factor in Hong Kong investors. The dummy for extremely short sunshine duration (snL) shows positive signs in Hong Kong stock markets. Usually, as the temperature and humidity are very high in Hong Kong, short sunshine duration can make investors feel pleasant and active. This evidence is coincided with the findings of Saunders (1993) and Hirshleifer and Shumway (2003), who interpret the positive association as a result that investors' mood is optimistic on less cloudy days and consequently raises stock market returns. On the other hand, extremely long sunshine duration (snH) shows negative impacts on stock returns, as expected.

In case of SZI returns, the significance of two other weather variables (tmL and $tmH * hmH$) provide statistical evidence for the weather effect on the SZI returns. This means that in these two extreme weather conditions Shenzhen market shows positive returns with a statistical significance. Howarth and Hoffman (1984) argue that high humidity can increase aggression with discomfort and apathy with reduced attention and alertness. Extremely low temperature can also increase aggression. In a study related to anomaly in stock market returns, Cao and Wei (2005) maintain that, since aggression can result in more risk taking and apathy can impede risk taking, high humidity may involve higher or lower stock returns, depending on the trade-off between the two competing effects. In this context, our evidence could be interpreted as a result of aggression associated with an aggressively risk-taking behavior.

Table 8 shows the effects of extreme weather condition on the stock returns of the HSI and the SZI using 31-day MA-MSD method. As shown in this table, the estimated values of parameters in the GARCH model are positive and $(\alpha + \beta) < 1$. These results satisfy the non-negativity constraint and stationarity in the conditional variances in both markets. As well, there is no January effect (Jan) in both markets.

Table 8. Effects of weather conditions on returns using 31-day MA-MSD method.

	HSI		**SZI**					
			Whole Period		**Pre−QFII Period**		**Post−QFII Period**	
	Coeff.	**t-Value**	**Coeff.**	**t-Value**	**Coeff.**	**t-Value**	**Coeff.**	**t-Value**
μ	0.1518	2.28	0.1114	1.21	0.0914	0.77	0.1571	1.04
Jan	−0.0421	−0.69	0.0086	0.11	0.2121	2.00	−0.2426	−1.86
Mon	−0.0016	−1.75	−0.0014	−1.16	−0.0012	−0.79	−0.0017	−0.88
tmL	0.0711	0.84	0.0497	0.51	**0.3286**	**2.36**	−0.2075	−1.33
tmH	−0.0606	−0.87	−0.1004	−1.19	−0.1467	−1.28	−0.0310	−0.24
hmL	−0.0273	−0.34	0.0571	0.56	0.1710	1.35	−0.0760	−0.46
hmH	0.0748	0.88	0.0531	0.46	−0.1020	−0.75	0.2205	1.11
snL	−0.0725	−0.97	−0.0045	−0.05	−0.0406	−0.33	−0.0366	−0.25
snH	0.0460	0.74	0.0073	0.09	−0.0630	−0.52	0.0373	0.30
$tmL * hmL$	−0.0089	−0.06	0.0628	0.33	**−0.5710**	**−2.35**	**0.8206**	**2.66**
$tmL * hmH$	−0.1001	−0.74	−0.2393	−1.37	−0.1956	−0.91	−0.3042	−1.06
$tmL * snL$	0.0551	0.43	0.0543	0.33	−0.1816	−0.86	0.2774	1.04
$hmL * snH$	−0.0351	−0.16	−0.1315	−0.61	0.0677	0.22	−0.2426	−0.72
$tmH * hmL$	−0.0824	−0.59	−0.2522	−1.55	−0.3138	−1.54	−0.3357	−1.24
$tmH * hmH$	0.0676	0.36	0.2264	0.79	0.2749	0.81	0.3765	0.60
$tmH * snL$	−0.0159	−0.06	−0.1791	−0.59	0.0209	0.05	−0.3067	−0.60
$tmH * snH$	0.1096	0.85	**0.3403**	**2.32**	**0.5366**	**2.88**	0.1659	0.66
$hmL * snL$	0.0497	0.21	−0.3724	−0.93	0.1867	0.32	−0.5358	−0.88
$hmL * snH$	−0.0976	−0.84	−0.1349	−1.00	−0.1336	−0.76	−0.0873	−0.39
$hmH * snL$	0.0623	0.51	0.0673	0.43	0.1027	0.54	0.0970	0.38
$hmH * snH$	−0.2786	−0.39	0.0119	0.01	0.3870	0.02	−0.3814	−0.30
ω	0.0152	4.95	0.0407	6.43	0.0803	5.12	0.0259	3.53
α	0.0616	12.74	0.0763	14.54	0.1140	10.47	0.0487	9.73
β	0.9318	166.6	0.9136	177.1	0.8552	64.67	0.9456	186.4
$\log L$	−7287.6306		−8129.1059		−3282.2657		−4813.8673	
AIC	14623.2612		16306.2117		6612.5313		9675.7345	

Note: See the note of Table 7.

As shown in Table 8, there is no weather effects in Hong Kong stock market, as all the weather variables are not statistically significant. However, in Shenzhen stock market, weather effect is identified in $tmH * snH$ weather condition.

5.2. Market Openness and Effects of Weather on the Shenzhen Stock Returns

We investigated whether the Shenzhen A stock market reduced the weather effects on stock returns based on whether they were open to foreign investors who were less affected by local weather than domestic investors. For this, we divided the SZI series into two sub-periods: the pre-QFII period (i.e., the period prior to the implementation of the QFII plan on 9 July 2003, during which the shares were traded only by domestic investors) and the post-QFII period (i.e., the period during which the shares were traded by both foreign and domestic investors).

The right part of Table 7 reports the test results for the effect of weather on the SZI returns over two sub-periods (pre-QFII and post-QFII periods) using 11-day MA-MSD method. In the pre-QFII period, two weather conditions have significant effects on the returns. For example, the estimated values of *tmL* weather condition is significant and positive, but that of $tmL * snH$ is statistically significant and

negative. These results show that the domestic investors are affected in their investment decision by extreme local weather conditions before the market openness to foreign investors.

In the post-QFII period, however, we cannot find any significant evidence for the effect of weather on the stock market. This changed evidence supports our hypothesis that the weather effect in the SZI market has been weakened, due to the market entry of foreign investors. This finding suggests that the investment market is more efficient, as the foreign investors are generally less sensitive to local weather conditions and have been largely increased in the Shenzhen market.

As shown in the right part of Table 8, the test results using 31-day MA-MSD method are similar to the results using 11-day MA-MSD method. The test results of Tables 7 and 8 are summarized in Table 9. From this table, we can conclude that there is weather effect in Hong Kong and Shenzhen stock markets, and that the efficiency of the Shenzhen stock market has been considerably increased since the QFII plan as a result of the participation of foreign institutional investors.

Table 9. Number of significant weather dummy variable.

	HSI	**SZI**		
		Whole	**Pre-QFII Period**	**Post-QFII Period**
11-day MA-MSD	2	2	2	0
31-day MA-MSD	0	1	3	1

Note: Numbers in this table indicate the significance of weather dummy variable at least 10% level.

6. Conclusions

The literature of anomaly suggests that weather conditions can affect people's emotional state or mood and prevent them from making reasonable decisions. The impact of weather on the investor's decision-making process can be reflected in the movement of stock returns.

In this regard, this study investigates the effects of meteorological conditions on the Hong Kong Stock Exchange and the Shenzhen Securities Exchange on the 11-day (and 31-day) MA-MSD method. We also explore the impact of the QFII plan on foreign investors to enable them to participate in the Shenzhen A-stock market and assess the weather effects on stock returns. Thus, this study explores the origin and nature of efficiency in Chinese stock markets and analyzes the change of the efficiency due to stock market openness policy from the perspective of behavioral finance.

Our empirical analysis, under the assumption that domestic investors would be more sensitive than foreign investors to the local weather conditions in Shenzhen, provides three key findings. First, there is a weak evidence for the effect of weather on the returns of the Hong Kong Exchange, but a relatively strong effect of weather on the returns of the Shenzhen Exchange. This result may indicate that the Shenzhen Exchange is less efficient than the Hong Kong Exchange. Second, there are some significant effects of weather on the returns of Shenzhen market during the pre-QFII period, but the effects have been considerably weakened during the post-QFII period. This finding suggests that the efficiency of the Shenzhen stock market has been largely improved after the QFII plan as a result of foreign institutional investors' participation. The evidence is consistent with the finding of Kang et al. (2010) who show the effect of weather on the Shanghai B-share market after domestic investors are allowed to participate in that market. Third, although foreign investors are consisted of a small proportion of the total capitalization in the Chinese stock markets, the QFII reform has generally led to enhance the informational efficiency of the markets.

These findings suggest that the existence of a meteorological effect on stock returns raises questions about the efficiency of the Chinese stock market and that incorporating weather factors into the asset pricing model can be useful in analyzing the dynamics of the Chinese stock market.

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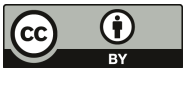

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Global Economy: New Risks and Leadership Problems

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Abstract: After the global crisis of 2008–2009, the world economy entered the era of restructuring. This article focuses on the risks that a new leader will face in the process of shaping the world economy. The methods employed in the research include big data processing of continuous change and the results of the symmetric macroeconomic analysis based on the statistics collected by the International Monetary Fund (IMF), The Word Bank (WB), Bank for International Settlements (BIS), Central banks and Treasuries. The study results proved that the recessionary processes, their depth and global nature, are caused by a combination of world financial system crises and general civilization problems. These new systemic risks for the world economy might result in new global crises that will limit the resources of international financial institutions for sustainable development. Besides, for most banks these crises will mean shifting a big share of derivatives to the off-balance liabilities, using Special Purpose Vehicle (SPV) in deals, followed by an increase in state and corporate debts, trade wars, a slowdown of economic development in China, and widening contradictions between global and national finances. Regular research and systematization have developed certain guidelines for the global economic restructuring process. First of all, it is recommended on the base of interstate compromises to focus on international agreements to ensure a solid foundation for global finance. On the basis of the comparative analysis carried out for the USA, China and other counties, it was made clear that no one leader in world economy in 21st century views the world reserve as based on the currency of one country only. Instead, there will be a slow transition to using Special Drawing Rights (SDR) with a basket from 15–20 currencies G20.

Keywords: world economy; nature of global crises; risks of the financial markets; leadership problem

JEL Classification: F3; F43; F6; F63

1. Introduction

The global crisis of 2008–2009 and long post-crisis recession have raised questions about the future of the world economy. This future depends on the interaction of the world economy and world politics, the directions of their development and the nature of interference. The history of the last decade showed that modern civilization is in a general crisis. It covers the economy, policy, culture, ecology, and in general, the human. The movement of world economy since the beginning of the 1980s towards the global, financial, and economic environment and a system came to an end with the global crisis and ten years of slow recession, formation of a tendency to deglobalization and dedollarization. Obvious achievements of globalization, large trade, and investment agreements are called into question. Efforts of the World Trade Organization (WTO), BIS, regional unions, and global infrastructure institutes are cancelled out by populism, trade wars, and a new approach to world order. Attempts at an audit of the developed architecture of the global economy cause concern in the international academic community.

Thinking of the crisis of civilization, we address the reasons and the nature of the global crisis of 2008–2009 and the decade of post-crisis recession again.

The first crisis of the century is viewed as a crisis of the basic elements of global finance. The international markets of financial assets failed to regulate themselves, and aggravated conflicts between global and national finance. During the years 2010–2019 the world economy faced the risks of a post-crisis period. Deglobalization and dedollarization processes questioned the previous philosophy and world economic leadership. The authors present their point of view on the processes of globalization and risks to sustainable development and leadership problems in the world economy.

The purpose of the article is to reveal the deep nature of the global crisis of 2008–2009, the post-crisis recession, the weakening of interest rates in 2010–2019, new risks of the world economy, problems of the new leader. Research tasks and problems: (1) Justification of the concept: "The global crisis is a combination of civilization problems and imbalances in the functioning of elements of a world financial system". (2) Identification of the legal base of the global economy and finance. (3) Systematization of risks for national and world economies. (4) Comprehensive consideration of "a problem of the new leader" for the world economy.

2. Methodology

The research leans on a number of methodological principles. The principle of ascension from concrete to abstract and back has allowed revealing important regularities and communications. Global crisis and post-crisis recession are considered in terms of the deep social and economic nature and the phenomena which are on the surface. Their combination defines the start of a crisis phase of a cycle, its depth, and scale. Moreover, they are analyzed as roots of modern economic problems and contradictions. Consideration of the mortgage crisis as the main cause of the global crisis does not explain its depth, scales, and 10-year post-crisis recession. We show that a combination of crisis elements of the world financial system (including mortgage) and the deep nature (transition to a new technological way, a call to solve of civilization problems) made the crisis nature, complexity, and duration of its overcoming.

The principle of systemic. Global crisis 2008–2009, as well as all smaller global crises, starting with Mexican (1994) and the Southeast Asian countries (1997), was a product of the global financial and economic environment and a system. Their cradle, national economy and its critical unbalance. The external factor, FDI and its withdrawal from the country is a factor which aggravates crisis processes but does not initiate them. Two traditional markets of financial assets saved a global investor, currency (USD, JPY, CHF) and gold (including stocks of the gold mining companies). Therefore, the deep nature of crisis caused problems of post-crisis recession.

The authors suggest using the principle of determinism according to which the nature of crisis and post-crisis 10-year recession is considered as a root of modern economic problems and contradictions, but the directions of its permission allow to consider its use.

The analysis of continuous changes (as principle) was used to assess the soundness of currencies of peer groups. Assessment of volatility and reliability of currencies is methodologically carried out by means of comparative analysis of four euro currencies and four currencies of the developing economies on BIS REER base with the horizon of the analysis of 1994–2018.

The research uses various methods of analysis: big data processing, method of group, SWOT analysis. The leadership problem in the world economy for the 21st century is methodologically solved with the help of the criteria of four groups: (1) Size of the economy (GDP), (2) quality of life (GDP/per capita, quality of life index, purchasing power, index security, index health care, cost of living, real estate price per income, time in traffic, jam pollution index, climate index), (3) global competitiveness (productivity, global innovation index) and (4) currency (weight, SDR basket, share in global payment, volatility). The research used a method of quantitative analysis of macroeconomic indicators according to databases and analytics of the IMF, WB, BIS, the central banks, and the ministries of finance.

3. Main Results

3.1. The Nature of Global Crises, Post Crisis Recession and Problems of Growth of Modern World Economy

The global financial and economic crisis of 2008–2009 and a long post-crisis recession have raised a lot of questions for world economics, monetary authorities, international economic institutions, and businesses about the future of the world economy and the structure of global finance in the XXI century. The first question concerns the global financial and economic crisis of 2008–2009 and its origins: Whether the first world crisis of the XXI century is a crisis of the financial system based on the monetarism model and technologies of the XX century, or a crisis of its separate elements?

There is no single answer to this question. Our analysis has shown that the most likely explanation lies in the nature of globalization. Globalization of the financial markets has allowed capital to move freely all over the world, which made its taxation and regulation at the national level more complicated. Financial capital, unlike industrial, has easier access to the national markets and to credit organizations, interest and non-interest revenues. The experience of free capital flows in the 80s has shown that the global investor is capable of deep crisis processes in the national economy. Therefore, the monetary authorities are compelled to trace and control the foreign capital flows more closely than the national. The global financial and economic crisis has aggravated these contradictions between global and national finances.

The global financial system is an unstable system and it is based on the assumption that international financial markets are regulated by the «market fundamentals» and an «invisible hand» of free competition. However, under the pressure of crisis the system, which did not have prudential regulation, it failed. It seems, though, that it is not the system of global finance itself that originated the global crisis, but the poor operation and coordination of its separate elements and institutions. The IMF, the major institution of global finance, has insufficient credit resources with a deficit of $500 billion and tends to ignore the role of China, Russia, India, Mexico, Brazil, and some other dynamic countries in the world economy. The world currency system remains unstable because of the weaknesses of dollarized economies, while commodity markets are unbalanced by the fixed rate of the Yuan. Multinational banks (MNB) have insufficient capital adequacy according to Basel III and free capital, a big share of short positions in the investment portfolio, more than $600 trillion in derivatives (about 800% world GDP), out-of-balance liabilities, besides the use of depositary accounts in trading operations. Some have been spotted money-laundering through their offshore branches and taking risks in fiduciary deals.

The markets of financial assets also had weaknesses. The money market has an insufficient level of syndicated crediting in emerging markets. The debt capital market used Special Purpose Vehicle (SPV). FOREX gained money from real assets markets: Ultrahigh profitability increased volumes of speculative deals: Turnover reached 75% ($3–4 billion a day). On the stock market, numerous short-term operations (up to six months) made it more difficult to determine a fair price when estimating capitalization of the companies.

The monopolization and oligopolies of the rating and auditor service market resulted in a whole network of errors: The crisis of 1997 in South Asian countries, a default of 1998 in Russia and the global crisis of 2008–2009. Problems of national financial security remain unsolved. There is an excessive public debt: 200% against 60% forecast by the UN, IMF, and EU. The cumulative tax and gross national product ratio is 60%–80% against an optimum value of 15%–30%. There is also a problem of money surplus sterilization.

3.2. Legal Basis of Global Economy Regulation

The global economy cannot function without infrastructural institutes, the international agreements and regional associations which regulate relations of the parties. We investigate questions of legal bases of systems of regulation and management of risks in the world economy. The second key question of the post-crisis world financial system is that of its regulation. What should be the basis for the

international financial system: National sovereignty and protectionism or international regulation? There are two possible solutions. The first is the construction of the system of international regulation on the basis of national sovereignty. Even though national central banks adapted Basel standards of capital adequacy, it did not prevent governments from taking protectionist measures. For example, after an actual default of Iceland, the Central Bank of Norway reduced trust in the banks of that country, and the central banks of Eastern Europe revised the requirements for banks with foreign capital. The UK parliament's independent commission suggested a buffer by creating reserve capital at a 3% rate for the big retail banks. FRS (the Dodd-Franc Act) and the Bank of England introduced restrictions for speculative operations with securities for commercial banks. The Central Bank of Switzerland did the same for the international investment operations of the major banks. ECB placed a temporary ban on operations of banks operating short positions (The Economist 2011).

The second solution is international regulation, which should (unless it conflicts with national economic interests) prevail over national regulators. Otherwise, it might lead to speculations on different regulation conditions in different segments of the markets. Businesses and assets might move to the countries with the most attractive investment climate and mildest regulation. The success of globalization has been connected with the liberalization of currency legislation, i.e., with a decrease in the level of national regulation. However, the crisis has demonstrated that market fundamentals have not been a bulwark against international financial market crashes. Therefore, it is extremely difficult to convince the monetary authorities of countries to give preference to international regulators rather than national ones.

In the 1980s governments rejected national financial protectionism, but it did little to help to overcome the consequences of the financial and economic crisis of 2008–2009, while processes of deglobalization and dedollarization have been accruing. The open economy should still prove that it has more advantages than a closed one and international regulation of the system of global finance, with national markets and finances, should prove its efficiency. The Basel standards of capital adequacy, IAS, SWIFT should be expanded. Thus, the international regulation of the global economy can be more effective, but in conditions of deglobalization, aspirations to regional associations such regulation can be a result of only compromises of the countries on a being and the form (to the preference, procedures, voting, arbitration). However, during post-crisis, recession contradictions between the global and national finance are increased. The global investor ignores national economic interests. Global problems (ecological, power, and food security) are not solved, but can provoke trading wars and protectionism. The insufficient volume of investments for the decision of common global problems is more than $35 trillion that makes about 50% of world GDP. The WTO, out-of-date procedures on voting, arbitration, preferences for the developing countries in the developed markets, cannot resist to trading wars and sanctions. Thus, the system of the global economy needs revision, updating, and expansion of regulators according to the international bank standards, international agreements, the best cases of globalization (such as uniform anti-recessionary policy G20).

3.3. Risks and Threats for World Economy and Finance (2010–2019)

At the end of 2009—beginning of 2010 the majority of G20 countries announced that they had overcome the global crisis. However, the post-crisis period had its own new risks. They became threats to steady development and can provoke a new global crisis. Our analysis of systematized risks has revealed new threats to sustainable development.

Rates decrease risks in the development of the world economy.

Our research has shown that during the post-crisis period (2010–2018) average annual growth rates of the world economy were 3.44% (with a range of minimum values from 3.4% in 2015–2016 to the maximum 5.4% in 2010). Substantially, it became the result of long, soft, national, and regional anti-recessionary programs with the offer of money at a low percentage rate and repayment of bank debts. In January 2017, the FED stopped the Quantitative Easing Program (QE) and transferred to a policy of increasing discount rate. In 2018, the ECB also finished the QE (2010–2018) program of

redemption of state securities for the sum of €2.6 trillion. In spite of the fact that thanks to QE developed economies reached the level of 2.2% of growth, the effect for the world economy was 3.5%. It reached considerably to the capacious markets of the EU, the USA, and also FDI in the developing economies.

However, the steady growth of the world economy was not reached nor provided with either national or international programs. In 2019–2020, the IMF predicts a decrease in growth rates to 3.3% and, most importantly, a delay of rates in 70% of national economies (Lagarde 2019).

Rates of economic growth have several aspects of the analysis and algorithms of actions of the monetary authorities. First, a clear understanding of the nature of the decrease in growth rates and the elimination of the reasons lying on the surface, and components of the current agenda for economic policy is necessary. Secondly, and most importantly, the problem of long-term steady growth connected to factors of the uncertainty and complexity of the solution of civilization problems.

Are the current reasons for delay of growth strengthening tensions in world trade, and toughening, by many countries, financial conditions for business? The solution to these problems lies in the plane of a smooth transition to such monetary policy which will provide only unstable economic development of the world economy in the ranges of 2%–4.5%, the developed countries of 1%–2.5%, and the developing, 3%–5%. Sharp actions of the monetary authorities at the rates of the money market and taxes, most likely, will lead to problems of refinancing and service of the state and corporate debts will enhance volatility (nervousness of the markets and change of trends) of exchange rates and the bid-and-asked quotations of financial stock market instruments.

In emerging markets and softer monetary policy financial terms and conditions for the national capital, FDI can improve state priming of the economy. The outflow of FDI during the period from 2015–2019 began to break the balance of emerging markets that developed as a fruit of the global financial and economic environment and system.

The model of a monetary policy resulted above can provide only unstable growth which is vulnerable in the face of geo-economics conflicts between countries, for example, Brexit for EU and U.K. Sustainable growth is caused by more general factors of uncertainty and the beginning of the solution of civilization problems. Considering factors of uncertainty, we will note, first of all, high level of debt of countries (the number of countries with a state debt of 100%–200%/GDP growth) and the companies with high financial leverage that is making them unstable, and reducing time to a possible default. The tension in world trade increasing after 2010 became another factor of uncertainty: Conflicts, disputes, mutual claims, and sanctions, wars by duties and threats. The system of the WTO, the procedures, rules, agreements of its participants, cannot extinguish a wave of aggravation of trade contradictions. The most important infrastructure institute of the global economic environment does not work.

According to the history of international regulation of world trade since 1947 (GATT and the WTO), the reduced average world sales duties from 55% to 2%–3%, demonstrates that free trade and low trade barriers are a benefit to all countries. Probably, the modern crisis of a global system of trade will be solved on the issues of state subsidies to participants of foreign trade activities, creation of effective systems of protection of intellectual property and confidential data. There are good prospects at digital commerce in terms of fair competition and equality of conditions. There will be a modernization of the major institute of the WTO in its main functions: Negotiation procedures and permission of trade disputes.

Crisis and a post-crisis depression started the deglobalization mechanism and created a trend of leaving the multinational corporations from emerging markets. It is important to carry items favorably still (these are 50% of the World GDP). However, in the system of trade, there are distortions which cause contradictions between countries. These distortions will always arise as a result of the decrease in prime cost in production and logistics. However, trade barriers are not the permission of trade contradictions. Moreover, trade integration stimulates investments into port and trade infrastructure and warehouses, and creates new jobs (World Economic Outlook WEO, April). Estimates of the IMF growth of tariffs (this analysis covers tariffs, non-tariff measures, and bilateral agreements about

purchases) by 25 percentage points on all goods in trade between the USA and China can lower annual GDP in volume to 0.6% in the USA and 1.5% in China (World Economic Outlook WEO, April, chp. 4).

Drivers of the world economy. The global economy provides no answer to the question of how economy and strata might promote the growth of the world economy. The middle class of the developed countries and emerging markets seems to function as its locomotive. The world economy needs modernization of the global financial system, an introduction of additional regulators, new world reserve currency (Euro, Yuan, CDR, or other currency) and improvement of the risk control system of market derivatives (total derivatives averaged $659 trillion in the period 2009–2018, with 768% of world GDP) (BIS Statistics (2019). Exchange-traded derivatives (OTC derivatives)). Thus, from the point of view of micro-economics, the key problems of economic growth have not been solved despite the optimization of business processes and change of business model.

Risks of public debt growth. There was a growth of cumulative state debt/GDP from 78% in 2007 to 118% in 2014 (Lipssky 2010). In 2016, the global debt made $164 trillion (225%/World GDP) (IMF 2018, Fiscal Monitor), which is higher than the national economic safety level.

Chinese economic slump. Delay of growth rates of real GDP of the second economy of the world poses a serious threat to the steady growth of the global economy. Before the global crisis of 2002–2007, growth rates in China were 9%–14%, during the crisis they fell by up to 9.4%, and since 2010, they have consistently decreased by the rate of 1% a year and were, in 2018, 6.6% with the forecast of the IMF for 2024 at 5.5% (World Economic Outlook WEO). Historically, a decrease in economic growth in China to 6% might affect the world raw material and capital markets. The national economy is overheated by cheap credit. Loans to private sector in China averaged 9794.11 CNY HML from 2002 until 2019, reaching an all-time high of 46015 CNY HML in January of 2019 (and a record low of −974 CNY HML in October of 2005), i.e., increased by 2.6 times compared to 2010 (20000 CHY HML) (Trading Economics China 2019). As a result, the economy faced two waves of increase in prices of the supplies (PS): In 2009–2012 and 2016–2017 that demanded monetarist efforts of the People's Bank of China on their control.

The financial sector of the Chinese economy achieved liquidity, but the real sector failed to demonstrate steady growth. The increase in state expenditure on social programs, maintenance of social stability, innovative programs increased state budget, state debt and tax burden for businesses, might start the inflation flywheel. The economy of China with its limited internal demand, a surplus of liquidity, increasing incomes of business and population, and poor quality of production will face inflation growth, and a decrease in economic growth and competitiveness. The ambition to become a new world economic and technological leader with Yuan, as a new reserve currency, will be postponed for 10–15 years. Therefore, the People's Bank of China will continue to support the current world reserve currency.

3.4. The Leader for the World Economy in 21st Century

After the global crisis, the processes of dedollarization and deglobalization intensified and raised the question of who will be the leader of the world economy. Will the US maintain its leadership, or will it be replaced by China, the EU, Japan or others? Change of the leader of the world economy means deep re-structuring of all systems of the global economy and finance. We start with a high urgency of this question for 21st century and have carried out comparative analysis of the USA and China, and also other economies by following four key criteria: The size of economy, quality of life, competitiveness, and soundness of currencies.

Comparative advantages of the U.S. economy. The USA, being one of the main architects of globalization, has benefited the most. In the 1980s, the USA managed to make its stock market attractive for foreign banks and investors. As a result, the net capital inflow increased from $19.4 billion in 1980 to $153 billion in 1987 and $324.5 billion in 2008 (US Census Bureau 2012). It strengthened the position of the USA in the global economy, increased the country's share in the world GDP from 25% to 30% and market capitalization from 30% to 50% ($12.5 trillion) For the current positions of USA see Table 1.

Table 1. Comparative advantage of the USA vs. China (if other is not specified), 2019 *.

	Macroeconomic Indicators	USA	China
(1) Markets	Forex USD/CHY, 12/06/2019	6.9340	
(2)GDP	GDP, constant prices, $ trillion	18.91	
	GDP, current prices, $ trillion	19.390	12.238
	GNP per capita, $ thousand	54,225.45	15,308.71
(3) Share of the sectors of economy in GNP, %, 2015	Services	76.7	43.1
	Industries	21.1	46.8
	Agriculture	1.2	10.1
(4) Labour	Unemployment rate, %	3.60	3.67
	Wages per hour/per year, $,	23.3/41,696.93	/11,892.27
(5) Demographic indicators, 2015	Labor productivity, growth, %	3.40	NA
	The population share (at the age of 15 and older), %	20	17
(6) Prices	GDP deflator index	111.33	656.41
	Inflation rate, %, YoY	1.80	2.70
(7) Money	Central Bank interest rate decision, %	2.50	4.35
	Bank balance sheet, $ trillion	17.22	0.466
	Loans to private sector, $ trillion	2.3	0.3
(8) Trade	Current Account, $ billion, Q1	134.88	58.60
	Imports, CIF, $ trillion	2.576	1.721
	Gold reserves, tones	8133.50	1864.30
	Net capital flows, $ billion	−8.1	−5.86
(9) Government	Government budget value/GDP, %	−3.80	−4.20
	Government spending, $ trillion	3.21	3.19
(10) Business	Corp. profit, $ trillion	2.00	0.26
	Market cost of publicly traded companies, $ trillion	17.14	3.408
	Competitiveness rank	1	28
(9) Consumer	Private sector credit, $ trillion	9.76	
(11) Taxes	Corporate Tax rate, %	21	25
	Personal Income Tax Rate, %	37	45
	Sales Tax rate (VAT), %	0	16
	Social security rates for: Employees/Companies	7.65/7.65	11/37

* Sources: Trading Economics China (2019), Trading Economics United States (2019).

In 2019, the size of the USA GDP (GDP, current prices) was $19.390 trillion (in China for comparison is $12.380 trln), that, on the one hand, allows provision of a high quality of life: GDP/per capita $54.225.56 (in China $7320.09), with another—stable expenses of the Government of $$3.21 trillion (Hereinafter Table 1. Items 2, 9). Rates of economic growth were 3.20%, that corresponds to an average value during the period 1948–2019 (the highest level of 13.40% was in 1950, the lowest during the global crisis of 2009, −3.90%). The economy is not overheated and has the smallest unemployment rate in 49 years at 3.60%. The contribution of various sectors of the economy to the production of GDP reflects its readiness to enter the world of technologies 4.0. The USA manufacturing industry creates 21.1% of the national GDP (in China 46.8%. See Item 3). At the same time, the cost of its products grows due to complicated labor (2019 $2.2 trillion), and the share in GDP falls. On the contrary, services (information, communications, financial and legal) as a portrait of new technological revolution, promptly grow. In 2019 they created a cost of 12.9 trillion with a contribution to the GDP of the country of 76.7% (in China 43.1%. See. Item 3). The structure of the economy is modern, aimed at mastering the first high-tech. The increase in productivity of labor (without agriculture) in 1Q 2019 (YoY) was 3.40% % (see Item 4), with an output of 3.9%, the index of labor productivity 106.96 with an average for 1950–2019 60.65%. High-quality indicators of labor productivity demonstrate a perception of the economy for new conditions of the economic policy, with a transition to technologies of 4.0 and investment activity of business. The rate of inflation in May 2019 was 1.8% (in China 2.70%. See Item 6), a fall in comparison with 2018, it is significantly less than the average level of 3.26% in 1914–2019 that substantially is a result of the long-term strategy of the FRS of cheap money. At the same time root

inflation (the core inflation rate) excluding power and food products was 2.0%. There was a growth of wages per hour to record $23.38/hour (Item 4) in comparison with the average level of 11.24 USD/hour during the period from 1964–2019. As a result, the AAA sovereign rating was in the first position (2018) on global competitiveness among 140 countries.

The essential weaknesses of economy in 2019 in the form of payment (−134.88 billion USD) and trade (−50.79 billion USD) deficits, budget deficit (−207.77 billion USD), and public debt (exceeding GDP (105.4%) are hedged by USD (as world currency, reserve, steady with small volatility), historical lack of defaults of the state and big reserves of gold (8133.50 tons). At the same time, there is a real threat to a country default to the beginning of each next financial (budgetary, fiscal) year by 1 October 2019 or next year.

The retrospective of these facts is that since 1991, the current account of the balance of payments in the US was in deficit and increased from $12 billion in 1982 to $856 billion in 2006, it did not pose a threat to the financial stability of the country (Table 1). The deficit was covered by foreign investments, mostly from China and oil-producing countries. In 2005, foreign assets of American residents amounted to $9.6 trillion, while foreign assets in the USA—$12.5 trillion, with the net foreign investment at $2.8 trillion. In 2006, FDI into the USA reached $184 billion, with leading investors being the UK and Germany (USA 2007).

Since the 80s the USA has learned and has got accustomed to living on credit. In 1980 loans amounted to $909 billion (33.3% GDP), and in 2011—$14.972 trillion (99.7 % GDP) (see Table 1). This, however, did not affect the investment appeal of the country and its sovereign ratings as the FED and the US Treasury have never declared a default and have been serving its internal and external debts. Besides, if weighing state debt against the market cost of publicly traded securities rather than against the GDP it will account for 87.74%. not 100%. Moreover, the holders of 50% of obligations were non-residents. For example, China, as the second economy of the world, was the main investor in exchequer obligations and in 2006 it held T-bills for the sum of $801.5 billion. The American stock market remained more profitable than the European (15% annual vs. 12%). In 2011 foreign residents of the USA owned 11% of traded financial assets ($17 trillion), including credit market instruments, US corp. equities, mutual fund shares, trade receivables (US Census Bureau 2012, Statistical Abstract of the United States).

Besides financing the US industrial and public debt, globalization benefits in the period from 1980 to 2011 included the growth of the net value of households (8.3% vs. 2%), gross national product per capita from about $28 thousand to $54 thousand (see Table 1, Item 2) and a decrease in cumulative tax for businesses from 18.2 % GDP to 15.2% (CIA 2012).

Comparative advantages of China's economy. China, whose share in the world GDP in 2013 amounted to 12.22%, after the recession on international commodity markets, re-oriented towards the domestic market. The strategy of two markets (domestic and foreign) yielded a result (see Table 2). Currently, in 2019, China is still the first nation on population, the extent of the international liquidity, export, trade balance, and the second economy of the world on GDP (GDP constant prices). China is already not just the "factory" of world brands, the Chinese companies led by Huawei have become competitors of the world leaders in high-tech more and more.

Growth rates of the economy of China in 2018 developed twice as high at 6.40% (in USA 3.20%. See Table 2, Item 1). Average growth rates of GDP during the period 1989–2019 were 9.52% (the highest level of 15.40% was in 1993, the lowest 3.80% in 1990). Substantially, it was the result of the Deng Xiaoping policy of modernization, the effect of globalization and involvement of FDI. However, despite the state support of output and aggregate demand (AD), it is difficult to support during the post-crisis period, high rates which will decrease, first of all, against the background of a trade war with the USA.

The historical background of the economic development of China in the 20th century caused the low level of technological bases of the economy, finally, very low during the period 1960–2019 the GDP per capita (PPP) of $1662.03. Growth of the important indicator of the quality of life, up to $7320.09 in 2019 (in the USA $54225.45. See Table 1. Item 2), shows the effect of market reforms, a mixed economy

and the turn of economic policy towards domestic demand. Nevertheless, the reached level of $7000 corresponds to only 58% of the average world value. The contribution to GDP of the processing (quite often "smoky") industry of China makes 34%. It will fall, but slowly because China is a factory of the world economy.

Nevertheless, during 2015–2019, the share of services that already makes 57.59% in GDP of the country is still growing. The unemployment rate of 3.67% (1Q 2019) is not high in comparison with an average value of 4.09% for 2002–2019 and that demonstrates the transfer of focus to the domestic market. In China, during the period 1952–2018, the average nominal salary/month was 1184.76 CHY. In May 2019—8293.32 CHY ($1196.04), a growth of seven times. Great progress for the modern history of the country, but in comparison with the leading economy of the world, the lag of nominal salary in annual terms is 2.9 times. The rate of inflation in China in 2019 is not high, 2.7%, in comparison with the average level of 5.16% during 1986–2019, a decrease of 1.9 times. This is evidence of the effective work of the People's Bank of China. In monetary and credit and investment policies, the strategy of liberalization is traced: Consistently the interest rate falls, from 6% (2015) up to 4.35% (2019) (Table 2. Item 8), the balance sheet total of the banking system ($465.8 billion), loans to households, the credits to companies grows, FDI grow ($2019 54.6 billion with the rate of 3.5% per annum).

At the same time, points of weakness of the economy are low, GDP/per capita (58% of the average world level), the low salary, record deficit of the budget due to a decline in income of the state, decrease in profit of enterprises in 14 branches of the economy of all forms of ownership, the 28th place in the list of global competitiveness and a high rate on the company on social taxes (37% vs. 7.65% in the USA). At the moment, China is ahead of the US in export volumes ($2.14 of trillion, first place in the world export of securities with a share of 11.7%), foreign reserves ($3.1 of trillion) and total investments, with the positive balance of payments and state debt to GDP ratio 2.3 times less than USA (see Table 2. Item 8).

Table 2. Comparative advantage of China vs. the USA (if other is not specified), 2019 *.

	Macroeconomic Indicators	China	USA
(1) GDP	GDP growth rate, YoY, %	6.40	3.20
(2) Labour	Population, million	1.419 819.622	328.950
(3) Prices	Core inflation rate, %, YoY	1.7	2.0
(4) Money	Forex reserves, $ trillion	3.1	0.127
(5) Trade	Balance of trade, $ billion	41.66	−50.8
	FDI, $ billion	54.6	50.9
	Retail sales, YoY, %	7.2	3.1.
	Exports, FOB, $ trillion	2.1385	2.0685
	External Debt, $ trillion	19.7	19.8
	The current balance of payments, $ billion, including % of GDP	586	−134.4 (Q1)
		0.4	−2.4
	Total investments/GDP, %	54.2	12.4
(6) Government	State debt, $ trillion	NA	22.02
	State debt/GDP, %	47.6	105.4
	Government revenues, $ billion	250.33	232.06
	Government budget deficit, $ billion	−10.43	−207.77
	Foreign reserves, $ trillion	3.1	0.127
(7) Business	Industrial production, YoY, %	5.4	0.9
(8) Consumer	Bank lending rate, %	4.35	5.5
	Personal saving, %	37.10	6.20

* Sources: Trading Economics China (2019), Trading Economics United States (2019), Worldometers (2019), US Population (2019).

Lastly, it is impossible to ignore the demographic factor's role in economic growth. Despite the absolute advantage of China in population (1395.4 billion people in China vs. 328.950 million people in the USA) and comparable indicators of life expectancy (74.68 years vs. 78.37 years) (UN Stats 2012) the country will face a serious problem of a reduction in population, including an aging demographic, in the middle of the XXI century (Table 1, Item 5). The USA, on the contrary, has a relatively young population and, according to the UN forecasts, will have a higher population growth (1.4 times vs. 1 in China) in 2011–2050 and a larger share of young people (20% vs. 17% in China).

Since the purchasing capacity of the domestic market is considerably lower than the international one, it leads to the consecutive GDP decline. Dynamics of decrease in rates of GDP growth of the country is traced: From 14.2% in 2007 to 6.3% in 2019 (decrease in 2.3 times) (IMF WEO/CHN 2019). Aggregate demand (AD) in China (as a share in nominal GDP) falls from 47% in 2003 up to 38% in 2015. The dynamics of the decrease in the country's GDP growth rate are traced. Steady growth, rates reduction began after 2007 (14.2%) and amounted to 6.3% in 2019, i.e., it decreased by 2.3 times (IMF WEO/CHN 2019). This suggests that in the conditions of declining demand in the global markets after the global crisis, China could not support former growth rates of GDP due to domestic demand. In spite of the fact that from 2011 to 2018 aggregate demand (AD) grew from $494 billion to $914 billion, its average annual rates steadily decreased from 18.3% (2012) up to 6.9% (2017).

At the same time, the household saving rate in China is much higher than in developed economies. It was 37.10% in 2018 vs. 6.20% in the USA. Personal household income savings in China averaged 33.48% from 1992 until 2015, reaching an all-time high of 39% in 2010 and a record low of 27.20% in 2002 (Trading Economics China 2019; Trading Economics United States 2019).

China's household consumption is low, the ratio of consumption to GDP is 37% versus 50% in the developed countries. What are the causes of this phenomenon and statistics? This partially reflects China's growth model, a high level of saving. The saving rate is 37.1% vs. 6.20% in the United States. From 1980 to 2008 the ratio of private consumption expenditures to GDP decreased 1.5 times from 55% to 36% (Baldacci et al. 2010, p. 4). To understand the pattern of income distribution between savings and consumption in other countries, we will note that in South Korea, Indonesia, India, Philippines this indicator is 50%–70%. Among the reasons of such model of consumption in China, the IMF in a special research notes high economic growth, a demographic structure with an elderly population, the insignificant number of the public companies (which would pay dividends) vs. state-owned companies (SOC), weak state health programs, higher education, etc. (Baldacci et al. 2010).

The level of household savings in China fell slightly to 37.10 percent in 2015 from 38 percent in 2014, as the inflation rate was 2.7% (the average indicator in 1986–2019 was 5.16% with a decrease of 1.9 times). We can confidently predict consumption growth in China due to an increase in household incomes (wages for 1952–2018 grew seven times to 1184.76 yuan). A high level of savings, part of which goes to investments, financing works to increase consumption. The Chinese national economy is based on the special economic zones created in the 1980s when transferred factories formed a «factory of world brands». It is as yet unlikely to become a leader in technology, which requires an innovative economy rather than copying production. In 2013 China produced $9.240 trillion GDP and there is a high risk of recession and an increase in inflation. The Chinese Yuan can be a strong currency for mutual transactions inside BRICS, but it is not strong enough for the global commodity and financial markets.

Other candidates for the role of the leader of the world economy.

Japan, which in 2018 had a contribution to world GDP of 4.1%, Germany (accordingly to 3.2%) and Euro Area (11.4%) cannot compete with the United States (15.2%) and China (18.7%) (World Economic Outlook WEO). Japan still tests an echo of recession of the 1990s and the global crisis, EU zone constantly is in 2009–2019 under the blow of various waves of recession, connected in particular to debts of the Mediterranean countries. The slow recession of the European economy turned out to be more painful and difficult than in the US, as countries were attempting to shift to the new technological mode of production. Germany and France are burdened by their obligations to preserve the European Union and maintain the Euro and, thus, cannot become new world economic leaders yet.

It is possible to continue to search for arguments in favor of a particular country. Despite the urgency of the question of leadership, there are also civilizational problems of the Mediterranean countries, a migratory crisis in the EU, Brexit, the populism breaking the architecture of national economies and geo-economy. Their solution is only possible if G20 and international economic organizations take joint actions to create conditions for global financial stability and search for new sources of economic development. In substantiation of the given thesis, we will consider the criteria of leadership in the XXI century and requirements of the leader.

In a substantiation of the given thesis, once again it is reversible to criteria of leadership for the 21st century and to requirements to the leader, but at different level of the analysis. We concretized four criteria of leadership: (1) Size of the economy (GDP), (2) quality of life (GDP/per capita, quality of life index, purchasing power, index security, index of health care, cost of living, real estate price per income, time in traffic, jam pollution index, climate index), (3) global competitiveness (productivity, global innovation index), and (4) currency (weight, SDR basket, share in global payment, volatility). By these criteria, we carried out the analysis on the big sample of the countries.

We were guided by macroeconomic indicators of IMF, WB, BIS as criteria and received following results. Based on the size of the economy (GDP nominal) in 2016, 2020, 2030, and 2050 there are four countries among the leaders—the USA, Japan, China, and India (IMF WEO 2016). Quality of life is traditionally estimated as GDP per capita with the same leaders of the USA, China, and Japan. If we include such indicators as quality of life, purchasing capacity, safety, health services, life cost, and ecology, then it would be Denmark, Switzerland, and Australia. If global competitiveness of the national economy depends on the competitiveness of businesses, quality of corporate government, production efficiency and management, here the leaders are Switzerland, Singapore, and the USA (World Economic Forum WEF).

If the major indicator of business competitiveness is labor productivity calculated as GDP (PPP)/per hour, then according to this indicator, the leaders are Norway, Luxembourg, and the USA.

The world economy in the XXI century will be based on technological innovation. The global innovation index, 2015 shows that in R&D (research and development) the leading countries are South Korea, Israel, Finland, Sweden, Japan. In the innovative production—Switzerland, Ireland, Singapore, Germany, Austria. In the quantity of high-tech companies—Unites States, China, Japan, South Korea, Canada. In higher education – South Korea, Russia, Finland, Israel, Ukraine. Scientific research—Finland, Iceland, Denmark, Israel, Singapore (The Bloomberg Innovation Index 2015).

The national currency is a very sensitive indicator of the stability and strength of a national economy. The most significant indicators are the transaction currencies, international liquidity, reserves, and SDR basket. On 1 October 2016 weights of the five currencies in the new SDR basket were: U.S. dollar 41.73%, Euro 30.93%, Chinese Renminbi 10.92%, Japanese yen 8.33%, Pound sterling 8.09%. Compared to the previous period the USD lost in weight from 44% to 41.73%. For the first time CHY was included in the SDR basket and won the third position ahead of the Euro, JPY, and GBP.

Markets value currencies through SWIFT, by carrying out basic calculations on real and financial assets markets. The USD share amounts to 44.64%, Euro—28.30%, GBP—7.92% (Swift 2014). The major reserved currencies are the USD, Euro, JPY, GBP, and CHF as they are less volatile and more stable according to BIS REER (2018).

The research shows a very important result, that today there is no absolute leader in the world economy. Many countries possess comparative advantages (as it can be seen in the comparison between China and the USA), but only in some positions. The age of the absolute domination of one super state is over. The structure of the global economy and finance will not be based on the domination of one country and one currency. International economic and financial organizations will play a major role as global institutes and regulators. We do not exclude the possibility of the establishment of a world government at the end of the XXI century. In the interim period, we might expect an aggregated SDR with a basket formed by 15–20 currencies and the appearance of local currencies on the wave of deglobalization and dedollarization.

Nevertheless, today the USA, EU, Japan, Great Britain, China, Russia, and India perform a special role and responsibility. The world economy might receive a new impulse of growth if the USA overcomes its own financial imbalances caused by the three deficits—budget, balance of payments, and state debt—and becomes «a world workshop» of new high technologies. Japan as the third world economy might repeat its "economic miracle" with the development of high-tech. China, BRICS, and other countries of emerging markets with a high balance of payments surpluses and extensive foreign reserves might become key sources of world economic growth too, if they re-orient production towards domestic demand and consumption. The IMF and the World Bank Group should be focused on maintaining global financial stability, searching and supporting new sources of growth of the world economy and solving the civilizational problems of mankind.

4. Discussion

The historiography of a subject is so extensive that it demands special analysis. For the purpose of our research, we will be limited to some generalizations of scientific discussions. The problematics of the new phenomena in the world economy is so complex that it requires a separate study of its concepts, ideas, and approaches. The Bretton Woods Institutes noting 75 years, and being some of the architects of the global economy, distinguish three main problems: Economic growth, tension in world trade and the lack of confidence between national and global finances, national and international institutes. The IMF, in official documents and research, sees necessity in its own reformation (Tooze 2019, pp. 30–31), world cooperation for extraction of advantages in cross-border flows of the capital and goods (Raghuram 2019, pp. 18–19). The World Bank offers innovations in rules of the WTO in the multilateral system of trade (Goldberg 2019, pp. 20–23).

Another key institute of global finance—BIS—looks for a better balance between monetary policy, structural reforms, fiscal policy, and macro-prudential measures (BIS 2019; Lamers et al. 2019, pp. 17–18, 28). In focus of the analysis and the recommendations of a problem of reliability of banks and bank systems, inflation and deflation (Mehrotra and Yetman 2018, pp. 83–84, 91–95), new phenomena of financial deglobalization in banking (McCauley et al. 2017, pp. 12, 14, 16, 18, 20; 2019, pp. 125–27).

One of the central problems in the world's academic agenda is sustained economic growth which is considered through a prism of world, regional, and national economies. What research attracts interest? Inter-country inequality as an essential brake on the world economy (Fuller and Dwivedi 2019, p. 7), stability of all EU Member States as key to the economic growth of all the union (Popescu et al. 2017, p. 73), use of the capacity of G20 for sustainable development (Esty 2017), the "green", ecologically focused economy (Popescu and Ciurlau 2016, p. 79), a search of the most effective models of management of country financial systems on the basis of the comparative analysis of the best cases (Zogning 2017, pp. 55–56), use of opportunities of global transport systems focused on "time is an economic category" (Zhuravleva 2017, p. 123) and flexible monetary policy in the conditions of high volatility of the international commodity and foreign exchange markets (Bikar and Sedliacikova 2018, pp. 30–31) for country's economic growth.

