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