The threats of a new global crisis, risks of state and corporate debts are the subject of monitoring and the analysis of IMF, the auditor companies and rating agencies, special research. There are already many such works and official reports. However, we will note that the IMF is not decided on the problem of corporate debt. A debt in different forms (accounts payable, accounts receivable, overdue debt) is organic for the business in general and for corporate risk management. As Kliestik et al. (2018a, pp. 112, 121) showed in their research of risks bankruptcy on the database of more than 62 thousand companies in the Slovak Republic, the indicators of "debt" play a very essential role. In the correlation model of "Risk bankruptcy" (corrected for 2/3 companies) "Current Debt Ratio" and "Financial Debt Ratio", there are among 14 indicators very high *P*-Value 0.30678 and 0.149362 respectively. This is the fourth weight value in the correlation model after indicators of return and a turnover. If the corporate debt is a component of everyday risk management, then the massive growth of defaults means an imbalance not in the companies, but in the external environment—in the economic

system. The business model has changed. For this purpose, it requires correlated research between a company's "financial health" and external factors, including business regulation, tax laws and FDI outflow (Kliestik et al. 2018b, pp. 800–1). Problems of change of technological bases of the economy of Technology 4.0 are the cornerstone of the true and future aspects of macro and microeconomics. Generalization of effects of digital technologies, smart-contracts, chain networks deserves attention (Tuffnell et al. 2019, pp. 9–10) and product decision-making information systems (Lafferty 2019, p. 20).

The science, the international institutes, and the markets were under the illusion that the global economy is incapable of allowing a global recession, but illusions still take place. Therefore, the subject of crisis is relevant today. In this regard, a certain interest represents research about the effects of harvest on recession in the USA and China (Chang et al. 2019), relending of the private sector (White 2010) and financial aid programs of the IMF during Asian crises (Shin 2017).

The problems analyzed above are important aspects of a more common problem—"Globalization or Deglobalization". The historiographic boom for dilemma arose after the global crisis of 2008–2009. Contradictions between global and national finance became aggravated. There were new phenomena in the world economy and economic policy of the states. Processes and aspiration to regionalization, and thirst for regional economic associations are amplified. The architecture of global economy and finance cracked: Central banks reduced USD share in their international liquidity, payments increased in not reserve currencies, investments into U.S. T-bills decreased, FDI is leaving emerging markets, agreements on trade and investment partnership, tariffs, compromise agreements within the WTO began to be revised. Cryptocurrencies appeared as an alternative to traditional money and became threats for Central Banks, systemic banks, and international payment systems.

The new phenomena of de-globalization found reflection in academic science. Key questions became a subject of the analysis: The possibility of de-globalization, throw prism of "nature of manufacturing" (Livesey 2018, pp. 180, 183), "measuring of new realities: Dynamics of imports and exports of goods and services at a global or regional level, dynamics of expats' money remittance, inflows and outflows brought by foreign direct and portfolio investments" (Postelnicu et al. 2015, pp. 4–5), threats to sustainable economic development (Zuindeau 2012), influence of Brexit and Trump policy "as a reversal . . . globalization process" (Martin 2018, pp. 65–66).

The new trend of the world economy introduces amendments in economic policy of the country and corporate management. How do they change? "The new revised economy" already became an object of research. Some of the sticklers of deglobalization are Bello (2002, pp. 69, 71, 108, 112) and Khor (2001, p. 117), exact review of these books was provided by Hartwick (2006, pp. 262–63). The anti-globalists brightly and fairly systematize contradictions of the world economy among which the civilization problems of hunger, poverty, a gap between rich and poor countries have not been solved. However, the "new economy" constructed on the principles of "rethinking globalization" except criticism of the IMF, the WB, and WTO, is not offered by the authors.

The markets of financial assets and infrastructure institutes are the first reaction to the new phenomena, so the analysis of deglobalization in international banking is extremely relevant. BIS, on the basis of bank reports and statistics, recorded a certain reduction in assets of EU banks abroad as a reaction to global crisis and ECB requirements due to keeping capital base. Banking systems in Canada, Japan, and even the USA, on the contrary, strengthened the assets, deals, branches, transactions (McCauley et al. 2017; 2019, pp. 120–21). Formulation of the question "de-dollarization vs. globalization" through a prism of small economies is interesting and perspective (Iversen 2009, pp. 645–47).

The Chinese economy is of interest not only as a phenomenon of a country demonstrating rapid growth, but also as a test ground for new financial instruments. For example, the international comparative analysis of "green credits» has shown that the profitability of China's banking sector is positively affected by the amount of assets, management expense ratio, cash ratio, GDP growth rate, and non-performing loan ratio. However, the asset size and capital adequacy ratio negatively affect the

international banking sector (Song et al. 2019). Other studies on the "green assets" of Chinese banks in the Gulf Islamic stock markets (Medhioub and Chaffai 2019) have shown similar results.

The above research is limited to the circumstance that new phenomena and processes are in a stage of formation, development. Not all of them will remain in the economy, which often shows a swing, return, and renaissance of old forms, therefore, the debate on "globalization vs. de-globalization" will be continued.

5. Conclusions

The research has shown that the future structure of the global economy will most certainly be defined by the following factors.

1. Post-crisis recession and many problems of modern global economy result from the global crisis, and are viewed as combinations, on the one hand, of failures of separate elements of a financial system (markets of financial assets, IMF), and, on the other hand, of transition to technologies 4.0 and common problems of the world economy (ecology, pure water, famine).
2. The regulation of the world economy should be based on international law, agreements, and institutions as the compromise between the countries defending the sovereignty and economic security.
3. The modern economy has faced new risks, the scale and depth of which are capable of causing a global crisis. The analysis has shown that risks of decreasing rates, delays of economic development of China, prompt growth of the state and corporate debts, loss of former sources of economic growth are posing a threat to the sustainable development of the world economy. New trends of deglobalization and dedollarization have deepened risks and initiated the rollback mechanism from the achievements of globalization, leading to trade, tariff, sanctions wars.
4. Global crisis and post-crisis recession have accelerated the processes of de-globalization and de-dollarization and have raised the issue of changing the leader in the world economy. The comparative analysis of the USA and Chinese economies, including other groups of countries for the leadership potential (the size of the economy, quality of life, competitiveness, the stability of currency) has shown the leader absence solo. Therefore, the countries of the 21st century should no more seek the leadership of one country as a driver of the economy and capital market, but rather focus on developing and using SDR (with a basket from 15–20 currencies of G20) as a reserve currency.

The research faced a number of restrictions. The perspective of the article and solvable tasks were aimed to detect the patterns of global finance, crises, risks, anti-recessionary actions of the monetary authorities, and finally, systematization of the directions of restructuring of the global economy. The range of tasks of the research does not allow considering all factors, relationships of cause and effect and correct correlation of the variables. The database was made from different sources. The audit of their techniques is impossible. The reliability of data limits the correctness of the comparative analysis. Restrictions of the research are also caused by the absence of a standard glossary of terms and definitions needed for the academic science and business. The authors did their research in accordance with moral, ethical, and legal restrictions as the global economy exists in a close connection with geopolitics, ethno-cultural relations, and contradictions. Moreover, it was difficult to consider the interdependence of national and international law.

The future directions of the research might concern such issues as the correlation between the sustainable development of the world and national economies, MNC and domestic companies (sustainable economic development is caused not only by balancing the sectors of economy and pursuing effective economic policy, but also by the ability of the national economy, while maintaining its position in the global economy, to resist external pressure and prevent the outflow of FDI, collapses in the world forex and stock markets). Another possible direction of the research concerns new sources of economic growth for the 21st century, as former sources of economic growth in emerging markets

and the middle class in the West seem to have exhausted its current potential. With the technological revolution 4.0 the search for new sources of growth for the world economy becomes quite expedient. In the context of the world economy, the issue of cryptocurrencies vs. reserve currencies and classical money is of primary importance as well. Cryptocurrency necessitates the revision of the classical theory of money, functions of the Central Bank, systemic banks, and international payment systems. Digital money and assets are subject to thorough research in order to ensure their effective legislative regulation. Finally, the questions raised in this paper might be interesting for those who study the world system of funding. Even though the world economy system of funding does not set requirements for sustainable development, there is a need to review the theoretical and practical resource base of the IMF, Central Banks, reserve and investment funds of regional associations.

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Determinants of Indebtedness: Influence of Behavioral and Demographic Factors

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Abstract: This study aims to examine the influence of behavioral and demographic factors on indebtedness by constructing a model using specific determinants. The exploratory method is used through the partial least square (SmartPLS) technique, by surveying 320 respondents in Kuala Lumpur, Malaysia. A self-administered questionnaire was administered to respondents, addressing both demographic and behavioral factors. The results confirmed four of the eight hypotheses stated. Among the determinants, risk perception had a highly significant relationship with both materialism and emotion, while indebtedness had a relationship with emotion and materialism. The findings also indicated that significant differences exist between indebtedness and behavioral factors on the basis of gender, marital status, age, income, and dependence on credit cards and loans. The results may assist various economic players to design better models for credit offerings and address the credit problem in the long term.

Keywords: indebtedness; behavioral factors; demographic factors; Malaysia

JEL Classification: G32; G110; M300

1. Introduction

Credit availability is helpful in ensuring household economic well-being. In Malaysia, particularly after the late-1990s Southeast Asian financial crisis, credit was apparently easily available (Yusoff et al. 2000). Consequently, rising household and individual debts resulted in unprecedented bankruptcy filings, which weakened the intended benefits of this credit availability. Various reports on Malaysian household debt profiles indicate that individuals' spending exceed their income and also that the number of bankruptcy cases in Malaysia is increasing dramatically. The reports also indicated a trend that suggests that the number of bankruptcy cases is more from the economically active age group of 35–44 years, males, and Malays (Loke 2016). Obviously, this presents a disturbing trend for the Malaysian government, which has consequently taken several steps to control the credit problem. However, considering the behavioral factors that quicken the propensity rate toward indebtedness as a given, rather than verifying it, may amount to overstretching assumptions and a policy response flaw (Ottaviani and Vandone 2011). This becomes pertinent when considering that prior studies in behavioral finance found mixed results in establishing a relationship between demographic variables

and indebtedness, and that behavioral and psychological factors may significantly influence the propensity toward indebtedness.

In addition, this study intends to offer a comprehensive understanding of the causes of individual indebtedness, which may address the credit problem in the long term and help current concerns regarding the rising individual debt in Malaysia. Despite the necessity to understand the behavioral factors so as to avoid unnecessary expenses, few empirical research studies (Flores and Vieira 2014; Ottaviani and Vandone 2011) have highlighted how behavioral factors influence household indebtedness. An attempt to bridge this gap in the existing related literature indicates the relevance of this study.

Moreover, the economic determinants of indebtedness should be able to fully explain the increasing trend of individual indebtedness; however, in the actual scenario, this does not occur. This causes an unexpected increase in family debt, default in debt repayments, and bankruptcy (e.g., Malaysian Department of Insolvency has recorded 253,635 bankruptcy cases from 2007 to 2013). Thus, understanding behavioral factors may improve the current situation by identifying the comprehensive reasons for individual indebtedness, which may, in turn, lead to the development of actions to prevent indebtedness and assist defaulters. Indeed, credit should ideally help people improve their financial condition, such as by assisting them in acquiring assets, covering essential expenses, becoming economically solvent in the long term, and so on. However, in reality, on many occasions credit supply seems to make people more indebted. Many Malaysian people have reported facing financial difficulties and feeling embarrassed by their debt repayments (Endut and Hua 2009; Ghani 2010; Mann et al. 2013). Consequently, the increase in the indebtedness of borrowers has raised public concern about the effects of credit.

Given this scenario, it is important to identify and understand the determinants (behavioral factors) of individual indebtedness. This study considers four determinants highlighted in the literature as the factors influencing indebtedness: financial literacy, risk perception, materialism, and emotion. The major reasons of rising indebtedness are low income, high income, and reluctance to save (Azma et al. 2019). The low-income group justified spending more than they earn because they are unable to cover their basic expenses with their income. They might have to borrow to fulfill their basic expenses. Conversely, it is quite irrational for the high-income group to spend more than they earn, as they can cover their essential expenses with their income. Logically, the high-income group should have some savings instead of having debt. The main reason for the high-income group to be indebted is because of their strong desire to spend. Reluctance to save explains the behavioral factors that mostly influence young people. The foregoing argument motivates this study, that is, it is probable that credit problems are not only produced by economic factors, but also influenced by behavioral factors (Keese 2012; Reed and Cochrane 2012; Selvanathan et al. 2016). Indeed, credit should help people to improve their financial condition, such as to acquire assets, cover essential expenses, and become economically solvent in the long run. Thus, the main objective of the study is to investigate the impact of behavioral and demographic factors that influence the propensity toward indebtedness, and to examine whether there is a difference in the propensity toward indebtedness and behavioral factors among inhabitants in Malaysia across demographic divisions.

The remainder of the paper is structured as follows. Section 2 discusses the theoretical basis of the study. Section 3 describes the methodology and Section 4 presents the results and discussion. Finally, Section 5 presents the conclusion, implications, and limitations.

2. Theoretical Basis

Behavioral determinants (e.g., financial literacy, risk perception, materialism, and emotion) may influence the propensity towards indebtedness (Azma et al. 2019; Muñoz-Murillo et al. 2020). The first crucial determinant of this study is financial literacy, which seeks to improve the capacity of persons to understand financial problems. Financial literacy has a greater positive impact on financial outcomes in the long term (Azma et al. 2019). It is an important determinant of whether an individual has sufficient

savings for future consumption. According to Muñoz-Murillo et al. (2020) and Lusardi et al. (2013), financial literacy is imperative for people who are at an early stage in their career. Parents' financial socialization influences their children's decision-making behavior (Kalwij et al. 2019). For example, Okech et al. (2013) said that children observe how their parents save money, and learn from their actions. Less financial knowledge could affect the financial outcomes in many areas such as retirement planning, borrowing decisions, and stock market participation (Lusardi and Mitchelli 2007; Jalil and Rahman 2010). Ward and Lynch (2019) indicated that financial literacy can help individuals make their financial decisions and income wisely. Flores and Vieira (2014) found that financial literacy has a significant impact on indebtedness. According to Flores and Vieira (2014), Darriet et al. (2020), and Katona (1975) there are three reasons to explain why people spend more than they earn: (i) low-income people cannot cover essential expenses; (ii) high-income people with a strong desire to spend; and (iii) lack of desire to save income. Katona (1975) discussed the origin of the credit problem, and Azma et al. (2019) highlighted psychological and behavioral factors. Following this view, Eberhardt et al. (2019) and Vitt (2004) identified that consumers' financial decisions may reflect their psychological and social values.

The second determinant is risk perception, which indicates how a person views risk during decision-making. Barros and Botelho (2012) suggested that consumers who have a strong expectation for acquisition could underestimate the risk. People with high risk perception tend to have low levels of debt (Nguyen et al. 2019; Caetano et al. 2011). Flores and Vieira (2014) found that risk perception is positively linked with emotion and negatively linked with materialism. Risk perception overcomes uncertainty. Loretts et al. (2019) stated that perception of risk is influenced by the characteristics of farms, whereas market risk is associated with price. Gärling et al. (2009) highlighted that risk perception is an essential component of financial decision-making and other risk-related behaviors.

The third determinant highlighted in the literature is materialism. Materialism is related to the act of consumption (Mishra and Mishra 2016; Richins and Dawson 1992). Chaplin et al. (2019) highlighted the several strategic factors that assist reducing materialism in younger consumers. People with high levels of materialism are characterized as spenders (Azma et al. 2019), while those with low levels are savers because immaterialized people will invest in stocks, bonds, and mutual funds (Chatterjee et al. 2019; Stock and Watson 2003). Santos and Fernandes (2011) observed that people associate excessive materialism with a search for status. Flores and Vieira (2014) stated that when the motivation is anchored in values that are more collectively oriented, materialism is viewed positively. The fourth crucial determinant, emotion, is linked to the individual ability to express emotions when handling financial decisions. Roazzi et al. (2011) contend that emotion constitutes a complex and multifaceted concept and depends on the form of expression. Quelch and Jocz (2007) found that indebtedness affects emotions. According to Huy and Zott (2019), Flores and Vieira (2014) mentioned that emotion influences people's behavior (i.e., consumption, risk-taking, decision-making). In the sociocultural context, each subject gives in to emotions. Considering this context, Roazzi et al. (2011) classify emotions into three categories: background (long-lasting and influential on how primary emotion is expressed, e.g., apathy), primary (people easily express these, e.g., anger and fear), and social (influenced by society and culture, e.g., pride, embarrassment, and jealousy). Flores and Vieira (2014) indicated emotions that consider how indebtedness influences subjective issues (i.e., pride, shame, and nervousness).

The earlier studies (Farrar et al. 2019; Baker et al. 2019; Metawa et al. 2019; Phan et al. 2019) found a relationship between demographic factors and financial behavior (e.g., financial literacy, risk perception, materialism, and emotion). Fletschner and Mesbah (2011) and Farrar et al. (2019) found a significant relationship between gender and financial literacy. Their findings showed that females are less financially informed than males are, but this improves significantly with education, wealth, and encouragement by spouses to acquire and use their finances. Hsu (2016) identified that females are more financially informed when their spouses start to lose cognitive skills. Moreover, risk perception differs based on individual occupations, income, religion, marital status, and level

of education (Keese 2010). Ponchio (2006) and Lin et al. (2019) focused on the relationship between demographic factors and debt, and identified that men are not more favorable to debt than women are. Younger people tend to perceive their debt burden as significantly lower, whereas those over 45 years are more likely to have a higher debt (Daud et al. 2019; Keese 2010). Older people are less likely to take on debt (Ponchio 2006), and that a lower education level influences the propensity to take on debt (Greig et al. 2019), that is, the lower the education level, the greater the propensity. Flores and Vieira (2014) noted that females are less favorable to debt than males are. Young people, below 30 years of age, tend to take the debt burden lightly as compared to the heads of families aged over 45 years (Keese 2010). This finding shows that the heads of families take the debt burden seriously so that the other family members are not affected by the heads' actions. People aged below 30 years are also found to have higher levels of debt (Flores and Vieira 2014; Sevim et al. 2012). Ahmed et al. (2010) noted that credit card usage could increase the level of personal debt. This is consistent with the findings of Flores and Vieira (2014) indicating that people who use and rely on credit cards are more likely to be in debt.

3. Methodology

The study uses the exploratory method, through the partial least square (SmartPLS) technique, and aims to test for specific research hypotheses. A theoretical model is developed to investigate the influence of determinants in debt situations. Additionally, to evaluate demographic and cultural variables, in total, eight hypotheses are considered for testing, as shown in Table 1. These eight hypotheses refer to the described model, which illustrates the relationships among the constructs considered. The eight relationships that refer to demographic and cultural variables are analyzed by hypothesis testing.

This study uses four independent variables (e.g., financial risk tolerance, risk perception, materialism, and emotion) and one dependent variable (indebtedness). For financial literacy, 12 items were adapted from Disney and Gathergood (2011), and for materialism, nine items were used from Ponchio (2006). For risk perception and indebtedness, 13 items were adapted from Caetano et al. (2011) and Flores and Vieira (2014). Emotion was measured by using 10 items adapted from Quelch and Jocz (2007).

Table 1. Hypotheses and research relations with references.

	Hypotheses/Relations	References
H1:	Financial literacy positively affects propensity toward indebtedness.	Disney and Gathergood (2011)
H2:	Risk perception positively affects indebtedness.	Caetano et al. (2011)
H3:	Risk perception negatively affects materialism.	Flores and Vieira (2014)
H4:	Risk perception positively affects emotion.	Flores and Vieira (2014)
H5:	Materialism positively affects indebtedness.	Ponchio (2006)
H6:	Emotion positively affects indebtedness.	Quelch and Jocz (2007)
H7:	There is a significant difference between demographic variables with respect to the four determinants.	Keese (2010); Flores and Vieira (2014)
H8:	There is a difference between demographic variables with respect to individual indebtedness.	Flores and Vieira (2014)

Source: Elaborated by the authors.

The theoretical model provides the idea that the first hypothesis established a relationship between financial literacy and indebtedness. Based on Disney and Gathergood (2011), our efforts decided whether financial literacy positively influences indebtedness. With respect to the construct of risk perception, three hypotheses can be set forth, related to indebtedness, materialism, and emotion. Caetano et al. (2011) indicated that the higher the perceived risk, the lower the level of debt. However, risk perception may also influence indebtedness and emotion. Flores and Vieira (2014) examined that risk perception affects materialism negatively and emotion positively.

Next, the fifth hypothesis of the theoretical model attempts to identify the effect of materialism on indebtedness. Ponchio (2006) found that more materialistic people face or are prone to higher levels of indebtedness. For instance, more materialistic people will probably take up credit for utilization

purposes. Moreover, the higher the level of materialism, the greater the probability that the individual will be in debt.

The final hypothesis of the theoretical model aims to measure the relationship between emotion and indebtedness. Quelch and Jocz (2007) indicated that consumption affects individuals emotionally. Given this perspective, Flores and Vieira (2014) found that a significant relationship exists between emotion and indebtedness. From the aforementioned hypotheses, a theoretical model is proposed in Figure 1.

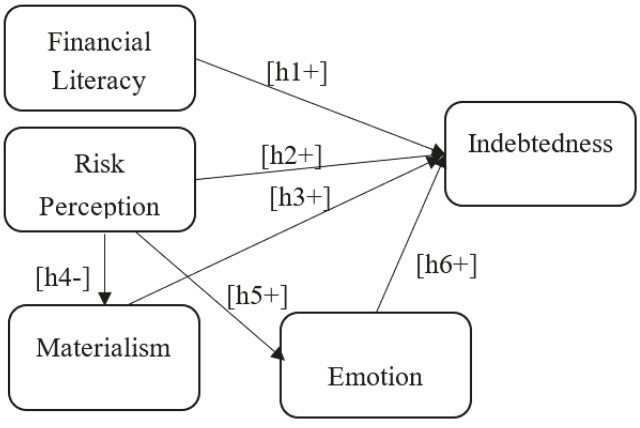

Figure 1. Theoretical model.

The survey for this study was conducted in the city of Kuala Lumpur in Malaysia. The sampling frame consists of working people from both public and private sectors who work within the Kuala Lumpur enclaves. Kuala Lumpur has the highest population density in Malaysia. This population is suitable for analyzing the urban life of these enclaves and their behavior toward financial management. The prospective respondents were chosen using the probability sampling method.

A structured questionnaire, divided into two sections, was used. The first section addressed the respondents' profiles, whereas the second section explored the determinants (behavioral factors) based on the following references: financial literacy, using the scale of Disney and Gathergood (2011); materialism, using the scale of Ponchio (2006); risk perception and indebtedness, based on the scale of Caetano et al. (2011) and Flores and Vieira (2014); and finally, emotion, using the scale of Quelch and Jocz (2007). A five-point Likert scale from 1 (strongly disagree) to 5 (strongly agree) was used for the five factors (financial literacy, risk perception, materialism, emotion, and indebtedness). A total of 400 questionnaires were distributed, of which 350 were returned. The final 320 valid responses presented an actual response rate of 80%.

Using SmartPLS software, the measurement model was assessed, and the hypotheses were tested. PLS is an appropriate tool because it confirms the theories to determine how well a model can estimate a covariance matrix for the sample data. Hair et al. (2013) stated that PLS operates much like a multiple regression analysis and is particularly valuable for exploratory studies.

4. Results and Discussion

4.1. Respondents' Demographic Characteristics

Data were collected from December 2016 to April 2017, generating a sample of 320 valid responses. According to the respondents' profiles, the statistical analysis shows that the majority of the respondents are males (58.7%) compared to females (41.5%). The findings also indicate that more than half of the participants are married (53.5%), while 44.2% are single, and 2.3% selected the "others" option. Most

respondents are aged between 25 and 35 years (55.5%), followed by those below 24 years (23.2%) and 36 to 45 years (14.3%). In terms of educational background, around half of the respondents have a university degree as the highest degree (49.7%), followed by those with a college degree (28.1%), and diploma (22.2%). The results also reveal that 58.4% are private-sector employees, followed by those in the public sector (33.3%), and finally, the self-employed (8.3%).

4.2. Measurement Model Assessment

From the methodological point of view, we have considered all the dimensions together for testing the measurement model before the structural model. Having established the different measures, a confirmatory factor analysis (CFA) was conducted. This study used both a measurement model and a structural model. Hence, Table 2 indicates the results of convergent validity of the study. The validity of the constructs and CFA were carried out. The relationships among the constructs were measured using a PLS statistical tool. The findings revealed that factor loading ranged from 0.813 to 0.954, the value of average variance extracted (AVE) from 0.702 to 0.872, composite reliability (CR) value between 0.888 and 0.971, and Cronbach's Alpha value from 0.823 to 0.934, which indicates convergent validity of this study. In the measurement model estimation, some changes were carried out due to adjustment issues. Table 3 presents the findings of discriminant validity for all the five variables in this study. The discriminant validity of this paper is achieved (see Table 3) because the square root of every latent construct shows the higher correlation. For instance, Hair et al. (2013) indicated that the square root of AVE for each latent variable should be higher than the correlation of any latent variables (Hair et al. 2013). Figure 2 shows the measurement model with regression weights.

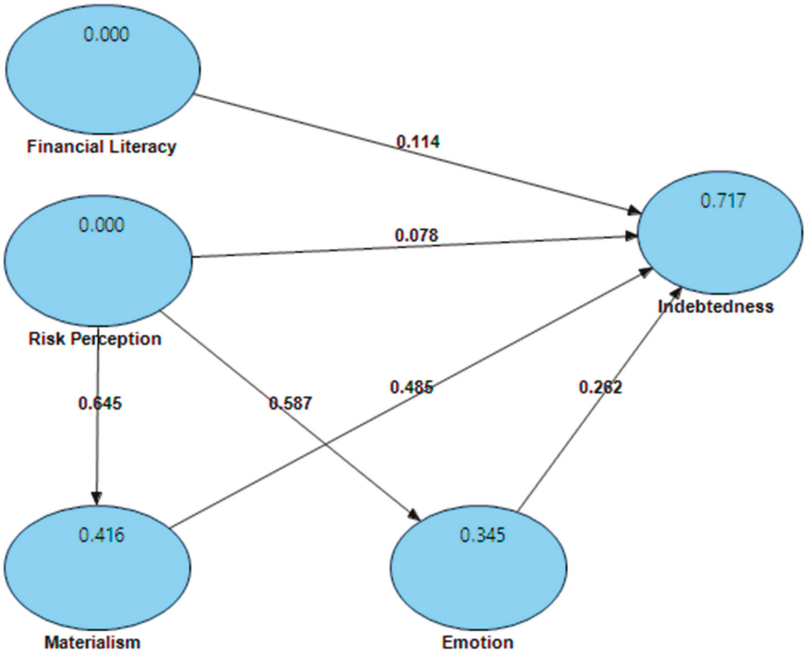

Figure 2. Measurement model.

Table 2. Convergent validity.

Code	Characteristics	Factor Loadings	AVE	CR	Alpha (α)
	Financial Literacy		0.806	0.954	0.934
[FL1]	Saves money every month.	0.867			
[FL2]	Saves to buy more expensive products (e.g., car, house).	0.822			
[FL3]	Has a financial reserve greater than or equal to three times the monthly income that can be used in unexpected cases (e.g., unemployment, sickness).	0.846			
[FL5]	Analyzes personal finances in depth before making any major purchase.	0.841			
[FL7]	I am satisfied with my own system to control finances.	0.855			
[FL9]	Uses credit cards because no money is available to cover some expenses. (if applicable)	0.881			
[FL11]	Pays credit card bill completely to avoid finance charges (interest and fines). (if applicable)	0.895			
[FL12]	Checks credit card bills to examine errors and unauthorized charges. (if applicable)	0.835			
	Risk Perception		0.872	0.971	0.824
[RP2]	Accepts being a guarantor for someone.	0.897			
[PR3]	Spends money carelessly, without thinking of the consequences.	0.920			
[RP4]	Invests in businesses that have great chances of not working well.	0.938			
[RP5]	Lends a great proportion of personal income to a friend or relative.	0.925			
	Materialism		0.852	0.958	0.835
[MT1]	I admire people who possess expensive houses, cars, and clothes.	0.895			
[MT2]	I like to spend money on expensive things.	0.927			
[MT3]	My life would be much better if I had things I actually do not have.	0.954	0.728	0.888	0.823
[MT4]	Buying gives me pleasure.	0.916			
[MT5]	I would be happier if I could buy more things.	0.912			
[MT6]	I like to possess things to impress other people.	0.816			
[MT8]	It bothers me when I cannot buy everything I want.	0.887			
[MT9]	Spending much money is among the most important things in my life.				
	Emotion		0.836	0.953	0.934
[ET1]	I would feel ashamed if I were indebted.	0.897			
[ET2]	I would feel nervous if I were indebted.	0.821			
[ET4]	I would feel depressed if I were indebted.	0.853			
[ET5]	My dietary habits would be affected if I were indebted.	0.793			
[ET6]	My family relations would suffer if I were indebted.	0.898			
[ET7]	My relations with friends would be harmed if I were indebted.	0.860			
[ET9]	My work performance would be affected if I were indebted.	0.826			
[ET10]	I would smoke more than usual if I were indebted.	0.873			
	Indebtedness		0.703	0.904	0.862
[ID1]	It is not correct to spend more money than I make.	0.849			
[ID2]	It is better to gather money first and then spend it.	0.822			
[ID3]	I know exactly how much I owe in stores, in credit cards, or to the bank.	0.892			
[ID5]	I would rather buy in installments than to wait to gather money to buy in cash.	0.862			
[ID6]	It is important to know how to control the expenses in my house.	0.813			
[ID7]	I would rather pay in installments even if the total is more expensive.	0.828			
[ID8]	People would be disappointed with me if they knew I had a debt.	0.884			

Table 3. Discriminant validity Fornell–Larcker criterion.

	Emotion	Financial Literacy	Indebtedness	Materialism	Risk Perception
Emotion	0.8977				
Financial Literacy	0.5382	0.9143			
Indebtedness	0.4914	0.7414	0.8384		
Materialism	0.4994	0.6262	0.7844	0.9230	
Risk Perception	0.3477	0.5917	0.5755	0.6068	0.9338

4.3. Structural Model

The findings of the structural model analysis are illustrated in Table 4. In the structural model, the results are examined through beta coefficient (β), and t-statistics for latent constructs. The findings show that four hypotheses are accepted at significant levels of 0.01 and 0.05, respectively, while two hypotheses are not accepted. According to Hair et al. (2013), the value of t-statistics equal to or higher than 1.64 are considered significant. The beta coefficient value assesses the strength of the relationship between independent and dependent variables. The beta coefficient value ranges from zero to one, indicating positive or negative significant relationships. The findings illustrate that a higher significant relationship is found between risk perception–materialism (β = 0.645) followed by risk perception–emotion (β = 0.587), materialism–indebtedness (β = 0.485), and emotion–indebtedness (β = 0.262). Therefore, H3, H4, H5, and H6 are accepted and H1 and H2 are not accepted. Figure 3

shows the structural model with the hypothesis test. The findings also reveal that the coefficient of determination (R^2) value represents the percentage of variance. Hence, the dependent variables can be explained by independent variables, and range from zero to one. Cohen (1988) assumed that the closer the value to one, the more the independent variable explains the dependent variables. Thus, risk perception explains 41.6% of materialism and 34.5% of emotion. In addition, a total variance of indebtedness, 71.7%, is explained by financial literacy, risk perception, materialism, and emotion.

Table 4. Hypothesis testing.

Hypothesis	Hypothesized Relationship	Beta Coefficient (β)	Standard Error	*t*-Statistics
H1	Financial Literacy → Indebtedness	0.114	0.115	0.988
H2	Risk Perception → Indebtedness	0.078	0.098	0.786
H3	Risk Perception → Materialism	0.645	0.071	9.070 **
H4	Materialism → Indebtedness	0.485	0.125	3.864 **
H5	Risk Perception → Emotion	0.587	0.083	7.061 **
H6	Emotion → Indebtedness	0.262	0.095	2.764 **

Note: ** $p < 0.01$, * $p < 0.05$.

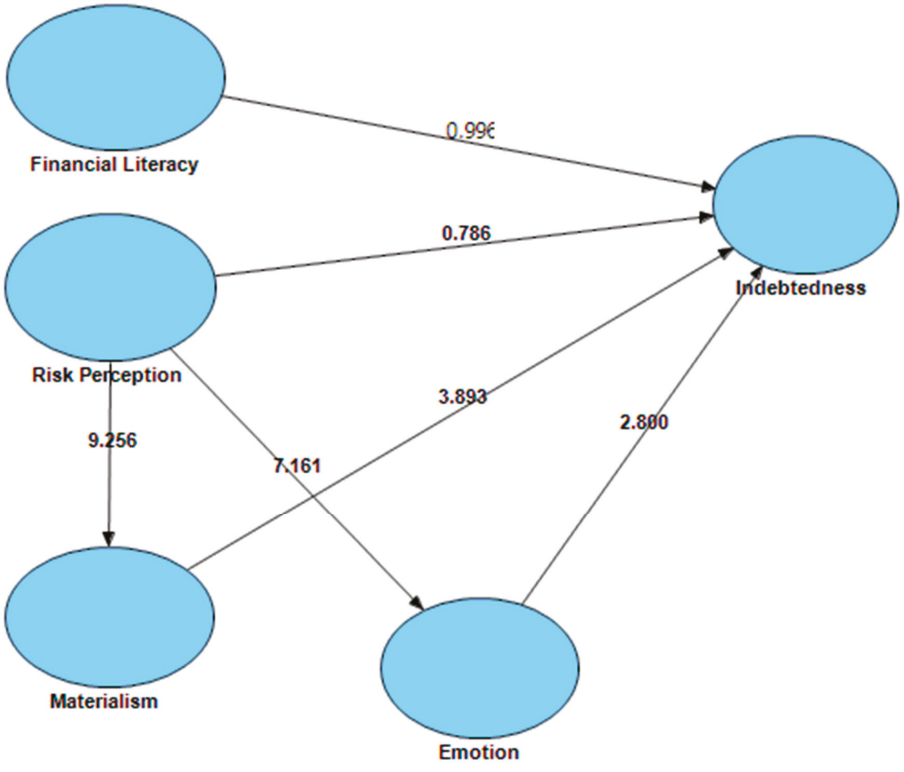

Figure 3. Structural model. Note: *t*-value ≥ 1.64 significant at $p < 0.05$, *t*-value ≥ 2.32 significant at $p < 0.01$.

4.4. Assessment of Demographic Profile and Constructs

In this study, *t*-tests (for gender, marital status, credit card, and loan) and one-way ANOVA (for age and income) were used to analyze the difference between males and females, single and married people, owning credit card and loan or not; as well as age and income groups in terms of indebtedness, emotion, materialism, risk perception, and financial literacy. Table 5 reposts the *t*-test results that show the difference between males and females in terms of indebtedness, emotion, materialism, risk perception, and financial literacy. The results show that *t*-values for indebtedness and risk perception are statistically significant at $p < 0.05$, while materialism is highly statistically significant at $p < 0.01$. This finding indicates that there are differences between the means for males and females for all variables. Males scored higher means than females did in indebtedness, materialism, risk perception, and financial literacy, while females scored significantly higher than males in emotion. This indicates that there is no significant difference between males and females in terms of emotion and financial literacy.

Table 5. Relations between demographic profile and constructs.

Relations between FL, RP, ET, MT, ID, and Gender					
Characteristic	**ID**	**ET**	**MT**	**RP**	**FL**
Gender:					
Male	3.02	3.28	3.07	2.25	3.72
Female	2.74	3.40	2.61	2.03	3.70
t	1.96 *	−0.86	3.43 **	1.98 *	0.15
Relations between FL, RP, ET, MT, ID, and Marital Status					
Single	2.83	3.48	2.83	2.12	3.73
Married	2.81	3.30	2.68	2.07	3.69
t	1.78	1.47	1.26	0.40	0.39
Relations between FL, RP, ET, MT, ID, and Credit Card					
Yes	2.85	3.24	2.75	2.03	3.94
No	2.80	3.45	2.73	2.13	3.55
t	0.37	−1.75 *	0.17	−0.80	3.78 ***
Relations between FL, RP, ET, MT, ID, and Loan					
Yes	2.86	3.28	2.77	2.09	3.74
No	2.70	3.58	2.66	2.08	3.63
t	1.19	−2.36 **	0.73	0.45	0.99
Relations between FL, RP, ET, MT, ID, and Age					
21–30	2.84	3.38	2.81	2.17	3.59
31–40	2.80	3.31	2.72	2.08	3.86
41–50	2.79	3.46	2.38	1.67	3.75
51 and above	2.63	3.44	2.24	1.52	3.89
F	0.16	0.17	1.81	2.25 *	2.20 *

Note: Independent variables: Financial literacy (FL), Risk perception (RP), Materialism (MT), Emotion (ET). Dependent variable: Indebtedness (ID). *** Significant at $p < 0.01$, ** Significant at $p < 0.05$, * Significant at $p < 0.10$.

The findings also indicate that there are differences between the means for single and married people for all constructs. Single people scored higher means than married people did in all five constructs. The t-values of all constructs were not significantly different. This implies that there is no significant difference between single and married people in terms of indebtedness, emotion, materialism, risk perception, and financial literacy. In addition, the statistical result indicates that there is no significant difference between "Yes" and "No" in terms of indebtedness, materialism, and risk perception, while financial literacy shows a highly significant difference between "Yes" and "No." Moreover, the results also reveal that there are differences between the means of having a loan or not having a loan for all variables, as the t-value for emotion was significant at $p < 0.05$. Table 5 also reports that there is a significant difference between respondents from four age groups and two constructs

(risk perception, financial literacy), whereas the rest (indebtedness, emotion, materialism) were found insignificant. However, the age group from 21 to 30 years scored higher means in indebtedness, materialism, and risk perception while the age groups of 41 to 50 years and above 51 years scored higher means in emotional and financial literacy, respectively.

Based on the findings of hypothesis testing, materialism and emotion have a significant relationship with a propensity toward indebtedness. These findings are associated with the study of Flores and Vieira (2014). In the context of propensity toward indebtedness in Malaysia, the results found that risk perception and financial literacy are not statistically significant with indebtedness. This result is contradictory with the earlier study of Flores and Vieira (2014) because they found that financial literacy and risk perception have a significant relationship with indebtedness in the context of Brazil. With respect to the sign of the coefficient of financial literacy, the hypothesis related to this issue is not confirmed. Interestingly, this study found that financial literacy was neither practically nor statistically significant to indebtedness. In case of Malaysia, this study suggests that financially literate people are more prone to indebtedness possibly because they have the confidence in managing their debt. They probably know better the function of loans or credit cards, the implications of interest rates, duration of repayment, etc. Conversely, financially illiterate people are less confident in taking on debts possibly because they have insufficient knowledge about the functions and implications of debt.

Flores and Vieira (2014) assume that people with high risk perception tend to have low levels of debt. This finding is consistent with the finding of the present study. Moreover, the statistical analysis reveals that risk perception has a higher significant and positive relationship with materialism and emotion. This study is a new finding in the context of Malaysia and is not associated with Flores and Vieira (2014), who examined the context of Brazil and found that risk perception affects materialism negatively and emotion positively. They also noted that high consumption levels do not always provide benefits; on the contrary, such consumption levels may adversely affect individual welfare. The positive relationship between materialism and indebtedness is noteworthy; indeed, there is a positive relationship, indicating that people with high levels of materialism tend to have a high propensity toward indebtedness. People who value possession of goods highly tend toward a higher propensity of being in debt because they are prone to spending without proper planning.

Regarding the relations of demographic variables to indebtedness, the results of the current study show that males are more likely to be in debt than females are, in accordance with the results of Flores and Vieira (2014). However, this study found no significant difference between single and married people with respect to indebtedness. However, Gathergood (2012) found that single people tend to have a higher propensity toward indebtedness compared to married people. Therefore, further investigation is needed to confirm the result. People who use credit cards have higher debt levels, although the difference is not significant, supporting Ahmed et al. (2010). With respect to age, young people (under 30 years) are more likely to be in debt, according to the results of Disney and Gathergood (2011) and Sevim et al. (2012). However, their differences are not statistically significant. Further, respondents who take loans are more indebted compared to those who do not take loans. This result is similar with that of Flores and Vieira (2014).

5. Conclusions, Implications, and Limitations

Propensity toward indebtedness is one of the main serious issues in Malaysia. Although many people have not realized this situation, it presents a great concern to the government, decision makers, and researchers. Therefore, initiatives should be undertaken seriously for overcoming this challenge. The present study tries empirically to address the gap in the literature of the behavioral factors that predict the propensity toward indebtedness. The findings suggest that behavioral factors are among the reasons that cause indebtedness. Self-control is important to avoid being indebted, especially considering that materialism is the only statistically significant factor explaining the propensity toward indebtedness in this study's hypothesized model. This contribution could be a useful source of information for the higher authority to guide people to improve their financial planning through

programs and mass media. The empirical evidence exists to demonstrate that there are many possible causes of the increasing level of debt worldwide. The results from this study can contribute to the existing line of research in behavioral finance and personal financial management. The study précises diverse behavioral and demographic factors that may influence the propensity toward indebtedness in Malaysia. In terms of practical contributions, this study helps broaden the understanding of behavioral factors, which may lead to the development of actions to prevent indebtedness and assist defaulters. The researcher also hopes that financial institutions could benefit from the results of this study by building stronger models of credit offerings.

In addition, this study suggests that financial institutions may have to improve their model in addressing credit problems in the long term. As materialism is a significant factor explaining the propensity toward indebtedness, the higher authority should consider this behavioral factor and take the necessary steps to guide people to have better financial planning and disseminate it widely through programs and mass media. Financial institutions should measure people's level of materialism before approving loan applications, as it is directly linked to indebtedness. For example, the loan application of a highly materialistic person should be considered carefully. In their efforts to reduce the indebtedness among Malaysians, financial institutions should urgently impose reasonable down payment for house and car loans, and should check thoroughly people's sources of funds to pay the installments.

Besides, in order to reduce the occurrence of moral hazards after taking a business loan, financial institutions should closely monitor how the recipients are spending their funds. A post-disbursement monitoring system would include close supervision of the status or progress of the business undertaken and some technical assistance in achieving a viable business project. This includes offering advice during the initial stage, ensuring consistent progress evaluation, marketing, and ensuring business continuity. Even though borrowing enables individuals to improve their lifestyle and consumption, some individuals are at risk of indebtedness that is unsustainable with their earnings and may reach over-indebtedness. Over-indebted people are prone to suffer from poor psychological well-being, health problems, and weak social networks. Thus, governments should focus on this aspect and conduct programs that could enhance people's understanding about both the benefits and harmful effects of debts.

This study has some limitations. For example, the scope of this study is confined to only the Klang Valley area. Working individuals may differ from those in the other states in terms of experiences and characteristics. These elements may affect individual propensities toward indebtedness. Thus, generalizing this aspect to the Malaysian population is imperative. Future research may carry out comparative studies between people in private and public sectors, or those who work in different states in Malaysia. This strategy could help explore the underlying reasons, and the truth about people being indebted, based on the experiences gained by financial advisors as well as the bankrupted people.

Author Contributions: M.R. carried out the literature review, statistical analysis, and drafted the manuscript. N.A. and Y.I. helped with the data collections, data analysis, and discussion. M.A.K.M. participated in the discussion, and communicated with the editor. All authors read and approved the final manuscript.

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Market Orientation and Marketing Innovation Activities in the Czech Manufacturing Sector

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Abstract: Market competition drives organizations to higher efficiency. This paper analyses the relationship between the prevailing organization's market orientation and marketing innovation activities. The sample of organizations consists of business enterprises from the manufacturing sector in the Czech economy. Data come from the Community Innovation Survey in 2014 and are analyzed using the innovation process econometric modeling. This innovation survey covers the period of a 3 year J-curve of real GDP growth. Czechia is one of the most open economies in the world and has one of the largest shares of exports and imports to GDP. This paper evaluates four types of marketing innovation activities (design, pricing, placing and promotion methods) at the enterprise level as a factor of marketing capability. The analyzed sample consists of observations about new-to-the-market innovators and enterprises that did not engage in new-to-the-market innovation activities in the last three years. The second group are considered to be lower-level innovators, i.e., adaptors to technological change. This paper explores the relationship between local, national, European and World market orientation in addition to an enterprise's marketing innovation activities. The results suggest that not all types of marketing innovations are dependent on market orientation, while some have indirect positive and negative effects. Feedback and the future effects of marketing innovation activities are present at the enterprise level. Results also suggest that the marketing innovations of innovators form the manufacturing sector while they are dependent upon the strategies of enterprises to enter new geographical markets and gain the motivation to unlock new (hidden) demand.

Keywords: market orientation; international competition; business performance; marketing innovation; motivation; innovation strategies; exporters; manufacturing; marketing capabilities

JEL Classification: O31; M31; L60

1. Introduction

Market orientation as a theoretical discipline with a conceptual framework can be observed from the perspective of the theory of market orientation. This theory comes with a rather broad definition, stating that "*Market orientation is the organizationwide generation of market intelligence pertaining to current and future customer needs, dissemination of the intelligence across departments, and organizationwide responsiveness to it*." (Kohli and Jaworski 1990, p. 6). This theory focuses on the relationship between the "market orientation construct" and business performance, the organization's strategy, employee dispositions, innovative behavior, supply, demand-side factors, customer attitudes and behavior.

The enterprise's orientation based on distance is one of the observable "end-products" of the marketing orientation construct. This paper analyses the relationship between the construct and innovation behavior (as a mix of management decisions, the acquisition of knowledge and results of marketing intelligence analysis), innovation strategies (as a fragment of strategic behavior), innovative performance (as a fraction of overall enterprise performance) and other characteristics such as company size and ownership variables.

Extended market orientation theories add factors like culture (Narver and Slater 1990) and test the relationship between market orientation and constructs such as marketing capabilities, enterprise performance, cost leadership strategy, differentiation strategy and organizational power (Cacciolatti and Lee 2016). Core marketing processes (as marketing capabilities), like product development management, supply chain management and customer relationship management, are considered factors of an enterprise's market orientation that influence business performance (Jaakkola et al. 2016).

A review of the market capability literature by Kamboj and Rahman (2015) reveals a positive relationship between "doing great" in marketing capability dimension and business performance. However, they did not identify any issues or problems with the research methodology and data collection and representativeness. Are all industries directly comparable? Is the understanding of marketing capabilities similar in all industries' trade, manufacturing and services? Are the indicators used in the studies (market share, customer satisfaction, sales growth, profitability and ROI) a good enough or even a comparable approximation of business performance? There are a lot of methodological issues that raise new research questions and need further research.

Strategic intentions form enterprises' directions; that is why multinationals and exporters have recently gained a lot of attention from business economics scholars. The issue with previous research is the endogeneity between the enterprise's internal factors (processes, capabilities, performance outcomes and other organizational characteristics). To some extent, we can observe that external factors (competition, regulation and other environmental factors) are endogenously related to internal factors as well. That is why feedback theories account for last year's organizational outcomes as a key influencer forming managers' strategic intentions (Kaleka and Morgan 2019).

This paper deals with the population of new-to-the-market innovators and tries to contribute to the debate about the complex relationship between capability factors and business performance. New-to-the-market marketing innovations are not common in the Czech economy. Companies usually innovate their product or service or improve the production process and subsequent methods of the traditional marketing mix (product, price, place and promotion).

That is why this issue is worth exploring. The sample of Czech manufacturing enterprises guarantees representativeness of product exporters and, given the high ratio of foreign-owned enterprises in the Czech economy, we also critically studied multinationals. The originality is in using the CDM modeling approach (named after economists Crépon, Duguet and Mairesse) for marketing innovations (see Lööf et al. 2017 for further CDM best practices and contributions). This model deals to some extent with the endogeneity of the financial and innovation output variables and the selection bias.

Marketing innovations follow the logic of general marketing mix processes (product, price, place and promotion), include Industry 4.0 technologies like the Internet of Things and require knowledge-intensive services like Automatization and Artificial Intelligence. Marketing innovation requires skilled labor and mature management to process data as well as information about customers in today's smart digital era. Their preferences underpin the companies' smart marketing innovations, such as mobile applications, information technologies in addition to systems, new ways of delivery, and pricing.

The goal of this paper is to analyze the characteristics of new-to-the-market innovators as well as their marketing innovation activities with respect to market orientation factors (distance). The research questions are: what is the relationship between marketing innovations and distance-based types of

market orientation? What is the role of other innovation strategies? Are the results dependent on the type of the economy or comparable to other studies? The purpose is to entangle the complex relationships of the marketing innovation activities of product innovators and contribute to the debate about marketing capabilities in the manufacturing industry-oriented export activities.

2. Literature Review

Current research dealing with marketing innovation is aimed at the linkages between the marketing capabilities and competitiveness of small and medium-sized enterprises (SMEs). Marketing innovation is highly important in the "reseller industry" and retail trade in general. There is a relationship between the two types of competitiveness: brand and reseller enterprise. Marketing innovations from a brand enterprise are highly influenced by the competition in the market and not by the reseller enterprise (Gupta et al. 2016).

The debate is also about a certain divide between marketing innovation and technological innovation. Is there a dis-synergistic effect or does it depend on the industry? What type of complementarity (and endogeneity) are we speaking about? The dual innovation strategy was found to be a better concept in Germany in 2008 in a sample of enterprises of different sizes and industries (Grimpe et al. 2017).

There is a quite high failure rate in marketing innovation projects regarding the implementation of customer relationship management (CRM) information systems. Without appropriate knowledge about management processes, failure is imminent because managers must be able to get information and knowledge from the customer data (Garrido-Moreno et al. 2015) and have the appropriate infrastructure (hardware, software, etc.).

The learning capability of employees and subsequent marketing innovations contribute to the higher financial performance of hotel enterprises (Nieves and Diaz-Meneses 2016) which are not considered as high-intensive knowledge industries in comparison to the health or ICT industry. Skill-intensity is an indicator of a good level of knowledge management practices. Innovation activities (product and marketing) of skill-intensive enterprises generate higher productivity growth. Innovation-fostering programs and public support programs should aim at skill-intensive enterprises with the proper level of knowledge management (Junge et al. 2016).

Similarly, in the agri-food industry in Canada, market scanning (and subsequent knowledge management techniques) and competitive pressures contribute to technological and marketing innovation activities (Mirzaei et al. 2016). Information from competitors, suppliers and customers leads to marketing innovation. External knowledge management is a prerequisite to innovation activities in the manufacturing industry in Spain (Javier Ramirez et al. 2018).

Macroeconomic variables can influence marketing innovation activities as well. The result suggests that marketing innovations are driven by aggregate demand and demand from abroad. The Spanish enterprises that introduced marketing innovations were those that exported to countries outside the European Union. There was a general decline (more than half) in marketing innovation activities after 2008 in Spain (Medrano and Olarte-Pascual 2016). Enterprises in creative industries (fashion, style, architecture, design, industrial patterns, etc.) set the trends, and their innovation activities affect global markets. However, cultural antinomies play an important role in the global fashion paradigm as well (Khaire and Hall 2016).

Global economic networks and global value chain companies are the bearers of marketing innovation. Knowledge of these flexible companies includes know-how about institutions and market channels, while every member or contractor is important. Intensifying globalization and the recognition of knowledge in modern economies have led to an uncertain world. Economic leaders and so-called 'go-between leaders' are needed to navigate the global markets. The first one conducts an innovation strategy, while 'go-betweeners' manage the producing and selling strategy (Baulant 2015). Sustainable production practices are associated with globalization and integration

into an enterprise-wide manufacturing network. Sustainable sourcing practices are associated with integration into the external supply chain (Golini and Gualandris 2018).

To summarize the contribution of current knowledge, the bivariate (or multivariate) specification (a simultaneous model) has to be considered in marketing innovation research. This is because a weaker effect of marketing innovation activities was found in the product innovation equation. This means that marketing innovations benefit from product innovation activities (Bartoloni and Baussola 2016). That is why this paper uses the bivariate equation in the innovation output stage of the innovation business process and adds as many reasonable control variables as possible to account for industry-specific factors. The relationship of internal factors is naturally endogenous. There is feedback based on the enterprise's past and endogenous relationship with many factors from the external environment. New-to-the-market innovators are a relatively homogenous group of capable enterprises in comparison to non-innovators. The role of strategies, market orientation factors and other characteristics can be tested in this unique sample located in the small export-oriented economy.

3. Materials and Methods

The 2014 wave of the Czech Community Innovation Survey (CIS)[1] served as the dataset for the analysis (3015 observations). Only enterprises from the manufacturing industry were selected for the final sample. There are no service or trade enterprises in the sample. For the purpose of the estimation procedure, financial variables (in thousands of CZK) are per one full-time employee and logarithmically transformed. A total of 22% of manufacturing enterprises innovated their goods and services between 2012 and 2014. The descriptive statistics about sales and the number of employees suggest a very heterogeneous sample (Table 1).

Table 1. The summary of statistics from the sample of manufacturing enterprises in 2014.

Variable	Obs.	Mean	Std. dev.	Min	Max
New-to-the-market innovator	3015	0.22	0.41	0	1
Sales	3015	9.80×10^5	7.04×10^6	512	2.97×10^8
Number of employees	3015	208.59	638.47	10	24,354

Four types of marketing innovation are recognized: a new design (Design), a new promotion method (Promotion), a new product selling and placing method (Placing), and a new product pricing method (Pricing). Marketing innovator (59%) is an enterprise that introduced new-to-the-market innovation and one of the four marketing innovations (Table 2).

Table 2. The summary of statistics from the sub-sample of new-to-the-market innovators in 2014.

Variable	Obs.	Mean	Std. dev.	Min	Max
Number of employees	641	418.80	1165.82	10	24,354
R&D expenditures	641	6.31×104	6.05×105	5	1.51×107
Marketing innovation	641	0.59	0.49	0	1
Manufacturing process innovator	641	0.65	0.48	0	1
Sales of new-to-the-market innovations	641	635,463.7	5,934,088	109.35	1.40×10^8

Eurostat technological level control variables were introduced to control for long-term industry R&D differences (Eurostat 2016). Almost all enterprises (97%) were product innovators, so it does not

[1] Community Innovation Survey datasets for Czech Republic are accessible for scientific purposes through the "safe center" procedure at Czech statistical office.

make sense to estimate the bivariate structural model of product and marketing innovation equation. Instead of the product innovation equation, we used the manufacturing process innovation equation.

For estimation, we used recommendations for cross-sectional datasets (Mairesse and Mohnen 2010) and followed the stage logic of innovation as a business process (Table 3). The term innovator is rather narrowly described as an enterprise that is identified as having non-zero R&D expenditures that introduced a new-to-the-market innovation in the last three years (from the 2014 Community Innovation Survey).

Table 3. Innovation model used for estimation.

Dependent	Model Description	Equation Number
New-to-the-market innovator (Probit)	$\begin{cases} r_i^* = 1 \; if \; r_i = \left(X_{1i}\beta_1 + \varepsilon_{i_1}\right) > 0 \\ r_i^* = 0 \; if \; r_i \leq 0 \end{cases}$	(1)
R&D expenditures per employee (ln)	$k_i^* = \ln(k_i) \big\vert (r_i > 0) \; = \; X_{2i}\beta_2 \; + \varepsilon_{i_2}$	(2)
Sales of new-to-the-market innovations per employee (ln)	$t_i^* = \ln(t_i) \big\vert (k_i > 0) = X_{3i}\beta_3 \; + \alpha k_i^* + \varepsilon_{i_3}$	(3)
Marketing and Manufacturing process innovations (bivariate Probit)	$manproc_i^* \begin{cases} 1 \; if \; manproc_i = \left(\rho \hat{k}_i^* + \; X_{4i}\beta_4 + \varepsilon_{i_4}\right) > 0 \\ 0 \text{ otherwise } (manproc_i \leq 0) \end{cases}$ $marketing_i^* \begin{cases} 1 \; if \; marketing_i = \left(\sigma \hat{k}_i^* + \; X_{5i}\beta_5 + \varepsilon_{i_5}\right) > 0 \\ 0 \text{ otherwise } (marketing_i \leq 0) \end{cases}$	(4)

The first two dependent variables are estimated using the logic of the Heckman procedure. We used marginal effect Probit estimation and ordinary least-squared regression with Mill's ratio. The $X_{ni}\beta_{n's}$ (with n = 1, 2, 3, 4 and 5) are vectors of explanatory variables; every equation has a unique set of control variables (market orientation, innovation strategy variables, public support variables, training expenditures, cooperation, etc.). The $\varepsilon_{in's}$ (with n = 1, 2, 3, 4 and 5) are random-error terms. The vector of parameters to be estimated is denoted $\beta_{n's}$ (with n = 1, 2, 3, 4 and 5). Sales of new-to-the-market innovations per employee are estimated using ordinary least-squared regression. The last two-equation model is estimated using the bivariate Probit procedure. The first equation is identified uniquely by machinery acquisition expenditures and training expenditures, which are necessary for new manufacturing methods and less important for marketing innovations in the manufacturing industry. Also, the latent innovation intensity variable $\hat{k}_i^*$ (linear prediction of Equation (2)) is used instead of real R&D expenditures.

4. Results

The orientation to world markets and facing of global competitors is not related to a higher probability to introduce marketing innovation in the sample of new-to-the-market innovators in the Czech manufacturing industry. On the other hand, marketing innovation was driven by the strategy of the enterprise to unlock hidden demand with innovation activities and the entry to new geographical markets. It was less probable in multinational companies (foreign ownership > 50%) and enterprises that mainly operate in European markets (Table 4) in comparison to the local, market-oriented enterprise.

There is a simultaneity between marketing innovation activities and manufacturing process innovation, as one supports the other in the manufacturing industry. Design innovation contributed to higher R&D expenditures per employee and promotion to fewer R&D expenditures. There is no additional effect on the sales of innovated goods and services of all types of marketing innovation (Table 5). The business performance of new-to-the-market innovators in the manufacturing industry is dependent on a complex mix of many R&D expenditures allocated to more types of innovation activities (product, process, logistics, organizational, marketing and environmental innovation).

Table 4. The bivariate Probit model of marketing and manufacturing process innovations.

Variable	Marketing Innovation	Manufacturing Process Innovation
Number of employees	0.094 ** (0.05)	−0.424 ** (0.11)
National markets	−0.065 (0.23)	0.325 ** (0.14)
European markets	−0.402 * (0.23)	−0.284 * (0.14)
World markets	−0.374 (0.27)	0.180 (0.17)
Foreign ownership	−0.436 *** (0.13)	-
Control variables	Being part of a group, latent R&D and innovation strategies.	Being part of a group, latent R&D and machinery expenditures.
Constant	−0.710 * (0.39)	2.205 *** (0.38)
Number of observations	637	637

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$, robust standard errors in parentheses.

Table 5. The decision to innovate, R&D expenditures and sales of innovated goods intensity.

Variable	Decision to Innovate (Marginal Effects)	R&D Expenditures	Sales of Innovated Goods and Services
Number of employees	0.068 *** (0.01)	−0.424 ** (0.11)	−0.020 (0.05)
Marketing innovation–Design	-	0.325 ** (0.14)	−0.047 (0.12)
Marketing innovation–Promotion	-	−0.284 * (0.14)	−0.178 (0.13)
Marketing innovation–Placing	-	0.180 (0.17)	−0.082 (0.14)
Marketing innovation–Pricing	-	−0.126 (0.25)	−0.088 (0.18)
Control variables	Technological levels, foreign ownership, market orientation, being part of a group.	Foreign ownership, Mill's ratio, funding variables, cooperation, being part of a group.	Foreign ownership, the log of R&D expenditures per employee, innovation strategies, being part of a group.
Constant	-	5.834 *** (1.04)	5.09 *** (0.31)
Number of observations	2978	637	637

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$, robust standard errors in parentheses.

5. Discussion

The relationship between marketing innovations and focus on distant markets is not straightforward in the Czech manufacturing industry. Results from a 2014 survey of 3015 enterprises suggest that world market orientation contributes to the decision to engage in all types of innovative activities through the R&D expenditure channel. This means that we did not find a direct relationship between marketing innovation and orientation to more distant markets.

All the new-to-the-market innovators were predominantly product innovators (97%) and marketing innovation was introduced only in about 59% of enterprises. Marketing innovation complements innovative activity among manufacturing companies and their product innovation. The simultaneity is between manufacturing process innovation and marketing innovation. This means that the dual innovation strategy is, to some extent, present in the Czech Republic (see Grimpe et al. 2017) and the effects of marketing innovation activities aim at different time frames.

Marketing innovation activities (design, promotion, placing and pricing activities) had no additional effect on the sales of innovated goods and services in the manufacturing industry.

The introduction of a new product design was in a positive relationship with R&D expenditures. Design projects are R&D-intensive and the effect on sales of innovated goods and services was only through total R&D expenditures per employee variable (innovation input/output ratio). The effect was short-term.

Promotional marketing innovation activities negatively affected R&D expenditures. Similar to the case of design innovations, promotional activities can get very expensive in the manufacturing sector and the channel of R&D expenditures (innovation input/output ratio) lowers the sales of innovated goods and services. However, we know that the current and future effects of past promotional marketing innovation activities are expected to be positive. The effect seems to be medium-term.

The results also confirm that the relationship between marketing capabilities is complex and some activities had a negative impact on the present financial performance but are expected to have positive performance in the future. This supports the feedback theories (Kaleka and Morgan 2019). As discussed by Mairesse and Mohnen (2010), there are many issues with the endogeneity of variables and their effect comparability across industries.

In terms of global competitive pressures, foreign-owned companies (multinational enterprises) have a lower probability of introducing marketing innovation than local enterprises. One of the explanations for this is that the strategic intentions are heavily aimed at integration into the global supply chain, whereas marketing innovations are managed and sourced by other entities (Baulant 2015; Golini and Gualandris 2018).

Marketing innovation was motivated by the strategy of the enterprise to uncover as well as analyze hidden demand, and the entry to new geographical markets. This strategy seems typical for new-to-the-market innovators from the manufacturing industry. Further research can explore differences between the "reseller industry" (highly intensive in marketing innovation activities Gupta et al. 2016), knowledge high-intensive non-ICT (rather oriented at the national market), ICT service industries (rather oriented at international markets) and the manufacturing sector.

"Quality culture" is one of the adaption factors to Industry 4.0 and in Slovak manufacturing enterprises. Assurance of quality is a successful innovation approach that can uncover hidden demand, and it was detected in the Slovak manufacturing (Durana et al. 2019). This adaptation (new-to-the firm innovation) seems to influence the marketing innovations of the manufacturing enterprises.

Further research should deal with the issue of a global consumer culture (Steenkamp 2019) and other factors of accelerated (de)globalization tendencies (Witt 2019) and their impact on promotional marketing innovation activities. These further managerial and business economics research questions should be approached from a social science interdisciplinary perspective (sociology, economics, economic history) to account for past dependence, and the endogeneity of a change in the external socio-economic environment.

The research in this paper is limited by the methodology of innovation process econometric modeling. Most of the known issues are dealt with to some extent by including the manufacturing industry only. The results represent small and medium-sized enterprises in addition to large enterprises, but the dynamics of micro-enterprises as well as sole-traders are missing.

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Disclosure of Strategic Managers' Factotum: Behavioral Incentives of Innovative Business

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Abstract: Many kinds of research has suggested that innovation is positively linked to business performance and that it acts as an intermediary between organizational variables and financial performance measured by earnings achieved. Researchers worldwide have paid great attention to identifying and exploiting the main drivers of innovation management, which has led to many research articles that have adopted different approaches and identified several factors that are related to innovation. Nevertheless, there is some ambiguity about the critical behavioral factors for innovation. Therefore, this study aims to identify behavioral incentives, or key factors, that impact business innovation and financial stability, mainly in the field of strategic management, and to reveal the latest trend in corporate innovation policy by using bibliographic mapping. The purpose is to precisely define specific incentives that can influence the overall productivity and profitability of a business, and this list of innovation factors can be of benefit to a strategic manager in introducing or supporting innovative activities. The analysis is preceded by an in-depth study of publications from the Web of Science and Scopus databases and based on the VOS Viewer method (which is a mapping and clustering program for network data), the available keywords are analyzed, and then a list of incentives in strategic innovation is compiled.

Keywords: bibliometric analysis; business innovation; strategic and financial management; earnings; innovation factor

JEL Classification: M21; O16; O31; O32

1. Introduction

Undoubtedly, innovation is one of the most critical strategic and operational levels that is available to managers to create a competitive advantage. Wang (2018) suggested that there is a severe discrepancy between what the companies would like to achieve and what they gain from their investment in innovation. Conventional performance measurement approaches have had little impact on innovation management so far. Therefore, we analyzed some of the more relevant issues that many experts are dealing with innovation at the level of specification of individual factors. Above all, researchers have paid great attention to the identification and leveraging of key innovation management incentives at the enterprise level, leading to many research articles that have adopted different approaches and identified several factors that are related to innovation. Despite the vast amount of literature, there is a discrepancy in the identification of the critical factors of innovation and their implementation in an innovative culture within an enterprise (which is portrayed in the literature review), and it is therefore essential to address this issue.

The main aim of this paper was to reveal the latest trend in corporate innovation policy by using bibliographic mapping and to produce visual representations of mutual relations among all units of interest (e.g., key factors, keywords, and journals). The bibliographic mapping was focused on particular articles in selected journals that had been published in the reputable databases the Web of Science and Scopus, and it subsequently examined their significance concerning innovations in the company and identifies critical factors of innovation.

The purpose of this analysis was to highlight the importance of the determination of these factors and current trends that may affect the business, managerial, and especially, financial decisions.

Factors can be considered as interconnected networks that interact and work together to create value for an organization, which means that a missing factor can disrupt the system of interconnections and its functioning, thus hampering innovation (Lim et al. 2018). Analysis at individual levels, such as individual, team, and organizational, allows for the identification of innovation factors. Businesses have been relying on innovation for many years because it stimulates growth and sustainability. Innovations help companies to extend the development of new products or services as a result of new business opportunities (Wu et al. 2015). Without creating new products or services, it is difficult for businesses to maintain growth and stay ahead of their competitors (Schumpeter 1983). At the same time, an overview of the resources that are used by the company explains how the company develops its competitive advantage by the innovation capacity (Coff 1997). The resource-based view argues that a sustainable competitive advantage results from a unique set of resources that competitors cannot mimic (Barney 1991; Coff 1997; Rouse and Daellenbach 2002).

Innovation is an integral part of business. If innovation is not managed, it will be a big challenge for businesses to maintain a competitive edge and stay on the market. The economic success of companies depends on the innovation of their products and services (Tidd et al. 2013). They need to identify their innovative capabilities before they start participating in the management of innovation activities. It is vital that companies can measure their innovativeness, because something that is not measured cannot be controlled (Rejeb et al. 2008). By measuring innovation skills, businesses can change their business strategy (Cordero 1990). If the measurement is done correctly, companies can understand their current position and identify areas that need to be improved to expand future innovation activities (O'Regan et al. 2006).

A competitive environment creates an environment for companies that need new innovative products and services to succeed in the market. The importance of innovation has therefore been increasingly considered in business research, and the leadership styles of top managers are considered to be one of the most important factors that influence the creative behavior of employees and the innovative capacity of organizations (Jung et al. 2016). Innovation management is considered one of the most challenging aspects of current leaders (Oke et al. 2009). It includes not only the creative act of forming new ideas but also the targeted transformation of these ideas into useful products and services (Mumford et al. 2008).

The study consists of four parts. In the introduction, the importance and significance of the knowledge of the critical factors of innovation are mentioned, and then we analyze, in detail, the theoretical approaches of the innovation management. The third section depicts the methods that were used in the research paper, such as the VOS Viewer (a software tool for analyzing and visualizing scientific literature) and the analysis of the selected journals. The outcomes of the investigation and the detailed study are available in a list of innovative factors in the Results section. In the Discussion section, the possibilities of using processed data are portrayed.

1.1. Literature Review

Every business that wants to be successful in the long run needs an innovation management system so that it is not left to chance. Innovation management creates structures and framework conditions so that innovation potential can be systematically identified, and then ideas can be designed and successfully implemented. Managing innovation is necessary for determining the factors that

ensure innovation at each level in a company. Identifying key innovation factors at individual, team and organizational levels is an important goal, and a large number of articles from the Web of Science and Scopus databases were analyzed to identify them.

1.1.1. Individual Level

Several researchers have identified the individual level as one of the most important areas for innovation (Hammond et al. 2011; Anderson et al. 2004). Hammond et al. (2011) explored the impact of individual differences, motivation, and working qualities on workplace innovations within an individual level. Their meta-analysis showed that creative personality, openness, the complexity of work, autonomy, and role expectations have strong correlations with individual innovation. Intrinsic motivation, self-sufficiency, and creativity are positively linked to individual innovation.

Anderson et al. (2004) used a similar approach, suggesting that individual innovation requires a person to be capable (e.g., has some cognitive skills and personality characteristics) and willing (e.g., motivated and experienced) to be innovative (Giebels et al. 2016; Orth and Volmer 2017). Additionally, job characteristics such as autonomy and job requirements determine whether an individual will be involved in innovative behavior; that is, some individuals will leave the organization if they are dissatisfied, and others will try to change the situation (Schepers et al. 2016).

Additionally, the impact of psychological capital on innovative performance and stress is also essential. These issues were addressed by Abbas and Raja (2015), and their results showed that psychological capital is positively linked to innovative work performance and contrary to work-related stress. People with psychological capital were rated to show more innovative behavior, generate more support, and implement new ideas at their workplace. Bharadwaj and Menon (2000) also believed that individual creativity refers to the various activities that individual employees do to strengthen their ability to develop something meaningful and new to the working environment. In this respect, however, the responsibility of the organization introduces formal approaches, tools, and resources to promote creative behavior within the organization. Therefore, they concluded that the highest level of innovation performance was based on a combination of individual and organizational mechanisms of creativity.

Glynn (1996) stated that innovation is impossible in the absence of creative geniuses who initiate innovative processes and intelligent organizational systems that recognize and promote viable innovation. Internal motivation is seen as a necessity for creativity and innovation, and it is likely to have a stronger effect than external motivation. Motivational variables are necessary to have creative and original ideas and to apply them to organizational needs and challenges.

1.1.2. Team Level

Though many creative proposals come from an individual level, new ideas are generally implemented by working groups. Researchers have identified several team-level factors related to innovation in organizations. However, there are some variations in the extent and direction of the effects of these variables and the state of the literature on innovation at the team level, which is chaotic (Hülsheger et al. 2009). Nevertheless, some key variables have been described as necessary in most literature, such as factors that are related to the creation of an open and secure environment that allows for autonomy and proactive behavior. This case usually occurs in the socio-cultural context of a relatively lower power distance culture, where confidence can be more natural among stakeholders (Elenkov and Manev 2005).

Between globalized competition and shortened life cycles on the one hand and new opportunities on the other, businesses are increasingly confronted with the challenge of optimizing their innovation processes. While the implementation of approaches (such as open innovation and team collaboration) leads to desired success (Petkovska 2015; Tjosvold and Tjosvold 2015), empirical results show that under challenging phases (such as problem analysis and future scenario generation) team motivation can be maintained at a high level (Hahn et al. 2017). Teambuilding presents a variety of exercises that

include the belief that the team or organization supports teamwork, evaluates different views, and promotes risk-taking (Thayer et al. 2018).

Hemlin et al. (2008) addressed the creative knowledge environment in their study and explained that creative potential is expressed by different degrees depending on the context in which the group operates. They further argued that an innovative environment tends to emphasize diversity, flexible boundaries, collaboration, and teamwork, and it conveys a sense of collective pride and faith amongst employees.

Anderson et al. (2004) argued in their meta-analysis of team-level innovation predictors that team process variables (such as vision, innovation support, internal/external communication and cohesion) have a strong positive impact on innovation. The size of the team shows a positive relationship to team innovation, and, more significantly, it brings more knowledge and skills; however, at the same time, it shows a slightly negative relationship to individual innovations as a tendency to engage in social wasting time in larger teams. Anderson et al. (2004) found that team composition (heterogeneity) is of paramount importance because resources (knowledge, skills, abilities) to be innovative depend on variables such as diversity of knowledge and experience within team members. Thus, the creation of working groups or business units stimulates the process of collective learning and competence development by physical and non-physical interactions between organizational members. This fact also applies to the interaction between groups, and it is therefore essential to avoid intercontinental and in-house barriers as they can act as barriers to communication and stimulate internal culture as competitive rather than cooperative (Pitt and Clarke 1999).

Innovations and possibilities for management were discussed by Siddiq et al. (2016), and they used a brainstorming approach that brought together a group of experienced employees with a shared understanding of specific challenges to have open and creative conversations and find solutions to the problems. Similar issues were addressed by Paulus et al. (2016) and van Wulfen (2016).

1.1.3. Organizational Level

Organizational innovation is probably the most comprehensive level of analysis (Anderson et al. 2004). Various factors, such as individual characteristics (e.g., CEO openness) or organizational characteristics (e.g., market share, structure, culture, level of formalization, and environment) play an essential role. Hammond et al. (2011) noted that contextual influences are equally important for the stage of designing ideas as well as for the implementation phase. Positive atmosphere, sufficient resources, supervisor support, and the quality of leadership replacement are positively linked to innovative performance.

Three components of the organizational work environment were addressed by Amabile (1996) and include all the factors in businesses that have been identified as necessary for creativity and innovation. First, corporate motivation for innovation involves the absence of elements that can undermine creativity, e.g., political problems, destructive criticism, competition within the organization, strict control by senior management, and a surplus of formal structures and practices. Another component that is important for innovation promoting is the resource that includes everything that an organization has to support its work in the innovation target area. It may consist of many elements, such as sufficient time to produce new jobs, people with the necessary expertise, funding, material resources, systems and workflows, relevant information, and training. The last component includes the level of the organization as a whole and the level of individual departments and projects. Management is found to facilitate innovation by allowing for freedom or autonomy, linking individuals with work tasks (based on abilities and interests). It provides work supervision (precise planning and feedback, excellent communication between supervisor, and working group and support) and creates productive workgroups that represent a diversity of skills and knowledge.

Innovation communication plays a crucial role in ensuring integration in the various departments responsible for managing internal and external interests throughout the innovation process (Bruhn and Ahlers 2017). Looking at innovation and communication, the meaning and reality that are the prerequisites for news are based on communication relations between businesses and their internal and

external stakeholders (Patsch and Zerfass 2013). Innovations are also influenced by how conflicts are resolved. It turns out that the common evolution of subsequent problems and their solutions provokes the emergence and development of radical innovations.

Companies have a strong incentive to find innovative solutions to outstanding issues to achieve a competitive advantage in the markets (Coccia 2017). Sharing knowledge is another crucial factor for innovation.

Wang and Wang (2012) emphasized that knowledge sharing not only has a positive effect on performance but also influences innovation, which in turn contributes to the continuous performance. Spanish researchers, who tested the impact of different knowledge-sharing mechanisms on innovation capabilities and the effect of innovation capacity on business performance, were also dealing with a similar issue. The results obtained showed that knowledge sharing is a vital issue for strengthening innovation capacity (Sáenz et al. 2012).

The innovation system is failing due to structural problems, blocking its formation and spreading (Jung et al. 2016). To overcome such systemic failures, it is necessary to address the shortcomings of the existing system and create a new system and structure in which innovation actors can accelerate innovation. The study of Kratzer et al. (2017) was based on the fact that there is a common understanding that innovation is driven by people who are at the core of innovation activity in every business.

Integration processes that contribute to the integration of innovation capabilities are essential; however, the unity of purpose is also an important factor as it definitely has a strong effect of creating meaningful work for individuals with a mission to the organization as an entity (Denison and Mishra 1995). The ability to connect people from different backgrounds, disciplines, cultures, and generations is a matter of importance if enterprises want to meet their objectives (Ibarra and Hansen 2011). Adler et al. (2011) believed that it is a matter of combining a sense of shared intent with a supportive structure where businesses mobilize all workers, knowledge, talents, and expertise to promote innovation and efficiency.

The key to managers is also to align the implementation of the plan with the type of target (Earley 2015). Management by objectives (MBO) is a performance management approach that strikes a balance between employee goals and organizational goals. By increasing engagement, managers have the opportunity to focus on new ideas and innovations that contribute to the development and goals of organizations (Kearney and Berman 2018).

According to Foroudi et al. (2016) to understand the impact of innovation ability, we need to take into account the experience of customers and how they perceive a business, regardless of whether they have built a reputation and loyalty.

Innovation supports the need for constant change and renewal, which can affect all areas of business. A change often persists and requires appropriate incentives and rewards to support the necessary innovation (Hosking and Anderson 2018; Chapman and Hewitt-Dundas 2018).

Corporate culture-shared values, beliefs and behavior play an important role in shaping an innovative environment. Innovation performance can also depend on these factors, and it can be assumed that some differences in innovation activity and innovation results can be explained by differences in organizational culture (Kaasa 2016). This indicates a critical trend that shapes their innovative performance in terms of creating new ideas, knowledge, and skills (Halim et al. 2015).

Recently, profound technological changes and more significant customer demand have suddenly increased electronic service innovations. Innovation can be seen as the acceptance and spread of something new in a given context. E-commerce is also an innovation when it is introduced into a new emerging market environment or when a new class of user industries adopts it. Several global forces encourage the adoption of e-commerce, such as global competition, trade liberalization and ever-increasing advances in IT and internet (Hanna 2016). Recently, the increase in the use of e-commerce services has catalyzed the innovative development of robots for use in warehouses (Bogue 2016). Moreover, innovation in electronic services has had a positive impact on value creation (Chuang and Lin 2015).

To achieve a competitive advantage, it is often necessary to listen to and understand what customers say about their products and services (Kwon and Hong 2015; Hoornaert et al. 2017). The current social media analysis frameworks do not provide benchmarks that allow businesses to compare the sense of customer on social networks to quickly understand where a company is taking its actions correctly and where it must be improved (He et al. 2015). Benchmarking is seen as one of the basic techniques for identifying and evaluating competition information (Bogetoft 2013). The continuous implementation of this method should provide a range of valuable information about the competition, its strategic intentions, and financial results. The offered services or products of the competitor, or their costs, operating processes, used technology, and quality procedures can be compared. In terms of quality, Antunes et al. (2017) dealt with the relationship between innovation and overall quality management. Their study suggested that companies that adopt process innovation strategies are improving their performance, both operationally and financially, while product innovation only improves organizations' financial performance. Total quality management (TQM) procedures have also been found to support the definition of innovative product and process strategies. By using benchmarking in the area of business cost management, a category of cost benchmarking was created, and it is one of the necessary cost management tools that is applied in practice (Rolstadås 2013). Moreover, the appropriate process steps of the best-in-group company have been identified for these cost items. The goal is to reveal the potential for improvement (Popesko 2009).

The results of recent analyzes have suggested that internal learning mechanisms and external information exchange do not always work symbiotically. The new findings provide exciting results for (managing) innovation processes and supply chain relationships. Berghman et al. (2012) addressed these issues and, based on their analysis, detected that information from suppliers also has an essential impact on innovation and performance, so mutual collaboration is important.

Information systems are the main business asset in terms of the benefits they provide and their costs. Therefore, organizations must plan in a long-time horizon on how to acquire information systems and services that support business initiatives and the innovation process (Bruce et al. 2014). At the same time, companies must respond to emerging opportunities. Wilfredo Bohorquez Lopez and Esteves (2013) dealt with improving their knowledge-gathering and allocation process where businesses should configure internal and external networks to support the reorganization of their classic structures.

Over the past decade, sustainable innovation has taken a prominent position in many corporate agendas and is also one of the crucial factors of innovation at the organizational level (Dangelico et al. 2017). In general, sustainable innovation can be defined as innovation that must consider environmental and social issues, as well as the needs of future generations. Though sustainable innovation brings new opportunities for societies, it is much more complex, requiring some organizational skills to address upcoming challenges (Ketata et al. 2015). The innovation of eco-products is increasingly crucial for policy makers, companies, and society in general. As a result, the number of studies on the development of organic products has significantly increased in recent years, which has necessitated the analysis and synthesis of the effects of these studies (e.g., Dangelico 2016). Global companies such as Tesla, Ikea, Unilever, Nike, Toyota and Whole Foods generated at least $1 billion in revenue from products or services that are sustainable (Williams 2015). All these indications suggest that eco-product innovation is one of the significant shifts in our times, requiring attention and research to support managers and firms interested in selling "green products" (Kotler 2011; Slotegraaf 2012). According to Arundel and Kemp (2009), research into eco-innovation and data collection should not be limited to environmentally-oriented innovations but should include all products, processes, and organizational innovations with environmental benefits.

Another factor is the competence base, which includes employee appraisal based on their performance as individuals or groups, employee behavior following corporate values, and changes that the enterprise implements as part of its innovative philosophy. Performance evaluation is critical to the effective management of human capital, and employee appraisal helps develop individuals,

improves organizational performance and contributes to business goals (Ahmed et al. 2013). It is also essential to include the job and the adequacy of the post (Venkataramani et al. 2016). The performance of individuals against organizational goals determines whether an organization meets its goals. The fundamental objectives of performance evaluation are twofold: firstly to reward employees for achieving the organization's objectives, and secondly to determine which targets are not met and to develop action plans to ensure their achievement in the future (Islam and bin Mohd Rasad 2006). It is also vital that employees are familiar with and adopt the objectives and values of the business, and that their activities and behavior are consistent with the benefits of the company (Noe et al. 2017). Businesses are facing increasing demands for change, but they are often so challenging that they face considerable resistance. Changing organizational structure supports the development of a reflective approach to organizational change and provides an overview of why it may be challenging to maintain the dynamics of change processes (Alvesson and Sveningsson 2016).

The authors found strong evidence that employee-friendly and mentoring-friendly companies achieve greater innovation success, especially in sectors where innovation is more challenging to achieve. Additionally, employee-friendly companies have also been more inclined to maintain R&D investment. These findings are consistent with the view that an employee-friendly workplace helps develop tolerance towards failure, which promotes innovation engagement (Chen et al. 2016).

At the organizational level in the context of innovation, it is also essential to make decisions about launching new products, as these are sophisticated and risky efforts that companies must continually carry out. The launch of new products and their impact was addressed by Gielens (2012). The timing of the company deciding to launch a new product is also important (Araman and Caldentey 2016). The right timing and use of the opportunity were addressed by Klingebiel and Joseph (2016), who stressed that combining the right timing with the possible occurrence enables a company to earn the highest profits. They applied this theory in the framework of strategic analysis of mobile phones. It is vital to set up and manage teams when introducing and developing new products (Sivasubramaniam et al. 2012). Additionally, prototyping is an essential activity in most new product development processes. Whether the goal is to explore new opportunities or to improve existing solutions, prototyping can be a valuable tool (Elverum et al. 2016). If a company wants to start selling a new product or service successfully, it is essential to exclusively focus on the target groups. These may be customers who are now buying something similar and appreciate the additional features that are offered by the new product or service. That is why it is crucial to consider customer needs in the process of a new product development and thus to engage the customer in the creation process and to create a suitable strategy (Li and Atuahene-Gima 2001). Many companies lack a clearly worded and well-informed product innovation and technology strategy. Such an approach is necessary and is closely linked to a positive impact on product innovation (Cooper and Edgett 2010). According to Cui and Wu (2016), there are three forms of customer engagement in innovation: customer participation as an information source, customer engagement as co-creators, and customer participation as an innovator. They propose that these three forms of customer engagement use different ways of using customer knowledge and are therefore otherwise influenced by the nature of customer knowledge, the company's knowledge management strategy, and the organizational support for knowledge management implementation.

The issue of intellectual property rights is becoming increasingly important, especially for innovative companies seeking international growth that leads to a growing need for intellectual property research. However, it is not known how contemporary research responds to this new need (Acemoglu and Akcigit 2012). Therefore, Candelin-Palmqvist et al. (2012) found out how intellectual property research was developed in innovation management literature, and they identified current trends.

Additionally, it is crucial that the company has a plan to promote established innovations. Social media platforms provide an increasingly popular way for individuals to share content online. Though

it brings undoubted social benefits, including the content ability to spontaneously broadcast creates an ideal environment for reputation, it also brings the spread of misleading information (Webb et al. 2016).

It is also essential to follow competition tactics. There are several ways to find out the competition strategy. Turner (2012), for example, mentioned the use of "mystery shopping" in their publications—the concept of mysterious shopping.

The rapid and accurate identification of consumer requirements and the systematic assessment of product quality are essential for success in developing a new product, especially for fast-moving consumer goods (Yang et al. 2012). Therefore, the elimination of the information or knowledge deficit is the primary task of the successful implementation of the innovation process (Loučanová 2014).

In general, businesses are perceived as learning processes generating new knowledge or transforming established knowledge (Phang et al. 2008). Some scientists suggested that organizational learning will not only result in organizational innovation but also lead to a sustainable competitive advantage (Chang et al. 2008; Sinkula et al. 1997; Stata 1989). In the last two decades, TQM has also been seen as a management practice that provides organizations with better performance (Feng et al. 2006; Carlos Pinho 2008).

Many researchers are concerned with identifying attributes for applying knowledge management in innovation (Donate and Sánchez de Pablo 2015; Alegre et al. 2013; Durst and Runar Edvardsson 2012). They have further detailed the nature of the knowledge management task in innovation as well as its value offer. Innovation depends on the availability of knowledge and therefore needs to be analyzed, identified, and managed to ensure successful innovation (Jensen et al. 2016).

As with tangible assets, intangible assets such as innovations and brands need to be protected, thus achieving optimum use in business. However, on the other hand, it is essential to address the possibilities of commercialization. As the number of new products developed by new technologies are increasing, the importance of commercializing new technologies has become crucial for manufacturers to successfully deliver valuable new products and services on the market (Cho and Lee 2013).

In the case of implementing an idea that seems to be unsuccessful over time, there should be some degree of tolerance in the business (McDonald 2018). Risking is not natural for everyone. If an enterprise prefers a more stable, less risky situation, it should make an effort to change this attitude. The work of the 21st century requires leaders and leaders to be innovators and beneficiaries of risk (Nanda and Rhodes-Kropf 2016).

2. Materials and Methods

Currently, interest in bibliometric research is growing thanks to information and communication technologies that allow for the processing large amounts of data while providing the means to visualize the results comprehensibly and sophistically, usually in the form of science maps. The knowledge of bibliometrics is gradually becoming part of decision-making processes, and it also helps to identify new trends, and this information can also be useful for scientists themselves in their research activities (De Bellis 2009). Based on publications, bibliographic references, and citations, it is possible to explore historical developments in specific science areas and often uncover hidden relationships between disciplines, authors, and topics and visualize their interrelations. On the other hand, we can use bibliometric methods to identify the most recent issues of scientific research or the speed of their obsolescence. The first step of this study was the formation of the data set considering the publications focused on the innovation in the last 5 years (2014–2018)—this most recent time horizon was crucial for the correct determination of the latest trends. There was a need to find those sources in which the most important studies and research in the innovation were published. Several institutions are involved in assessing the importance of scientific journals. Among the most significant are the Web of Science and Scopus. Scopus uses the SCImago Journal Rank indicator (SJR indicator). It is a scientific journal ranking (SJR) measure of the scientific impact of a journal and calculates the prestige of the journal by using the number of journal articles citations and their importance. A variant to the SJR indicator is the impact factor used in Thomson Reuters. The impact factor refers to data from the

Web of Science database, and the difference between them is that when calculating the impact factor, it considers two years ratio, while the SJR puts it into a three-year ratio. The SJR is a measure of the scientific impact of journals that corresponds to the number of citations that are accepted by the journal, as well as the significance or prestige of the journals from which the citation originates. The higher the values of the SJR, the more prestigious the journal (Scimago Journal & Country Rank). Identifying the most relevant databases, the second step was to consider the main scientific publications—results analysis by treemaps where the development of studies was analyzed considering different aspects, e.g., categories, document type, source title, and authors. (the results analysis by treemaps is available in the Web of Science database). By analyzing the results by the source title, we were able to identify the most significant journals focusing on the innovations:

- IEEE Transactions on Engineering Management.
- Technovation.
- Technological Forecasting and Social Change.
- R&D Management.
- Research Policy.
- Journal of Product Innovation Management.

This group of journals was first analyzed by Linton and Thongpapanl (2004) and Biemans et al. (2007), then by Thongpapanl (2012), and followed by Sarin et al. (2018a, 2018b).

Thirdly, for each paper (focused on the innovation) from the identified significant journals, the following information was found: authors, title, name of the journal, citation details (volume, issue, and page numbers), abstract, keywords, and a record of cited references (Garcia-Machado 2018). All the data were used in the bibliometric analysis to form maps and figures in the results section of this paper. Together, almost 3000 papers (most cited articles) focused on innovation were analyzed in the given period; they were identified by using a computer analysis (Van Eck et al. 2010): 1552 in the journal Technological Forecasting and Social Change, 252 in the R&D Management journal, 741 in the Research Police journal, and 350 in the Journal of Product Innovation Management.

All considered articles were downloaded from the journals, and, finally, the VOS Viewer was used to produce the term/bibliometric maps based on the co-occurrence frequencies of terms, which are a commonly used measure of the relatedness of terms. Van Eck et al. (2010) claimed that the VOS Viewer is especially useful for displaying large bibliometric maps in an easy-to-interpret way. Thus, the interpretation of the map is crucial to understand the results. VOS Viewer is a software tool for creating maps based on network data and for visualizing and exploring these maps. VOS Viewer can be used to construct networks of scientific publications, scientific journals, researchers, research organizations, countries, keywords, or terms. Items in these networks can be connected by co-authorship, co-occurrence, citation, bibliographic coupling, or co-citation links (Van Eck and Waltman 2020). When working with co-authorship, citation, or bibliographic coupling links, the citations attribute indicates the number of citations that were received by a document or the total number of citations that were received by all documents published by a source, an author, an organization, or a country. When working with co-citation links, the citations attribute indicates the number of citations that were made to a cited reference, a cited source, or a cited author. When working with keywords, the occurrences attribute indicates the number of documents in which a keyword occurs (Van Eck and Waltman 2020).

Items may have various attributes in VOS Viewer. If items are assigned to clusters, cluster numbers are an example of an attribute. Special importance is the weight. These attributes are represented by numerical values. Weight attributes are restricted to non-negative values (Van Eck and Waltman 2020). The higher the weight of the factor, the larger the label and the circle of the item; the stronger the relationship between the terms, the smaller the distance between them in the map. In the visualization of a map, items with a higher weight are shown more prominently than items with a lower weight. There are two standard weight attributes, referred to as the links attribute and the total link strength

attribute. For a given item, the links and total link strength attributes indicate, respectively, the number of links of an item with other items and the total strength of the links of an item with other items (Van Eck and Waltman 2020). Different colors are used to determine the clusters of the terms—the same color means that terms within the cluster are more closely related than terms in different clusters. An item may belong to one cluster only. Items may have various attributes in VOS Viewer. In the network visualization, items are represented by their label and, by default, also by a circle. The color of an item is determined by the cluster to which the item belongs. Lines between items represent links.

We used the map creating based on bibliographic data and the normalization method Association strength was used. If this option is selected, the association strength method is used for normalizing the strength of the links between items (Van Eck and Waltman 2020). Resolution was used for clustering. This parameter determines the level of detail of the clustering that is produced by the VOS clustering technique. The parameter must have a non-negative value. The higher the value of the parameter, the larger the number of clusters produced by the VOS clustering technique. In our cases, the minimum number of a keyword occurrences to be selected for the analysis was the occurrence of 25 times. The keywords with the greatest total link strength were selected and verified.

As asserted by Heersmink et al. (2011), VOS Viewer is an excellent tool for the formation of maps of authors and journals based on co-citation data or keywords.

3. Results

To identify critical factors, the VOS Viewer was used to show their occurrence from innovation-oriented journals. In this part, we performed the bibliometric analysis with the help of the VOS Viewer tool. By using this approach, it was possible to find out the degree of linking of articles with its authors from different countries, citations, the number of documents, the occurrence of keywords, citation map from various databases, as the program allowed us to process data from the Web of Science, Scopus, PubMed, RIS and Crossref JSON databases.

Figure 1 shows the network visualization of the keywords from the IEEE Transactions on Engineering Management Journal. We decided to analyze the keywords to use this information to identify innovation-related factors.

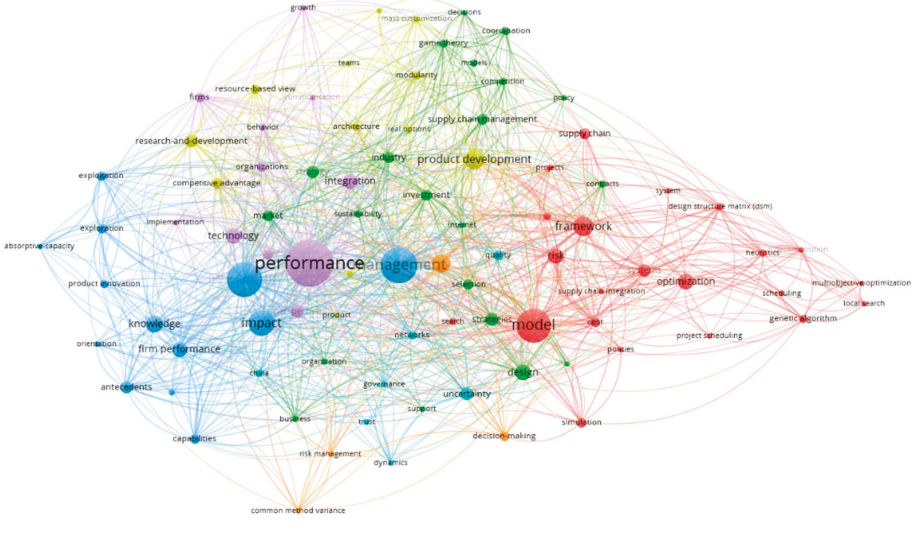

Figure 1. VOS Viewer: keywords from the IEEE Transactions on Engineering Management Journal. There were seven clusters detected in this journal; the total number of keywords was 90.

A total number of seven clusters were identified in the IEEE Transactions on Engineering Management Journal (See Figure 1). In the first cluster, there were 22 keywords, including optimization, project management, risk, simulation, and policies. The second cluster included 21 items such as competition, markets, and sustainability. The third cluster contained 13 keywords (exploration, capabilities, knowledge, product innovation, etc.). The fourth cluster contained 12 keywords (teams, flexibility mass customization, modularity, etc.) The fifth cluster contained 11 keywords (communication, growth, implementation, organization, performance, success, etc.). The next sixth cluster included seven keywords (China, networks, quality, and trust). The last cluster contained only four items (common method variance, decision-making, information, and risk management).

The total number of clusters in the Technovation Journal was six (Figure 2). In the first one, there were 23 items (competitive advantage, exploration, market, integration, R&D, etc.). There were 17 keywords in the second cluster (institutions, enterprises, patent, policy, investment, etc.), and the next cluster also included 17 items, such as industry, product, radical innovation, and adoption. The fourth cluster contained 15 items, including networks, evolution, design, and biotechnology. The fifth cluster comprised 14 items (future, performance, start-ups, etc.). The last cluster contained 14 items, such as discovery, business, communities, and creation.

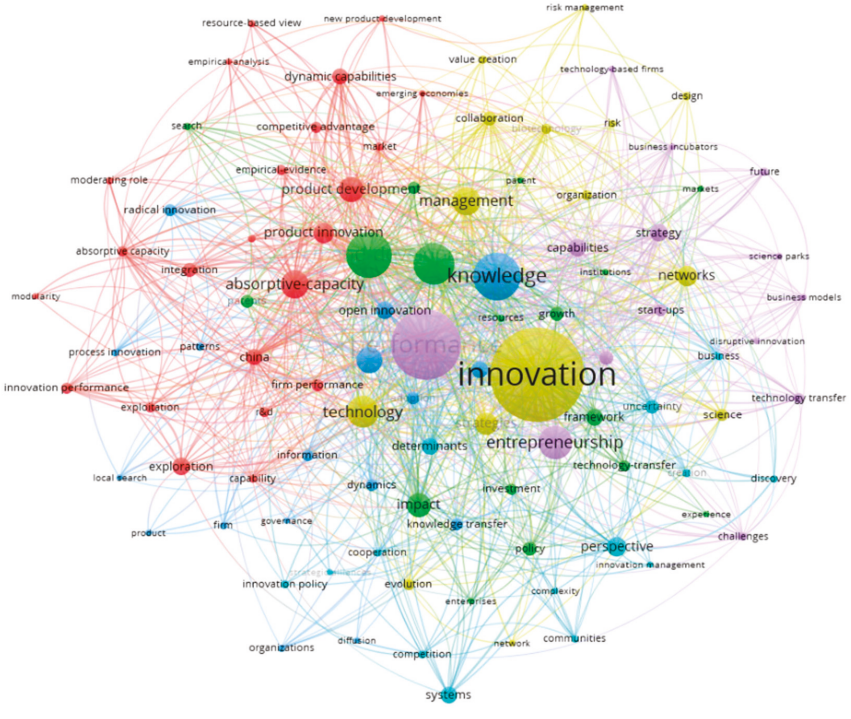

Figure 2. VOS Viewer: keywords from the Technovation Journal. There were six clusters detected in this journal; the total number of keywords was 100.

The next analyzed Technological Forecasting and Social Change Journal contained the highest number of articles, and the number of clusters was eight (See Figure 3). The first was a total of 112 items and included keywords such as DEA (data envelopment analysis), eco-innovation, efficiency, knowledge economy, patents, and technological innovation. The second cluster contained 106 items and included keywords such as barriers, adoption, consequences, and creative economy. The third cluster comprised 93 items such as climate change, e-government, energy policy, health, and wind energy.

In the next cluster, there were 73 items including alliances, cooperation, education, and networks. In the fifth cluster, there were 71 items such as advantage, complexity, entry, and stakeholders. The sixth cluster included 62 items (citations, discovery, imitation, intellectual property, etc.). The next cluster contained 39 items and incorporated keywords like scenario, selection, democracy, and uncertainty. The last cluster involved the least number of items at 30, among which there were items such as diversity, openness, universities, and perspective.

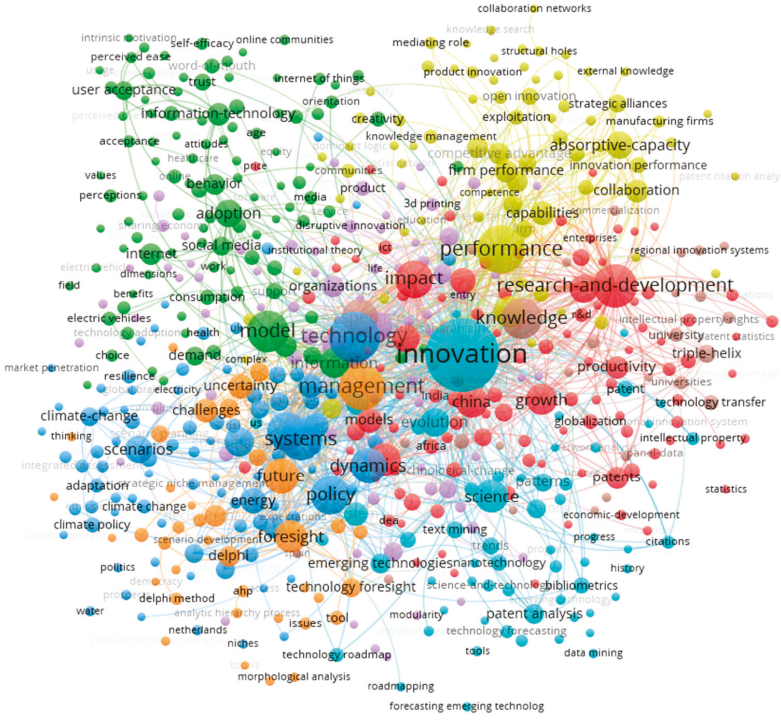

Figure 3. VOS Viewer: keywords from the Technological Forecasting and Social Change Journal. Eight clusters were detected in this journal; the total number of keywords was 586.

The Journal R&D Management keywords split into seven clusters (Figure 4). The first included 16 items, such as impact, strategy, value creation, and appropriability. The second cluster contained 14 keywords, such as evolution, indicators, and portfolio management. The third had 12 items (cooperation, model, productivity, work, etc.). There were ten keywords in the fourth and fifth clusters. In the fourth, we found challenges, networks, trusts, and uncertainty. The fifth cluster included five keywords—absorptive-capacity, competitive advantage, dynamic capabilities, product development, and resource-based view.

In the next journal (Research and Policy; see Figure 5), the keywords were grouped into eight clusters. The first cluster included 78 keywords, including career, communities, internet, mobility, and university research. There were sixty-six items included in the second cluster (adoption, globalization, environmental innovation, technological change, and others). In the third cluster, there were 52 items, such as failure, open innovation, patent, and vertical integration. The fourth cluster contained 44 keywords, including experience, government, sector patterns, and market structure. The fifth cluster comprised 34 items (firm survival, labor mobility, proximity, trade, and others). The sixth cluster included 33 keywords, including diversification, heterogeneity, market value, and specialization.

The seventh cluster contained 28 items, including patenting, invention, returns, and contracts. The last cluster included ten items, such as knowledge, design, product, and technological innovation.

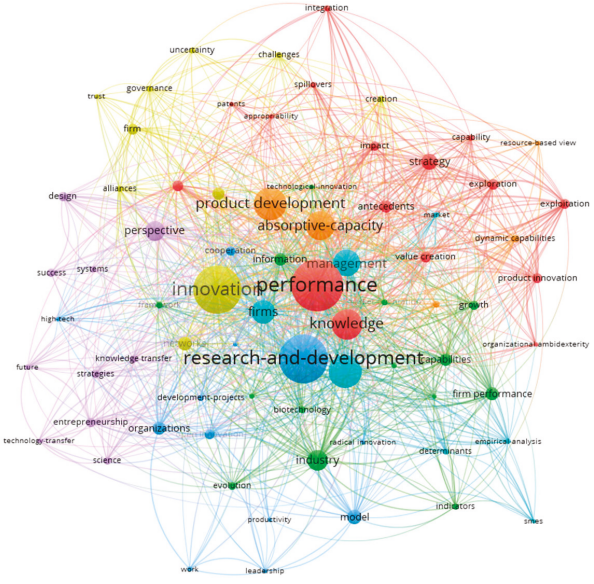

Figure 4. VOS Viewer: keywords from the R&D Management Journal. There were seven clusters detected in this journal; the total number of keywords was 74.

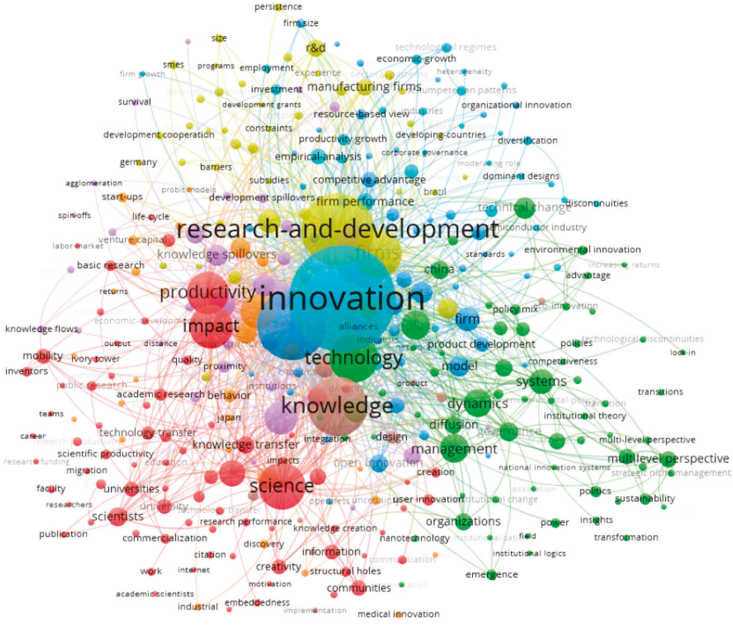

Figure 5. VOS Viewer: keywords from the Research Policy Journal. There were eight clusters detected in this journal; the total number of keywords was 345.

There were seven clusters in the Journal of Product Innovation Management (Figure 6), and the first involved 25 items, among which we could find capability, determinants, industry, and strategy. The second contained 21 items (adoption, behavior, performance, social network, etc.). The third included a total number of 20 items, and there were keywords such as customer, employee creativity, perceptions, and work-environment. In the fourth cluster, there were 16 items, including management, risk-taking, moderating role, and socioemotional wealth. The fifth cluster comprised 12 items (empirical-evidence, project, resource-based view, systems, and more). The sixth cluster including 11 items, such as benchmarking, technological innovation, strategies, and advantage. The last seventh cluster contained three keywords, namely local search, mediating roles, and organizational ambidexterity.

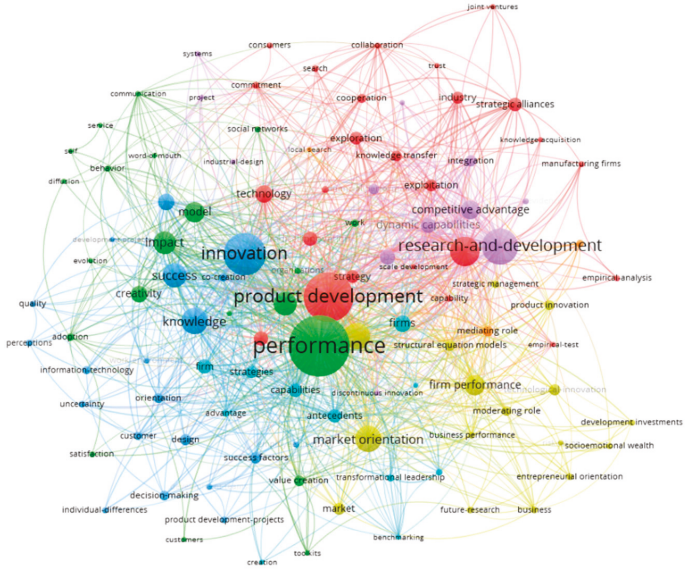

Figure 6. VOS Viewer: keywords from the Journal of Product Innovation Management. There were eight clusters detected in this journal; the total number of keywords was 345.

It can be concluded that despite the different prestige of the journals considered, measured both by the impact factor or SJR indicator, the topics of the authors concurred and the most important topics (considering the period 2014–2018) were technologies, performance, product development, knowledge and science, research and development. The way innovations have been recently managed is dramatically different compared to other past periods and reflects the changes on the global market related to the globalization of processes, the era of digitalization, and computerization. In order to stay competitive and financially sound, enterprises have had to develop incremental and disruptive innovations that are mostly associated with product development and plentiful information flows supported by the adoption of new technologies in business structures. Other important factors of smaller weights (marked by smaller circles in individual figures) are to be seen in the individual bibliometric maps.

4. Discussion

To confirm the importance of the findings in the bibliometric mapping, we tried to compile a list of factors and involved indicators that support these factors when studying other important pieces of research and discussing the relevance of the obtained results. Each indicator was confronted with key research study related to the innovative area (Table 1). Several studies, such as Linton and Thongpapanl (2004), Terziovski (2010), and Sarin et al. (2018a), helped process this section.

Table 1. Identified innovation factors.

Factor	Indicator	Study
Innovation ability	Communication	(Patsch and Zerfass 2013)
	Knowledge sharing	(Sáenz et al. 2012; Wang and Wang 2012)
	Barriers	(Jung et al. 2016; Kratzer et al. 2017)
	Unity	(Adler et al. 2011; Ibarra and Hansen 2011)
	Change implementation	(Hosking and Anderson 2018; Chapman and Hewitt-Dundas 2018; Alvesson and Sveningsson 2016)
	Culture of innovation	(Halim et al. 2015; Kaasa 2016)
	Tolerance of ineffective ideas	(McDonald 2018; Chen et al. 2016)
	Risk-taking	(García-Granero et al. 2015; McDonald 2018; Nanda and Rhodes-Kropf 2016; Thayer et al. 2018)
	MBO	(Kearney and Berman 2018)
Personality	Autonomy	(Giebels et al. 2016)
	Openness	(Orth and Volmer 2017)
	Leadership	(Elenkov and Manev 2005)
Motivation	Career growth	(Noe et al. 2017)
	Stimulating tasks	(Schepers et al. 2016)
	Evaluation of work results	(Ahmed et al. 2013; Noe et al. 2017; Islam and bin Mohd Rasad 2006)
	Influence of decision	(Luhmann 2018; Irawanto 2015)
Teamwork	Teambuilding	(Hahn et al. 2017; Petkovska 2015; Tjosvold and Tjosvold 2015)
	Brainstorming	(Siddiq et al. 2016; Paulus et al. 2016; van Wulfen 2016)
Cooperation and problem solving	Department cooperation	(Mehralian et al. 2017; Tjosvold and Tjosvold 2015; Petkovska 2015)
	Conflict solving	(Coccia 2017)
Sustainable development	Environment	(Slotegraaf 2012)
	Customer ecological requirements	(Kotler 2011)
	"Green products	(Mala and Bencikova 2018; Dangelico 2016)
	Environmental technologies	(Smith and Stirling 2018; Ketata et al. 2015)
	Environmental impact	(Arundel and Kemp 2009)
	Recycling	(Arundel and Kemp 2009)
Working characteristics	Working pressure	(Abbas and Raja 2015)
	Adequate job classification	(Venkataramani et al. 2016)
	Consulting	(Chen et al. 2016)
Cognitive abilities	Divergency	(Anderson et al. 2004)
	New ideas	(Irawanto 2015; García-Granero et al. 2015)
	Spreading new ideas	(Thayer et al. 2018)
Benchmarking	Market research	(Janoskova and Krizanova 2017; He et al. 2015)
	Product comparison	(Bogetoft 2013)
	Cost comparison	(Rolstadås 2013; Popesko 2009)
	Comparison of operational processes	(Kwon and Hong 2015)
	Technology comparison	(He et al. 2015)
	Quality comparison	(Antunes et al. 2017)
Organizational intelligence	Customer feedback	(Hoornaert et al. 2017)
	Opinions from suppliers	(Berghman et al. 2012)
	Information from literature	(Bruce et al. 2014)
	Information from the internet	(Wilfredo Bohorquez Lopez and Esteves 2013)
	Learning from employees	(Bruce et al. 2014)
E-commerce	Cooperation on the internet	(Chuang and Lin 2015)
	Presentation of products	(Hanna 2016)
	Transactions	(Hanna 2016)
	Restructuring of business model	(Bogue 2016)
	Global innovation networks	(Bogue 2016)
Knowledge management	Intern information exchange	(Alegre et al. 2013; Jensen et al. 2016; Durst and Runar Edvardsson 2012)
	Access to information	(Donate and Sánchez de Pablo 2015; du Plessis 2007)

Table 1. *Cont.*

Factor	Indicator	Study
Intellectual property	Patents	(Candelin-Palmqvist et al. 2012)
	Competitive advantage	(Candelin-Palmqvist et al. 2012)
	Auditing	(Acemoglu and Akcigit 2012)
	Promotion plan	(Webb et al. 2016)
	Competition tactics	(Turner 2012)
	Forecasting sales, preferences	(Yang et al. 2012; Loučanová 2014)
Business strategy	First on the market with new product	(Gielens 2012)
	Regularly introduced products	(Elverum et al. 2016; Li and Atuahene-Gima 2001)
	Responding to opportunities	(Suszynska 2017; Klingebiel and Joseph 2016)
	Market and financial risk	(Oláh et al. 2019; Dvorsky et al. 2018)
Commercialization	Time	(Klingebiel and Joseph 2016; Araman and Caldentey 2016; Janoskova and Kral 2015)
	Distribution control	(Aarikka-Stenroos and Sandberg 2012)
	Organizational knowledge	(Lin et al. 2015)
	Product complexity	(Cho and Lee 2013)
	Meetings	(Siddiq et al. 2016; Paulus et al. 2016)
Development of new products	New product strategy	(Cooper and Edgett 2010)
	Customer requirements	(Popescu Ljungholm 2018; Cui and Wu 2016)
	Development documentation	(Cooper and Edgett 2010)
	Foreign customer requirements	(Cui and Wu 2016)
TQM/learning organization	Creating value for customer	(Love et al. 2000)
	Customize products to customer	(Mahmood et al. 2015)
	Customer loyalty	(Foroudi et al. 2016)
	Fast response to customer needs	(Yang et al. 2012; Zizlavsky 2016)

The identification of the crucial factors of innovations both by the bibliometric analysis and the systematization of notable published papers that have focused on theoretical and practical knowledge reveal that the main factors that have been identified are mostly the same. Moreover, the factor indicators seem to correspond with factors of lower weights (having a smaller circle) that were identified in the term maps.

Despite the robust results of the analysis, there were some limitations that need to be mentioned. We only use the VOS Viewer software solution to identify the crucial factors of innovation; some studies have dealt with the identification of innovation factors by another style and method. Only six specialized journals were chosen for this research that summarized the most cited articles.

The VOS Viewer software solution is a handy tool for processing large numbers of articles and can be used in different areas. In this case, we applied it to analyze innovation factors in the most significant journals. By considering the term maps in the selected journals, product development, performance, research and development, it can be concluded that innovation technologies, knowledge and science have been the most important topics in the last five years. Additionally, the output of the research can be adopted in further research connected with the corporate practice to confirm the adequacy of constructed factors in the analysis of principal components and factor analysis, supported by Cronbach's alpha. Then, it is possible to examine the interdependence or correlation between identified innovative factors and deal with innovative efficiency by regression analysis and data envelopment analysis.

5. Conclusions

The basis for a prosperous business is a systematic and goal-directed strategic management that must, above all, be based on the innovation. Innovation processes are specific and unique tools of business activity that allow for the possibility of gaining a competitive advantage and eliminating possible risks in the financial decision making on the other. The results of the realized bibliometric mapping revealed innovative factors and involved indicators, providing information about the most important topics in the field of innovations in the last years, i.e., corporate performance,

product development, knowledge and science, research and development, and new technologies. The findings may be useful, not only for academics to choose the direction of their research in the innovation management but also for experts to improve their knowledge and develop new ideas when making all kinds of corporate decisions. Taking the constantly changing and developing environment into account, the future topics influencing the innovations could be related to the fourth industrial revolution—Industry 4.0 (including smart manufacturing, internet of things)—and also moonshot thinking, 5G revolution, kinesthetic (haptic) communication technology, and gamification (the application of a gameplay mechanism to non-game situation). Knowing the crucial factors of innovations presents the perfect start point for strategic management and to be the leader, not only the follower on the market, and to spend the corporate finance effectively. The disclosure of innovative factors helps strategic and financial managers to use them in such a way that can come up with what the market requires at the right time and place.

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Towards Improving Households' Investment Choices in Tanzania: Does Financial Literacy Really Matter?

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Abstract: This paper primarily aims to assess the impact of financial literacy on households' investment choices. The paper employs secondary data from the FinScope survey (2017) conducted by Financial Sector Deepening Trust (FSDT). In particular, the study aims at establishing whether the choices of investment platforms are influenced by the financial literacy level of the heads of households. To do so, the study employed both bivariate and multivariate analytical techniques. The study finds that financial literacy is positively and significantly associated with household investment choices. More specifically, as households become more financially literate, they divert from investing in informal groups towards more formal investment platforms such as investment accounts, agricultural ventures as well as personal business. Such observations may be partly attributable to the facts that individuals whose financial literacy is sound enough are more likely to be equipped with skills and knowledge of risks associated with investment opportunities and some other several financial products. The study also reveals that financial literacy is significantly associated with households' socio-demographic factors, and that the adult population exhibits a large financial literacy gap and, therefore, adults should not be considered as a homogenous group—instead, gender, age, education and income levels of the households, which are showcased in this study, should also be taken into consideration. The study opines that, because most of households, as revealed in the survey from which the employed dataset is based, are hailing from rural settings where agriculture is the main economic activity, we establish that agricultural ventures require a complete revamp for Tanzania to become a middle-income economy through its industrialization agenda. The study also proposes the financial literacy programmes to be rolled on to students from early stage of their education such as secondary schools.

Keywords: age; gender; education; financial literacy; investment choices

1. Introduction

The world economy is currently going through some economic challenges such that every individual needsto be active and smart in investment decisions so as to cater for the rising cost of living. Many individuals consider investments to be captivating because they make decisions and later see the outcomes of the decisions they make (Awais et al. 2016). So ideally, everybody contributes toone form of investment or another; even those who do not participate in investment activities related to buying and selling of financial instruments and other related assets still take on investments through participation in other forms, for instance, pension plans and employee savings programs, buying life insurance, real estate investments and investment in bank fixed deposits (Gallery et al. 2011). However, investments in any form require a sufficient level of financial education, which is a challenge to most individuals who would wish to engage in investment ventures. The role of financial education in improving decision making abilities of individuals has long been recognized across the world. In actual fact, financial literacy helps households in making sound and informed investment decisions,

and this may lead to future income and subsequently to economic growth, as clearly determined by Claessens et al. (2009). According to Claessens et al. (2009) financially literate households, as opposed to their counterparts, illiterate ones, have a greater ability to access financial services, which may enable them to improve their economy byinvesting in education and health (contributing to human capital), starting business ventures and expanding existing investments.

Generally, sophisticated investment decisions such as on the type of financial assets to invest in, and the type of financial institutions to engage with all require a reasonablelevel of financial literacy for one to make viable decisions (Lusardi 2008). Studiessuch as Hastings and Mitchell (2011) emphasize the position of financial literacy in the economy. According to these scholars, financial literacy contributes very much topoverty eradication, improving the living standards of households, improving the market efficiency and ultimately improving economic development.

The United Nations' Sustainable Development Goals (SDGs) purposely recognized the importance of financial literacy by pronouncing goal number four to be"ensuring inclusive and equitable quality education and promote life-long learning opportunities for all." The purpose of this goal is to provide direction to countries towards improved anfinancial literacy level of users and providers of financial services by inspiring these countries to integrate financial education into their local curricula by the end of 2020.

Tanzania hasnot been left behind in taking the direction shown by the United Nations' Sustainable Development Goals (SDGs). It is categorically highlighted in the Tanzania Development Vision (2025) that financial illiteracy hampers access to financial services, which negatively affects the country's economic competitiveness in the global market. To implement this vision, through the Bank of Tanzania, Tanzania established the national financial education framework in 2016 with the sole aim of boosting levels of financial literacy among households (Bank of Tanzania 2016).

Apparently, in Tanzania there is a rapidly growing trend of savings and lending groups among households, especially women. Most of the group members in such savings and lending groups usually end up taking-over members' assets due to their failure to repay the borrowed money from the group. One of the pressing reasons for failure to repay such debts is associated with the wrong choice of investment avenues by members after borrowing the money, due to a lack of proper financial literacy.

Some of the research on financial literacy is not consistent as to whether the financial education programs improve financial decision-making competence of the beneficiaries (Al-Tamimi and Kalli 2009; Gallery et al. 2011; Brown and Graf 2013). Of more interest is the topic of financial literacy in Tanzania where, regardless of the inauguration of National Financial Education Framework the majority of Tanzanians are still financially illiterate and relatively poor, and there is a scarcity of scholarly works which investigate the value of financial literacy in improving mobilization of wealth among Tanzanian households through investment ventures. This study aims at examining the influence of financial literacy on households' investment choices. We use the credible dataset from FinScope (2017) with their respective definitions of financial literacy and investment choices. To the best of the author's knowledge, this study is among the first of its kind to be conducted in Tanzania. The findings of the paper have a significant implication for financial education and public policy programs.

2. Literature Review

2.1. Theoretical Underpinnings

OECD (2005) defines financial literacy as "the process by which financial consumers/investors improve their understanding of financial products, concepts and risks, and through information, instruction and/or objective advice, develop the skills and confidence to become more aware of the financial risks and opportunities to make informed choices to know where to go for help and to take other effective actions to improve their financial wellbeing". Thus, it can be correctly stated that financial literacy improves households' ability to know, monitor and effectively use financial resources to enhance their economic well-being. The measurement of financial literacy is not an easy task.

According to Lusardi and Mitchell (2011), as quoted "While it is important to assess how financially literate people are, in practice it is difficult to explore how people process economic information and make informed decisions about household finances". Other definitions are also available in the literature. According to Beverly et al. (2003), financial literacy is the ability of an individual to possess financial knowledge. Mandell (2008) considers financial literacy as the ability to evaluate the new and complex financial instruments and make informed judgments on both the choice of instruments and extent of use that would be in their own best long-run interests. Also, we have Schagen (2007) who defines financial literacy as the ability to make informed judgements and to take effective decisions regarding the use and management of money. Furthermore, Nguyen and Rozsa (2019) categorize the definition of financial literacy into basic literacy, which includes the individual's understanding of basic financial concepts such as compound interest, inflation, the time value of money, the money illusion and the advanced financial literacy, which calls for understanding of individuals of financial issues such as risky assets, long-term period returns, volatility, diversification, asset allocation, performance, risk rating and return rating.

Investment choice is one of the important decisions when it comes to investment ventures done by households across the world. Consequently, empirical studies confirm that financial education is paramount in investment choice decisions (Falk et al. 2010; Rooij et al. 2011; Brown and Graf 2013). Literature recognizes the importance of financial literacy in investment choices, and several studies (Al-Tamimi and Kalli 2009; Brown and Graf 2013) have established a relationship between financial literacy and investment choices in different markets ranging from financial markets to physical markets, which ultimately results in an improvement in the living standards of households and thereby leads to economic growth in developing countries, Ellis et al. (2010). Financial illiteracy among households results in an inability to manage savings and investments.

On the one hand, financial literacy aids households in making well-informed financial decisions concerning investments and savings, and also makes them able to mitigate prospective financial risks linked with financial services and products. On the other hand, financially literate households ordinarily demand more financial services and products, consequently leading to reinforcement of the financial market firmness or stability and remarkably leading into economic growth and development (Ellis et al. 2010).

2.2. Empirical Literature

It is indisputable that a low level of financial literacy leads individuals to make sub-optimal economic choices and commit financial mistakes. On the asset side of the household balance sheet, poor financial literacy affects saving and investment decisions, accumulation of wealth, access to financial markets and portfolio choices. In particular, a poor level of financial literacy is related to lower savings and wealth accumulation before retirement (Lusardi and Mitchell 2007; Clark and Strauss 2012; Bernheim and Garrett 2012), leads investors to choose high-fee investment funds (Hastings and Tejeda-Ashton 2008; Hastings and Mitchell 2011), reduces access to financial markets and stockholdings (Christelis et al. 2010; Rooij et al. 2011; Klapper and Lusardi 2013; Cole and Andrew 2014) and induces sub-optimal portfolio diversification (Guiso and Jappelli 2009; Abreu and Mendes 2010; Santos and Abreu 2013). On the other hand, onthe liability side, poor financial literacy influences financing decisions in terms of funding costs, refinancing choices and risk of over-indebtedness and financial distress. Lower levels of financial literacy are associated with higher mortgage fees (Campbell 2006; the use of more expensive financing alternatives Agarwal et al. 2009), over-indebtedness (Stango and Zinman 2009; Lusardi and Tufano 2008) and mortgage delinquency. The social negative outcome of poor financial literacy is, therefore, financial fragility (Lusardi and Mitchell 2007; Lusardi and Tufano 2008).

Some research work, for instance Christelis et al. (2010), insist on the importance of financial literacy in preventing households from making poor financial decisions. According to the authors, a higher level of financial literacy increases level of households' living standard. Furthermore,

poor financial literacy leads to negative credit behavior, which causes higher indebtedness and debt accumulation problems, high-cost borrowings and loans and making unideal choices form ortgages and other financial products (Lusardi and Tufano 2008).According to Lusardi and Tufano (2008), one may claim that financially literate consumers make better financial decisions, have more chances to invest on stock markets, diversify risk, obtain cheaper borrowing and mortgages, avoid getting into debts, manage efficiently their investments, plan for retirement and accumulate more retirement savings.

Previous empirical studies have established a strong relationship between financial literacy and different perspectives of investment decisions (Al-Tamimi and Kalli 2009; Gallery et al. 2011; Brown and Graf 2013). According to literature (Al-Tamimi and Kalli 2009; Gallery et al. 2011; Brown and Graf 2013), successful financial decision making is the function of different factors including financial information, residence of the households and demographic factors of the households. The investment behavior of the investors can be influenced by the level of financial information that the decision maker possesses. Chong and Lai (2011) describe financial information to include accounting reports, general information about price movements, a firm's reputation, status of a firm in the investment market, past performance of the firm's stock as well as the expected performance of the firm. According to Chong and Lai (2011), when implementing a particular investment decision, decision makers seek information on a firm's performance as well as the investment behavior of other investors in the market, and that the timing and delivery of such market information is very crucial in influencing how investors make their decisions.

Similarly, findings of previous studies from developed economies such as Lusardi and Mitchell (2006) and Rooij et al. (2011) reveal that informal sources of financial information e.g., information from friends and families do not necessarily make individuals financially literate. Likewise, those individuals who have high level of financial literacy mostly rely on formal financial advice like that provided by professional financial advisors.

3. Methodology

3.1. Data

This paper employs secondary data from the FinScope survey (FinScope 2017) conducted by Financial Sector Deepening Trust (FSDT) in collaboration with the Bank of Tanzania (BOT), National Bureau of Statistics (NBS) and Ministry of Finance and Planning (MoF). This is a national survey representative of adult individuals living in Tanzania. The survey considers an adult to be any Tanzanian who is 16 years or older at the time of conducting the survey. The survey targeted 1000 enumeration areas (EA) from five regions in the Tanzania mainland, namely Iringa, Singida, Mtwara, Rukwa and Mwanza. However, only 998 enumeration areas were reached to interview 9459 respondents from the sample of 10,000 respondents. In addition, because the focus of this study is on the household level, the analysis data was collapsed to 3812 households, limiting respondents to the heads of the households.

3.2. Variable Description

Financial Literacy

In this paper, financial literacy is measured in terms of an elementary financial understanding of three key components: interest rates, discounting and borrowing, as used in a FinScope (2017) survey where the data of this study are adapted from. This approach is also proposed by Lusardi and Mitchell (2011), where three questions are asked to the households to test their knowledge of the aforementioned concepts, including interest rates, discounting and borrowing. Each correctly answered question is awarded one point, while an aggregate score is calculated by taking the average of the results of the three questions, and is considered as the measure of the financial literacy, termed AGG_FL (Aggregate Financial Literacy).AGG_FL is an ordinal variable which takes the value of 1 if the respondent answers

all three questions correctly and therefore is considered financially literate, and is 0 otherwise. The rest of the variables are described in Table 1 below.

Table 1. Variables Description.

S/n	Variable	Description	Nature
1.	Investment Choices	i. Informal Groups ii. Agriculture iii. Personal Business iv. Investment Account	*Categorical variables*; In each investment choice, the variable takes the value 1 if the choice is either Informal, Agriculture, Personal Business or Investment Account; Otherwise, the variable takes the value 0 for each respective choice.
2.	Age **(*age*)**	Number of years lived by the household head	*Continuous Variable*
3.	Gender **(*gender*)**	Sex of the head of the household	*Dummy variable:* It takes the value of 1 1 if the head of the household is male and 0 if female.
4.	Income **(*hhincome*)**	Represents household annual income	*Continuous Variable*
5.	Education level **(*edu*)**	Represents highest level of education reached by the head of the household. i. No Formal Education ii. Primary iii. Secondary iv. Tertiary	*Categorical variables:* 1 if no formal education, 0 otherwise; 1 if primary education, 0 otherwise; 1 if secondary education, 0 otherwise; 1 if tertiary education, 0 otherwise.
6.	Employment **(*emp*)**	Represents an employment status of head of the household whether he/she is employed or not	It is a dummy variable with a value of 1 if the head of the household is employed and 0 otherwise.
7.	Information **(*info*)**	Indicates the source of financial-related information obtained by head of the household whether formal or informal	This is a dummy variable with the value of 1 if the source of information regarding financial matters is formal and 0 for informal sources
8.	Location ***(loc)***	This denotes the head of the household's place of residence	It is a dummy variable coded as 1 if urban and 0 if rural.

3.3. Analytical Design

A binary probit regression model was employed in this study where household investment choices (dependent variable) are considered as discrete choices. The assumption used in this model is that the error term is normally distributed with a mean of zero and a unitary standard deviation as articulated by Greene (2012). The probit model to examine the effects of financial literacy as well as other independent variables on the household investment choice was specified as follows:

$$pr(choice_i = 1) = \varnothing(\beta_0 + \beta_1 AGG\_FL_i + \beta_2 hhincome_i + \beta_3 loc_i + \beta_4 edu_i + \beta_5 emp_i + \beta_6 info_i + \beta_7 gender_i + \varepsilon_i)$$

where

$choice_1$ = Informal groups
$choice_2$ = Investment account
$choice_3$ = Household personal business

$choice_4$ = Agricultural investment
ε_i is the error term
$Info_i$ is the information
$gender_i$ is the gender of the household head i
edu_i is the highest education level attained by the household head i
loc_i is the location or household head's place of residence.
emp_i is the employment status of the household head i
$hhincome_i$ denotes household head i's income
ε_i is the error term

4. Results and Discussions

Multivariate Analysis

This paper employed probit regression to assess whether financial literacy influences households' investment choices in Tanzania, while controlling for households' demographic and socioeconomic factors. Various diagnostic tests were conducted such as a multicollinearity test and heteroscedasticity test. In order to test for the presence of multicollinearity, Variance Inflation Factors (VIF) and Pearson correlation analysis were employed. The analysis found a mean VIF of 3.06, which is far below the cut-off point of 10 as suggested by Belsley et al. (1980) which determines whether there is serious multicollinearity. According to the cut-off point, the VIF reported that multicollinearity is not a problem. After testing for multicollinearity, a Breusch-Pagan test for heteroscedasticity was conducted. The fear in testing for heteroscedasticity is the existence of homogeneity of variance of the residuals. This is one of the conditions to be observed before employing and multivariate regression analysis. The results of Breusch-Pagan test show a Chi square value below the critical value, implying that the hypothesis for homoscedasticity could be accepted. Likewise, the heteroskedasticity test shows that the variances of the OLS estimators are not biased.

In order to assess the link between financial literacy and household investment choices and decisions, probit regression was run with investment choice as a dichotomous dependent variable and financial literacy as an independent variable. This was followed by socio-demographic characteristics as control variables. The results in Table 2 show that financial literacy has a strong and positively statistically significant relationship with the investment choices. The relationship is statistically significant at the 1% significance level. The study further shows that 82% of financially literate head of households are more likely to invest in investment accounts, while 47% of them would more likely prefer personal business accounts. The study also shows that 42% of the literate heads of households are more likely to invest their proceeds in agricultural projects, while about 43% of these household heads would choose to invest their money in informal groups. These results imply that as households become more financially literate, they divert from investment in informal groups towards formal investment accounts, agricultural investment as well as personal business. This observation can partly be attributed to the fact that financial literacy increases understanding of risks associated with investment ventures and knowledge on financial products, as well as other profitable investment ventures. The findings are consistent with Rooij et al. (2011) who found out that financially literacy among households increases participation in the stock market.

The results further reveal that urban households are about 13%and 9% more likely to invest in investment accounts and personal business, respectively, as compared to their counterparts, rural households. Likewise, urban households are approximately 7% and 3% less likely to invest in informal groups and agricultural investment, respectively, as opposed to their counterparts, rural households. The explanation of this finding can partly be supported by the reality that urban households may easily access financial products due to the presence of a greater number of financial institutions located in urban compared to rural areas, and that urban households rarely participate in agricultural activities due to lack of enough land in townships. The results also show that households in urban areas are

more likely to invest in personal businesses because it is believed that demand for business goods as well as services is usually higher in urban areas than in rural areas. This finding is in agreement with Cole et al. (2009).

Table 2. Probit Regression Results.

VARIABLES	Informal Groups	Investment Account	Household Personal Business	Agricultural Investment
Financial literacy	−0.431 ** (0.202)	0.817 *** (0.130)	0.468 *** (0.101)	0.418 *** (0.112)
Location	−0.0711 *** (0.0231)	0.133 *** (0.0154)	0.0935 *** (0.0119)	−0.260 *** (0.00996)
Gender	−0.0301 (0.0238)	−0.00656 (0.0153)	−0.0253 ** (0.0116)	0.0382 *** (0.0130)
Primary	−0.0764 *** (0.0286)	0.155 *** (0.0151)	0.0335 ** (0.0138)	−0.0922 *** (0.0161)
Secondary	−0.236 *** (0.0418)	0.280 *** (0.0288)	0.0162 (0.0221)	−0.226 *** (0.0221)
Tertiary	−0.320 *** (0.0568)	0.617 *** (0.112)	0.0520 (0.0344)	−0.129 *** (0.0307)
Employment status	−0.161 *** (0.0355)	0.227 *** (0.0375)	−0.264 *** (0.0340)	−0.0854 *** (0.0194)
Information	−0.177 * (0.0986)	0.122 (0.0819)	−0.0330 (0.0576)	−0.0180 (0.0570)
Observations	3812	3812	3812	3812
Wald Chi2 (9)	195.03	525.32	178.70	915.03
Significance	0.0000	0.0000	0.0000	0.0000
Pseudo R2	0.0831	0.1462	0.0724	0.2483
% correctly classified	63.65	71.65	86.31	79.17

Note: Robust standard errors in parenthesis. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

The gender of household heads is an important parameter that influences the investment choices at the household level. The results in Table 2 show that male household heads are about 3% less likely to invest in personal businesses, but are about 4% more likely to invest in agricultural investments relative to female household heads. These findings indicate that men are more risk averse and less likely to invest in the informal groups, investment accounts as well as personal businesses. Based on the same argument, men are more likely to participate in agricultural activities relative to women.

Regarding the education level of heads of households, results reveal that heads of households with only primary education are approximately 8% and 9% less likely to invest in informal groups and agricultural investment, respectively, but are 16% and 3% more likely to invest in investment account and personal business, respectively, compared to households with no formal education. Similarly, household heads with a secondary education are approximately 24% and 23% less likely to invest in informal groups and agricultural investments, respectively, but are 28% more likely to invest in investment accounts compared to households with no formal education. Also, household heads with a tertiary education are approximately 32% and 13% less likely to invest in informal groups and agricultural investment, respectively, but are 62% more likely to invest in investment accounts and personal businesses, respectively, compared to households with no formal education. The message which one can derive from these findings is that an increase in education level lowers the likelihood of investing in informal groups as well as agricultural ventures. These findings are in line with Rooij et al. (2011).

The results, further, reveal that employed household heads are approximately 16%, 26% and 9% less likely to invest in informal groups, personal businesses and agricultural investment, respectively, but are 23% more likely to invest in investment accounts relative to unemployed household heads. These results are consistent with Calderone (2014). This study further reveals that household heads that access financial advice from formal sources are approximately 18% less likely to invest in informal groups relative to household heads with access to informal sources of financial information. This can partly be attributed to the fact that formal financial advice increases financial literacy among households.

5. Conclusions

This paper primarily aims at assessing the impact of financial literacy on enhancing households' investment choices. The results of the paper reveal that as households become more financially literate, they divert from investing in informal groups towards more formal investment platforms such as investment accounts, agricultural investment as well as personal businesses. Such observations may be partly attributed to the facts that individuals whose financial literacy is sound enough are in a way equipped with skills and knowledge of risks associated with investment opportunities and other several financial products.

The study also reveals that financial literacy is significantly associated with household socio-demographic factors, and that the adult population exhibits a large financial literacy gap; therefore, adults should not be considered as a homogenous group. Instead, gender, age, education and income levels of households, which are showcased in this study, should also be taken into consideration. The study indicates that because most of households, as reflected in the survey from which the adapted dataset is based, are hailing from rural settings, and because in their setting agriculture is the main economic activity from which the source of their income is derived, we establish that agricultural ventures require a complete revamp for Tanzania to become a middle-income economy through its industrialization agenda. The paper also proposes for financial literacy to be a mandatory program for the secondary schools curriculum in Tanzania as practiced elsewhere, for example in the Czech Republic and Slovakia, because appropriate management of personal finance creates preconditions for a successful and high quality life.

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Investor Sentiment and Herding Behavior in the Korean Stock Market

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Abstract: This paper investigates herding behavior and the connection between herding behavior and investor sentiment. We apply a Cross-Sectional Absolute Deviation (CSAD) approach and the quantile regression method to capture herding behavior in the KOSPI and KOSDAQ stock markets. The analysis results are outlined as follows. First, we find that herding behavior is exhibited during down-market periods in the KOSPI and KOSDAQ stock markets. However, we show that adverse herding behavior occurs in low-trading volume and low-volatility periods. Second, according to the results of the quantile regression, herding behavior is found in the low and high quantiles of the KOSPI and KOSDAQ stock markets. However, adverse herding behavior is also found, which means that investors herd in extreme market conditions. Third, the relationship between investor sentiment and herding behavior is analyzed through regression and quantile regression, and investor sentiment is confirmed to be one of the important factors that can cause herding behavior in the Korean stock market.

Keywords: herding behavior; investor sentiment; CSAD; quantile regression; Korean stock market

JEL Classification: G12; G14; G41

1. Introduction

Understanding the decision-making process of market participants in the stock market and how investor behavior patterns affect stock prices is important for both business and academia. Market participants' investment behavior is linked to many factors, such as trading strategies, market volatility, other market participants' behavior, corporate value changes, and economic fluctuations. It is also known that there are various cognitive biases and flaws, such as human error, in the trading process in financial markets. Sometimes investors fail to act on their own information or ignore their beliefs. Investors follow market sentiment or rely heavily on other investment actions and act to sell or buy. This is called "herding behavior," which means that people are imitating each other. This phenomenon was also seen during the 2000–2002 IT bubble and the 2007–2008 global financial crisis.

Bikhchandani and Sharma (2001) observed that herding behavior can be either rational or irrational investor behavior. Rational behavior occurs when an investor utilizes information about other people's behavior. That is, rational herding behavior theory asserts that information cascades (Banerjee 1992; Bikhchandani et al. 1992), compensation structures (Scharfstein and Stein 1990; Roll 1992; Admati and Pfleiderer 1997), and reputation maintenance actions lead to herding behavior (Prendergast and Stole 1996; Trueman 1994).

On the other hand, the theory of irrational herding behavior asserts that some irrational market participants' investment behavior may result in herding behavior. That is, it is argued that investors

sometimes make investment decisions in a way that simply follows the flow of the market without assessing the fundamental value of financial instruments (De Long et al. 1990; Froot et al. 1992).

Some theoretical studies of irrational herding behavior suggest that it is intentional behavior caused by investor sentiment. This explains that investors remember from experience that rising prices will continue to rise, and this memory will prompt them to buy stocks when stocks rise, which will continue to drive stock prices up. This type of herding behavior is driven by psychological factors, such as investor confidence that stock prices will rise, wishful thinking, consideration of other's judgments, and pressure to conform (Bikhchandani and Sharma 2001).

In investigations of whether herding behavior exists in financial markets, many scholars have reported empirical results (Christie and Huang 1995; Chang et al. 2000; Economou et al. 2015; Hwang and Salmon 2004; Galariotis et al. 2015). Although studies have applied various methods, they do not provide identical empirical results or consensus regarding the presence or absence of herding behavior. There are also several empirical studies that have reported on the relationship between herding behavior and investor sentiment (Lakonishok et al. 1992; Liao et al. 2011; Vieira and Pereira 2015; Economou et al. 2018). Hwang and Salmon (2009) showed that when investor sentiment is positive (optimistic), individual asset returns are expected to rise, regardless of systematic risk. They also found an increase in herding behavior. Lakonishok et al. (1992) and Liao et al. (2011) also concluded that investor sentiment is a major factor in herding behavior.

Thus, there is some relationship between investor sentiment and herd behavior. This study analyzes whether there is herding behavior in the Korean stock market (KOSPI and KOSDAQ) and whether investor sentiment can be a major factor in the occurrence of herding behavior.

This paper analyzes the Korean stock market, including KOSPI and KOSDAQ, and new evidence into developing stock markets. We find evidence of herding behavior during down-market periods. Additionally, our results suggest that herding behavior in the Korean stock market is influenced by investor sentiment. This study contributes to the existing literature by conducting a thorough analysis of herding in the Korean stock markets under different market conditions, and also introducing the investor sentiment into the herding behavior model. Our results provide useful information for investors and regulators, especially during down-market and high-trading volume periods, and can be helpful in hedging.

The rest of this paper consists of the following: Section 2 introduces the theoretical background and previous empirical studies, and Section 3 explains the methodology. Section 4 describes the analysis results, and finally, Section 5 summarizes the results and presents conclusions.

2. Literature Review

There are more empirical studies than theoretical studies of herding behavior, which is because it is difficult to measure the extent of herding behavior in the real market. Therefore, many measurement methods have been used in empirical studies, such as the Lakonishock, Shleifer, and Vishny (LSV) model, Portfolio Change Measure (PCM), Cross-Sectional Standard Deviation (CSSD), and Cross-Sectional Absolute Deviation (CSAD) (Lakonishok et al. 1992; Grinblatt et al. 1995; Christie and Huang 1995; Chang et al. 2000). Until recently, however, the most popular approach has been the CSAD, since other measurement methods require investor's holding information and use low-frequency data.

In their major empirical studies, Christie and Huang (1995) used the CSSD to analyze herding behavior among investors during market stress in the US stock market. Their results showed that there was no herding behavior in a period of high price volatility. Chang et al. (2000) used the CSAD instead of the CSSD. They found that there was no herding behavior in the US, Hong Kong, or Japan, but that there was herding behavior in Korea and Taiwan. Tan et al. (2008) and Chiang et al. (2010) found that there was herding behavior in the Shanghai and Shenzhen A stock markets. Yao et al. (2014) reported that there was a stronger presence of herding behavior in the Chinese B stock market than in the Chinese A stock market. Lao and Singh (2011) found that herding behavior exists in the Chinese stock market. When the market is a down-market and trading volumes are high, herding behavior is

stronger. Chiang and Zheng (2010) analyzed whether there were acts of violence in 18 countries and found that there were in 13, including Australia, France, Germany, Hong Kong, and Japan, excluding the US and Latin American markets. Lam and Qiao (2015) confirmed that there was herding behavior in Hong Kong's stock market and in periods of a bull market, high-trading volume, and high and low volatility. Galariotis et al. (2015) analyzed US and UK stock markets for herding behavior. They reported that the UK exhibited herding behavior during the dot-com bubble and that the US exhibited herding behavior during the financial crisis.

Analyzing the markets of Belgium, France, the Netherlands, and Portugal, Economou et al. (2015) found that before the Euronext merger, there was herding behavior only in the Portuguese market but that all four countries exhibited herding behavior after the merger. Gavriilidis et al. (2016) reported that during Ramadan, there was herding behavior in Muslim stock markets (Bangladesh, Egypt, Indonesia, Malaysia, Morocco, Pakistan, and Turkey). However, Yousaf et al. (2018) asserted that there was no herding behavior in the Pakistani stock market during Ramadan. Pochea et al. (2017) reported that there has been herding behavior in seven countries, including Bulgaria, Croatia, the Czech Republic, and Hungary.

However, several recent empirical studies found evidence of reverse herding behavior (Clements et al. 2017; Gębka and Wohar 2013). Reverse herding means that market participants act on their own information rather than market movement, which leads to a high level of CSAD. Gębka and Wohar (2013) explained that reverse herding increases return dispersion above the level of national price. This implies that investors readjust their portfolios to secure riskless assets amidst high fear and uncertainty.

Studies have also analyzed the relationship between herding behavior and investor sentiment. Liao et al. (2011) found that investor sentiment plays an important role in explaining fund investors' herding behavior. Blasco et al. (2012) analyzed whether investor behavior can be explained by emotional factors. They analyzed the Spanish stock market using the Granger causal test, and found that herding behavior was explained by past returns and investor sentiment and reported that investor sentiment is an important factor explaining herding behavior. Lakonishok et al. (1992), Liao et al. (2011), Vieira and Pereira (2015), and Economou et al. (2018) also concluded that market sentiment is a major factor in herding behavior.

This study differs as follows from the previous studies discussed above. First, Chang et al. (2000), Chiang and Zheng (2010), and Laih and Liau (2013) analyzed the KOSPI market, but there is a lack of empirical research that only analyzes the Korean stock markets (KOSPI and KOSDAQ). Therefore, this study analyzes whether there is herding behavior in the KOSPI and KOSDAQ markets. Second, this study analyzes whether herding behavior exists in various market situations (changes in volume and volatility). Third, this study analyzes the relationship between herding behavior and investor sentiment. Theoretically, many studies have argued that investor sentiment is an important factor that can lead to herding behavior, but few empirical studies have actually proven this assertion. Therefore, this study is important in that it is the first to analyze the relationship between herding behavior and investor sentiment on the Korean stock market.

3. Data and Methodology

3.1. Data

This study analyzes the KOSPI and KOSDAQ stock markets to confirm the existence of herding behavior in the Korean stock market. The KOSPI market is a benchmark stock market of Korea and is a market where mainly blue-chip companies with listing requirements are traded. The KOSDAQ market is for the purpose of providing funds for startup companies as well as small to mid-size enterprise (SME) in such tech-savvy areas as IT (information technology), BT (bio technology), and CT (culture technology), and is a market where stocks of startup companies and SMEs are traded. Additionally, we analyze the relationship between herding behavior and investor sentiment. We use daily data for KOSPI and KOSDAQ constituent securities from between January 2003 and December 2018. This corresponds to 3958 daily closing prices. These data were obtained from Informax.

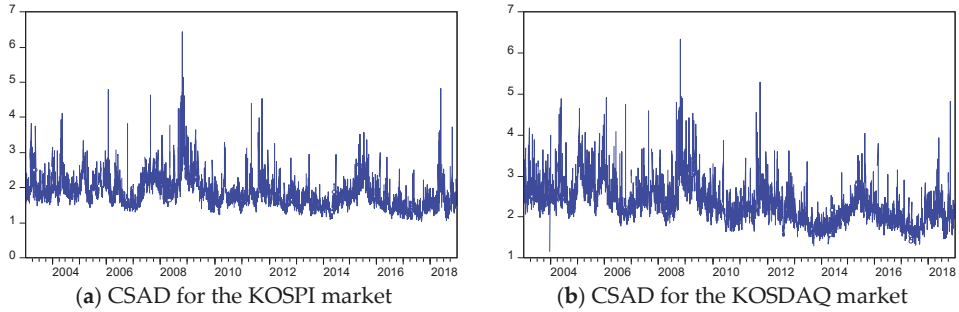
Many previous studies have used various investor sentiment proxies to measure investor sentiment. In the study, Korean investor sentiment is proxied through the VKOSPI. VKOSPI is Korea's representative implied volatility index based on the KOSPI200 option. This volatility index is generally known as a fear index and is used as a proxy for investor's sentiment (Smales 2017; Economou et al. 2018). When the volatility index is lower, the investor is the more optimistic, while when the volatility index is higher, the investor is the more pessimistic.

Table 1 presents the descriptive statistics and unit root test for each market's CSAD and investor sentiment (Sent). Looking at the CSAD, the average value in the KOSPI market is found to be lower than in the KOSDAQ market. However, the CSAD standard deviation in the KOSDAQ market is larger than in the KOSPI market, which means that the KOSDAQ market is more volatile than the KOSPI market. To test the stability of the time series, the Augmented Dickey–Fuller (ADF) test and the Philips–Perron (PP) unit root test were used. Panel B presents the unit root test results for each market's CSAD and Sent. The results show that each market's CSAD and Sent are identified as stationary time series. Figure 1 shows the time series for the two markets' CSAD and Sent. The markets' CSADs were relatively high during the financial crisis.

Table 1. Descriptive statistics and unit root test of CSAD and Sent.

Panel A: Descriptive Statistics								
	Mean	**Max**	**Min**	**Std. D.**	**Ske.**	**Kur.**	**J-B**	**N**
KOSPI	1.8688	6.4392	1.0418	0.4817	2.0591	11.7608	15454.6 ***	3958
KOSDAQ	2.3479	6.3245	1.1678	0.5364	1.3677	6.8118	3630.1 ***	3958
Sent	−0.0002	0.4344	−0.3027	0.0536	1.1027	9.7720	8239.4 ***	3958
Panel B: Unit Root Test								
	ADF (1)		**ADF (2)**		**PP (1)**		**PP (2)**	
KOSPI	−7.3493 ***		−9.6390 ***		−43.8588 ***		−47.0165 ***	
KOSDAQ	−7.0294 ***		−8.9427 ***		−38.7360 ***		−45.5168 ***	
Sent	−30.4317 ***		−30.4316 ***		−71.8796 ***		−71.9138 ***	

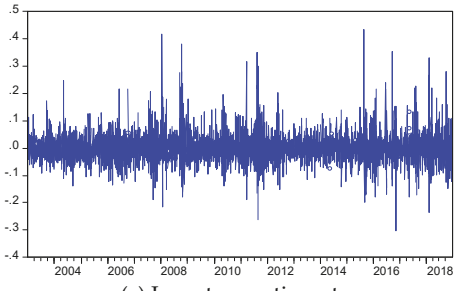
Notes: The Std. D., Ske., Kur., and J-B denote the standard deviation, skewness, kurtosis, and Jarque–Bera test, respectively. *** indicates statistical significance at the 1% level. ADF (1) and ADF (2) denote the Augmented Dickey–Fuller (ADF) tests that include a constant and a constant and a linear time trend in the test regression, respectively. Additionally, PP (1) and PP (2) denote the Philips–Perron (PP) tests that include a constant and a constant and a linear time trend in the test regression, respectively.



(**a**) CSAD for the KOSPI market

(**b**) CSAD for the KOSDAQ market

Figure 1. *Cont.*



(**c**) Investor sentiment

Figure 1. Dynamics of Cross-Sectional Absolute Deviation (CSAD) and Sent series: (**a**) CSAD for the KOSPI market; (**b**) CSAD for the KOSDAQ market; (**c**) Investor sentiment.

3.2. Methodology

3.2.1. Herding Behavior

In this study, the cross-sectional absolute deviation (CSAD) proposed by Chang et al. (2000) is used to measure herding behavior. This model assumes that if herding behavior exists, individual stock returns will converge to the market returns. Thus, herding causes a small difference in individual returns versus market returns. CSAD is the average value reached by taking an absolute value for the difference between individual stock returns and market returns, which can be obtained as follows:

$$CSAD_t = \frac{1}{n}\sum_{i=1}^{n}\left|R_{i,t} - R_{m,t}\right| \tag{1}$$

where n is the total number of securities on a day, $R_{i,t}$ is the return of the company at time t, and $R_{m,t}$ is the average market return of a cross section (all the company at time t). We adopt the model proposed by Chang et al. (2000) to test herding behavior. Chang et al. (2000) argued that market returns and the CSAD should have a positive linear relationship in the capital asset pricing model (CAPM), but that these linear relationships are no longer maintained when herd behavior occurs. The CSAD can identify the presence of herding behavior for the entire period, including high-market volatility and stable periods, but it has a nonlinear relationship due to herding behavior during periods in which market conditions are extreme.

$$CSAD_t = \alpha + \beta_1\left|R_{m,t}\right| + \beta_2 {R_{m,t}}^2 + \varepsilon_t \tag{2}$$

where $CSAD_t$ is a measure of cross-sectional return dispersion. $R_{m,t}$ is the average market return of a cross section of all firms' stocks at time t, and $\left|R_{m,t}\right|$ is the absolute term. ${R_{m,t}}^2$ is a nonlinear term that captures investors' herding behavior. If β_2 is negative and significant, this suggests that herding behavior exists in the stock market. However, if β_2 is positive and significant, reverse herding behavior exists in the stock market. This means that investors ignore the information that has been delivered in line with market sentiment and price movement. Gębka and Wohar (2013) explained that investors tend to partially trade in extreme or abnormal ways. This behavior implies specific stock price increases, and hence an increase of the CSAD above the rational level.

However, Equation (2) has the same value for the up- and down-market periods. This has the limitation that it cannot reflect the effect of the market state. Investor behavior can differ in up- and down-market periods. Therefore, to test whether investors' behavior differs in different market periods, we investigate the following Equation (3):

$$CSAD_t = \alpha + \beta_1 D\left|R_{m,t}\right| + \beta_2(1-D)\left|R_{m,t}\right| + \beta_3 D{R_{m,t}}^2 + \beta_4(1-D){R_{m,t}}^2 + \varepsilon_t \tag{3}$$

where D is a dummy variable to represent the market state (if the market return is negative, it has a $D = 1$, otherwise it has a $D = 0$). In Equation (3), if β_3 (β_4) has a significant negative value, it means that herding behavior occurs when the market goes down (when the market goes up). Additionally, investors can differ in their response to changes in trading volume and volatility. Lam and Qiao (2015) and Gavriilidis et al. (2016) explained that changes in trading volume and volatility can cause irrational behavior. When investors create a gap between the stock's fundamental value and its price in the market, there is tremendous trading volume and fluctuation in the stock market. Thus, herding behavior will be associated with changes in trading volume and volatility. The effect of trading volume on herding behavior has been studied by Economou et al. (2015), Lam and Qiao (2015), and Gavriilidis et al. (2016). In other words, high-trading volume is a sign that information-providing investors have entered the market. Based on this explanation, to explain the effect of trading volume and volatility on herding behavior, we divide trading and volume into low and high periods. These are low (high) if they are less (greater) at time t than the previous 30-day moving average. Hence, the dummy variable $D = 1$ when periods are classified as low in trading volume and volatility. We analyze the effect of changes in trading volume and volatility on herding behavior using the following equation:

$$CSAD_t = \alpha + {\beta_1}^{Vol} D\left|R_{m,t}\right| + {\beta_2}^{Vol}(1-D)\left|R_{m,t}\right| + {\beta_3}^{Vol} D{R_{m,t}}^2 + {\beta_4}^{Vol}(1-D){R_{m,t}}^2 + \varepsilon_t \quad (4)$$

$$CASD_t = \alpha + {\beta_1}^{V} D\left|R_{m,t}\right| + {\beta_2}^{V}(1-D)\left|R_{m,t}\right| + {\beta_3}^{V} D{R_{m,t}}^2 + {\beta_4}^{V}(1-D){R_{m,t}}^2 + \varepsilon_t \quad (5)$$

where the superscripts Vol and V denote that models are estimated for days of low-trading volume and volatility.

3.2.2. Quantile Regression of Herding Behavior

We find it necessary to identify whether the independent variable effect differs at the various quantile intervals for different markets, trading volumes, and volatility conditions. For this purpose, we use quantile regression, which can analyze various conditional distributions of dependent variables.

If the distribution of dependent variables is not normal and there are outliers, then the Ordinary Least Squares method (OLS) fails to consider information about outliers. OLS focuses on mean values, making them less efficient for regression of outliers (Koenker and Bassett 1978; Barnes and Hughes 2002). In this case, the quantile estimates may be more efficient than the OLS estimates (Buchinsky 1998). Extreme outliers are frequently found in financial time series, which can have a significant impact on OLS estimates and consequently distort the estimated results. Thus, quantile regression can yield more robust and efficient estimates. In this study, the following quantile regression model is used:

$$Q_\tau(\tau|X_t) = \alpha_\tau + \beta_{1,\tau} D\left|R_{m,t}\right| + \beta_{2,\tau}(1-D)\left|R_{m,t}\right| + \beta_{3,\tau} D R_{m,t}^2 + \beta_{4,\tau}(1-D)R_{m,t}^2 + \varepsilon_{\tau,t} \quad (6)$$

where τ is quantiles. To confirm the analysis results in various quantiles, this study estimates quantiles with 20% intervals ranging from 10% to 90%.

3.2.3. Herding Behavior and Investor Sentiment

We analyze how investor sentiment affects herding behavior by estimating the following regression equation:

$$CASD_{i,t} = \alpha + \beta_1\left|R_{m,t}\right| + \beta_2 R_{m,t}^2 + \beta_3 Sent_t + \varepsilon_t \quad (7)$$

where $Sent_t$ is an investor sentiment variable in the KOSPI and KOSDAQ markets and VKOSPI is used as a proxy variable. The estimated β_3 may have a positive value and a negative value. A negative value means that when investor sentiment rises, investors are likely to follow-the decisions of other investors. This means that if investors change from a pessimistic view of the future, they exhibit herding behavior. On the other hand, when investor sentiment is low, investors do not feel the need to imitate other investors' decisions. If β_3 is positive, the opposite occurs. This means that reverse herding behavior

exists in the stock market. In addition, we analyze the influence of investor sentiment on various quantiles using the quantile regression used in the above analysis.

4. Empirical Results

4.1. Empirical Results Regarding Herding Behaviour

Table 2 shows the empirical results from Equation (2) on herding behavior in the Korean stock market. In the KOSPI and KOSDAQ markets, β_2 is negative but not significant. This indicates that there is no evidence of herding behavior in the KOSPI and KOSDAQ markets. However, based on these results, it is difficult to conclude that there is no herding behavior in the Korean stock market.

Table 2. Estimates of herding behavior without market conditions.

	KOSPI	KOSDAQ
α	1.5864 (0.0090) ***	2.0744 (0.0112) ***
β_1	0.3960 (0.0126) ***	0.3155 (0.0134) ***
β_2	−0.0028 (0.0021)	−0.0017 (0.0020)
R^2	0.4404	0.3357

Notes: Numbers in parentheses are standard errors. *** represents significance at the 1% level.

Table 3 reports the results of the estimates of herding behavior in up- and down-market periods based on Equation (3). The results show that investors react asymmetrically during up- and down-market periods. According to the results, there is evidence of herding behavior during down-market periods in the KOSPI and KOSDAQ stock markets, since coefficient β_3 displays a significant result. This indicates that when market returns are falling, as investors' fear rises, investors exhibit herding behavior. However, since the β_4 coefficient does not have a statistically significant result, there is no herding behavior during the up-market period in each market. In addition, the herding behavior of investors may be related to changes in trading volume and volatility.

Table 3. Estimates of herding behavior in up- and down-market periods.

	KOSPI	KOSDAQ
α	0.1598 (0.0091) ***	2.0811 (0.0113) ***
β_1	0.4160 (0.0142) ***	0.3585 (0.0150) ***
β_2	0.3702 (0.0164) ***	0.2665 (0.0184) ***
β_3	−0.0053 (0.0024) **	−0.0065 (0.0022) ***
β_4	−0.0009 (0.0039)	0.0001 (0.0044)
R^2	0.4417	0.3424

Note: Numbers in parentheses are standard errors. *** and ** represent significance at the 1% and 5% levels, respectively.

Tables 4 and 5 present the results of the analysis of trading volume and volatility based on Equations (4) and (5). Table 4 explores whether herding behavior occurs when the change in trading volume differs, and Panel B explores whether herding behavior occurs when the change in volatility differs. Panel A shows that coefficients (β_3, β_4) in the KOSPI and KOSPI stock markets are statistically significant during high- and low-trading volume periods. However, β_4 is negative, which suggests that there is herding behavior during high-trading volume periods in the KOSPI and KOSDAQ stock markets. However, there is reverse herding behavior during low-trading volume periods since β_3 is positive.

Table 4. Estimates of herding behavior in high- and low-trading volume periods.

	KOSPI	KOSDAQ
α	1.5962 (0.0092) ***	2.0756 (0.0111) ***
β_1	0.3060 (0.0186) ***	0.2451 (0.0157) ***
β_2	0.4497 (0.0143) ***	0.3884 (0.0159) ***
β_3	0.0147 (0.0054) ***	0.0080 (0.0026) ***
β_4	−0.0100 (0.0023) ***	−0.0124 (0.0026) ***
R^2	0.4501	0.3478

Note: See the note of Table 2.

Table 5. Estimates of herding behavior in high- and low-volatility periods.

	KOSPI	KOSDAQ
α	1.5741 (0.0097) ***	2.0647 (0.0139) ***
β_1	0.4343 (0.0210) ***	0.3185 (0.0356) ***
β_2	0.3544 (0.0128) ***	0.2837 (0.0141) ***
β_3	0.0327 (0.0065) ***	0.0494 (0.0166) ***
β_4	0.0003 (0.0022)	0.0022 (0.0021)
R^2	0.4633	0.3461

Note: See the note of Table 2.

As shown in Table 5, β_3 is significant and positive, but β_4 is not significant. This means that there is inverse herding behavior during low volatility in the two markets.

Tables 6 and 7 present the estimated results of quantile regression for up- and down-market periods (Panel A), low- and high-trading volume periods (Panel B), and low and high volatility (Panel C) based on Equation (6). The estimation using the quantile regression method presents robust results for the characteristics of herding behavior in extreme market situations (i.e., lower and upper quantiles).

In Panel A in Table 6, β_3 is negative and statistically significant for the 10% and 90% quantiles, but β_4 is only positive and statistically significant for the 90% quantile. We find that the herding behavior for the KOSPI stock market is stronger in the down-market than in the up-market. Panel B presents strong evidence of adverse herding over quantiles during the low-trading volume period. However, in the high-trading volume period, the magnitude of impact of β_4 on the CSAD increases from the 10% quantile to the 90% quantile. This suggests that there is herding behavior during the high-trading volume period. Panel C reports the herding behavior results under asymmetrical volatility conditions. β_3 is positive and statistically significant for the 10%, 30%, 50%, and 70% quantiles, but β_4 is only positive and statistically significant for the 50% quantile, where we find less significance in the high-volatility period. This suggests that adverse herding tends to occur under the 70% quantile.

The results in Table 7 are similar to those in Table 6. In Panel A, β_3 is negative and statistically significant for the 10%, 30%, 50%, and 90% quantiles. We find the herding behavior for the KOSDAQ stock market to be stronger in the down-market than in the up-market. However, β_4 is positive and statistically significant for the 30% and 50% quantiles. This shows evidence of reverse herding behaviour in the KOSDAQ stock market. In Panel B, β_3 is positive and statistically significant at lower quantiles, but β_4 is negative and significant above the 50% quantile. This suggests that there is herding behaviour during the high-trading volume period. This is the same result as in the KOSPI stock market. Panel C reports the herding behavior results for low- and high-volatility conditions. β_3 is significantly positive for the 10% quantiles, and β_4 is only significantly positive for the 90% quantile, where we find less significance in Table 6. This suggests that adverse herding tends to be displayed at the lower and upper quantiles but that there is no herding in low- and high-volatility conditions.

The combined results from Tables 6 and 7 suggest that herding behavior is highly sensitive to returns and trading volume fluctuation in extreme market conditions (lower and upper quantiles).

However, reverse herding behavior occurs in periods of low-trading volume, up-markets, and low volatility in the extreme lower and upper quantiles. In conclusion, investors who participate in the KOSPI and KOSDAQ markets tend to herd due to changes in market conditions.

Table 6. Quantile regressions on estimates of herding behavior in market conditions in KOSPI.

	α	β_1	β_2	β_3	β_4	**Pseudo** R^2
Panel A: Returns up and down						
Quantile ($\tau = 10\%$)	1.2322 *** (0.0131)	0.3494 *** (0.0205)	0.3000 *** (0.0268)	−0.0028* (0.0016)	−0.0039 (0.0024)	0.1465
Quantile ($\tau = 30\%$)	1.4071 *** (0.0198)	0.3668 *** (0.0198)	0.3344 *** (0.0268)	0.0009 (0.0037)	−0.0001 (0.0090)	0.1735
Quantile ($\tau = 50\%$)	1.5587 *** (0.0144)	0.3776 *** (0.0256)	0.3337 *** (0.0483)	0.0013 (0.0049)	0.0120 (0.0207)	0.1987
Quantile ($\tau = 70\%$)	1.7406 *** (0.0255)	0.4158 *** (0.0335)	0.2937 ** (0.1225)	−0.0049 (0.0048)	0.0273 (0.0699)	0.2300
Quantile ($\tau = 90\%$)	2.0347 *** (0.0239)	0.4827 *** (0.0411)	0.2035 *** (0.0787)	−0.0105* (0.0061)	0.1110 *** (0.0337)	0.2999
Panel B: Trading volume high and low						
Quantile ($\tau = 10\%$)	1.2400 *** (0.0116)	0.2575 *** (0.0218)	0.3456 *** (0.0187)	0.0246 *** (0.0030)	−0.0084 *** (0.0018)	0.1485
Quantile ($\tau = 30\%$)	1.4115 *** (0.0095)	0.2821 *** (0.0167)	0.3896 *** (0.0201)	0.0183 *** (0.0027)	−0.0051* (0.0029)	0.1775
Quantile ($\tau = 50\%$)	1.5637 *** (0.0116)	0.2835 *** (0.0272)	0.4148 *** (0.0242)	0.0232 ** (0.0094)	−0.0059 (0.0048)	0.2036
Quantile ($\tau = 70\%$)	1.7345 *** (0.0135)	0.2841 *** (0.0325)	0.4618 *** (0.0270)	0.0218* (0.0124)	−0.0106 ** (0.0053)	0.2348
Quantile ($\tau = 90\%$)	2.0150 *** (0.0185)	0.3031 *** (0.0434)	0.5523 *** (0.0408)	0.0275 ** (0.0128)	−0.0192 *** (0.0063)	0.3006
Panel C: Volatility high and low						
Quantile ($\tau = 10\%$)	1.2254 *** (0.0127)	0.3388 *** (0.0257)	0.3111 *** (0.0191)	0.0230 *** (0.0038)	0.0004 (0.0015)	0.1496
Quantile ($\tau = 30\%$)	1.3990 *** (0.0151)	0.3660 *** (0.0313)	0.3146 *** (0.0541)	0.0479 *** (0.0044)	0.0059 (0.0203)	0.1839
Quantile ($\tau = 50\%$)	1.5342 *** (0.0110)	0.4317 *** (0.0230)	0.3237 *** (0.0176)	0.0360 *** (0.0038)	0.0093 *** (0.0034)	0.2150
Quantile ($\tau = 70\%$)	1.7190 *** (0.0196)	0.3919 *** (0.0550)	0.3062 *** (0.0582)	0.0683 *** (0.0234)	0.0135 (0.0194)	0.2465
Quantile ($\tau = 90\%$)	2.0095 *** (0.0392)	0.4319 * (0.2284)	0.3173 *** (0.0638)	0.0641 (0.1510)	0.0154 (0.0145)	0.3090

Note: Numbers in parentheses are standard errors. ***, **, and * represent significance at the 1%, 5%, and 10% levels, respectively.

Table 7. Quantile regressions on estimates of herding behavior in market conditions in KOSDAQ.

	α	β_1	β_2	β_3	β_4	**Pseudo R^2**
Panel A: Returns up and down						
Quantile ($\tau = 10\%$)	1.5987 *** (0.0149)	0.3178 *** (0.0198)	0.2234 *** (0.0232)	−0.0040 ** (0.0020)	−0.0032 (0.0020)	0.1142
Quantile ($\tau = 30\%$)	1.8756 *** (0.0413)	0.3137 *** (0.0171)	0.1662 *** (0.0267)	−0.0027* (0.0016)	0.0203 *** (0.0064)	0.1273
Quantile ($\tau = 50\%$)	2.0527 *** (0.0136)	0.3629 *** (0.0217)	0.2323 *** (0.0287)	−0.0086 *** (0.0020)	0.0076 *** (0.0078)	0.1542
Quantile ($\tau = 70\%$)	2.2577 *** (0.0284)	0.3829 *** (0.0336)	0.2401 ** (0.1200)	−0.0079 (0.0052)	0.0131 (0.0624)	0.1828
Quantile ($\tau = 90\%$)	2.6006 *** (0.0318)	0.4184 *** (0.0349)	0.2664 ** (0.1200)	−0.0137 *** (0.0047)	0.0317 (0.0541)	0.2475
Panel B: Volume high and low						
Quantile ($\tau = 10\%$)	1.5890 *** (0.0197)	0.2224 *** (0.0247)	0.3319 *** (0.0574)	0.0073 *** (0.0020)	−0.0114 (0.0207)	0.1126
Quantile ($\tau = 30\%$)	1.8657 *** (0.0133)	0.2078 *** (0.0196)	0.3085 *** (0.0183)	0.0105 *** (0.0027)	−0.0021 (0.0027)	0.1229
Quantile ($\tau = 50\%$)	2.0434 *** (0.0210)	0.2535 *** (0.0711)	0.3612 *** (0.0303)	0.0060 (0.0249)	−0.0091 ** (0.0037)	0.1516
Quantile ($\tau = 70\%$)	2.2470 *** (0.0193)	0.2554 *** (0.0514)	0.4032 *** (0.0281)	0.0089 (0.0184)	−0.0102 ** (0.0041)	0.1858
Quantile ($\tau = 90\%$)	2.5931 *** (0.0221)	0.2330 *** (0.0578)	0.4910 *** (0.0317)	0.0190 (0.0173)	−0.0245 *** (0.0047)	0.2584
Panel C: Market volatility high and low						
Quantile ($\tau = 10\%$)	1.5887 *** (0.0192)	0.2481 *** (0.0520)	0.2330 *** (0.0202)	0.0366 (0.0247)	0.0060 *** (0.0016)	0.1090
Quantile ($\tau = 30\%$)	1.8575 *** (0.0200)	0.2695 *** (0.0621)	0.2502 *** (0.0230)	0.0256 (0.0344)	0.0054 (0.0039)	0.1201
Quantile ($\tau = 50\%$)	2.0383 *** (0.0169)	0.2931 *** (0.0468)	0.2758 *** (0.0296)	0.0402 (0.0254)	0.0031 (0.0073)	0.1503
Quantile ($\tau = 70\%$)	2.2214 *** (0.0218)	0.3734 *** (0.0748)	0.3069 *** (0.0240)	0.0418 (0.0459)	0.0022 (0.0035)	0.1844
Quantile ($\tau = 90\%$)	2.5680 *** (0.0294)	0.3862 *** (0.0717)	0.2956 *** (0.0866)	0.1060 *** (0.0179)	0.0119 (0.0248)	0.2571

Note: See the note of Table 6.

4.2. Empirical Results of Herding Behaviour and Investor Sentiment

Table 8 presents the results from Equation (7) exploring the relationship between herding behavior and investor sentiment. In Table 8, this estimation shows that investor sentiment affects the CSAD in the KOSDAQ stock market. The estimated coefficient (β_3) is positive, which means that reverse herding behavior occurs when investors are pessimistic about the future in the KOSDAQ stock market. However, in the KOSPI stock market, β_3 is found to be insignificant. This means that investor sentiment does not explain herding behavior in the KOSPI stock market.

Table 8. Regressions on estimates of herding behavior incorporating investor sentiment.

	KOSPI	**KOSDAQ**
α	1.5866 (0.0193) ***	2.0766 (0.0212) ***
β_1	0.3958 (0.0308) ***	0.3147 (0.0226) ***
β_2	−0.0029 (0.0045)	−0.0025 (0.0029)
β_3	0.0255 (0.1246)	0.4568 (0.1333) ***
R^2	0.4404	0.3377

Note: See the note of Table 2.

Table 9 presents the estimated results of quantile regression for the KOSPI stock market (Panel A) and the KOSDAQ stock market (Panel B). In Panel A, β_3 is positive and significant at the 10% level in the lower ($\tau = 10\%$) and upper quantiles ($\tau = 70\%$).

Table 9. Estimates of herding behavior incorporating investor sentiment.

	α	β_1		β_3	**Pseudo R^2**
Panel A: KOSPI					
Quantile ($\tau = 10\%$)	1.2338 *** (0.0119)	0.3221 *** (0.0183)	-0.0007 (0.0014)	0.2520 ** (0.1170)	0.1443
Quantile ($\tau = 30\%$)	1.4063 *** (0.0102)	0.3479 *** (0.0179)	0.0023 (0.0040)	0.1534 (0.1329)	0.1729
Quantile ($\tau = 50\%$)	1.5557 *** (0.0107)	0.3596 *** (0.0187)	0.0039 (0.0041)	-0.0393 (0.1638)	0.1982
Quantile ($\tau = 70\%$)	1.7286 *** (0.0225)	0.3740 *** (0.0624)	0.0040 (0.0236)	0.3318* (0.1846)	0.2279
Quantile ($\tau = 90\%$)	2.0105 *** (0.0296)	0.4302 *** (0.0900)	0.0025 (0.0327)	-0.3558 (0.3888)	0.2910
Panel B: KOSDAQ					
Quantile ($\tau = 10\%$)	1.5906 *** (0.0141)	0.2633 *** (0.0177)	0.0029* (0.0015)	0.5309 *** (0.1443)	0.1081
Quantile ($\tau = 30\%$)	1.8640 *** (0.0129)	0.2612 *** (0.0148)	0.0011 (0.0014)	0.7259 *** (0.1376)	0.1221
Quantile ($\tau = 50\%$)	2.0463 *** (0.0116)	0.3036 *** (0.0136)	-0.0035 ** (0.0016)	0.4598 *** (0.1684)	0.1488
Quantile ($\tau = 70\%$)	2.2449 *** (0.0165)	0.3362 *** (0.0259)	-0.0021 (0.0051)	0.5547 ** (0.2641)	0.1794
Quantile ($\tau = 90\%$)	2.5863 *** (0.0295)	0.3736 *** (0.0655)	-0.0051 (0.0181)	0.3007 (0.2607)	0.2453

Note: See the note of Table 6.

According to Panel B, the coefficient on β_3 is positive and significant at the 5% level from the lower to the upper quantiles ($\tau = 10\% \sim \tau = 70\%$). This is a similar result to that for the KOSPI stock market. These results show that reverse herding behavior is observed in the extreme low and high quantiles, indicating that when investor sentiment is high, it can lead to reverse herding behavior, meaning that rather than imitating others, investors make their own decisions. In other words, when investor sentiment is low, it can lead to herding behavior. These findings are consistent with the results of Gębka and Wohar (2013) that reverse herding may occur in high and low quantiles. They explain that reverse herding behavior is the result of noisy traders in low and high quantiles. Noisy traders

and irrational traders tend not to trade based on accurate information and fundamental values, so the CSAD increases while trading assets are in the wrong direction.

5. Conclusions

This study analyzed the existence of herding behavior and the relationship between herding behavior and investor sentiment in the KOSPI and KOSDAQ stock markets.

The results of the empirical analysis are as follows. First, the analysis of up- and down-markets shows that herding behavior occurs during down-market periods in the KOSDAQ and KOSPI stock markets. Second, according to the results of the quantile regression method, herding behavior is found in the low and high quantiles in the KOSPI and KOSDAQ stock markets. This means that herding behavior occurs in extreme market conditions (low and high quantiles). Therefore, the CSAD depends on signs of extreme market conditions. In extreme periods, investors ignore their own information and beliefs, follow market movements, and imitate other investors.

Third, the analysis of the relationship between investor sentiment and herding behavior showed that investor sentiment has a positive effect in the KOSDAQ stock market but is not significant in the KOSPI stock market. In the KOSDAQ market, there is herding behavior when investors are optimistic about the future. In addition, through quantile regression analysis, the KOSPI and KOSDAQ stock markets show that investor sentiment has a significant positive effect at lower and upper quantiles. This shows that low investor sentiment can lead to herding behavior in the KOSPI and KOSDAQ stock markets. Therefore, investor sentiment has a stronger influence on herding behavior in lower and upper quantiles (extreme market conditions).

In conclusion, herd behavior occurs in periods of down-markets or in extreme market conditions. Investors herd based on market conditions and other investors' decisions rather than using their information due to heightened anxiety and fear. We also identified that investor sentiment is one important factor that could lead to herding behavior. In particular, greater global financial liberalization and the development of IT heighten information and emotion sharing, so there is a possibility of more herding behavior.

Therefore, investors should be more careful to make investment decisions rationally when market returns fall and in extreme market conditions. Furthermore, it is desirable for the government to devise measures to reduce the impact of investor sentiment by making the market more stable.

This study contributes to the existing literature by conducting a thorough analysis of herding in the Korean stock markets under different market conditions, and also introducing the investor sentiment into the herding behavior model. Our results provide useful information for investors and regulators, especially during down-market and high-trading volume periods, and can be helpful in hedging.

Future research can analyze different investor sentiment indexes and study whether herding behavior is affected by different factors (macro information) apart from sentiment. Because herding behavior occurs in extreme events (financial crisis, recession), if the copula model considering extreme events is applied, new evidence may be presented in the stock market.

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Audit of Museum Marketing Communication in the Modern Management Context

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Abstract: Marketing communication is a concise part of modern museum management. Museums operate in a competitive environment; therefore, it is important to pay sustained attention to every component of a given museum's marketing communication. Changes, international trends, and visitor preferences have an influence on marketing communication. Museum management must devote expert deliberation towards determining which components of their marketing communication are significant for museum visitors. Moreover, the effectiveness of the use of expenses plays an important role in museum management; it is also essential to combine effectively the individual components of marketing communication. The present research aims to find a correlation between the components of museum marketing communication, which is not being addressed in detail in the contemporary research. The aim of the research is therefore to determine the dependence amongst elements of the marketing communication of museums on questioning the visitors. The aim was achieved by implementing the modern audit approach and empirical research into marketing communication: the Paper Aided Personal Interview (PAPI) method with a Likert scale, a reliability check with Cronbach's alpha, and dependency determination with Pearson's correlation. All results were investigated through the use of a questionnaire on the international EU 27 sample of museum visitors. These conclusions allow museum management to build their marketing communication on the principles of Economy, Efficiency, and Effectiveness (the 3E principles).

Keywords: audit; communication; management; marketing; museum; risk

JEL Classification: G32; M31; M42

1. Introduction

Society continually experiences cultural change. Moreover, the world is shifting from a static dimension to a dynamic dimension, which is supported by Industry 4.0. This expands reality through the introduction of a digital reality, which brings new challenges. This may be applied to the cultural sphere as well, and specifically to museums. It is clear that even historical artifacts should meet current visitors' expectations and communicate with them in a modern way. That is where marketing communication comes into play and becomes an informal channel between museums and their visitors. Hypothetically, such communication processes might be complex, risky, and ineffective. Thus, it is crucial to address, research, and systematize the issue.

One of the aims of the present research involves identifying the interdependency between museum marketing communication components. The justification of the research aim is mostly

founded in the urgent need to obtain information on the perception of marketing communication by the non-expert public: museum visitors. Currently, in the time of information, advertisement fog, and mutual competition, museum management needs to understand which components of museum marketing communication cause visitors to react and how they react. The aim of the research is therefore to determine the dependence amongst elements of the marketing communication of museums by questioning museum visitors. This aim is connected with the research questions and evidentiary hypothesis.

The entire research herein is based on the Paper Aided Personal Interview (PAPI) method (Barbu and Alexandru 2011). It is then supplemented by the Likert scale (Hayes 1998) and tested on a randomly chosen sample of museum visitors. The reliability is measured with the help of the Cronbach's alpha (Giddens 2013), whereas the dependent components of the marketing communication are determined with the help of Pearson's correlation (Wijayatunga 2016). It can be stated that the results of the research on the dependency of the marketing communication components will clarify for museum workers which exact marketing communication components should be used, ultimately serving the promotion of the museum sciences in general.

2. Literature Review

The following research gives an overview of the authors' theories on the current situation in museum marketing. Along with this, it implies possible solutions for the questions that are raised. In the research, therefore, the authors are addressing the museum issue, which is then situated into a marketing communication context to uncover risk areas for the museum sphere.

2.1. Museums Environment

It is important to establish the definition of the word "museum" from the theoretical point of view. The ICOM (International Council of Museums) code of professional ethics for museums defines it using the international perspective: "A museum is a non-profit, permanent institution in the service of society and its development, open to the public, which acquires, conserves, researches, communicates and exhibits the tangible and intangible heritage of humanity and its environment for the purposes of education, study and enjoyment" (ICOM 2017, p. 48). It is evident that this definition symbiotically interlinks with the aforementioned theories (Mariani and Guizzardi 2019). Even in national legislation acts, we may find the relevant defining references.

"The cultural and creative industry is a key indicator of measuring the development of a nation or a society". (Shiau and Hu 2020, p. 325). The society-wide extent of museums is supported by Kollár (2003). In this regard, the promotion of culture and education nowadays constitutes a challenge for museums (Lukáč and Mihálik 2018; Podušelová 2002). It is then provable from the literature that museums form an important part of society (Johnová and Černá 2007). Competition exists even in the museum sphere, making it essential to pay adequate marketing attention to museums (Nechita 2014). Bourgeon (2000) highlights the importance of understanding the emotions of museum visitors. In this regard, there is a need to identify their reactions, for example towards marketing communication.

After defining the issues from a theoretical perspective, it is also important to define them from a social perspective. Johnová (2008, p. 40) declares the following: "The main objective of the museum itself is to collect, store, research and exhibit art pieces, fulfill the education purpose towards the society". From this definition, the three main roles of a museum can be derived. Among them are the scientific, collecting, and cultural educating roles (Cerquetti and Ferrara 2018). Moreover, it becomes evident that such aims bring high financial requirements, as Tajtáková (2010) or Butoracová-Šindleryová and Benková (2009) show in their work. Modern marketing components can mainly contribute to museum financing (Bačuvčík 2012; Agwu and Onwuegbuzie 2018; Hoeven 2019).

"Marketing and museums have a long relationship, rife with dilemmas and prejudices about the way in which marketing could (should) be accepted in museums' practice" (Komarac et al. 2017,

p. 216). Zbuchea (2015) directly supports marketing and museums with the aim of attracting visitors, which is also supported by Komarac et al. (2019).

2.2. Modern Marketing

What is modern marketing (Al-Waely 2019)? "The aim of marketing is to create a value of customers and to capture value from customers in return" (Kotler and Armstrong 2010, p. 26). Based on this definition, it can be concluded that marketing can find its implementation in culture, or more precisely, in the museum sector. Lukáč (2015) directly links marketing to culture. His review explicitly shows that the overlap in between these two fields became visible after the Second World War in a quest to distract the attention of society from the events of the war. The interconnection of culture and marketing was defined around the end of the twentieth century and the beginning of the twenty-first century (Butoracová-Šindleryová et al. 2019; Brown and Crosno 2019).

Rentschler and Hede (2009, p. 12) directly link the role of modern marketing (Cluley et al. 2020; Sheth 2020) to museum marketing: "Marketing is still a dirty word to some in museums. With the term comes images of used car salesman and the 'Disneyfication' of culture. Is it possible to market your product successfully without 'dumbing' it down? This brief history of museum marketing, the changes it has undergone, and the approaches taken in many museums, shows that it is". This argument is also justified by Kesner (2005), who stresses that for culture and museums, marketing becomes mainly a tool for achieving the objectives of cultural organizations towards society. The submitted theories help to define museum marketing from the literature perspective.

"For museums, marketing is an exchange process in which a museum aims to offer visitors great value at a low cost and at the same time create a surplus or break-even in the exchange. Marketing is at its core an exchange process between those who seek a product or service (experience, idea, place, information) and those who can supply that product" (Kotler et al. 2008a, p. 22). Kesner (2005) looks at the aforementioned argument from the cultural-economic perspective and adds that the aim of marketing for cultural organizations is to ensure a market share concerning attendance, satisfaction, and visitors (Godwin 2019). Such a market share is guaranteed by the further mentioned approaches.

Museum marketing communication may be included among the primary approaches, which is supported by Kotler's basic theory (Kotler 1991). The main aim of marketing communication as per Hesková (2001) is information sharing, directing the visitor towards the sales strategy of the organization, in the current case, the museum. According to Strišš et al. (2007), the aim of communication is to inform visitors about cultural events, to provide motivation for those who are interested in culture and, last but not least, to educate and nurture the cultural community. That is the current definition of marketing communication.

2.3. Marketing Risks

The development of contemporary marketing processes reasonably reflects new opportunities (Petrů et al. 2019a), and at the same time new risks (Tkachenko et al. 2019; Ferreira et al. 2020). It is important to have an adequate reaction towards the latter. Risk itself is a unique social phenomenon (Yoe 2012) that impacts the surrounding from a materialistic perspective. "The risk is the historical notion that traces back to the 17th century when it first appeared in the connection with boat shipping. The word 'risico' has Italian origin and means a bottleneck which sailors must avoid". (Smejkal and Rais 2010, p. 10). In Merriam-Webster's *Collegiate Dictionary*, the notion of risk is defined as follows: "To expose to hazard or danger". (Damodaran 2012, p. 58).

A modern definition of marketing risks can be derived from the findings of Mulačová and Mulač (2013, p. 209): "The risk can be commonly defined as the probability of having the result of the event derogating from the objective that we want to achieve. It is a scale of the uncertainty connected with the expected result". In the context of the given work, risk is understood as a situation that can greatly impact the aim of marketing communication, or as the combination of events and their results with negative consequences (Hopkin 2018; Dvorský et al. 2019). A responsible approach to the selected

risks of marketing communication might then have a positive impact not only on the organization management (Vybíhal and Cedidlová 2014; Břečková 2016), but on the management of the museum sphere in general.

The issue of having risks is not directly linked to the marketing sector (Sadgrove 2016); however, one can observe the statistics listed in the international "Report to the Nations. 2018 Global Study on Occupational Fraud and Abuse" that marketing is indeed among the riskiest environments (Association of Certified Fraud Exers 2018). Andersen et al. (2014, p. 6) add to the topic: "It indicates a potentially negative effect on an asset that may derive from given processes in progress or given future event. In the common language, risk is often used as a synonym of probability of loss or a danger". This definition might be related to the type of marketing communication under examination.

The defined chain—museum communication risk—is worth paying attention to, whether in the context of management, marketing, or science. As long as management is not familiar with the risks, negative consequences connected mainly with marketing investments may occur. According to Pickett (2005), an audit approach needs to be in place to prevent such negative consequences as a way to mitigate any associated risks. According to Kumar and Sharma (2005), an audit of the processes, risks and marketing effectiveness might be used for subjective marketing communication. This will help to identify any gaps in the marketing activities and consider further steps to exclude them (Ferrell and Hartline 2014). The following part of the work is dedicated to the aforementioned subject.

3. Purpose, Material, and Methodology

This section describes the material chosen for the research project on marketing communication. Subsequently, certain components are presented that might be implemented to achieve the desired aims (a modern audit). Moreover, the methodical approaches are specified for determining the identified issue (computational statistics).

The importance of the research is to shed light on the dependence on marketing communication components in order to enable adequate marketing communication adjustments for museum management. The extent of the research is therefore limited to the following research questions: "Which components of marketing communication (Labanauskaitė et al. 2020) are evaluated most positively by visitors ($Q1_{descriptive}$)?"; "What is the relationship (Hausmann and Poellmann 2013) between marketing communication components ($Q2_{comparative}$)?". The aim of this research is therefore to determine the dependence amongst elements of the marketing communication of museums on questioning the visitors. The realization of the aim of the research might clarify the following hypotheses: the individual components of marketing communication are rated differently (H1); a significant dependency exists between marketing communication components (H2).

3.1. Marketing Communication

Marketing communication was chosen as the subject matter for this work. The decision was made based on the fact that the effective application of marketing communication has become a meaningful part of the marketing strategy of modern museums. To maintain the effectiveness of such communication, the seller and customer, in other words, the sender and the receiver of the communication, need to be interconnected (Blakeman 2015). Chaturvedi and Chaturvedi (2011, p. 11) state the necessity of such effectiveness: "Several changes in the modern technological age of information have made people pay more attention to communication as an important tool in successful management". Moreover, Kotler et al. (2008b) support the analysis of the subject matter.

Chaturvedi and Chaturvedi (2011, p. 302) define marketing communication as follows: "Marketing communication is information, benefits, attributes, perceptual image/persona, feeling, and attitudes all bundled into one". This quote is supported by Fill (2006, p. 9), who perceives it in the context of the recipient: "Marketing communications should be an audience-centered activity". The holistic purpose of the whole communication is then presented by Přikrylová and Jahodová (2010, p. 41): "Marketing communication represents for the market the very nature of the brand personality, creates awareness

on the brand, reinforces brand knowledge, impacts customer views on the brand meaning creation of unique and positive associations".

Marketing communication is then analyzed and defined in terms of the museum-specific context. According to Lukáč (2015, p. 68), it aims is to address present and potential visitors, which is also confirmed by Hausmann (2005), at the cultural level. Macalik (2018) states that the adjustment of museum marketing communication should reflect the social concept. Hausmann and Poellmann (2013) support this point of view and emphasize the expanding role of museum marketing communication. Museums are a part of competitive environment; that is why it is important here to apply marketing communication (Nechita 2014; Colladon et al. 2020).

The following marketing communication components were chosen for research into their dependencies: Advertisement, Direct Marketing, Personal Selling, Public Relations, Sales Support, Digital Media. This selection, organized respectively by the importance of the components, is based on the fundamental classification of marketing communication (Réklaitis and Pileliené 2019; Labanauskaitė et al. 2020; Bae et al. 2020).

From the presented literature analysis, it is clear that marketing communication creates an exposed component for museum management (Tsai and Lin 2018). The reviewed interconnection might be extended by the thoughts of Kotler and Keller (2013, p. 515): "That is why we perceive marketing management as a piece of art, as the science of the target market choice, as collecting, maintaining and developing of the customers with the help of creating, delivering, and communicating of the valuable customer values". The management here operates with various components (Říhová et al. 2019) that help to ensure the highest professional care is given to the chosen marketing communication approach. The audit approach by Kupec (2017) belongs among these analytical components.

3.2. Audit Approaches

The modern audit aims for the analytics of certain processes using different methodical approaches. Müllerová (2013) shows the basic approach, where an audit is understood as a scientific discipline that observes and recognizes certain facts. In the context of the aforementioned interconnected marketing and management, Pickett's (2005, p. 3) audit approach may be recognized: "It helps an organization accomplish its objectives by bringing a systematic, disciplined approach to evaluate and improve the effectiveness of risk management, control, and governance processes". It is evident from the above that multiple audit techniques provide help to management in all the mentioned fields and sectors (Furtună and Ciucioi 2019; Lobo et al. 2020).

One of the benefits of management, or the modern audit technique, might be its focus on changing businesses and changing business processes, which are stressed by Oláh and Rózsa (2009), Jeřábek and Čapošová (2016), and Petrů et al. (2019b). In such a situation, marketing communication becomes a subject matter, or audited process, which, according to Blakeman (2015), is supported by both the seller and buyer, or the receiver and the recipient in the communication process. Further, such processes undergo constant development, as Chaturvedi and Chaturvedi (2011) claim. We need to pay proper attention to the processes, and through this help management (Christensen et al. 2019; Kaban 2020) in the relevant field.

In the context of a marketing communication audit (Kitchenko and Kuchina 2019), the analytical processes (Liangcheng et al. 2019) are interpreted primarily as per Kotler and Keller's (2013) methodology, which understands the audit as an examination of the marketing surroundings which are highly variable. To make this argument more precise, the definition of a marketing-oriented audit by Lyková (2000, p. 11) is presented as follows: "[a] marketing audit represents a systematic sequence of the diagnostic steps which take up the marketing activities of the organization on a broad scale. It is about a complex, systematic, independent, repetitive examination. After the analysis, it comes to an action plan for the improvement of organization's marketing".

Skelton (2014) links to this argument in his work, and Písař and Kupec (2019) summarize it in practice. From the methodical point of view, the audit might be perceived as an analytical tool offering

consulting and advisory services. Keller (2007) adds to the aforementioned by stating that, first of all, it is about a comprehensive examination of marketing processes and proposing an action plan to improve the marketing performance of the organization. Kotler et al. (2008b) affirm the audit in an interdisciplinary sense. The mentioned approaches depict the current situation with regard to sectoral knowledge. Further, in the work, an overview of the particular methods used while auditing museum marketing communication is provided.

3.3. Research Methods

The entire audit, or analytics and research, were based on the methodology of interviewing a select set of museum visitors. The size of the sample was derived from the primary data; according to the National Information and Advisory Center for Culture (2018), in 2018 there were 6,333,294 international visitors in Czech museums. The sample size for the questionnaire was calculated at 0.1% of the primary data based on the expert estimate calculation, which amounted to 633 respondents. The survey took place in one selected museum site using the stratified selection of the respondents. The sample was then demographically divided in proportion to the representation of each Member State of the EU 27 (even distribution among men and women aged 18 years or older).

Data collection took place from September 2018 to August 2019, focusing on international EU 27 respondents. As per the aforementioned selection, 633 respondents were contacted. The structure of the questionnaire and particular questions (Troilo 2015; Keramitsoglou et al. 2018) were as follows: "How do you evaluate each component of marketing communication?". The following components of marketing communication were evaluated: Advertisement, Direct Marketing, Personal Selling, Public Relations, Sales Support, and Digital Media, as per the classifications given by Chaturvedi and Chaturvedi (2011) and Labanauskaitė et al. (2020). The evaluation was conducted using the Likert scale with 5 points (1—very negative perception of the marketing communication component; 2—negative perception; 3—neutral perception; 4—positive perception; 5—very positive perception).

The appropriateness of the PAPI method for the present research resides in the possibility of direct contact with the respondents for the purposes of gaining quantitative data (Barbu and Alexandru 2011; Troilo 2015; Keramitsoglou et al. 2018). The PAPI method fully respects the international codes and rules of market research and public opinion polling: the International Code on Market and Social Research (ICC/ESOMAR); EFAMRO quality standards (EMRQS—EFAMRO Market Research Quality Standards); and the international ISO 20252 norm on Market, Opinion and Social Research—Vocabulary and Service Requirements, including the definitions set out, specific codes, and ESOMAR guidelines.

The PAPI method was supported by the Likert scale, which measures the values of the respondents' answers (Hayes 1998). The reliability check (Gavora 2010), was made based on Cronbach's alpha (see Equations (1) and (2)). Cronbach's alpha (Kramer et al. 2018) uses values from 0 to 1, of which the value 1 might be reached only under the circumstances that all the examined items are linearly connected, which means that the researched example has a high explanatory value. A low value indicates the opposite. Wijayatunga (2016) recommends these methods as well. The calculation of the values using Cronbach's alpha was performed using the IBM SPSS version 25 statistical tool.

Equation (1): Cronbach's alpha:

$$\propto = \frac{k}{k-1}\left(1 - \frac{\sum_{j=1}^{k} var\left(Y_j\right)}{var\ (Y)}\right) \quad (1)$$

where, k is the number of test items, var (Y_j) is the dispersion of the j item values, and var (Y) is the dispersion of the overall test score.

For the items with yes/no answers, the Cronbach's alpha formula could be simplified into the following formula, named Kuder and Richardson's formula:

Equation (2): Kuder and Richardson's formula:

$$\propto = \frac{k}{k-1}\left(1 - \frac{\sum_{j=1}^{k} p_j q_j}{var(Y)}\right) \quad (2)$$

where, p_j is the likelihood of a correct answer on the j item, and $q_j = 1 - p_j$ is the likelihood of an incorrect answer.

For the determination of marketing communication components that are dependent on visitors, Pearson's correlation (see Equation (3)) might be used. The formula measures the relationship between the two variables. Tsintsadze et al. (2018) submit that the positive side of this formula includes the possibility of measuring the consequences of the variables of interest interaction. Chornous and Ursulenko (2013) also support this. Tran (2011) specifies Pearson's correlation as a number between 1 and +1 that determines the mentioned variables' ratio. A positive number denotes a positive association, while a negative number denotes an inverse association. Pearson correlation contains the variables x and y, which are used in the following example:

Equation (3): Pearson's correlation:

$$px, y = \frac{COV(x,\ y)}{\sigma x \sigma y\ 1} \quad (3)$$

With the relevant example of the $r_{x,\ y}$ correlation:

$$r_{x,\ y} = \frac{\sum_{i=1}^{n}(x_i - \overline{x})(y_i - \overline{y})}{(n-1)S_x S_y}$$

where, COV (x, y) is the occurrence of correlation between x and y, σx is the standard deviation of x, and σy is the standard deviation of y.

In Equation (3), x and y denote the standard deviation. Here, Pearson's correlation coefficient determines the intensity of the relationship between the variables (Tsintsadze et al. 2018); in other words, it shows the intensity of the link between variables (when less than 0.20, the relationship is negligible; when ranging from 0.20 to 0.40, the relationship is not very close; when ranging from 0.40 to 0.70, the relationship is intermediate; when ranging from 0.70 to 0.90, the relationship is very close; when the relationship is more than 0.90, we can speak about an extremely dependent relationship). The results of the analysis show mutual interrelation as follows: with values exceeding 0.40, the relationship between variables is significant for the research; with values exceeding 0.70, the relationship between variables is crucial.

4. Results and Discussion

The research aimed to determine the components of marketing communication that are dependent on visitors. At the same time, the results further develop our previous research, along with the project called "Marketing Models in Industry 4.0" (VŠFS 7429/2017/04). The primary outcomes worth mentioning include the fact that marketing communication is an essential part of marketing management in the museum sphere concerning the positive, significant data of the research (see below). In terms of sector-specific discussion, the theories of Kotler et al. (2008a) or Kesner (2005), both of which place emphasis on the significance of communication in the modern marketing practices of museums, could be affirmed.

Other findings include the test results on the reliability of the data examined. The calculation of reliability with the help of Cronbach's alpha formula for the $n = 6$ items examined (Advertisement, Direct Marketing, Personal Selling, Public Relations, Sales Support, Digital Media) denotes 0.817. Kramer et al. (2018); Giddens (2013); Gavora (2010), values for Cronbach's alpha exceeding 0.7 depict high data reliability. That is why we can claim that the analyzed data is reliable. Based on the data

received, the adequate audit recommendation following the approaches of Kotler and Keller (2013) or Müllerová (2013) can be drawn.

The resulting analysis of Pearson's coefficient showed significant values, coefficients, or, in other words, the results of the conducted research (see Table 1). From the audit perspective on the analyzed marketing components in the museum sphere as per the respondents, Direct Marketing and Digital Media were the two most important components (0.860). The second most important components of marketing communication comprise Advertisement and Sales Support (0.709). Public Relations and Personal Selling (0.653) close out the trio. All other components under the audit loop reach 0 to +1 values as well, which, as per Tran (2011), denotes clear evidence of the positive relationship of the respondents towards all the remaining marketing communication components. Certain components just require expert-level focused attention.

Table 1. Pearson's correlation and the evaluation of Q1 and Q2 questions.

		Advertisement	Direct Marketing	Personal Selling	Public Relations	Sales Support	Digital Media
Advertisement	Pearson's Correlation	1	0.163 **	0.346 **	0.421 **	0.709 **	0.143 **
	Sig. (2-tailed)		0.000	0.000	0.000	0.000	0.000
	N	633	633	633	633	633	633
Direct Marketing	Pearson's Correlation	0.163 **	1	0.440 **	0.447 **	0.309 **	0.860 **
	Sig. (2-tailed)	0.000		0.000	0.000	0.000	0.000
	N	633	633	633	633	633	633
Personal Selling	Pearson's Correlation	0.346 **	0.440 **	1	0.653 **	0.524 **	0.495 **
	Sig. (2-tailed)	0.000	0.000		0.000	0.000	0.000
	N	633	633	633	633	633	633
Public Relations	Pearson's Correlation	0.421 **	0.447 **	0.653 **	1	0.546 **	0.473 **
	Sig. (2-tailed)	0.000	0.000	0.000		0.000	0.000
	N	633	633	633	633	633	633
Sales Support	Pearson's Correlation	0.709 **	0.309 **	0.524 **	0.546 **	1	0.304 **
	Sig. (2-tailed)	0.000	0.000	0.000	0.000		0.000
	N	633	633	633	633	633	633
Digital Media	Pearson's Correlation	0.143 **	0.860 **	0.495 **	0.473 **	0.304 **	1
	Sig. (2-tailed)	0.000	0.000	0.000	0.000	0.000	
	N	633	633	633	633	633	633

** Correlation is significant at the 0.01 level (2-tailed).

Based on the formalized audit techniques, the dependency of marketing communication components from Direct Marketing to Digital Media on museum visitors can be added among the summarized findings. The results might serve for museum management to invest into exact marketing communication components. From the above-mentioned table, the interdependency of components may be determined, thus enabling museum management to work with separate marketing communication components; in cases with positive results, such interdependency might be sustained by investment, while in cases with less positive results the interdependency might be enforced with the help of investment (Kupec 2018).

The exact results are presented in Table 1, with the help of which both hypotheses H1 and H2 were proved. This means that the individual components of marketing communication are rated differently (H1 approved; see Table 1) and a significant dependency exists between the marketing communication components (H2 approved; see Table 1).

The presented results should be an important addition to marketing management. In fact, the marketing management has been continually changing, which is confirmed by Al-Waely (2019). Although a unique concept or a single mix of museum marketing communication cannot be recommended, according to Brown and Crosno (2019) marketing communication must be continuously monitored, audited and improved. This confirms the above-mentioned results. In addition, the importance of the approaches used is verified by Cluley et al. (2020); however, with a critical acknowledgment of the application limits (see below). In any case, the results expand the approaches of marketing management according to Sheth (2020).

In terms of the discussion, the limits of the research traditionally related to the problematic measurability of marketing investments and their payback must be mentioned. Based on the overview

provided (Table 1), museum management might impose measurable marketing combinatorics. These particularly apply to: (1) the support for museum marketing communication in relation to the rehabilitation/restoration of historical artefacts; (2) the improvement of museum support services; (3) the increase of event marketing capacities; (4) the expansion of social media usage, particularly in the international context, offline communication forms have declined; (5) the extent of the society-wide museum aspect in terms of everyday marketing.

5. Conclusions

This work embraces museum marketing communication and the audit-based analysis of its components. The museum sphere and the communication strategies therein experience constant changes and development, together with the entire world. This, in most cases, risky development needs to be monitored in order to eliminate risks, control changes, and uncover ineffectiveness. The aim of this research was therefore to determine the dependence amongst elements of the marketing communication of museums by questioning the visitors. The aim and task of the submitted research were fulfilled by applying the audit approach, which allowed ineffective museum communication areas to be revealed. The main results include the identification of the degree of dependency between museum marketing communication components, showing the significance of the museum marketing communication for the visitors. The positively dependent components of the marketing communication can be listed in the descending order of importance: Direct Marketing and Digital Media, Advertisement and Sales Support, Public Relations and Personal Selling. The potential limits of this research traditionally related to the problematic measurability of marketing investments, the subsequent evaluation of marketing impacts, and financial payback. Thus, these limits outline a further research possibility, which lies in the continuous auditing and digital measurement of selected elements of marketing communication rather than in the PAPI survey. As it stands, the submitted results that if practically implied, help museum management to identify the most suitable ways and components of marketing communication to make adequate investment decisions. If this approach is not applied, museums might build their marketing strategies ineffectively and with a greater degree of risk. In the case of the successful implementation of audit results from the side of museum management, there is a greater chance to run an effective marketing communication, contributing to the development of the cultural sector as a whole.

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Compensations of Top Executives and M&A Behaviors: An Empirical Study of Listed Companies

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Abstract: This study empirically examines the relationship between executive compensation and mergers and acquisitions (M&A) behaviors by identifying the influence of short- and long-term incentive on the propensity and scale of M&A. When the short-term incentive is insufficient, M&A behaviors serve as a beneficial compensation mechanism. Thus, lack of executives' incentive promotes the propensity to engage in M&A and significantly affects the scale of M&A. With regard to long-term incentives, M&A behaviors serve as a beneficial creation mechanism. Shareholding of executives promotes M&A propensity, and does not significantly affect the scale of M&A. This study significantly contributes to research in M&A behaviors by revealing the beneficial distribution mechanisms of M&A behaviors.

Keywords: mergers and acquisitions behaviors; executive compensation incentive; beneficial distribution mechanisms; listed companies

JEL Classification: G34; M52; N25

1. Introduction

Top executives play an important role in the corporate mergers and acquisitions (M&A) behaviors (Zhou et al. 2020; Amewu and Alagidede 2019; Agyei-Boapeah et al. 2019). Separation of ownership and management rights enables high-ranking executives who control the resources of listed corporations to use M&A as a means for personal gain (Tang et al. 2020; Jensen and Meckling 1976; Fama and Jensen 1983). Consequently, such executives are motivated to pursue investments of large scale rather than large return, leading to losses in shareholder values. As an effort to increase the interest drive among high-ranking executives and shareholders, listed corporations often introduce a set of executive incentives, which aim to reduce agency costs through profit-sharing schemes that improve incentive compatibility (Chu et al. 2020).

The Code of Corporate Governance for Listed Companies in China clearly dictates that a board of directors should establish a subordinate compensation committee to oversee the design of executive-incentive mechanisms. The China Securities Regulatory Commission (CSRC) further requires that listed corporations disclose the work results of the compensation committee (as well as those of the audit committee) in their annual reports. The rationale behind this policy is that incentives may affect the behavioral propensity of high-ranking executives, particularly with regard to strategic behaviors concerning corporate development and resource allocation (Zhou et al. 2020). Preliminary investigations have been conducted on the associations between executive incentives and M&A, but these studies have neglected to compare the effects of short- and long-term incentives on corporate M&A.

The present study examines 952 listed companies across 3 years in the Shanghai and Shenzhen Stock Exchanges. For a theoretical framework of business expansion, this study implements the principal–agent theory for an empirical analysis of short-term (primarily compensation-based incentives) and long-term (primarily equity-based incentives) executive incentives and their effects on corporate M&A. Specifically, this study first investigates how executive incentives affect listed corporations in determining their expansion propensity in the M&A process, and subsequently determines how executive incentives affect the scale of M&A that listed corporations engage in.

This study offers three contributions to existing theories: (1) the principal–agent theory is applied in examination of executive incentives' effects on corporate M&A, thus broadening the horizon of M&A research; (2) the effects of both short-term (salary-based) and long-term (equity-based) executive incentives on corporate M&A are examined; and (3) the in-depth investigation on M&A involves comparison and further analysis of the propensity behind and scale of such operations. This study offers a valuable reference for the reform of executive-incentive systems and the improvement of M&A monitoring systems in China.

2. Theoretical Analysis and Hypothesis

2.1. Salary-Based Executive Incentives and Corporate M&A

The effectiveness of salary-based (or cash-based) executive incentives lies in the reasonability of the association between compensation and performance. Reasonable executive compensation can alleviate agency costs induced by executives' self-interested behaviors (Bizjak et al. 2008). Salary-based executive incentives have long served as a key governance mechanism for solving the agency problems between shareholders and corporate managers. Compensations are increasing for managers of listed corporations in both the United States and China. The problem of private managerial benefits is a focal point for the effects of agency problems on corporate expansion. The purpose of compensation-based executive incentives is to promote agency behaviors that align with the interests of the principals. Studies based on human capital theory and managerial power theory indicate that when a corporation's board of directors design a compensation contract for managers, compensations offered by similar corporations should be considered as benchmarks (Faulkender and Yang 2010; Bizjak et al. 2008). Benchmarks should also include corresponding salary levels in the industry and corporate size, because managers working for large corporations tend to receive higher salaries. The pecuniary gains that the managers receive from corporate expansion can serve as a driving force for corporate expansion (Grinstein and Hribar 2004; Firth 1980).

M&A propensity is represented by a relative value obtained from comparing the scale of M&A-based expansion with the scale of an expansion from a corporation's investments. That is, M&A propensity represents the degree of a listed corporation's propensity to choose M&A as an expansion strategy. The literature indicates that corporations with lower levels of executive incentives are more inclined to expand through M&A. However, endogeneity is also observed in the relationship between compensation-based incentives and the scale of an expansion based on a corporation's investments. Thus, whether executive compensations should be classified as incentives or rewards for corporate-investment-based expansion is difficult to determine. Compared with M&A, the investment-based expansion yields a longer cycle (Demsetz and Villalonga 2001). In addition, because of the fixed term of high-ranking executives in listed corporations, M&A is an effective means for high-ranking executives to directly vie for rapid obtainment of increased compensation. Harford and Li (2007) verify this point; they report that high-ranking executives tend to initiate mergers for their own benefits, such as for increases in personal salaries. Therefore, this study poses the following hypothesis:

Hypotheses 1. *Top executives receiving lower compensations are more inclined to choose M&A.*

Because the scale of M&A is positively correlated with the short-term pecuniary compensations high-ranking executives receive, unsatisfactory short-term compensation-based incentives can prompt

high-ranking executives to undertake large-scale M&A. The reasons for this are two-fold: first, M&A enables high-ranking executives who possess residual rights of control to rearrange their pecuniary compensations, thereby maximizing their private benefits (Gabaix and Landier 2008). Furthermore, M&A is a complicated undertaking, wherein high-ranking executives can obtain tremendous returns because of task complexity and the returns will be proportional to task complexity. Thus, large-scale M&A is beneficial in raising the short-term compensation of high-ranking executives. Second, the potential elevated compensation, power, fame, and status that M&A can generate may tempt managers to undertake large-scale M&A at the expense of shareholder interests (Jensen 1986; Shleifer and Vishny 1990). Based on these factors, this study presents the following hypothesis:

Hypotheses 2. *Salary-based incentives for top executives are negatively correlated with the scale of M&A; that is, top executives with relatively low compensation levels tend to engage in relatively large-scale M&A.*

2.2. Equity-Based Executive Incentives and Corporate M&A

In 2005, the Measures for the Administration of Equity Incentives of Listed Companies issued by the CSRC established a legal foundation for the promotion of stock options as executive incentives. Executive shareholding is a complicated mechanism that influences corporate business performance. Studies based on varying research contexts, data sources, and theories have concluded the following: (1) executive shareholding and corporate business performance show a linear correlation (Cael et al. 2003; Jensen and Murphy 1990); (2) executive shareholding and corporate business performance show a nonlinear correlation (Kole 1995); and (3) no significant correlation is observable between executive shareholding and corporate business performance (Himmelberg et al. 1999). Some studies present contradictory conclusions on the mechanisms through which executive shareholding influences strategic corporate decisions. Some researchers in support of the convergence-of-interest hypothesis argue that (1) from the perspective of principal–agent theory, executive shareholding is a mechanism that enables the convergence of managerial and shareholder interests, and this convergence can lower agency costs, and (2) from the perspective of team production theory, executive shareholding encourages and helps supervise managers to a limited degree (Chapple et al. 2020). Researchers in support of the managerial entrenchment hypothesis consider that increased executive shareholding endows managers with greater corporate control, which, due to the weakened external restraints from other shareholders and the market, tempts the managers to pursue private benefits and deviate from the corporate goal of value maximization. Equity-based incentives are a type of long-term incentives, and thus their relationship with the scale of corporate M&A is challenging to determine. Based on the cited information, this study hypothesizes the following:

Hypotheses 3a. *Corporations with higher executive shareholding are more likely to expand through M&A.*

Hypotheses 3b. *Corporations with lower executive shareholding are more likely to expand through M&A (competing hypotheses).*

Hypotheses 4. *Executive shareholding exhibits a nonsignificant effect on the scale of corporate expansion through M&A.*

3. Data and Summary Statistic

3.1. Sample Selection and Data Sources

The investigated sample consists of public companies listed in the Stock "A" markets at Shanghai and Shenzhen Stock Exchanges in China from 2011 to 2013. The reason for choosing this time interval is as follows: (1) it was necessary to avoid the impact of the share-sharing reform of China's capital market, which began exploratory attempts in the 1990s, and was basically completed in 2008; (2) since the new accounting standards were implemented in 2007, and the implementation effect required an adaptation period, the data after 2009 can guarantee the consistency and stability of accounting

standards; (3) in 2010, The State Council issued "The Opinions of the State Council on Promoting Mergers and Acquisitions of Enterprise", which accelerated the strategic adjustment of the layout and structure of the state-owned economy, promoted the development of the non-public economy and small and medium-sized enterprises, and had a significant impact on the M&A behaviors of listed companies. Therefore, we chose the year 2010 as the starting year. (4) Since the time period required for M&A transaction is relatively long, about 6–24 months, the sample that has completed the merger and reorganization in 2013 was selected to avoid the deviation caused by failure samples.

We obtained original data from the China Stock Market and Accounting Research (CSMAR) database. Data missing from the CSMAR database were accounted for through manually collected information from the announcements of listed companies on the CNINFO website. The following sample-exclusion criteria were followed, resulting in the identification of 952 valid samples (from a total total 2856 firm-year observations): (1) eliminate ST (special treatment) and *ST corporations, (2) eliminate corporations that experienced change in actual control, (3) eliminate listed corporations in the financial industry, and (4) eliminate corporations with noticeable anomalies in data or insufficient data disclosure.

The M&A data of the included samples from 2011 and 2013 were collected for further screening and processing according to the following criteria: (1) the transaction must be listed as a "success"; (2) the listed corporations must act as the "buyer" in the M&A; (3) the types of M&A are asset acquisition, merger, and takeover bid; (4) the targets are assets, equities, and assets and equities; and (5) if numerous mergers and acquisitions occurred in 1 year, the annual amount of cash involved in the M&A is the sum of the amounts for all the M&A.

This study follows the variable operating methods already studied for listed companies (Wadhwa and Kotha 2006) and considers a one-year lag period for some variables. The data time range is 2010–2013 for a total of 4 years. All variables are winsorized at the 1% level to avoid outlier influence.

3.2. Variable Selection and Definition

As described, the dependent variables in the present study include propensity to engage in M&A-based expansion and the scale of M&A-based expansion, and these variables are measured based on the methods proposed in the work of Jiang et al. (2011). Propensity to engage in M&A-based expansion is used to assess a corporation's relative inclinations toward general expansion or M&A-based expansion when a choice between the two is present. A dummy variable for whether the scale of M&A-based expansion is greater than that of general expansion is set up as follows:

$$CE_{it} = \begin{cases} 0, & \text{if } MAE_{it} < GE_{it} \\ 1, & \text{if } MAE_{it} > GE_{it} \end{cases} \quad (1)$$

The variable CE_{it} represents the expansion propensity of corporation i in the year t. In the event that the scale of M&A-based expansion is greater than that of general expansion, corporation i is more inclined to choose M&A-based expansion, and $CE_{it} = 1$; conversely, if the scale of M&A-based expansion is smaller than that of general expansion, corporation i is more inclined to choose general expansion, and $CE_{it} = 0$.

The scale of general expansion is defined as GE, which is measured as follows:

$$GE_{it} = (BFI_{it} - SFI_{it}) / TS_{it} * 100\% \quad (2)$$

where GE_{it} represents the scale of general expansion of corporation i in the year t; BFI_{it} represents the cash corporation i paid in the year t for the construction of fixed assets and for intangible assets; SFI_{it} represents the net cash return corporation i received in the year t for the sale of fixed assets and intangible assets; and TS_{it} represents the total assets of corporation i at the start of year t.

The scale of M&A-based expansion, MAE, is measured as follows:

$$MAE_{it} = ma_{it} / TS_{it} * 100\% \quad (3)$$

where MAE_{it} represents the scale of M&A-based expansion of corporation i in the year t, and ma_{it} represents the cash sum for the M&A operation or operations corporation i engaged in in the year t.

The independent variables include short-term incentives, for which compensation-based incentives are used as a proxy variable, and long-term incentives, for which equity-based incentives are used as a proxy variable. The data of each high-ranking executive of the sample corporations from the CSMAR database, including the executives' salaries and stock shares, are quantified and encoded. These values are then used in numerical calculations. The positions examined are core decision-makers in each corporation, such as the chairperson, general manager, assistant to the general manager, vice general manager, and department directors. The value of compensation-based executive incentives (TMTSA) is measured by calculating the mean of the salaries of high-ranking executives, followed by calculation of the natural logarithm of the mean. In this study, only the spot shares held by high-ranking executives are considered; options and numbers of shares are neglected. The value of equity-based executive incentives (TMTST) is measured as the ratio of total number of shares held by high-ranking executives to total share capital.

To control latent factors that affect a corporation's choice of expansion method, and to improve the quality of the model, this study consults similar studies for numerous other variables that can affect corporate behaviors in M&A. As shown in Table 1, these variables include the data year, type of industry, size of corporation, a corporation's age, innovation performance, number of follow-on offerings, and refinancing demands.

Table 1. Measurement of control variables.

Variable	Code	Measuring Method
Data year	YEAR	The year 2011is used as the base period for two dummy variables.
Industry	FIN	Per the *Guidelines for the Industry Classification of Listed Companies* (2012) issued by CSRC, the agricultural, forestry, husbandry, and fishery industries (type A) are used as the base period for 16 dummy variables. The financial (type J) and education (type P) industries are excluded.
Firm size	FS	The year-end total assets are used as the proxy variable, *LN* (unit: million RMB), for corporation size.
Firm age	FA	*Ln* (from time established to 2016).
Innovation performance	IPOR	Number of patent applications per million RMB.
Second offerings	SEOS	Number of follow-on offerings in the past 5 years, including public issuances and nonpublic issuances.
Refinancing demands	REFD	The cash-flow gap is used as the proxy variable for the standardization of total assets at the end of year (Shyam-Sunder 1999). Cash-flow gap = increase in long-term investment + increase in fixed asset investment + increase in working capital + dividends − cash flow from operating activities + financing expenses.

Panel A (see Table 2a) reports the summary statistics of regional distribution. Approximately 50% are mainly located in Guangdong Province (518, 18%), Jiangsu Province (300, 10.5%), Zhejiang Province (297, 10.4%), and Beijing (9.2%). The main reasons are: (1) the above-mentioned areas are the most dynamic areas of private economy (including Pearl River Delta, Yangtze River Delta) and

state-owned enterprise development (Beijing); (2) China's stock exchanges are located in Shanghai and Shenzhen, and the financial resources spillover effect is obvious.

Table 2. Summary Statistics.

(a) Panel A Regional Distribution of Samples					
Region	**No.**	**%**	**Region**	**No.**	**%**
Anhui	120	4.2	**Liaoning**	66	2.3
Beijing	262	9.2	**Inner Mongolia**	12	0.4
Fujian	102	3.6	**Ningxia**	6	0.2
Gansu	18	0.6	**Qinghai**	6	0.2
Guangdong	518	18.1	**Shandong**	198	6.9
Guangxi	15	0.5	**Shanxi**	30	1.1
Guizhou	15	0.5	**Shannxi**	42	1.5
Hainan	21	0.7	**Shanghai**	174	6.1
Hebei	42	1.5	**Sichuan**	102	3.6
Henan	114	4.0	**Tianjin**	27	0.9
Heilongjiang	12	0.4	**Tibet**	12	0.4
Hubei	93	3.3	**Xinjiang**	18	0.6
Hunan	89	3.1	**Yunnan**	30	1.1
Jilin	33	1.2	**Zhejiang**	297	10.4
Jiangsu	300	10.5	**Chongqing**	32	1.1
Jiangxi	48	1.7	**Total**	2856	100.0

(b) Panel B Ownership Distribution of Samples		
Ownership	**No.**	**%**
State-owned	827	28.86%
	97	3.38%
Private	1909	66.61%
others	23	0.80%
total	2866	1

(c) Panel C Year and Industry Distribution of Samples			
Year	**2011**	**2012**	**2013**
Industry	No. (%)	No. (%)	No. (%)
farming, forestry, husbandry and fishing (A)	17 (1.7)	15 (1.6)	15 (1.6)
Mining (B)	23 (2.4)	20 (2.1)	21 (2.2)
Manufacturing (C)	649 (68.2)	663 (69.6)	662 (69.5)
Electricity/heat/gas water production and supply (D)	17 (1.7)	18 (1.9)	19 (2)
Construction (E)	20 (2)	25 (2.6)	25 (2.6)
Wholesale and retail (F)	40 (4.2)	37 (3.9)	38 (4)
Transportation, storage, and post (G)	27 (2.8)	26 (2.7)	26 (2.7)
Accommodation and catering (H)	5 (0.5)	5 (0.5)	5 (0.5)
Information transmission/software and information technology services (I)	77 (8)	68 (7)	68 (7)
Real estate (K)	36 (3.7)	39 (4.1)	35 (3.7)
Rental and business services (L)	9 (0.9)	6 (0.6)	7 (0.7)
Scientific Research and Technology Services (M)	6 (0.6)	6 (0.6)	6 (0.6)
water conservancy/environment and public facilities management (N)	3(0.3)	12 (1.3)	12 (1.3)
Residential services, repairs and other services (O)	7 (0.7)	0 (0)	0 (0)
Health and social affairs (Q)	2 (0.2)	2 (0.2)	2 (0.2)
Culture, sports and entertainment (R)	8 (0.8)	8 (0.8)	8 (0.8)
Others (S)	6 (0.6)	2 (0.2)	3 (0.3)

According to the ownership distribution of sample data in Panel B (see Table 2b), private enterprises account for 66.6% of the total sample. State-owned enterprises account for about 29%, while foreign investment and other accumulations are less than 5%, which shows that the ownership of listed companies in our country is dominated by private enterprises.

Panel C (see Table 2c) is the Year and Industry Distribution of Samples. (1) Of the 17 industries covered in this study, manufacturing is the main industry, far more so than other industries, and the number of samples is gradually increasing, accounting for nearly 70% of the total. (2) In recent years, China's environmental protection policies have been issued intensively, increasing financial support in water conservancy, renewable energy, energy conservation and environmental protection, and air management (PM 2.5), and the number of enterprises in the water conservancy, environmental and public facilities management industries has increased significantly. (3) Since 2012, the sample number of residential services, repairs and other services has been zero; (4) from 2011 to 2012, manufacturing, electricity/heat/gas water production and supply, construction, information transmission/software and information technology services, real estate, water conservancy/environment and public facilities management increased, while the rest of the industries remained unchanged or even decreased from the previous year. From 2012 to 2013, only the sample number mining industry, electricity/heat/gas and water production and supply industry, wholesale and retail industry and comprehensive increased, while the rest of the industries were flat or even decreased from the previous year, indicating that the sample enterprises achieved industrial transformation through mergers and acquisitions, but the proportion was not high.

3.3. Econometric MODEL

The data used for this study span from 2011 to 2013, and some of the samples may be excluded owing to faulty data. For example, some corporations might not be listed or may have been delisted, some data may be missing, or the samples might not fully satisfy the inclusion criteria. Some new samples added may be considered unbalanced panel data because they represent initial public offerings or corporations that engaged in M&A in a certain year. Discrepancies are also observed in the distribution characteristics of dependent variables (i.e., propensity to engage in M&A-based expansion and the scale of M&A-based expansion), for which different econometric models are required for estimations.

The propensity to engage in M&A-based expansion is a dichotomous variable (between zero and one), which requires a Probit model for analysis and prediction. As shown in Equation (1):

$$Q_i = \alpha + \beta X_i \tag{4}$$

where: Q_i means the linear combination of company i (explanatory variable), which is a normally distributed random variable. The probability that the company i trends to expand through M&A behavior is:

$$P_i(y = 1|X_i) = P_i(y = 1|x_{i1}, x_{i2}, \ldots x_{ik}) \tag{5}$$

Thus, we can obtain:

$$Q_i = \alpha + \beta X_{\,i,t-1} + \gamma Z_{\,i,t-1} + \varepsilon_{\,i,t} \tag{6}$$

where: $X_{\,i,t-1}$ means TMTST/TMTSA, $Z_{\,i,t-1}$ means control variable.

The scale of M&A-based expansion is a limited dependent variable exhibiting left truncation (Meng et al. 2013). That is, the samples' scales of M&A-based expansion are distributed within a range of positive numbers with a relative concentration of zero. To address this limited dependent variable problem, this study adopts the classic Tobit model (Heckman 1979).

$$Y_{i,t} = \alpha + \beta X_{\,i,t-1} + Z_{\,i,t-1} + \varepsilon_{\,i,t} \tag{7}$$

$$Y_{i,t} = \begin{cases} 0, & \text{if } MA_{i,t} = 0 \\ y*, & \text{if } MA_{i,t} > 0 \end{cases} \quad (8)$$

where: $X_{i,t-1}$ means TMTST/TMTSA, $Z_{i,t-1}$ means control variable.

Because corporate M&A involves a cycle of 6–12 months[1] or longer from disclosure to completion, decisions for M&A are usually affected by the independent variables from the previous fiscal year. For this reason, the closing balances from the previous accounting period are used for independent variables.

All statistical tests are carried out using Statas software.

4. Empirical Analysis and Results

4.1. Descriptive Statistics and Correlation Analysis Results for the Variables

Table 3 reveals the descriptive statistics and correlation analysis results of the major variables. The mean of the scale of M&A-based expansion (MAE) is 0.025, indicating that only 8% of the sample corporations are inclined to choose M&A as the means for expansion. This is in accordance with the observations of Jiang et al. (2011), suggesting that listed corporations in China tend to choose self-invested expansion when considering the propensity and scale of expansion. This study also calculates the Pearson correlation coefficient and variance inflation factor of the variables, but no multicollinearity is observed in the results.

Table 3. Means, standard deviations, and correlations (N = 2823).

	MAE	CE	FS	FA	IPOR	REFD	SEOS	TMTST	TMTSA
CE	0.463 **	1							
FS	−0.018	−0.017	1						
FA	−0.005	−0.007	.008	1					
IPOR	−0.030	−0.054 **	−0.069 **	−0.142 **	1				
REFD	−0.018	−0.078 **	0.097 **	0.076 **	−0.102 **	1			
SEOS	0.032	0.078 **	0.088 **	0.236 **	−0.119 **	0.181 **	1		
TMTST	−0.016	−0.008	−0.136 **	−0.311 **	0.214 **	−0.214 **	−0.273 **	1	
TMTSA	−0.038 *	0.004	0.222 **	0.108 **	−0.089 **	−0.144 **	0.166 **	−0.221 **	1
Mean	0.025	0.080	11567	2.397	0.008	0.179	0.320	0.206	3.188
S. D.	0.143	0.279	57489	0.512	0.016	0.159	0.591	0.243	0.608

Note: * $p < 0.05$, ** $p < 0.01$.

4.2. The Influence of Executive Incentives on M&A Propensity

The influence of executive incentives on M&A propensity is tested using regression analysis with Models 1–4, and the results are reported in Tables 4 and 5. Model 1 is used to examine the influence of control variables on M&A propensity; the results indicate that the duration of a corporation's existence significantly affects M&A propensity ($\beta = -0.248$, $p < 0.01$). Corporations with a shorter history appear more likely to expand through M&A, whereas corporations with longer histories are more likely to expand through their own investments. The results suggest that innovation performance is negatively correlated with M&A propensity; this finding contradicts, who argue that a corporation with a competent research and development department is more likely to engage in M&A-based expansion. Refinancing demands inhibit M&A propensity ($\beta = -0.954$, $p < 0.01$). The number of follow-on offerings corresponds with significantly greater M&A propensity ($\beta = 0.314$, $p < 0.001$), suggesting that corporations that have issued multiple follow-on offerings in the past 5 years are highly likely to expand through M&A. Model 2 increases short-term incentives (i.e., executive compensations) while controlling the control variables. The results suggest that compensation-based incentives

[1] Per the regulations of the CSRC and individual stock exchanges, M&A of listed corporations are subject to a series of administrative or internal procedures from the disclosure of information to completion. The procedures can become even more complicated if the M&A involve major asset reorganization, stock issuance, asset purchase, or reorganization of state-owned assets.

significantly and negatively correlate with M&A propensity (β = −0.189, $p < 0.05$). That is, low executive compensations lead to stronger inclinations toward M&A-based expansion, whereas high executive compensations result in stronger inclinations toward expansion through the corporations' own investments. These observations provide statistical support for Hypothesis 1-1. Model 3 indicates that long-term incentives, or executive shareholding, increases M&A propensity (significance level = 0.1), which supports Hypothesis 2-1a. Hypothesis 2-1b is therefore unsupported. Model 4 encompasses all independent variables and control variables, and the results indicate that the effect and significance of both compensation-based and equity-based executive incentives are stable.

Table 4. Results of regression analyses on mergers and acquisitions (M&A) propensity.

	Model 1	**Model 2**	**Model 3**	**Model 4**
		Control variables		
YEAR	Include	Include	Include	Include
IND	Include	Include	Include	Include
FS	0.000	0.000	0.000	0.000
FA	−0.248 **	−0.227 ***	−0.232 **	−0.221 ***
IPOR	−9.147 *	−8.446 *	−8.423 *	−8.487 *
REFD	−0.954 **	−1.194 ***	−1.370 ***	−1.420 ***
SEOS	0.314 ***	0.280 ***	0.259 ***	0.284 ***
		Predictor variables		
TMTSA		−0.189 *		−0.230 **
TMTST			0.388 +	0.172 +
Model Indices	Wald = 79.17 ***	Wald = 87.19 ***	Wald = 80.31 ***	Wald = 101.72 ***
Obs	2823	2823	2823	2823

Note: + $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Table 5. Results of regression analyses on M&A scales.

	Model 5	**Model 6**	**Model 7**	**Model 8**
		Control variables		
YEAR	Include	Include	Include	Include
IND	Include	Include	Include	Include
FS	0.000	0.000	0.000	0.000
FA	−0.028	−0.144	−0.026	−0.197
IPOR	−1.650 *	−0.433	−1.334 *	−0.203
REFD	−0.077	−0.068	−0.070	−0.040 *
SEOS	0.055	0.074	0.057	0.008
		Predictor Variables		
TMTSA		−0.015 **		−0.016 ***
TMTST			−0.011	−0.014
Model Indices	Wald = 61.80 ***	Wald = 67.86 ***	Wald = 57.33 ***	Wald = 55.38 ***
Obs	2854	2854	2854	2854

Note: $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

4.3. Influence of Executive Incentives on the Scale of M&A

Models 5−8 are used to determine the Tobit results for the influence of executive incentives on the scale of M&A. In Model 5, only innovation performance exhibits a significant and negative correlation with the scale of M&A (β = 0.314, $p < 0.001$), suggesting that corporations with lower innovation performance tend to undertake larger-scale M&A. According to Model 6, compensation-based executive incentives are significantly and negatively correlated with the scale of M&A (β = −0.015, $p < 0.01$), suggesting that lower executive compensations in listed corporations may be associated with greater

scales of M&A. Thus, Hypothesis 1-2 receives statistical support. Model 7 reveals that equity-based executive incentives exhibit no significant correlation with the scale of M&A, thus supporting Hypothesis 2-2. In Model 8, the scale of M&A is adopted as a dependent variable and all independent variables and control variables are included; the results indicate that the effects and significance of both compensation-based and equity-based executive incentives are unchanged.

4.4. Robustness Test

In the investigation on M&A propensity, the Tobit method with corporation−year two-dimensional unbiased clustering standard error proposed by Petersen is employed for a robustness test, and the results match those determined using the conventional Tobit model. The problem of sample self-selection may exist in the estimations of M&A propensity; that is, there may be no difference between the corporations choosing or not choosing to expand through M&A.

After consulting the related literature for estimation methods, the present study chooses the two-step Heckman method to resolve the sample self-selection problem stemming from the limited dependent variables. In this method, the probability model (Probit regression) is first estimated to determine whether a corporation decides to expand through M&A, and the estimated probability value is used to calculate the Mills lambda. After sample selection bias is controlled in the first step, the scale of M&A-based expansion is estimated in the second step.

The results reveal a nonsignificant P value, indicating that serious sample self-selection is not present in the samples. The regression results of the two-step Heckman method exhibit no noticeable deviation from the Tobit results for which two-dimensional standard errors are corrected. In sum, the preceding analyses suggest that the distributions of dependent variables (the propensity and scale of M&A-based expansion) are significantly different; in addition, although the econometric models chosen for estimation are different, all display high robustness. Therefore, the results of this study are deemed reliable.

5. Discussion

5.1. Results Analysis

This paper presents empirical evidence on the beneficial distribution mechanism of M&A behaviors through identifying the relationship between compensation of top executives and M&A behaviors. The investigated sample consists of 952 public companies (form a total of 2856 firm-year observations) listed in the Stock "A" markets at Shanghai and Shenzhen Stock Exchanges in China from 2011 to 2013. The compensation of top executives in divided into short-term (salary incentive based) and long-term (equity incentive based) for the in-depth comparison and analysis of propensity and scale of M&A.

The results are as presented in Figure 1 and suggest that short- and long-term incentives involve different mechanisms for top executives, and exhibit significantly different effects on the M&A behaviors of listed corporations. We mainly find that M&A behaviors serve as a beneficial distribution mechanism for insufficient compensation of top executives and alleviates the agency problem. Therefore, lower compensations of top executives promote M&A propensity and significantly affect the scale of M&A.

Consistent with the previous research (Tang et al. 2020; Zhou et al. 2020), executive compensation has a complicated effect on M&A behaviors. When the short-term incentives are insufficient, M&A behaviors serve as a beneficial compensatory mechanism. Thus, lack of executives' incentive promotes the propensity to engage in M&A and significantly affects the scale of M&A. Regarding long-term incentives, M&A behaviors serve as a beneficial creation mechanism. Shareholding of executives promotes M&A propensity, which increase values of their holdings through stock price increasing after M&A, and does not significantly affect the scale of M&A. These results provide indications that compensation contracts can be set in a way that does not maximize firm value, which is supported by Abudy et al. (2020). The increase in value is greater for firms with weaker corporate governance and smaller for firms that grant a greater portion of equity-based compensation to their executives.

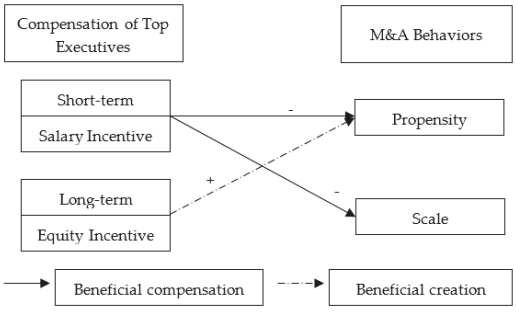

Figure 1. Compensation of Top Executives and M&A Behaviors.

5.2. Implications

This study tests the driving forces behind M&A. From the perspective of listed corporations, M&A represent external acquisition of resources, and the operations are affected by innovation performance. Empirical evidence suggests that innovation performance is negatively correlated with M&A propensity: that is, lower corporate innovation performance corresponds with a greater scale of M&A. Therefore, corporations with low innovation performance are more inclined to choose M&A as a method by which to obtain external resources. The number of follow-on offerings can also promote M&A in listed corporations, which confirms that the overconfident financing behaviors of managers and their opportunistic, self-interested motivations are primary driving forces behind repeated M&A operations of listed corporations.

The design of executive-incentive mechanisms in listed corporations substantially affects the scope of the M&A market in China. In view of the on-going strategy of intensifying M&A for the development of the real economy, the crucial nature of increasing executive incentives in listed corporations cannot be overemphasized. However, in the process of promoting executive incentives, attention should be paid to the synergy between short- and long-term incentives to achieve balance in the number and scale of M&A.

5.3. Limitations and Future Research

Based on the findings regarding the relationship between executive incentives and the number and scale of M&A, future studies should investigate whether executive-incentive mechanisms effectively promote the development of the real economy through M&A. Such studies may establish a model that contributes to corporate innovation, globalization, and corporate social responsibility. The present study offers a valuable theoretical foundation and empirical support for China's national strategy of strengthening executive incentives in listed corporations to stimulate M&A and the real economy. As noted by Brzozowski et al. (2018), entrepreneurial behavior of executives greatly affect the M&A behaviors, which is not tested in this research. Future studies should take entrepreneurial behavior of executives into consideration and test the related mechanism.

6. Conclusions

This study empirically examines the relationship between executive compensation and mergers and acquisitions (M&A) behaviors by identifying the influence of short- and long-term intensive on the propensity and scale of M&A. When the short-term incentive is insufficient, M&A behaviors serve as a beneficial compensation mechanism. Thus, lack of executives' incentive promotes the propensity to engage in M&A and significantly affects the scale of M&A. With regard to long-term incentives, M&A behaviors serve as a beneficial creation mechanism. Shareholding of executives promotes M&A propensity, and does not significantly affect the scale of M&A. This study significantly contributes to research in M&A behaviors by revealing the beneficial distribution.

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Analysis of Volatility Volume and Open Interest for Nifty Index Futures Using GARCH Analysis and VAR Model

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Abstract: The generalized autoregressive conditional heteroscedastic model (GARCH) is used to estimate volatility for Nifty Index futures on day trades. The purpose is to find out if a contemporaneous or causal relation exists between volatility volume and open interest for Nifty Index futures traded on the National Stock Exchange of India, and the extent and direction of these relationships. A complete absence of bidirectional causality in any particular instance depicts noise trading and empirical analysis according to this study establishes that volume has a stronger impact on volatility compared to open interest. Furthermore, the impulse originating from volatility of volume and open interest is low.

Keywords: GARCH model; Nifty Index futures; causal relation; volatility; volume; open interest; National Stock Exchange of India

JEL Classification: G2; G4; C30; C50; C58

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1. Introduction

Futures trading plays an important role in the price discovery process. Volatility in relation to other liquidity variables, such as volume and open interest, is of prime importance to hedgers, arbitrageurs and speculators for developing trading strategies. Volumes traded is a significant parameter as it identifies momentum and confirms a trend. A common observed phenomenon is that if trading volume increases, prices generally move in the same direction. Furthermore, if the Index moves higher in an uptrend, the volume increases as well. Studies suggest that trading volume is positively related to volatility and serves as a proxy for information flow in the market. As new information is received, traders take new positions depending on their judgment of trend and direction. Volatility is an appropriate measure which determines when the market has fully incorporated new information, as it reflects the magnitude of price movements within a stipulated period. Open interest, which represents the number of future contracts outstanding or total number of future contracts that have not been closed out, plays an important role in the prediction of volatility. Bessembinder and Seguin (1993) report an intuitive relation between price volatility and open interest. They study the relations between volume, volatility, and market depth in eight physical and financial futures markets. They suggest that volume shocks have large asymmetric effects on volatility. Furthermore, positive unexpected volume shocks on volatility are larger than the impact of negative shocks, and large open interest lessens volatility. Tseng et al. (2018) state that open interest has significant explanatory power with regard to futures' realized volatility for CSI 300 Index futures. Ferris et al. (2002) opines that the level of open interest is a good proxy for examining the capital flows into and out of the nearest S&P 500 index futures contract.

As index futures are cash-settled future contracts, they are appropriate for speculation, hedging and arbitrage. However, though previous studies regarding the relationship

provides impetus for reasoning and judgement, the relationship between these variables has not reached any consensus and remains intuitive. Girma and Mougoue (2002) opine that factors other than volume affect the persistence of volatility in the futures price they studied, and inefficiency could also be due to the fact that futures traders base their prices on the previous day's trading volume and open interest as a measure of both market consensus and market depth.

Kumar (2017) is of the view that even though Nifty enjoyed a monopoly, volatility used as a proxy for returns was not resilient due to low trading margins, low availability of credit and a lack of funds available for reinvestment.

High volatility in the underlying index could be attributed to exchange-traded Funds (ETFs), whose demand shock passes on to the underlying index and is a reflection of increased noise trading as suggested by Ben-David et al. (2018). Additionally, cross hedging stock sector risk with Index futures for hedging effectiveness (Hsu and Lee (2018)) has an impact on volatility, and furthermore Chang et al. (2018) document that volatility index (VIX) returns affect ETF returns.

This study focuses on the volatility facet of Nifty Index futures traded on the National Stock Exchange of India (NSE), and analyzes different categories of traders who trade Nifty Index futures.

The first objective is to find a best fit model for the different categories of investors who trade Nifty Index futures so that shocks to the uncertain variance are not firm after considering volume and open interest.

The second objective is to understand the extent to which liquidity factors such as volume and open interest affect volatility.

The third objective is to study whether or not a unidirectional or by directional causality exists between volatility and volume, and between volatility and open interest, and volume and open interest, for the different categories of investors.

The fourth objective is to model unexpected movements in the variables to predict future effects with the help of the impulse response function (IRF).

The literature documents work done with GARCH models on Nifty Index futures. However, this work is unique as we model different trader categories that trade Nifty Index futures. GARCH models are fitted to understand the extent to which previous positive and negative shocks affect the trading dynamics of specific traders by capturing specific details of volatility volume and open interest. Furthermore, the vector autoregressive (VAR) model, the Granger causality effect and Impulse Response Function (IRF) provide additional facets to the core analysis.

Beginning with the introduction, the paper is further organized in the following manner: Section 2 summarizes the literature reviewed; Section 3 provides the data description; Section 4 provides model development and observed findings, and Section 5 concludes.

2. Literature Review

A large proportion of previous studies have documented the relationship between volatility volume and open interesressivet. To a great extent, the literature has documented a positive contemporaneous relation between volatility and volume. Trading volume is affected by returns generated, and is indicative of news percolating in the market. Additionally, volatility is affected by both informed as well as uninformed traders who trade in the market. In accordance to the volatility volume relation documented, evidence is provided by Admati and Pfleiderer (1998), who state that large volumes provide a signal for traders to trade. Hence the effect of price movements depends on volumes traded. Thus, the underlying principle for suggesting this positive relation can be found in the basic supply and demand model, i.e., a change in demand induces a price change.

The causal price relation between volume and volatility is also on account of the mixture of distribution hypothesis (MDH) documented by Clark (1973), Epps and Epps (1976) and Harris (1986). They suggest that the two quantities, volatility (change in stock price) and volume, should be positively correlated because the variance in the price change depending

on a single transaction is conditional upon the volume of that transaction. Therefore, the relation between price variability and trading volume is due to the joint dependence of price and volume on the underlying common mixing variable, called the rate of information flow to the market. This implies that price and volume change simultaneously in response to new information.

One line of literature studies the effect on volatility with the introduction of derivative trading. Danthine (1978) suggests that the derivatives market increases the depth of a market and consequently reduces its volatility. In relation to the Indian equity futures markets, Mallikarjunappa and Afsal (2008) state that the introduction of derivatives does not have any stabilizing (or destabilizing) effect in terms of decreasing (or increasing) volatility. The introduction of derivatives has not brought the desired outcome of a decline in volatility. However, the result of the Chow test for parameter stability clearly indicates structural change in the volatility patterns during the post-futures period. They also opine that a change in the volatility process is not due to the introduction of derivatives, but may be due to many other factors, including better information dissemination and more transparency.

Bandivadekar and Ghosh (2003) is of a similar view and states that turnover in the derivative market of Bombay Stock Exchange (BSE) constitutes not only a small part of the total derivative segment, but is miniscule as compared to BSE cash turnover. Thus, while BSE Sensex incorporates only the market effects, the reduction in volatility due to the "future's effect" plays a significant role in the case of S&P CNX Nifty. Mall et al. (2011) advocates that volatility in the Indian stock Index futures markets is time-varying with asymmetric effects. Furthermore, bad news on account of the US sub-prime crisis increased volatility substantially.

The sequential arrival information hypothesis proposed by Copeland (1976), and later extended by Jennings et al. (1981), suggests a positive bidirectional causal relationship between the absolute values of price changes and trading volume. As new information that reaches the market is not disseminated to all market participants simultaneously, but to one participant at a time, an initially transitional information equilibrium is established. Only after a sequence of intermediate equilibriums have occurred, is the final information equilibrium established. Therefore, due to the sequence of information flow, lagged absolute returns may have the ability to predict current trading volume, and vice versa. Similarly, the asymmetric information hypothesis has also been suggested by Kyle (1985). Hiemstra and Jones (1994) argued that a sequential information flow results in a lagged trading volume having predictive power for current absolute price changes, and lagged absolute price changes having predictive power for current volume.

De Long et al. (1990) postulate the price–volume relationship in terms of the noise–trader model. Noise traders temporarily miss-price the stock in the short run or base their decisions on past price movements. Hence a positive causal relationship between volume and price changes is consistent with the hypothesis that price changes are caused by the action of noise traders. In the Indian context, Mahajan and Singh (2009) examined the empirical relationship between return, volume and volatility dynamics using daily data from the Indian stock market. They found a positive and a significant positive correlation between volume and return volatility, and evidence of causality flowing from volatility to trading volume. Their study also detected one-way causality from return to volume, which is an indicative of noise trading. In a similar line of study, Deo et al. (2008) found bidirectional causality between returns and volume for Hong Kong, Indonesia, Malaysia and Taiwan stock markets.

As risk is linked to volatility, extensive literature exists which analyzes time series data to analyze the relation between volume volatility and open interest. Susheng and Zhen (2014) used the ARMA-EGARCH model to examine the asymmetric GARCH effect and the impact of volume and open interest on volatility. They found that volume is positively related to volatility and open interest is negatively linked to volatility when lagged volume and lagged open interest is considered.

The most recent literature suggests causality between trading activity and volatility in Nifty Index futures over a multiple time horizon, as studied by Jena et al. (2018).The

causality from volatility to open interest signifies the effectiveness of hedging activities. Furthermore, applying the GARCH (1, 1) model, the authors Jena and Dash (2014) confirmed a positive relationship among current open interest and lagged volume inaexgplaining volatility in the Nifty index futures. They opine that short-term future price predictability can lead to effective hedge ratios. Magkonis and Tsouknidis (2017) suggested speculative pressures, as reflected by futures trading volume, and hedging pressures, as reflected by open interest, on account of large and persistent spillovers to the spot and futures volatilities of crude oil and heating oil-gasoline markets, respectively. Floros and Salvador (2016) opined that liquidity variables, namely volume and open interest, account for up to 20% of the variation for some markets, and are important variables causing volatility overall during periods of market stability.

3. Data Description

In this study, we consider two liquidity variables, i.e., trading volume (as a proxy for information arrival) and open interest (to analyze liquidity in the index), and its effect on volatility (the variability of price returns).

Quality data with comprehensive transaction details with respect to volume, volatility and open interest were collected from SEBI on Nifty Index futures. The data span was 1 January 2014 to 31 December 2019, collected from the Securities and Exchange Board of India (SEBI).

We have considered two liquidity variables, volume and open interest, to access the impact on volatility. The majority of future contracts traded in the data are found to be near month contracts, as they are the most liquid. This also shows that the contracts are liquid. The expiration date as specified by NSE is the last Thursday of the month. Furthermore, Nifty, being the benchmark index, has huge volumes traded. Nifty represents 52% of the traded volume of NSE and comprises 63% of the market capitalization of NSE.

To model data for volatility, we assume continuous compounding, and the daily return series are calculated as the first difference in the logarithms of the daily closing prices on Nifty futures index contracts.

Empirical studies have documented three main techniques of assessing volatility, namely, stochastic volatility models, implied volatility using options, or time-series models of returns. In this study we measure volatility (price changes) using a specific class of models based on GARCH specifications (Engle 2001).

To study volume dynamics, a preliminary analysis revealed the demography of the trader, whether domestic or a foreigner, along with the trader category, whether retail or institutional. With this information, the trader category could be split up into six categories, as follows: individuals (Category 1); partnership firms, including Hindu Undivided Families (HUF) (Category 2); public/private companies (Category 3); domestic institutional investors (DII) (Category 4); Non Resident Indians (NRIs), overseas body corporate, foreign direct investments (FDI) (Category 5); foreign institutional investors (FII) (Category 6).

Table 1 provides details regarding volume traded by the different categories of traders on the NSE (National Stock Exchange of India). We find that individuals constitute the maximum trading volume, and FIIs the least.

Table 1. Volume traded—index futures.

	Futures	Volume	
	Trader Category	**All Trades**	**Percentage**
1	Individuals	3,067,836,325	49.583
2	Partnership firms, Hindu Undivided Family, HUF	862,042,950	37.603
3	Public/Private companies	5,049,988,650	18.568
4	Domestic Institutional Investors, DII	82,143,925	4.472
5	NRIs, Overseas Body Corporate, FDI	66,961,850	3.655
6	Foreign Institutional Investors FII	2,671,117,850	0.416
	Full sample	11,800,091,550	23.730

Table 2 provides descriptive statistics for the volume volatility and the open interest series to get a preliminary understanding of the dynamics between these series.

Table 2. Descriptive statistics of volatility, open interest and volume in the individual category.

Statistics	Volatility	Volume	Open Interest
Mean	−0.0005	3679578	17340433
Median	−0.0006	3816800	16865106
Maximum	0.0289	8032767	28474865
Minimum	−0.0386	53200	5943600
Standard Deviation	0.0091	2031685	4117847
Skewness	−0.15	−0.28	−0.04
Kurtosis	4.50	2.30	2.71
Jarque-Bera test (*p*-value)	46.11 (<0.0001) *	15.64 (0.0004) *	1.72 (0.4229) *
ADF (*p*-value)	−22.74 (<0.0001) *	−1.75 (0.4046) *	−7.01 (0.4046) *
No. of observations	470	470	470

(Figures in parentheses are the *p*-values).* (The rest of the tables for different categories could be made available on request).

Each of the six categories of investors is dealt with separately in order to understand the causal relation between the three pairs of variables.

Table 2 represents the summary statistics of the volatility, open interest and volume for individuals. The mean volatility is −0.0005 with a standard deviation of 0.0091. The distribution of volatility is leptokurtic, while volume and open interest show platykurtic distribution. As regards skewness, all series are negatively skewed. The null hypothesis of normal distribution was tested using the Jarque–Bera test, whereby volatility and volume appear statistically significant, indicating non-normal distribution, while open interest accepted the null hypothesis by following normal distribution. ADF statistics of volatility are significant statistically, indicating that volatility is stationary, while volume and open interest series are non-stationary. Index returns are time-varying and highly unrelenting. To verify the stationary state, the Kwiatkowski–Phillips–Schmidt–Shin (KPSS) test was used. The null hypothesis states that data for volatility series are stationary around a mean or linear trend, where mean and variance are constant over time. Analysis revealed that the data were stationary for all categories at level I (0).

4. Model Specification

We fit the best model (symmetric or asymmetric) for different categories of traders. For this purpose, we firstly determine heteroscedasticity and then perform an asymmetric test to determine the best fit GARCH models (Kande Arachchi (2018)).

In order to determine heteroscedasticity, i.e., ARCH effect, we assess the ACF of the squared error term by fitting the ARIMA (1, 1, 2) model. The first lag term of the ACF of the squares of the residual series is significant. Hence heteroscedasticity exists. Additionally, the hypothesis of no ARCH effects up to lag 20 according to the Lagrange multiplier test is rejected. This further confirms the presence of heteroscedasticity.

4.1. GARCH (1, 1) Model:

As heteroscedasticity is confirmed, after a few iterations we find the GARCH (1, 1) model to be the best fit for all categories, except public and private firms.

We fit a GARCH (1, 1) model for all investors. The details of the model specification are depicted in Table 3.

Next, we test for asymmetric effects after fitting the symmetric GARCH (1,1) model based on the sign and size bias test (Akpan and Moffat (2017)). The test was run separately for all categories.

The asymmetric effect was found to be significant only for public and private firms.

Table 4 lists the empirical results of the EGARCH (1, 1) model for volatility in public and private firms, as accounted for each day, and monthly data were not appropriate for

use modeling data as the ARCH effect was not present in monthly data as suggested by the heteroscedasticity test with *p*-value > 0.05 by including both parameters volume and open interest. The ARCH effect appears in the daily data with *p*-value 0.0007. Further, the EGARCH (1, 1) model shows the best fit. The asymmetric (leverage) effect captured by the parameter estimate ϒ is positive and statistically significant, suggesting that the positive shocks have a greater impact on volatility than negative shocks after taking both volume and open interest into account. The null hypothesis of no heteroscedasticity in the residuals is accepted, indicating no ARCH effect on residuals (*p*-value 0.4128).

Table 3. Estimation results of GARCH (1, 1) model for individual investors.

	Parameters	**Coefficient**	***p*-Value**
Mean Equation	Constant (φ)	0.00069	0.6800
	Volume	0.00000	0.6343
	Open interest	0.00000	0.5156
Variance Equation	constant (ω)	0.00000	0.0319(S)
	ARCH effect (α)	0.09445	0.0013(S)
	GARCH effect (β)	0.86022	<0.0001(S)
	α + β	0.95466	
ARCH-LM test for heteroscedasticity			
ARCH-LM test statistic (N*R2)	1.5723		
p-value	0.2099		

S: Significance at 1% level. The empirical results of the GARCH (1, 1) model on volatility in the individual category are accounted for each day. Monthly data were not appropriate for modeling data as the ARCH effect was not present in monthly data as suggested by the heteroscedasticity test with *p*-value > 0.05 By including both parameters of volume and open interest, the ARCH effect appears in daily data with *p*-value 0.0001. The sum of the two estimated ARCH and GARCH coefficients (persistence coefficients) in the estimation process is less than one, suggesting that shocks to the conditional variance are not very persistent after taking volume and open interest into account. The ARCH-LM test statistics for all periods did not exhibit an additional ARCH effect (*p*-value > 0.05). This shows that the variance equations are well specified.

Table 4. Estimation results of the EGARCH (1, 1) model in public and private firms.

	Parameters	**Coefficient**	***p*-Value**
Mean Equation	Constant (φ)	−0.00010	0.9516
	Volume	0.00000	0.7949
	Open interest	0.00000	0.6823
Variance Equation	Constant (ω)	−0.51452	0.0178 (S)
	ARCH effect (α)	0.17961	0.0012 (S)
	GARCH effect (β)	−0.07343	0.0333 (S)
	Leverage effect (ϒ)	0.96001	<0.0001 (S)
	α + β	0.10618	
ARCH-LM test for heteroscedasticity			
ARCH-LM test statistic (N*R2)	0.6708		
p-value	0.4128		

S: Significance at 1% level.

4.2. VAR Model

In order to understand how volatility responds to volume and open interest, we further analyze our work with a three-variable VAR model of volume, open interest and volatility for individual and all other categories.

As such, we estimate a vector auto regressive model (VAR) model for equations (i) and (ii) when processes are integrated. We test zero-restrictions on a given set of parameters of a VAR specification. First, we check for the order of integration of the time series. Next, we use the Wald test for the unrestricted VAR models, as specified below:

$$\theta_t = \alpha_o + \alpha_1\theta_{t-1} + \alpha_2\theta_{t-2} + \alpha_3\theta_{t-p} + \beta_1 V_{t-1} + \beta_2 V_{t-2} + \cdots + \beta_3 V_{t-p} + \varepsilon_t \quad (1)$$

$$V_t = \alpha_o + \alpha_1 V_{t-1} + \alpha_2 V_{t-2} + \alpha_3 V_{t-p} + \beta_1\theta_{t-1} + \beta_2\theta_{t-2} + \cdots + \beta_3\theta_{t-p} + \varepsilon_t \quad (2)$$

where V_t denotes volume, one of the liquidity proxies that is investigated, O_t denotes volatility, p denotes the number of lags and ε_t is an error term. The optimal lag length, p, is determined through an optimization process based on Akaike's information criterion (AIC).

The null hypothesis of the Granger causality tests is based on non-causality, i.e.,

"V_t does not Granger-cause θ_t" for the first VAR model and
"θ_t does not Granger-cause V_t" for the second equation.

This test consists of testing whether all the βi of the model equal 0.

As the Grange causality test is sensitive to lagged differences, we utilize AIC (Akaike information criterion), SC (Schwarz information criterion), HQ (Hannan–Quinn information criterion) statistics to determine the best lagged differences. If the *p*-value is less than 5% the null hypothesis is rejected.

4.3. Variance Decomposition

We analyze the variance decomposition of the VAR model. A three-variable VAR model of volume, open interest and volatility for the individual group and other categories was built, and the graph of VAR can be provided upon request. An analysis revealed that most variance of volatility (volume or open interest) comes from itself. The impact of volatility on volume is stronger than on open interest, while the impact of open interest on volume is stronger than on volatility.

4.4. Impulse Response

Next, we use the impulse response function to analyze how volatility is affected by volume and open interest for different investors.

The impulse response function (IRF) traces the response of the dependent variable (volatility) in the VAR system to shocks in the error term. Such a shock will change the dependent variable in the current as well as future periods, and also have an impact on the independent variables (volume and open interest). The impacts of the shocks are traced for several periods in the future. The method of decomposition used is the Cholesky decomposition. The impulse response function aids in examining the responsiveness of one standard deviation shock given to the explanatory variable to produce a time path for the dependent variable.

After estimating the VAR, the vector moving average (VMA) is formulated to derive the effects of experimental shocks on the chosen variables over time. The method of decomposition used is the Cholesky decomposition.

Let y_t be a K dimensional vector series given by

$$y_t = A_1 y_{t-1} + \cdots + A_p y_{t-p} + \mu_t = \phi(B)U_t + \sum_{t-1}^{\alpha} \phi_i \mu_{t-1} \quad (3)$$

$$I = \left(1 - A_1 B - A_2 B \cdots A_p B_p\right)\phi(B)$$

where the MA coefficient measuring the impulse response is given by $\mathrm{cov}U_t = \sum \phi_i$.

5. Empirical Findings

The GARCH (1,1) model shows the best model fit. The sum of the two estimated ARCH and GARCH coefficients (persistence coefficients) in the estimation process is less than one (Table 3), suggesting that shocks to the conditional variance are not very persistent after taking volume and open interest into account. The ARCH-LM test statistics for all periods did not exhibit an additional ARCH effect (*p*-value > 0.05). This shows that the variance equations are well specified.

The Granger causality test explains the relation between volatility volume and open interest for individuals and all categories of traders.

The first column indicates *p*-values (for causal relations) from volatility to liquidity and vice versa. The second column indicates *p*-values (for causality) from open interest to volatility and vice versa. The third column indicates the *p*-value (for causality) from open interest to volume and vice versa for Nifty Index futures. Table 5 represents the Granger causality test after the VAR model is built between volume, open interest and volatility. Because the Granger causality test is sensitive to lagged differences, we utilize AIC (Akaike information criterion), SC (Schwarz information criterion), and HQ (Hannan–Quinn information criterion) statistics to determine the best lagged differences. The results of Granger causality suggest that, as the *p*-value is greater than 0.05, we cannot reject any null hypothesis in the above table. Thus, this indicates that for the individual category, volatility cannot be forecasted through volume (and open interest), volume cannot be forecasted through volatility (and open interest), and open interest cannot be forecasted through volatility (and volume).

Table 5. Results of Granger causality test.

	Nifty Index Futures					
Causal Relations	**Volume—Volatility**		**Open Interest—Volatility**		**Open Interest—Volume**	
Categories	**Volume Volatility**	**Volatility Volume**	**Open Interest Volatility**	**Volatility Open Interest**	**Open Interest Volume**	**Volume Open Interest**
Individuals	0.7532	0.8610	0.9574	0.6424	0.1699	0.4079
Partnership Firms	0.3629	0.2895	0.7016	0.3631	0.2433	**0.0411**
Public and Private Firms	0.1564	**0.0155**	0.6522	0.9984	0.2709	0.1002
DII	0.5985	0.7706	0.9692	0.2938	0.4350	0.8465
Overseas Corporate	0.5066	0.6589	0.8557	0.6486	0.6503	0.7458
FIIs	0.2808	0.0801	0.7411	0.0572	0.3886	0.6363

A unidirectional causality is seen for partnership firms from volume to open interest and for public and private firms from volatility to volume. The Granger causality test reveals the absence of bidirectional causality in any of the above cases. The theoretical explanation for bidirectional causality is that volume, which can be considered as a proxy for information, leads to volatility, i.e., a change in price. Large positive price changes imply higher capital gains, which encourage trade, leading to an increase in volume. However, unidirectional causality implies noise trading.

In order to understand the effects on the variables under study of unforeseen conditions, we use the IRF function as depicted in Figure 1.

The time horizon for the impulse response analysis is recorded on the *x*-axis of each individual graph. The interest of the work is to see the impulse response of a 0.125 unit shock (one standard deviation, SD) innovation to volatility series. The first plot shows the response of volatility to innovation of the volatility series, and the second the response of volume to innovation of the volatility series and the response of open interest to innovation of the volatility series.

When the response of volatility to a one SD innovation is traced (for the individual category), it is found that the volatility series responds negatively to its own innovation. Miniscule negative fluctuations are seen in the second period, and revert to equilibrium by the third period.

In the second graph, volume drops significantly in the second period, then gradually declines and stabilizes by the seventh period.

In the third graph the open interest series is seen declining gradually, and reverts toequilibrium gradually.

The impulse originating from either variable has a tiny effect on the other. Similar to variance decomposition, the impact of the impulse originating from volatility on volume and open interest is low at each period.

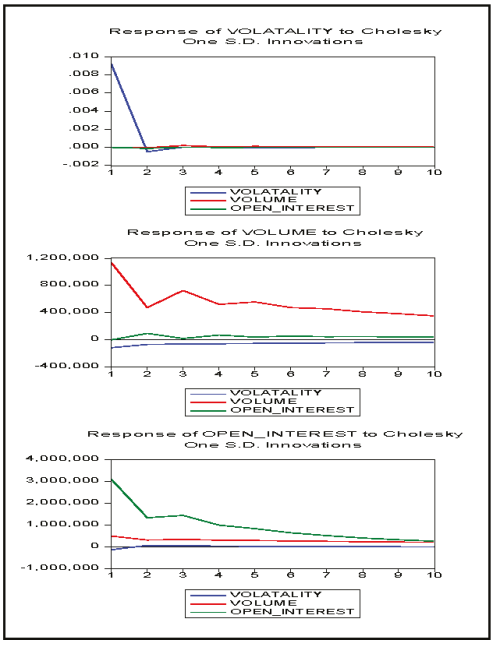

Figure 1. Impulse response function of volatility, volume and open interest on innovations in the individual category.

6. Conclusions

In this work we have studied the relation between volatility, volume and open interest.

Preliminary investigations revealed that the volatility, volume and open interest data were left skewed. This implies that most futures trades are undertaken for the purpose of hedging. The results show that the GARCH (1,1) model was the best fit for all categories except public and private firms, where an asymmetric EGARCH (1, 1) model is best suited. The sum of the two estimated ARCH and GARCH coefficients (determination coefficients) in the estimation process is less than one, suggesting that shocks to the uncertain variance are not determined after taking volume and open interest into account. As there was no additional arch effect, we state that the model was best fitted to all categories except public and private firms.

To further understand the relationships between volume, open interest and volatility for all investors, we used the VAR model. It was found that most variance of volatility (volume or open interest) comes from itself. Moreover, the impact of volume is stronger than open interest on volatility.

The estimation of Granger causality suggests noise trading, as there is a unidirectional causality only in two cases. A unidirectional causality is seen for partnership firms from volume to open interest, and for public and private firms from volatility to volume. This suggests noise trading.

The absence of bidirectional causality is reported in any particular instance. No bidirectional causal relationships are seen for any of the trader categories between the three pairs of variables.

The impulse response graphs signify that volatility to its own innovation reveals miniscule negative fluctuations. Volume responds more positively compared to open interest to an innovation in the volatility series. For all the categories of traders, volume has a stronger influence on volatility than open interest. The IRF strengthens the direction

of the relationships between the three variables, and confirms that volume has a greater influence on volatility than open interest.

These findings from the estimation of the model provide a strong foundation for further non-linear analysis of these relationships. Furthermore, the study reveals that there is market inefficiency in trading Nifty Index futures, and other factors apart from volume traded and open interest should be analyzed in order to understand better the volatility factor.

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The Moderating Role of Perceived Risks in the Relationship between Financial Knowledge and the Intention to Invest in the Saudi Arabian Stock Market

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Abstract: This research study aims to investigate the moderating role of perceived risks in the relationship between financial knowledge (represented by objective knowledge and subjective knowledge) and the intention to invest in the Saudi Arabian Stock Market. The researcher collected data from four hundred Saudi Arabian participants who were interested in investing in the Saudi Arabian Stock Market. The researcher used structural equation modeling (SEM) through the Smart PLS 3.3.2 software to analyze the data. This study's findings indicate that, in the formation of financial knowledge, the total effect of Subjective knowledge is greater than the total effect of objective knowledge. The findings also indicate that there is a positive relationship between financial knowledge and perceived risks and between financial knowledge and the intention to invest. Finally, the findings indicate that perceived risks have a negative effect on the relationship between financial knowledge and the intention to invest in the Saudi Arabian Stock Market.

Keywords: financial knowledge; perceived risks; intention to invest; Saudi Arabian Stock Market

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1. Introduction

Behavioral finance is an integral part of the decision-making process (Ainia and Lutfi 2019), which is based on the application of human psychology to finance (Hamza and Arif 2019). A better understanding of behavioral finance is important since it enables investors to make informed investment decisions. While the standard financial theory asserts that investors are rational and, therefore, tend to make risk averse decisions (Ainia and Lutfi 2019), the behavioral finance literature indicates that individuals do not always act rationally. The literature reveals that many factors influence an individual's financial decisions and push him or her to exhibit cognitive and emotional behaviors that lead to deviation from rational behavior (Sivaramakrishnan et al. 2017; Xiao and Porto 2017). Unfortunately, investors are less likely to objectively examine situations for perceived risks and returns and are mostly biased on their trading decisions that affect their attitudes (Ainia and Lutfi 2019). Additionally, investor sentiments affect the stock prices, which, in turn affect the demand from enough investors and values diverge because of the changes in security prices (Baker and Wurgler 2006).

The Saudi Arabian Stock Market is one of the largest financial markets in developed countries. It has great importance for the Kingdom of Saudi Arabia (KSA) due to its effect on the country's economic activities (Alshammari et al. 2020).

Some assert that investing in the Saudi Arabian Stock Market is a good opportunity. This is especially so with the entry of Saudi Aramco shares to be traded on the Stock Market, the increase in the ease of business within the KSA, and the convenience of the business

climate. This explains the current increasing number of investors in the Saudi Arabian Stock Market (Ungarino 2019).

On the other hand, others argue that it is wise for investors to monitor the Saudi Arabian Stock Market before investing in it (Konish 2019) because the investor is exposed to many investment risks in this Market. Since the KSA economy depends mainly on oil, fluctuations in oil prices lead to sharp fluctuations in the Stock Market. In addition, due to external crises, the Saudi Arabian Stock Market suffers from sharp fluctuations during different periods (Alshammari et al. 2020).

Whether investors decide to invest in the Saudi Arabian Stock Market or refrain from investing depends on their investment behaviors. These are affected by several factors including financial knowledge (Lim et al. 2018; Hamza and Arif 2019; Nguyen and Nguyen 2020) and perceived risks (Trang and Tho 2017).

However, there is insufficient evidence in the literature on whether perceived risks have a moderating role in the relationship between financial knowledge and the intention to invest. Consequently, this study aims to investigate the moderating role of perceived risks in the relationship between financial knowledge and the intention to invest in the Saudi Arabian Stock Market. The research findings will contribute to the literature on behavioral finance and provide evidence of the investors' decision-making processes in the Saudi Arabian Stock Market.

2. Literature Review

2.1. Financial Knowledge

Financial knowledge refers to an individual's understanding of important concepts related to finance (Robb and Sharpe 2009). It has two dimensions: namely, subjective knowledge and objective knowledge. Subjective knowledge refers to the extent of each person's self-rated level of knowledge of financial matters. On the other hand, objective knowledge refers to real financial knowledge calculated by the person's summary score of answers to knowledge items about financial concepts such as inflation, interest rate, stock market, savings, credit, and insurance (Khan et al. 2017; Lee et al. 2019).

The findings from previous studies indicate that financial knowledge plays a fundamental role in facilitating investment decisions. By surveying 1006 participants, Fedorova et al. (2015) examined financial knowledge's impact on the investors' stock market decisions. This study's findings showed that investors, who are knowledgeable about the financial literature, participate proactively in the stock market. In a different study, Sivaramakrishnan et al. (2017) examined financial knowledge's impact on the investors' stock market decision-making processes. The research employed the theory of planned behavior to explain the investors' participation in India's Stock Market. Planned behavior theory asserts that the investors' financial literacy determines how they control their behavior in the stock market. This study's findings showed that both objective and subjective financial knowledge had positive effects on the intention to invest in a stock market, while the investors' behaviors were influenced primarily by objective knowledge. This study's findings also showed that financial wellbeing had a positive influence on investor behaviors and their investment decisions. Therefore, while financial knowledge is necessary for investors, it does not lead an investor to make optimal investment decisions because only the objective financial literacy affects the actual behavior. However, both subjective and objective knowledge affect the intention to invest.

Furthermore, Khan et al.'s (2017) findings show the necessity of examining the relationship between an individual's subjective and objective knowledge (knowledge gap), since it helps in understanding their financial behaviors. An overestimation of an individual's financial knowledge can lead them to make risky investment decisions. Notably, older individuals with lower education have an overestimated perception of their financial knowledge and this leads to poorly informed investment decisions. Therefore, investors can be financially vulnerable and have an incorrect perception of the adequacy of their

actual financial knowledge. Reliance on insufficient knowledge leads to making poorly informed decisions that are ultimately suboptimal.

The investors' decision making is influenced by several factors. These include corporate data, repayment, risk and financial knowledge (Lubis et al. 2015). Similarly, Hamza and Arif's (2019) findings showed that financial knowledge is an important factor in the investment decision. Notably, this study's findings showed that financial knowledge and agreeableness had significant positive impacts on investment decisions along with significant negative impacts on openness to investment and neuroticism. Additionally, extraversion and conscientiousness had insignificant impacts on investment decisions. At the same time, when making investment decisions, neuroticism and openness play critical roles in mediating the role of financial knowledge. Therefore, financial literature alone cannot be relied on in investor decisions since the personality traits mediate its role in influencing the decision-making process. Notably, an investor's personality trait determines the attitude toward the potential investment decisions.

Nowadays, numerous organizations are developing financial literacy programs to equip investors with financial knowledge and to provide counseling based on the investor's attitude toward perceived risks (Hamza and Arif 2019). According to Gizem Korkmaz et al. (n.d.), there is limited evidence to show that investors have enough knowledge to facilitate their decision-making processes. Despite the vast sources of financial knowledge and increased educational programs, many individuals still make suboptimal financial decisions that negatively affect their economic activities (Agarwal and Mazumder 2013). Therefore, Gizem Korkmaz et al. (n.d.) examined the impact of risk behavior, risk propensity, and risk preference on financial decision-making. This study's findings showed that there is an inconsistency between risk behavior and risk preferences. However, financial knowledge is prudent since it helps to overcome the inconsistencies for risk-seeking individuals and worsens the level of inconsistencies for risk-averse individuals. Financial knowledge encourages individuals to indulge in risky behaviors while little knowledge reduces the chances of engaging in risky behaviors. Therefore, investment decisions, which lean toward risky investment decisions, suggest that investors have significant financial knowledge while risk-averse investors have minimal financial knowledge.

2.2. Perceived Risks

Perceived risks affect the investor's ability to use their financial knowledge to make an optimal decision. Risk perception describes how an individual interprets and develops a picture from the received information. This is normally different from reality, thoughts, and estimates (Ainia and Lutfi 2019). Risk perception is part of cognitive bias and, in uncertain situations, influences human behavior and decision -making. Similarly, Trang and Tho's (2017) findings showed that perceived risks have direct positive impacts on performance and the intention to invest and, through the performance of the investments, an indirect impact on the intention to invest. According to Ainia and Lutfi (2019), the greater the individual's risk perception, the lower the chance that they will make an investment, and the vice versa is true. Therefore, a high-risk attitude has negative impacts since these reduce the opportunities that an investor will allocate more funds to highly risky assets.

In contrast, Trang and Tho's (2017) findings showed that the greater the perceived risk, the more the investors are satisfied with their investment decisions. Similarly, the high obtained returns increase the intention to invest the next time. According to Trang and Tho (2017), investors are recommended to draw attention to stocks that are labeled 'controlled', 'warned', and 'halted trading'. Therefore, while financial knowledge is important in determining investment decisions, the perceived risks, associated with the stock, can override financial knowledge and influence their investment decisions. Additionally, the perceived risks can either influence an investor to make highly risky decisions or refrain from making risky investment decisions.

Entrepreneurs are risk-takers and set their investment goals by taking reasonable risks. According to De Bortoli et al. (2019), investors make the ideal, perfectly rational,

and self-interested people and choose the best available option to maximize their utility in an efficient market. Unfortunately, the individual investor's personal character traits are a notable factor that affect their investment decisions. Therefore, the agent's behavior is not perfectly rational since cognitive and emotional errors influence their investment decisions. According to De Bortoli et al. (2019), investors, who have greater risk tolerance and a high degree of openness to experience and violate prospect theory, are more likely to make high risk investment decisions. More specifically, the investor profile analysis (IPA) in relation to the personality openness to experience leads an investor to make high risk investment decisions.

Turning to prospect theory, an investor is less likely to make a risky investment decision when they violate provisions in the utility theory. Similarly, Sadiq and Amna (2019) say that investors can only make rational decisions with the availability of perfect information. However, unfortunately, investors have limited financial knowledge and this leads them to miss opportunities and make satisfactory investment decisions. Additionally, cognitive and psychological factors inhibit an investor's ability to make a rational investment decision (Sadiq and Amna 2019).

Therefore, while investors aim to decide which will promote the attainment of maximum revenue, their abilities to make an optimal decision when risks are involved are affected by their personalities that result from their psychological and cognitive makeup.

From their investigation of the impact of cultural differences in investors' decisions, Lobao and Maio's (2019) findings showed that culture influenced herding behaviors and, consequently, the investors' financial decision. Similarly, Chang and Lin (2015) investigated the factors that determined investor decision-making in an international stock market and, more particularly, the impact of national culture in influencing the investors' decisions in the global market. Their findings showed that herding behavior among investors happens in less sophisticated and Confucian equity markets. Notably, national culture has the most influence on herding behavior.

Furthermore, Chang and Lin's (2015) findings showed that the national culture's influence on the investors' herding behavior resulted in their making unfortunate investment decisions. Additionally, perceived risks and, in turn, their impact affects investors' decisions. According to Ferreira (2018), different people's risk attitudes and perceptions of risks are dependent on their financial models used in portraying perceived risks. The objective and subjective risk propensity explain the investment behaviors. However, cultural factors, institutions, and geographical location significantly influence the development of risk preferences in investments. Ultimately, national culture affects how investors perceive risks in the international market. The application of national culture compromises the individuals' needs to learn how the stock market in foreign countries operates and, hence, the high levels of investors' behavioral pitfalls in the international market.

2.3. Intention to Invest

The behavioral intention to invest refers to the investors' attitudes to making decisions due to the many factors that motivate them to act on their intentions and perceptions to make investment decisions. Ali (2011) studied the relationships between the individual investors' perceived corporate financial performance and their intentions to invest and the mediating impact of corporations' images on such relationships. The researcher emphasizes that investors are customers with knowledge requirements including the need to properly determine the risks and returns of businesses. The study's findings showed that investors formed their intentions to invest when they evaluated the businesses' financial positions. Thereafter, as they attempt to explain their investment decisions in the company's stocks, their emotional expectations of such assessments come into effect. This study's findings showed that, when the investors assessed a firm, their attitudes acted as a mediator before they decided to invest in a company's stocks.

This study's findings also showed that companies' attractive marketing strategies can have a huge influence on investors' emotions. Consequently, investors' attitudes

toward the companies' brands play a significant role, besides the cognitive assessment of companies in anticipating their final actions in terms of investing in these companies' stocks. Trang and Tho (2017) established new perceived risk measurement scales in relation to the Vietnam Stock Market. Their study investigated the impact of perceived risk on investment performance and used these scales to measure the investors' investment intentions. This study's findings show that the greater the investors perceive risks in making an investment, the greater the satisfaction of their investment decisions, or the more they will invest in the stock.

Perceived risks in the investing environment are described as unexpected or unpleasant results from the investor's action, in addition to establishing a new scale to measure the degree to which investors perceive the risk of investing in forms of stock trading on the stock market. Trang and Tho (2017) also measured the degree to which the perceived risks influenced investor satisfaction and their intentions on investment performance compared to their expectations and investment decisions. This study's findings showed that perceived risk had a significant positive effect on investment efficiency and on the investors' investment intentions. On the other hand, perceived risk had an adverse impact on the investors' intentions to invest through investment performance. This study's findings showed a positive relationship between the investors' perceived risks and the satisfaction of their investment decisions to invest in the stock.

2.4. Literature Gap and Research Purpose

The literature review shows that perceived risks and financial knowledge are both important factors in helping the shareholders make their investment decisions. Adequate financial knowledge enables an investor to make informed investment decisions (Fedorova et al. 2015; Khan et al. 2017; Sivaramakrishnan et al. 2017). Unfortunately, the extent of the investor's knowledge and attitude toward perceived risks affect the investor's ability to make rational investment decisions (Lubis et al. 2015; Trang and Tho 2017; Ainia and Lutfi 2019; Gizem Korkmaz et al. n.d.; Hamza and Arif 2019). The investor's attitude is influenced by different factors such as personality (De Bortoli et al. 2019; Sadiq and Amna 2019) and culture (Chang and Lin 2015; Ferreira 2018; Lobao and Maio 2019).

From reviewing previous studies, the researcher noted that no research study had investigated the perceived risks' moderating role on the relationship between financial knowledge and the intention to invest in the Saudi Arabian Stock Market. Therefore, this study investigated financial knowledge's impact on the investors' intentions to invest and also investigated the moderating role of perceived risks on the relationship between financial knowledge and the investors' intentions to invest in the Saudi Arabian Stock Market.

3. Methodology

3.1. Research Framework and the Development of the Hypotheses

Based on the aim of this research study, Figure 1 below sets out the conceptual frame work used in this study:

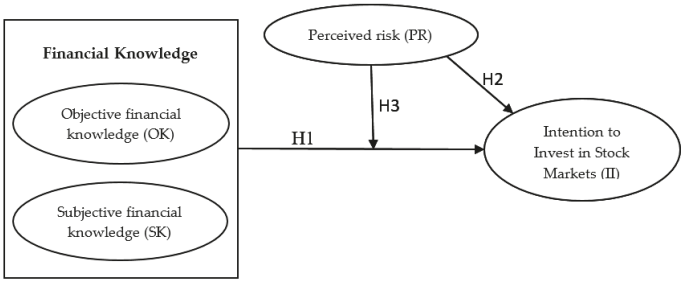

Figure 1. Conceptual framework. Source: Prepared by researchers from the literature review and research gap.

According to Figure 1, the researcher developed the following hypotheses:

Hypothesis 1 (H1). *There is a positive relationship between financial knowledge and intention to invest in the Saudi Arabian Stock Market.*

Hypothesis 2 (H2). *There is a positive relationship between perceived risks and intention to invest in the Saudi Arabian Stock Market.*

Hypothesis 3 (H3). *Perceived risks moderates the relationship between financial knowledge and intention to invest in the Saudi Arabian Stock Markets and, thus, the lower the perceived risk, the stronger the relationship.*

3.2. Measurement

With reference to previous studies, the researcher prepared a questionnaire to collect the primary data for this study. The questionnaire consisted of four main parts. The first part measured objective knowledge by asking the participants to answer five financial statements that include correct and incorrect answers about financial concepts. The researcher relied on a scale for this purpose (Hysmith 2017). The second part measured the subjective knowledge by asking the participants to answer five financial statements that included their self-evaluation on some financial concepts. For this purpose, the researcher used a five-point scale graduated from "I do not know anything about it" to "I know a lot about it" (Alqatawni 2016). The third part measured perceived risks by asking the participants to state the degree of their agreement with six statements about perceived risks. For this purpose, the researcher used a five-point scale, graded from "very agree" to "never agree" (Metzger and Fehr 2018). The fourth part measured the intention to invest by asking the participants to state the degree of their approval of three statements about the intention to invest on a five-point scale, graded from "very agree" to "never agree" (Sivaramakrishnan et al. 2017). Table 1 presents the scale used to measure the research variables.

Table 1. The scale used to measure the research variables.

Variable	Code	Item
Objective Knowledge (OK)	OK1	Suppose you had $100 in a savings account and the interest rate was 2% per year. After five years, how much do you think you would have in the account if you left the money to grow? (Answers: a. More than $102, b. Exactly $102, c. Less than $102, d. Don't know).
	OK2	Imagine that the interest rate on your savings account was 1% per year, and inflation was 2% per year. After 1 year, how much would you be able to buy with the money in this account? (Answers: a. More than today, b. Exactly the same, c. Less than today, d. Don't know).
	OK3	If interest rates rise, what will typically happen to bond prices? (Answers: a. They will rise, b. They will fall, c. They will say the same, d. There is no relationship between bond prices and the interest rates., e. Don't know).
	OK4	A 15-year mortgage typically requires higher monthly payments than a 30-year mortgage, but the total interest paid over the life of the loan will be less. True or false? (Answers: a. True, b. False, c. Don't know).
	OK5	Buying a single company's stock usually provides a safer return than a stock mutual fund: true or false? (Answers: a. True, b. False, c. Don't know).
Subjective Knowledge (SK)	SK1	Interest rates, finance charges, and credit term.
	SK2	Credit ratings and credit files.
	SK3	Managing finances.
	SK4	Investing money.
	SK5	What is on your credit report income

Table 1. *Cont.*

Variable	Code	Item
Perceived Risk (PR)	PR1	The uncertainty of whether the markets will rise, or fall keeps me from buying stocks.
	PR2	Stock markets are unpredictable, which is why I would never invest in stocks.
	PR3	When I hear the word 'stocks', the term 'possible loss' comes to mind immediately.
	PR4	I am willing to take financial risks in order to substantially increase my assets.
	PR5	I am aiming for capital growth in the long run, which is why I am willing to take considerable financial risks.
	PR6	In money matters, I tend to be willing to take risks.
Intention to invest (II)	II1	I expect to invest in equities (stocks/shares) and/or equity mutual funds.
	II2	I want to invest in equities (stocks/shares) and/or equity mutual funds.
	II3	I intend to invest in equities (stocks/shares) and/or equity mutual funds.

Source: (Alqatawni 2016; Hysmith 2017; Metzger and Fehr 2018; Sivaramakrishnan et al. 2017).

3.3. Data Collection

The researcher collected the data for this study during the period from February to July 2020 by publishing the questionnaire online. The researcher received correct responses from four hundred Saudi Arabian national participants interested in investing in the Saudi Arabian Stock Market.

4. Analysis and Results

To analyze the collected data, the researcher used a partial least squares (PLS) technique to perform component-based structural equation modeling (SEM) through the Smart PLS 3.3.2 software. According to Anderson and Gerbing (1988), the researcher adopted a three-step approach in carrying out the data analysis. First, he conducted a descriptive statistic. Second, he estimated the measurement model to ensure the construct's validity and reliability. Then, he evaluated the structural model to ensure its suitability for testing the hypotheses. The details of these three steps are as follows:

4.1. Descriptive Statistics

After collecting the data, the researcher ran a descriptive statistic of the research variables. Table 2 shows the descriptive statistics of the research variables.

Table 2. The descriptive statistics of the research variables.

Variable	N	Mean	SD
Financial knowledge	400	2.974	1.195
- Objective Knowledge		3.111	1.157
- Subjective Knowledge		2.836	1.217
Perceived Risk		3.059	1.259
Intention to invest		3.546	1.333

Source: Outputs of statistical analysis.

As shown in Table 2, the results indicate that the mean of financial knowledge was 2.974 (SD = 1.195). Objective knowledge was a larger component than subjective knowledge of financial knowledge. The mean of objective knowledge was 3.111 (SD = 1.157) and the mean of subjective knowledge was 2.836 (SD = 1.217). Consequently, the research sample's objective knowledge was greater than their awareness of financial knowledge (subjective knowledge). The results also indicate that the mean of perceived risk was 3.059 (SD = 1.259). This means that the research sample's perception of risks is relatively high and that five is the highest level of options. Finally, the results indicate that the mean of the intention to invest was 3.546 (SD = 1.333) and was the largest mean among the research variables.

4.2. Measurement Model

As shown in Figure 2, the measurement model illustrates the relationships between the indicators (items) and the latent variables that these indicators measure, in addition, to the expected relationship between these variables. It illustrates that the financial knowledge consists of two aspects, namely, subjective knowledge and objective knowledge and its measurable elements. Then, it shows the expected relationship between the independent variable, which is financial knowledge, and the dependent variable is the intention to invest. The perceived risks are entered as a moderate variable that may affect this relationship.

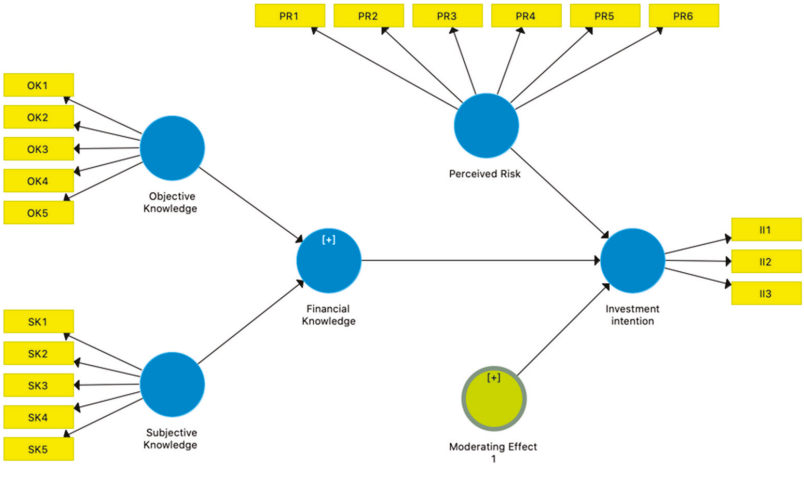

Figure 2. The measurement model. Source: Outputs of Smart PLS software considering the research framework and measurement.

In order to ensure that the indicators represent their latent variables and that the items meet sufficient convergent and discriminant validity, the researcher used factor loadings, composite reliability, and average variance extracted (AVE), as suggested by Hair et al. (2006). As a result of this test, the researcher deleted two items (OK1, OK5) from the objective knowledge scale because they did not meet the required standards. The rest of the elements achieved the required standards. Table 3 lists the converging credibility indicators.

Table 3 shows that, as suggested by Bagozzi and Yi (1998), after excluding (OK1, OK5), all the reflective index loads exceeded the necessary cutoff level of 0.60. Composite reliability values exceeded the recommended threshold value of 0.70 for all reflective combinations (Hair et al. 2006) where, as suggested by Fornell and Larcker (1981), AVEs are above the recommended value of 0.50 per build. As an embryo, the Cronbach alpha values are acceptable since, as suggested by Taber (2018), they are between 0.45–0.98. These indications point to the validation of the affinity.

Table 3. Convergent validity.

Item Indicators	Type of Measure	Item Loadings/Weights	Composite Reliability (CR)	Cronbach Alpha	AVE
Objective Knowledge					
OK2	Reflective	0.789	0.772	0.563	0.532
OK3		0.758			
OK4		0.632			
Subjective Knowledge					
SK1	Reflective	0.839	0.917	0.887	0.690
SK2		0.824			
SK3		0.874			
SK4		0.809			
SK5		0.805			
Intention to Invest					
II1	Reflective	0.910	0.947	0.916	0.856
II2		0.927			
II3		0.938			
Perceived Risks					
PR1	Reflective	0.648	0.865	0.812	0.521
PR2		0.737			
PR3		0.526			
PR4		0.769			
PR5		0.844			
PR6		0.764			

Source: Outputs of statistical analysis using Smart PLS software. Note the two items (OK1, OK5) were excluded from the objective knowledge scale because they did not meet the required standards.

For a further validity check, as suggested by Bollen and Lennox (1991), Diamantopoulos and Winklhofer (2001), MacKenzie et al. (2005), Petter et al. (2007), and Andreev et al. (2009), the researcher conducted discriminant analysis to check the degree of variation between the different compositional measures. He conducted the discriminant analysis by contrasting structural associations with the square root of the structure's AVE (Fornell and Larcker 1981). Table 4 presents the results of the discriminant validity.

Table 4. Discriminant validity.

	OK	SK	PR	II
OK	0.730			
SK	0.497	0.831		
PR	0.463	0.606	0.722	
II	0.390	0.463	0.582	0.925

Source: Outputs of statistical analysis using Smart PLS software.

Table 4 shows that the values in the diagonals of the matrix representing the square root of AVEs were in all cases greater than the non-diagonal elements in the corresponding row and column. This means that the correlation of each variable with itself is greater than its association with the rest of the research variables. This confirms the fulfilment of the discriminatory validity.

4.3. Goodness of Fit (GoF) of the Model

According to Tenenhaus et al. (2005), as the global fit measure, GoF is the geometric mean of both the AVE and the endogenous variables' average R^2. The GoF's aim is to take account of both the calculation and the study's structural model along with an emphasis on the model's overall performance (Chin 2010; Henseler and Sarstedt 2013). The calculation formula of GoF is as follows:

$$\text{GoF} = \sqrt{\left(\overline{R^2} \times \overline{\text{AVE}}\right)}$$

The determination of whether or not the PLS model is valid is based on the GoF criteria (below 0.1 = no fit, from 0.1 to 0.25 = small fit, from 0.25 to 0.36 = medium fit, higher than 0.36 = Large fit) (Wetzels et al. 2009). For this study, the GoF was (0.5066); this means that this study's GoF model was large enough to have sufficient global PLS model validity.

4.4. Structural Model

The structural model involves an analysis of the model's presumed association of exogenous and endogenous variables. Table 5 summarizes the structural model's path coefficient and regression result.

Table 5. Structural model's path coefficient and regression result.

Hypo.	Relationship	Std. Beta	Std. Error	*t*-Value	*p*-Value	Decision	Adj. R^2
H1	FK $\geq$ II	0.204	0.069	2.975	0.003	*Supported* *	
H2	PR $\geq$ II	0.385	0.061	6.329	0.000	*Supported* **	*0.385*
H3	Moderating Effect $\geq$ II	−0.143	0.039	3.664	0.000	*Supported* **	

Significant at ** p = <0.01, * p = <0.05. Source: Outputs of statistical analysis using Smart PLS software.

As shown in Table 5, there was a positive relationship between financial knowledge and intention to invest in the Saudi Arabian Stock Market since the Std. Beta was (0.204) and *p*-value was (0.003). This means that the first hypothesis is accepted. This relationship comes from subjective knowledge more than objective knowledge since the subjective knowledge path coefficient on financial knowledge was 0.819 compared with 0.296 for objective knowledge.

Table 5 also shows that there was a positive relationship between perceived risk and intention to invest in the Saudi Arabian Stock Market since the Std. Beta was (0.385) and P-value was (0.000). This means that the second hypothesis is also accepted.

Additionally, Table 5 shows that perceived risks negatively moderate the relationship between financial knowledge and intention to invest in the Saudi Arabian Stock Market and, thus the lower the perceived risk, the stronger this relationship. This is because Std. Beta was (−0.143) and the *p*-value was (0.000). Figure 3 presents the moderating effect.

Figure 3 shows the moderating effect on the relationship between financial knowledge and intention to invest in the case of high financial knowledge and low financial knowledge. It refers to perceived risks reducing by 14.3% the positive relationship between financial knowledge and intention to invest. This also means that the third hypothesis is accepted.

The researcher assessed the illustrative strength of the estimated model by the R^2 of the endogenous structures, and R^2 shows the variance in the dependence of all the exogenous variables in the model. As shown in Table 5, the R^2 value was 0.395. This means that the model has moderate illustrative strength (Falk and Miller 1992; Chin 1998).

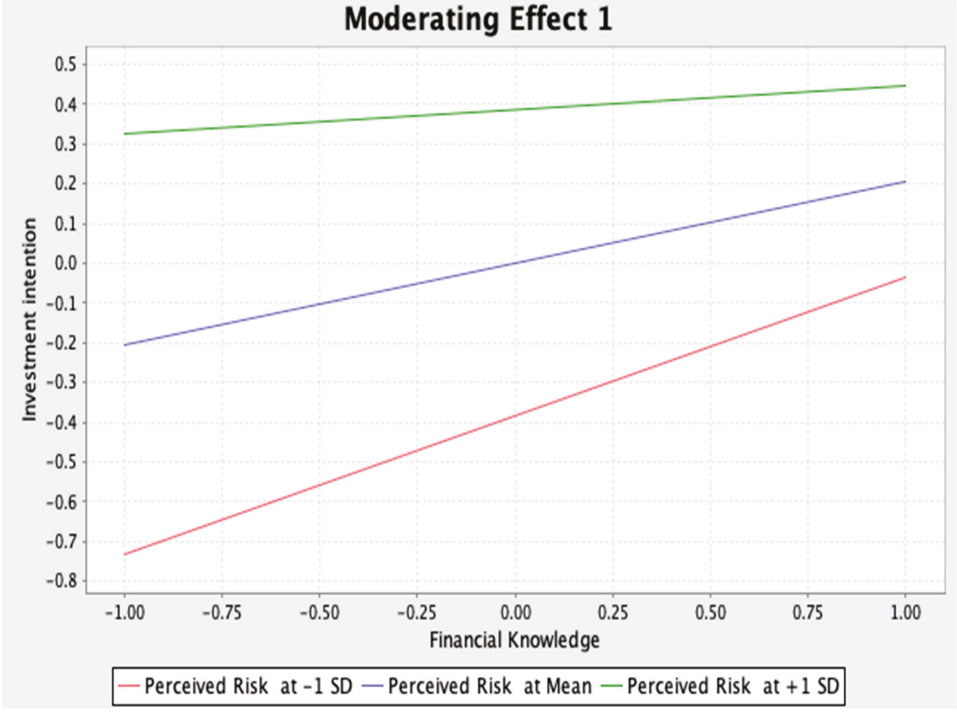

Figure 3. Moderating effect. Source: Outputs of statistical analysis using Smart PLS software.

To investigate the size of the financial knowledge's effect and perceived risk on intention to invest, and the size of the moderating variable's (PR) effect on the relationship between financial knowledge and intention to invest, the researcher calculated the effect size (f^2) as presented in Table 6.

Table 6. Assessment of effect size (f^2).

Constructs Relation	f^2	Result
Financial Knowledge (FK)	0.041	small effect size
Perceived Risk (PR)	0.137	small effect size
Moderating Effect	0.045	small effect size

Source: Outputs of statistical analysis using Smart PLS software.

According to Cohen (2013), the financial knowledge and perceived risks have small effects on intention to invest. In addition, perceived risks have small effects on the size of the relationship between financial knowledge and intention to invest.

To measure the ability of independent variables in predicting the dependent variable, the researcher tested the predictive relevance (Q^2), and its value was 0.322. This means that according to Chin (2010), the model predictive relevance is acceptable.

Based on the analysis and results, Figure 4 shows this study's final structural model.

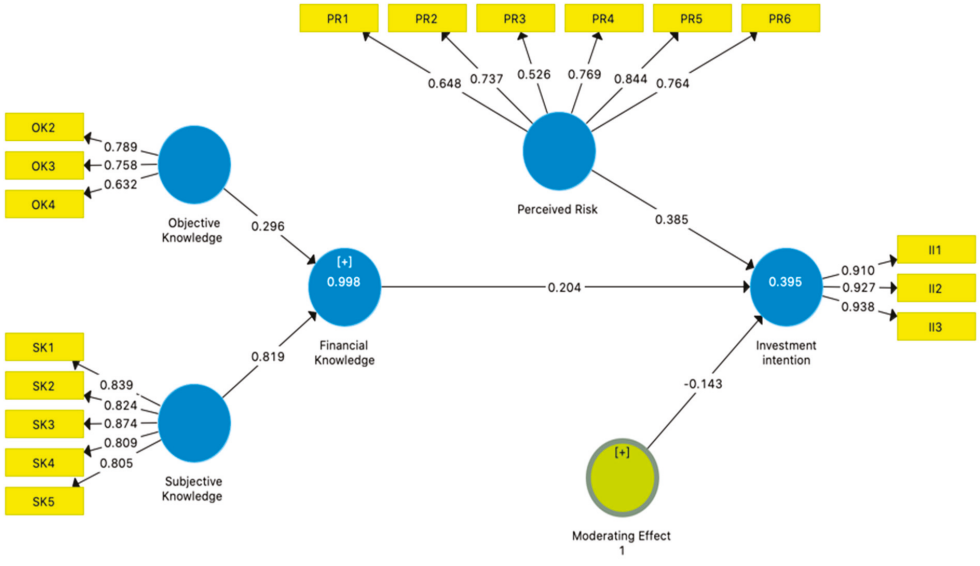

Figure 4. This study's final structural model. Source: Outputs of statistical analysis using Smart PLS software considering the measurement model.

5. Discussion and Implications

5.1. Discussion

This study aimed to investigate the moderating role of perceived risks on the relationship between financial knowledge and intention to invest in the Saudi Arabian Stock Market. This study's findings showed that there was a positive relationship between financial knowledge and intention to invest. There was also a positive relationship between perceived risks and intention to invest and that perceived risks moderate the relationship between financial knowledge and intention to invest in the Saudi Arabian Stock Market. The researcher collected data were from four hundred Saudi participants and used component-based structural equation modeling (SEM) through the Smart PLS 3.3.2 software to analyze their answers. This study's main findings are discussed below.

First, the results refer to the two dimensions of financial knowledge (namely objective knowledge and subjective knowledge) that are significantly associated with the latent variable that they express. This is consistent with Lee et al.'s (2019) findings. The results show that the total effect of subjective knowledge is greater than the total effect of objective knowledge in the formation of financial knowledge since the total effect of subjective knowledge was (0.819), while the total effect of objective knowledge was (0.296). This indicates the importance of subjective knowledge in forming financial knowledge.

Second, the results showed that there was a positive relationship between financial knowledge and intention to invest in the Saudi Arabian Stock Market. This result proves the correctness of the first hypothesis. It also appears to be very convincing in that the participants who had high financial knowledge had a greater intention to invest in the Saudi Arabian Stock Market. Moreover, this result was consistent with the results of previous studies regarding the existence of a relationship between financial knowledge and intention to invest (Fedorova et al. 2015; Lim et al. 2018; Hamza and Arif 2019; Nguyen and Nguyen 2020).

Third, the results showed that there was a positive relationship between perceived risk and intention to invest in the Saudi Arabian Stock Markets. This means that the second hypothesis is accepted. In addition, this result is consistent with Maziriri et al.'s (2019) findings. The higher the investor's awareness of risk, the greater the investor's

confidence in trading on the stock exchange, and thus the greater the intention to invest in the stock market.

Finally, perceived risk has a moderately negative effect on the relationship between financial knowledge and intention to invest in the Saudi Arabian Stock Market. Thus, the lower the perceived risk, the stronger this relationship. This means that the third hypothesis is also accepted. This downturn is a good sign because it reduces the investment that arises from decisions that are not related to the perception of risks that these investments involve. In turn, this leads to less bad investments in the Saudi Arabian Stock Market as well as an increase in market efficiency. The results of the moderating variable analysis also indicate that the effect of financial knowledge on intent to invest is greater if the perceived risk is lower, and the effect is lower in the case of higher perceived risk.

5.2. Implications

Investors do not always act rationally. There are many factors that influence an individual's financial decisions and push him to exhibit cognitive and emotional behavior such as biased and sentiments, which leads to deviation from rational behavior. Although the Saudi Arabian Stock Market is important, some investors have refrained from investing in it due to their fear of perceived risk or their lack of financial knowledge.

This study's findings showed that the better the investor's awareness of investment risks, the greater their intention to invest in the Saudi Arabian Stock Market due to having more confidence in companies surrounded by fewer perceived risks. This also improves an individual's investment decisions.

This study's findings also indicate that more financial knowledge helps to increase intention to invest. The more the investor is familiar with the financial concepts (such as interest rate, consolidation, mortgage, etc.), the greater their intention to invest in the stock market. This reduces biased and emotional decision-making and improves an individual's investment decisions.

However, the investor's perception of risk has a negative effect on this relationship. In such circumstances, the level of perceived risk may lead the investor to not rely on their financial knowledge when deciding to invest in the Saudi Arabian Stock Market. Regardless of their expectations toward the stock market, an investor may realize that it is a good opportunity to invest in low-risk companies rather than high-risk companies.

6. Conclusions

The primary purpose of this study was to investigate the moderating role of perceived risk in the relationship between financial knowledge and the intention to invest in the Saudi Arabian Stock Market.

This study's findings indicate that there was a positive relationship between both financial knowledge and perceived risk and intention to invest in the Saudi Arabian Stock Market. The findings also indicate that perceived risk had a negative moderating effect on the relationship between financial knowledge and intention to invest in the Saudi Arabian Stock Market.

Investors in the Saudi Arabian Stock Market should improve their knowledge of various financial aspects such as interest rate, mortgage, inflation, etc. This helps them to improve their financial decisions away from bias and emotion. Additionally, they should well study the risks surrounding companies trading on the Saudi Arabian Stock Market to reduce the losses that they are likely to suffer either future reductions in the prices of their shares, or reductions in the profits that companies distribute to them or the default or bankruptcy of these companies.

Decision-makers in companies whose shares are traded on the Saudi Arabian Stock Market must work to reduce the perceived risks to which investors are exposed when dealing in their shares. This may result from the possibility of lower share prices in the future or the possibility of reductions in the profit distributed by these companies. These companies may resort to diversifying their investments and try to reduce their investments

in high-risk areas. In addition to transparency in dealing with investors, there is a need to measure and predict risks in the long term and to also search for ways to reduce the likelihood of their occurrence and the resulting losses.

Finally, the Capital Market Authority must be transparent on the rules of disclosure, fairness, and speed in disseminating information among dealers on the Saudi Arabian Stock Market. This is especially important in respect of the information that affects the prices of the securities in circulation. Such action would increase investor confidence in the Saudi Arabian Stock Market.

This study had some limitations. First, it was conducted in the Saudi Arabian environment and, consequently, the results may differ according to the appropriate environment. Second, the researcher collected the data during the global COVID-19 pandemic and these circumstances may have impacted on the participants' responses. Third, this study was based on the participants' evaluation of themselves according to the research variables, and this may suggest a kind of social bias. Consequently, the researcher recommends that future studies are conducted on research variables in a different environment or within a different period or by using various measures.

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Exploring Investment Behavior of Women Entrepreneur: Some Future Directions

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Abstract: This study aims to explore the investment behavior of female entrepreneurs as the new competitor in the investment field and to determine the underlying factors that influence their investment attitudes. A qualitative investigation approach was employed for the study that includes 18 in-depth exploratory interviews to ascertain the fundamental determinants of the investment behavior represented by female entrepreneurs, an emergent section in investment. The accumulated data was analyzed through manual coding procedures. The study revealed that female entrepreneurs are not inclined to take risk in their business for investment decisions, they are somewhat conservative and risk averse. This research also asserts that if they spend quality time and get better training about the nuances of different investment tools, so they will also take risks in investment activities. Two big cosmopolitan cities Karachi and Lahore in Pakistan were selected as sample for this study. Research in other countries considering the culture and ethnicity must be conducted to expand the scope of understanding the investment behaviors of female entrepreneurs. This study outcomes would help the investment manager to understand women's psychology to develop significant portfolio recommendations, service providers to develop consultancy training centers, policy makers to mitigate their risk and maximize their return opportunities. Hence, intending to provide opportunities for gender equalities, this research appears to be the first in Pakistan to adopt the inductive approach in this domain.

Keywords: women entrepreneurs; financial decision-making; investment behavior; qualitative research

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1. Introduction

Running one's own business is arduous but not unachievable in the developing world. Although, there are limited resources and a number of obstacles to actualize the decided goals. Even though, establishing its own business would be advantageous since it mitigates issues of poverty and also enhances the standard of living. Global Entrepreneurship Monitor's (2017) report stated that total early-stage entrepreneur activity increased by 10% in the last two decades. Rashid and Ratten (2020) highlighted that entrepreneur skills had contributed tremendously to the economy. Similarly, Sajjad et al. (2020) addressed the input of female entrepreneurs globally that is still not regarded as it should be and not given attention, but is a significant benefactor for economic development.

On contrary, the participation of women in the national economy is still very low. Strong patriarchal notions envelop cultural, social, religious, economic and political spheres that eventually result in the punier social standing of women in the society. Women are often discouraged to take independent decisions including starting a business (Salahuddin et al. 2021). Currently, it is also observed that entrepreneurship is a key driver of economic progress and improvement in a country as it generates employment, raises

living standards, and alleviates poverty. Moreover, globalization and societal development have witnessed women playing a crucial role in uplifting the economy. Although, they make uncountable efforts to serve their economy like men, regardless due to certain factors, they underperform (Zeb and Ihsan 2020).

Hence, WEDs (Female Entrepreneurship Development System) developed by NPO (National Productivity Organization) enhance women's innovative entrepreneurship competency from home business to commercial ventures and assists them to begin with their own business. According to their report, women entrepreneurship (WE) and empowerment have played a vital role in social and economic development—approximately 48% of Pakistan's total population represents women and about 21% demonstrates women employment in different sectors of the economy.

Pakistani women executing their business has witnessed a boom in recent years. Their work has made a substantial impact on economic and social growth. However, their businesses are smaller in size and earn less profit as compared to the men entrepreneurs (Shakeel et al. 2020). Similarly, Baporikar and Akino (2020) highlights that women, owing their enterprises, have become essential to the economic expansion because it helps in alleviating poverty, reduces gender inequality, and demonstrates productive work. According to them, the highest ratio in the business world is mostly owned by women. Thus, women should be subsidized by government bodies to get financial training from different training institutions because financial knowledge and learning is an intangible asset that helps people to gain a competitive advantage in their field. For instance, the IBA (Institute of Business Administration) won "The Outstanding Specialty Entrepreneurship Program Award" rewarded by the United States Association for Small Business and Entrepreneurship (USASBE) in 2017. Hence, other institutions built by government should also contribute more to it.

Corresponding to the current study, Soomro et al. (2020) investigated the perceptions of fresh entrepreneurs who aspire to attain sustainable business in Pakistan. On the contrary, Dwyer et al. (2002); Bannier and Neubert (2016) investigated men's and women's entrepreneurship investment behavior. Niethammer et al. (2007) stated that Carmen Niethammer, a program manager GEM (Gender Entrepreneurship Markets), initiated an International Finance Corporation (IFC), Private Enterprise Partnership that facilitates the Middle East and North Africa (PEP-MENA facility). It is based in Cairo, Egypt, and heads the team that offers technical support solutions for growth-oriented small and medium women enterprises. It also makes aware of women contribution in economic activities. Thus, their motive is to provide financial training so that they can run successful businesses because women are considered appealing customers to relationship managers in banks. These managers very well understand the requirements and psychology of the investment party and in return, offer them adequate solutions (Paluri and Mehra 2016). The authors emphasize that approaches to provide investment solutions for women are not yet evolved. Thus, financial planners need to understand the investment goals, emotions, mode of communication, and decision process. This will eventually assist financial organizers and relationship managers to well-prepare themselves to interact with female entrepreneurs as investors and become their partners to complete their voyage of growth. Kappal and Rastogi (2020) pointed out that there is a wide scope for primary research to examine the attitude of the investor's decision process. Thus, there is a dearth of exploitation, investigation, and exploration to find the investment attitude of the women owning businesses.

Oppedal Berge and Garcia Pires (2020) empirically observed the investment methods employed by women. Moreover, Dwyer et al. (2002); Charness and Gneezy (2012) reported that women invest less than men and they possess a risk-averse attitude in general. Psychologically, Barber and Odean (2001); Mishra and Metilda (2015) discovered that men are more overconfident as compared to women. Consequently, proves that men indulge more in financial transactions than women because females depict risk-averse behavior as well as tend to hold long-term investments. This eventually results in limited financial

knowledge on the part of women (Lusardi and Mitchell 2008). According to Farrell et al. (2016) adequate timely financial knowledge to women will motivate them to invest diversely. Kumar et al. (2018) asserted that males take more interest in financial matters and gender affects rational decision making, which does not affect the anxiety of money and concern for sufficient saving for a later period. On the contrary, Trevelyan (2008) identified that gender is not the point of focus because according to him optimistic entrepreneurs are capable of letting go of uncertainty they focus on upcoming good circumstances. They tend to evaluate situations to magnify the strengths, focus on opportunities, and demote weaknesses and threats in their work.

This study also contributes to studies of women's investment behavior. Women entrepreneurs are focused because in existing challenging world they are actively competing and participating in different financial decisions. They differ from men in their investment behavior. Moreover, different private and government institutions are stepping ahead to promote women in executing their business.

The reasons behind this research is to study women gradual participation in financial decision-making for their families. Secondly, men and women's opponent financial behavior moreover, the role of Pakistani institution stepping ahead to grow women market. Thus, to study the increasing number of female entrepreneurs, it is essential to study their attributes towards investment. However, knowledge of the financial market or financial learning better helps to study female entrepreneurs. Moreover, policymakers, investment consultants, and different scholars will better understand Pakistani women's business owners through interview-based responses. This study aims to determine the influencing factors of Pakistani female entrepreneurs and to identify the behavior of Pakistani female entrepreneurs making investment decisions. The study took place in Karachi and Lahore which are the start-up hubs in Pakistan. Furthermore, this study interviewed 18 female entrepreneurs and employed a qualitative research tool for an in-depth interview.

2. Literature Review

Investment behaviors of men and women vary in several ways. Thus, this difference in investment behavior has augmented the scope of research in the context of behavioral finance. Similarly, Kappal and Rastogi (2020) also argued that individual investment behavior is affected by personality, gender difference, socio-economic environment, attitudes, myths, and other demographic info. The prevailing literature separately identifies female entrepreneur behavioral and psychological attributes that influence investment attitude in the context of Pakistan. This will ultimately help the financial service industry to offer adequate investment opportunities.

According to, Kahneman and Tversky (1979), prospect theory contributed a lot in the domain of behavioral finance to attain growth and development. It was found that during uncertain conditions, investor's attitudes deviate from the results proposed by the economic theory. Ritter (2003) proposed that behavioral finance employs models that encompass some agents that are not completely rational, either they differ in preferences or demonstrate wrong beliefs. Behavioral finance embraces that, in certain conditions, a financial market is inefficient. Moreover, behavioral finance determines and infer reasons behind individual investment attitudes that eventually assist in understanding the change in prices and also positioning various investment varieties in the financial market. Hence, behavioral finance can be comprehensively studied considering rational and irrational investment behavior. Secondly, the anomalies in the efficient market proposing hypothesis to explicitly elaborate behavioral models (Pompian 2006).

To determine the investment attitude of an individual, it is essential to understand that this behavior is determined through their financial knowledge and mathematics expertise. Thus, Khresna Brahmana et al. (2012) recommended modern finance-theory which demonstrates market efficiency is determined not only through the gen adjusted acceleration but through the existing information in the market. This suggests that asset prices include all information and estimations of the true-value through the passage of time.

Hence, this incorporation authenticates the assumption of rational behavior. Similarly, Nigam et al. (2018); Kumar et al. (2018); Baker et al. (2018); Chavali and Mohan Raj (2016) identified many other factors affecting the investor's financial decision process. According to them, humans fail to make rational decisions every time because they often make biased decisions depending on their attributes, gender, fund utilization, and other financial activities. They argue that individuals, while making financial decisions, are heavily affected by recurring market sentiments and their personal emotions and attitudes.

The current literature illustrates social influences, personal influences, behavioral influencing biases, and the level of financial knowledge, investment experiences, levels of optimistic behavior, and ability to resist uncertainty while making decisions to invest in any asset or engage in financial activity maintaining their entrepreneurial portfolio. Fisher and Statman (2000); Kumar and Goyal (2015); Kleinübing Godoi et al. (2005) argue that investors make biased decisions that lead them to make irrational decisions while performing investment activities. Moreover, Kleinübing Godoi et al. (2005) emphasized that cognitive biases derive from flawed reasoning that originate due to limited time, knowledge, and lack of attention. Correspondingly, Fisher and Statman (2000) identified the overconfidence bias of the investors who overestimate their capabilities of judgment. Similarly, Trevelyan (2008) argued that optimism found in entrepreneurs always produces constructive consequences in improving health, reducing stress, and coping with occurring uncertain challenges in the business. Litt et al. (1992) in their studies, also promoted the optimistic behavior of entrepreneurs. According to them, optimism promotes persistence and commitment. Moreover, McColl-Kennedy and Anderson (2005) asserted optimism enables entrepreneurs to retain their subordinates in the venture. Barber and Odean (2001) stated that optimistic entrepreneurs discourage any negative info about a stock. On contrary, anchoring bias prevails when the tendency to an immaterial number is considered as references (Fisher and Statman 2000). Availability bias arises when investors relate the most prevailing and familiar results instead of statistically plausible outcomes (Pompian 2006). Mishra and Metilda (2015) studied that several times traders give themselves credit for serving investors to book their profits and then blame external aspects when suffers loss also referred to as self-attribution bias. Fisher and Statman (2000); Pompian (2006) on the other hand studied other cognitive biases such as representativeness, ambiguity-aversion, mental accounting, confirmation, hindsight, an illusion of control, and framing biases. Similarly, Kleinübing Godoi et al. (2005) found that emotional biases are categorized as deviances from a predictable financial attitude that can be judged based on emotions. Pompian (2006) identified more emotional biases. Likewise, optimism bias Pompian (2006), loss aversion bias Kleinübing Godoi et al. (2005), regret aversion bias Barber and Odean (2001) were proposed by the respective authors.

Personal attributes are highly influenced while making decisions for investments. Comprehensive studies have taken place to comprehend the association between the type of personality and the investment attitude of an entrepreneur. Scholars have employed distinct traits of personality and have discovered the association between personal style and the ability to tolerate risk. The renowned inventories employed are from the big five model (Mayfield et al. 2008; Brown and Taylor 2014; Bucciol and Zarri 2017; Akhtar et al. 2018; Filbeck et al. 2005).

Hence, a discrepancy in the personality type of the investor and the selected portfolio can unfavorably affect an individual's wealth. Therefore, the financial consultant must understand the psychology of the potential investor before providing their respective investment proposal (Kannadhasan et al. 2016).

The literature also focuses on financial knowledge or learning that is widely regarded as a life skill leading to economic growth and good fortune. Kappal and Rastogi (2020) highlighted that financial awareness or literacy embraces knowledge, expertise, attitude, and personal traits that are essential to make smooth financial-decisions and achieve financial goals. Furthermore, the average financial literacy counts throughout G20 countries are 12.7 out of a maximum of 21 in which Pakistan lacks behind therefore, the point of

concern is that financial knowledge should be well equipped in businesses because these skills aid individuals, to choose those financial products that will secure their future. Considerably, parents also influence investment behavior. An optimistic and positive approach of their adults and surroundings will favorably help in gaining worthy financial knowledge (Grohmann et al. 2015). According to, Hibbert et al. (2004), financial wisdom inherited from parents significantly influences the young grown-ups' financial prudence because families who duly pay their outstanding never misuse their credit-cards this ultimately affects the children that they evade incurring debts. Bucciol and Veronesi (2014) stated that parent's financial socialization illustrates a 16% rise in the chances of saving funds when they mature this leads to a 30% increase in saving in all. Similarly, Akhtar et al. 2018 pointed out that family supervision, social-influence, and media also stimulate the financial decisions of investors. Besides, Kumar et al. (2018) address that education influences individuals' financial behavior towards affairs related to finance. (Mishra and Metilda 2015) asserted that highly educated people are more anxious about their savings and allocate their funds more vigilantly as compared to those who are not well-qualified because education increases overconfidence and self-efficacy bias. Correspondingly, the authors also assert that experience years in investment activity also influence while selecting the portfolio. Thus, investors who have more working experience possess overconfidence bias in their attitude whereas, less experienced investors have no impact on the self-attribution bias. Tang and Baker (2016) addressed that several psychographic factors highly affect the financial decisions of the investors. High self-esteem in an individual will expose better financial behavior. Hence, in light of the above studies, it is clear that both genders exhibit an effective role in the field of investment. Charness and Gneezy (2012) mentioned that female investors are risk-averse and they fail to do better future planning for investment. On the contrary, Hayat (2016) discussed the importance of financial knowledge asserting no difference in gender regarding attitude. However, Cramer et al. (2002) mentioned that female entrepreneurs can absorb risk and occurring challenges at times of unexpected conditions. The current study literature depicts investor psychology and the respective role of gender in investment activity. According to, Barber and Odean (2001); Charness and Gneezy (2012) female entrepreneur contribute less in investment activity. Scholars have conducted studies in neighboring countries but this exploratory study strives to find the issues that affect the personal decisions regarding investment owning a business in Pakistan. It is worth mentioning that female entrepreneurship is an emergent segment in the population of investors that is not deliberated nor studied comprehensively therefore, this study aims to add the best of knowledge for the researchers globally.

3. Research Design

Prevailing study adopted the inductive approach to comprehend the ground realities and comprehensive responses that help make us aware of the issue. The evolution of entrepreneurship in Pakistan and rapidly increasing female contribution have led to escalating distinct ventures found or co-founded by female citizens in the economy. This study discusses two multi-national cities in Pakistan, Karachi and Lahore, because these cities are considered the incubator accelerator centers such as The Nest I/O & Invest2Innovate, and others provide networks to connect mentoring, coaching and capital to fresh entrepreneurs. Karachi is considered the financial asset for Pakistan that headquarters several multi-national corporations and is a hub for investors.

Lahore is another city selected for the current study, which is home to the educational center and has been initiated as an incubator and accelerator to promote business for women to become competent entrepreneurs. This study adopts a non-probability approach as a purposive and snowball sampling method. For this sampling technique, it is imperative to have homogenous subjects and having similar criteria (Guest et al. 2006). The condition to conduct an interview is discussed as the interviewee must have three years of running the business; she should be living in Karachi or Lahore and would have invested in two or

more different financial instruments such as bonds, saving deposits, mutual funds, stock market, real estate, insurance company or peer to peer lending. The snowball sampling method was applied to get a response from one proficient respondent referring to other similar candidates. Table 1 presents a brief respondent profile. Guest et al. (2006) explained that purposive sampling requires the sample size to be saturated, referring to a point that restrains new information or themes extracted from the set of data. Thus, this study intended to collect data through comprehensive interviews until we attained saturation.

Table 1. Interviewee Profile.

Respondents	City	Enterprise	Age	Experience
1	Lahore	Pvt.Ltd.	30 and above	More than 10 years
2	Lahore	Pvt.Ltd.	30 and above	More than 15 years
3	Lahore	Pvt.Ltd.	40 and above	More than 15 years
4	Lahore	Pvt.Ltd.	51 and above	More than 20 years
5	Lahore	Partnership	41 and above	More than 20 years
6	Lahore	Pvt.Ltd.	31 and above	More than 20 years
7	Lahore	Pvt.Ltd.	31 and above	More than 15 years
8	Lahore	Sole Prop.	31 and above	More than 15 years
9	Lahore	Pvt.Ltd.	51 and above	More than 20 years
10	Karachi	Sole Prop	31 and above	Less than 10 years
11	Karachi	Sole Prop	31 and above	More than 10 years
12	Karachi	Pvt.Ltd.	31 and above	More than 15 years
13	Karachi	Pvt.Ltd.	51 and above	More than 20 years
14	Karachi	Pvt.Ltd.	41 and above	More than 15 years
15	Karachi	Sole Prop	41 and above	More than 15 years
16	Karachi	Pvt.Ltd.	41 and above	More than 15 years
17	Karachi	Pvt.Ltd.	41 and above	More than 10 years
18	Karachi	Pvt.Ltd.	51 and above	More than 20 years

To study the investment behavior of female entrepreneurs, the exploratory interview approach was nominated to execute further research because it is comfortable to use an inductive approach for collecting sensitive data. This enables us to apprehend attitudes and explore intuitive feelings and complicated phenomena. Kappal and Rastogi (2020) highlighted that interrogating has an opportunity for an examination that assists the scholar to evolve with every interview. Similarly, Matlay and Man (2006) emphasized those entrepreneurs who learn competently, are capable to actively seek learning opportunities. However, such opportunities give a tough time to avail. This is done by observing others and then learn things to avail opportunities out of one's domain. According to them, semi-structured interviews are the better perception that exhibits the respondent's biases. Baig and Khalidi (2020) pointed out that interview is a suitable instrument for grounded theory, interviewees allow us to understand the ground reality, feelings, accountabilities, and also allows for peeking data insight required for exploration and considering the issues.

Hence, this study employed a manual coding approach to directly interact with the respondents. Interviews were conducted in congenial environments such as their working place or restaurants and were recorded for the study. The interview took approximately half or one hour. Later the recordings were transcribed. Following Corbin and Strauss (1990), the open-ended question technique was used to obtain codes and to better interpret and categorize interviewee viewpoints and perceptions regarding investment instruments. Consequently, this study went through a process of coding as illustrated in Figure 1.

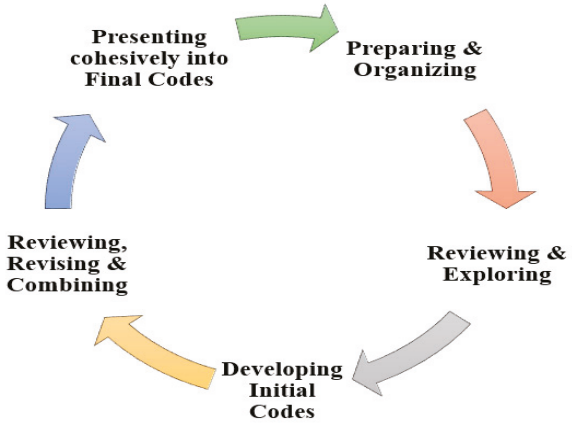

Figure 1. Process of Manual Coding Involved—(Source Corbin and Strauss 1990).

The responses were recognized as the initial themes, then connections between several codes were cohesively employed to derive the focused categories. As illustrated in Table 2. To estimate the validity of the coded data, it was proved with the prevailing literature and associated studies. This procedure was recapped after every interview that eventually directed towards the next interview and finally refinement for selective coding.

Table 2. Coding Identified on Common Subject Matter.

	Original Interview	Initial Theme	Focused Categories
1.	My mom invested her surplus money in fixed deposits. Therefore, I also prefer to deposit my excess money in the bank's profit/loss A/c.	Parents' Influence in Investment Decision	Social Influence
2.	My parents weren't familiar with the equity market as they were government employees so they had several benefits and availed pension at the age of retirement. Therefore, I never thought to invest my money in shares.		
3.	I have good trading skills inherited from my grandfather because he was a successful trader. Unfortunately, my father was in defense and he invested in the equity asset class. Their conversation made me learn these skills and now I have learned to trade in stocks.		
4.	I belong to a middle-class family living with old grandparents in a small house. My dad was a sole proprietor and traded in shares. They never discussed money in front of us, but I always observed dad speaking to one of his friends related to it. Thus, this taught me investment inequities. I reflect my mom too who always saved for a rainy day.		
5.	My close relative has witnessed a big hit in the stock market. Especially in Covid-19, when the stock market fell I don't think it is a piece of cake for me. People who survive are trading for years and have enough to take a chance.	Influence of Societal Experiences	
6.	I think the stock market is volatile and completely uncertain. I have witnessed many of my dear ones losing their money in it. Even best and regular players in the stock market have suffered loss. It is better that I must stay away from it.		
7.	I invest in mutual funds after taking financial consultancy from my advisor. They guide me about market fluctuations. Thus, this makes me pretty sure that I am engaged in safe investment process.	Investment Consultant	
8.	Hiring a financial manager is essential. As I believe in rational decisions so I convey my goal and objectives and move ahead.		
9.	For a decade, I am consulting a qualified CA. He manages and organizes my tax file and counsels me accordingly where to invest. A number of times I evaluate myself too then make a final decision.		

Table 2. *Cont.*

	Original Interview	Initial Theme	Focused Categories
10.	I feel uncomfortable when things aren't under my control. I have always wished to be independent as practical experiences polish my expertise and enable me to overcome distinct challenges of life. This also stimulates me to think logically. After all things are destined and uncertainty is in Allah's hand, we are the actors who act according to his directions.	Financial Independence	Personal Influence
11.	Independent decisions make me more self-controlled and well-organized.		
12.	I prefer taking independent decisions to uniform my spouse. My decisions are considered in my in-laws, and my sisters and brother also value my decisions. This is how we brought up to consider every member, whether male or female equally.		
13.	Taking risks is the charm of life! When I initiated with a small business, I invested my piece of investment and never restricted myself to any agreement or fear because doing so will always kill my passion and underestimate me to move ahead.	Risk Aversion	Behavioral Influence
14.	Taking risk is something digging ones grave oneself. Money earned is not only my family also has equal rights. Therefore, I can't engage myself in risky investments.		
15.	I believe in optimism and look at the bright side of the picture.	Optimism	
16.	As an optimistic entrepreneur, I have the ability to act, launch and explore if I am not overly confident in evaluating, adapting, consolidating, and exploiting. Thus, this keeps us away from frame-blindness.		
17.	I have maintained different accounts. Some of my investments are for the long-term that is saved for the family, and others engaged in rolling business.	Mental Accounting	
18.	I quietly plan investments and pay premium semi-annually to insurance company.	Long-Term Investment Attitude	Investment Attitude
19.	I am sure that I have enough investment to survive if I require it.		
20.	My approach towards investment is conservative. As it relieves stress and reduces risk.	Conservative Investment Attitude	
21.	The pandemic has given us a sense of adaptability. Ultimately, uncertainty makes no difference to us and we have learned how to diversify the funds.	Uncertainty	Controlling Factors
22.	I face challenges as I have developed flexibility in my attitude therefore, I easily identify new ways of investment and have the ability to resist unexpected business conditions.		
23.	I change my strategies in uncertain conditions to survive.		
24.	I have limited knowledge in financial markets knowledge and my investment is confined to bank deposits, mutual funds, and insurance.	Financial Learning	
25.	Financial learning is one of my weaknesses that I need to work on for the expansion of my business.		
26.	We prefer to trade in the property as it is a safe long-term investment.	Alternative Investment	Investment Decision
27.	I invest my surplus in fixed deposits and mutual funds as I am quite aware of it.		
28.	Although it is risky to play in stocks, I invest in it by consulting my financial advisor.		
29.	We are anxious to plan retirement because we haven't done yet.	Retirement Plan	
30.	Yes! We have secured not completely, but we have deep concerns regarding it.		

4. Result and Findings

Initially, it is very hard to absorb the risk that comes across women while establishing her business (Bowen and Hisrich 1986; Agarwal and Lenka 2018). On the contrary, Kappal and Rastogi (2020) exhibited that risk attitude in investment is not the same. This study assembled and evaluated data based on common subject matter that was finalized when 75% of interviewees communicated about a specific subject. Subsequently, the analyzed data emerged into 13 such themes under six constructs.

4.1. Social Influence

Parents influence in Investment Decision refers to parents influence on their young ones in terms of their habits and beliefs. In all, 83% of the interviewee stated that although, parents never discussed financial issues with them. However, still, they very well know what the importance of money is by observing parent's attitudes. This observation taught

them that money should be earned and saved. Thus, 88% of the responses demonstrated that investment choices are acquired by observing parents. For instance, parents investing in saving accounts so young ones will also follow the same. Similarly, if elders are investing in shares so their children do possess its knowledge and invest in the equity market.

Influence of societal experiences refers to the interrogation process, it was witnessed that friends and society greatly affect the investment decision. Although they want to invest in the equity asset class, the fear of societal experience refrains them because people around them suffered a loss in trading with shares in the stock market. Thus, this made them reluctant to invest in that market. Hence, 72% of people influenced by their friends, family, society, and community experiences depicted bad experiences regarding the stock market. This eventually discouraged them to perform investment activity in shares.

Investment Consultant means that women have limited knowledge of investment tools and instruments. Therefore, 94% of women business owners seek advisors or consultants to assist them in managing their wealth. The investment consultant may be their respective bank, kin, lawyer, or professional chartered accountant. Moreover, they also do some research after seeking valuable counsel from their respective consultant.

4.2. Personal Influence

Financially Independent refers to women interviewees that are mostly running their businesses. Who are ambitious and want to accomplish their goals because ambition reveals healthy self-esteem if well-aimed and backed by values. This makes them self-confident and enables them to make a difference in their surroundings keeping things under control. Figure 2 illustrates that 83%of women invest for the sake of their families.

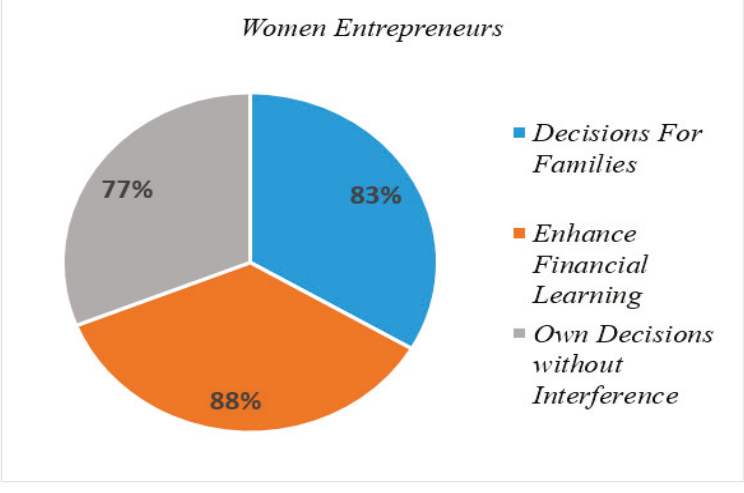

Figure 2. Women Financial Independence Illustrating Investment Attitude.

A total of 88% of interviewees stated that financial independence makes us aware of the nuts and bolts while performing the investing activity. More than 77% preferred that they are against interference and want their sole decisions for their surplus money to be invested.

4.3. Behavioral Influence

Risk aversion refers to those women working in the field, who demonstrate confidence when it comes to their business. Sometimes they take the risk, and sometimes they are afraid to take risks while investing. However, 83% of the interviewees stated that they are afraid when it comes to their investing activity. The majority of their portfolio consists of

fixed deposits, mutual funds, and government provident funds. This study observed that risk-averse attitude generates because of lack of sound knowledge about the market this showed that in Karachi and Lahore, women are not good players in the stock market and do not want to expose themselves.

Optimism means to exhibit positive approach. Women running business in Pakistan demonstrated positive results of optimism such as they are action-orientation, persistent, committed, and capable of motivating or stimulate others because they are found adaptable and have shown survival in unexpected conditions like Pakistan. Thus, 77% of women demonstrated optimism in their investment behavior.

Mental Accounting refers to a concept where one plans, evaluate, and organize its wealth to fulfill goals in life. Maintaining different accounts for revenues and expenditures while refraining from overspending. Thus, we found that 88% of female entrepreneurs keep organized records to overcome liquidity issues.

4.4. Investment Attitude

Long-term Investment Attitude explains that working women are good at contingent planning with anticipation to save more than recurring expenditures. On the contrary, there are a few who have not suffered or confronted hardships of life and are fond of spending rather than saving. In all, practically, there are 77% of women who invest for a long period ensuring that those investments are not withdrawn very often.

Conservative Investment Attitude explains that working women are mostly conservative because they absorb low risk simultaneously, safeguard their invested principal. Thus, 88% of the respondents invest in volatile instruments.

4.5. Controlling Factors

Uncertainty displays that about 94% of the interviewee delve into new investments as they think optimistically. Different asset classes require comprehensive-time to liberate oneself but unfortunately, due to scarce time riskier investment is not preferred. On contrary, they have guts to survive in uncertainty and maintain sustainability.

Financial Literacy refers to sound knowledge about financial activities which is unfortunately limited because in Pakistan few women are running their own business having little knowledge about investment tools moreover, they have little exposure in riskier asset classes and are willing to expand their portfolio by investing in equity or other capital investments.

4.6. Investment Decision

Alternative Investment refers to those women executing businesses who really understand that they possess limited knowledge about instruments. Scarce time refrain them in increasing their knowledge regarding certain assets. However, all of them have the curiosity to gain more knowledge about certain assets in which they need to learn more and increase their portfolio. The potential interviewees had made their perceptions about different investment avenues and they drove their investment decisions according to these perceptions. Figure 3 illustrates that 88% of women viewed fixed deposits as a secured and profitable tool to invest. A total of 77% felt real estate as a sound and sustainable investment. Similarly, 77% of females agreed that investing in mutual funds is better on contrary, since their lack of knowledge about other asset classes prevented them from paying lump sum investments.

However, they followed an organized investment plan to venture into mutual funds for regular investments. A sum of, 83% considered gold as the best option if needed for abstract investment. Only 16% were found who play in stocks.

Retirement Plan displayed that a total of 88% of respondents have not planned for retirement. They knew it very well that it requires few concrete decisions before their retirement.

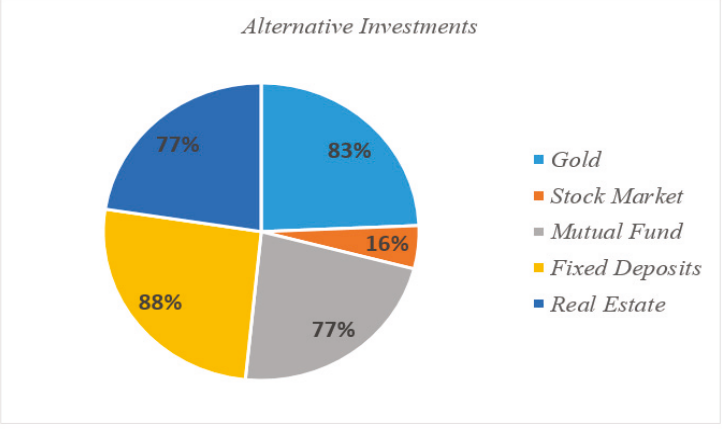

Figure 3. Most Preferable Investments by Pakistani Female entrepreneurs.

5. Discussion

These respondents showed risk-averse behavior towards investments as a result of, limited knowledge and scarce time to understand various investment areas. Female entrepreneurs preferred to allocate their funds in bank saving A/c and mutual funds. They wished to diversify their area by allocating their funds in other asset classes after having sound knowledge and skill regarding it. This depicted that are willing to engross risk after studying different investment tools. According to Prasad et al. (2014), in India, women who own businesses prefer capital appreciation, security, liquidity, speculation, tax-benefits, and stable income. However, the findings of their study depicted that they are not provoked to liquid assets, speculation, and stable income. However, they asserted that women are risk-averse and select uncomplicated and convenient tools to invest. On contrary, this study found that women invest in their families.

Sahi et al. (2013) inquired about investment behavior along with its biases. The scholars conducted in-depth interviews and found that investors are risk-averse. They evaluate risk and then invest. Moreover, society also influences their attitude toward investment activity. The current study illustrates that the majority of female entrepreneurs are not confident enough to make decisions on their own. Even though they refer to financial consultants, they take final decisions after verifying it through other means. Moreover, they feel that they should make more efforts to literate themselves financially as they stay away from risky assets. In short, they would take a risk but they are risk-averse. They need training for these risky asset classes. Paluri and Mehra (2016) studied the women's financial behavior and categorized them into clusters base on financial attitude. They took a sample of 177 women, 132 were between 18–35 years, 76 were students and 16 were self-employed.

The prevailing study classifies women according to their financial behavior and declared that such sorting would help organizations to trade appropriate products to diverse clusters. This study proposes to consider female entrepreneurs as a separate segment of the market. According to, Paluri and Mehra (2016), women tend to be economical and require immediate satisfaction after spending their funds. This has not proved good in the case of Pakistani female entrepreneurs. Current research depicts that women are good planners moreover, they save for their enterprise and families. Similarly, Rashid and Ratten (2020) explored the entrepreneurial experience of 12 artisans by conducting qualitative research with semi-structured interviews in Pakistan. The scholars found that to survive in the market, it is necessary to be adaptable. They further revealed that women heavily rely on rational learning by having a strong relationship with their subordinates and work. This

ultimately results in a successful, profitable business and an optimistic approach towards investment and executing entrepreneurship.

Since female entrepreneurs have limited knowledge, and their perception regarding risk is uncertain, they firmly believe that mutual funds are better for investing and tax saving. Moreover, fixed deposits are a safe option for bulky investments. Whereas, 77% of the interviewee prefer investing in real estate as they perceive it as a secured investment. About 83% of respondents prefer gold as another good option.

Parents also influence their attitude toward investment. According to Webley and Nyhus (2006) and Grohmann et al. (2015), family plays a crucial role in educating financial literacy. Moreover, children copy the investing and savings behavior of their adults. For Pakistan women, entrepreneurs engage in investment instruments for their families. They agree that if parents have a risk-taking attitude, they also venture into such assets as equity.

Practically, they accept the fact that discussing financial matters with young ones make them live in the real world and also prepare them for future rational decisions. On the contrary, negative experiences influence those who have lost money in the stock market. They seek an investment consultant who counsels them and finally after comprehensive research work they make decisions. This ultimately augments its portfolio. At the same time, lack of consultancy heads towards traditional investments.

This study also reveals that female entrepreneurs engage in long-term investment having a risk-averse attitude. Although they take the risk in their business, they avoid risk in their investments. They efficiently plan for their surplus when they budget their expenditures. If they find any investment in loss, they wait till it becomes profitable. They try to liquidate investments in losses. They analyze their portfolio but do not study investments in detail. The study discusses behavioral biases that affect their selection of instruments such as risk aversion and mental accounting, simultaneously keeping an optimistic view. It was found that they have not sufficiently equipped themselves for retirement. Similarly, a lack of financial literacy, the time they fail to be diversified. Figure 4 is proposed to be tested empirically for its robustness.

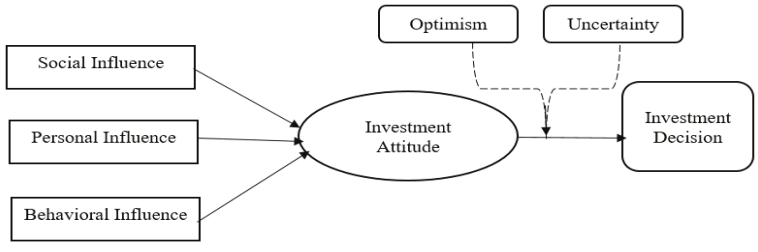

Figure 4. Model Proposed for Factors Affecting Women Investment Attitude.

The factors that affect investment behavior is limited knowledge and uncertain conditions that heads to financial satisfaction and plan for retirement. This research splits female entrepreneurs into four wide categories of factors that highly impact their behavior such as limited knowledge of instruments and uncertainty playing the moderating role which leads to healthier investment. The study gives an insight into female entrepreneurs and their investment behavior in two big cosmopolitan cities of Pakistan that require empirical testing on a larger sample size in several other cities to crosscheck the robustness of the proposed model that will ultimately provide guiding principle to policy-makers and financial consultants to give training to female entrepreneurs in our society.

6. Conclusions

This study concludes by revealing the personal decisions taken by female entrepreneurs in Karachi and Lahore. Moreover, it aims to exhibit a growing segment of investment. This study identified that female entrepreneurs invest in long-term funds having conservative

attitudes, and therefore, seek financial consultants. They are greatly affected by society and parents on the contrary, and want to be independent in their decisions. Limited knowledge due to time constraints has prevented them from the riskier investment but they still believe in adaptability in uncertainty, keeping an optimistic attitude towards their investments. Thus, appropriate knowledge of financial products and ample time to think over will make them learn better and will also play a tremendous role in distinct markets in the emerging economy like Pakistan.

This study exposes female entrepreneur's behavioral biases such as risk aversion and mental accounting. Therefore, scholars can include more biases in their studies that greatly impact their decisions towards investment. This study proposes 18 female entrepreneur interviews in the big cities Karachi and Lahore of Pakistan. It is recommended to conduct a study on a large sample size to extend the understanding of the current research because female entrepreneurs in rural area will depict opposite perceptions regarding investment behavior. Since, Karachi and Lahore are home to multi-cultural, multi-traditional, multi-lingual, and perception migrants so studies can be done on the effect of culture on female entrepreneur behavior concerning investing activity and the young ones who impersonate their parent's behavior when seeking for financial aid. Hence, for universal exposure, there is a need to investigate the female entrepreneur's behavior internationally in South Asian countries to further investigate the strong bonding of this relation by examining deeply among the regions.

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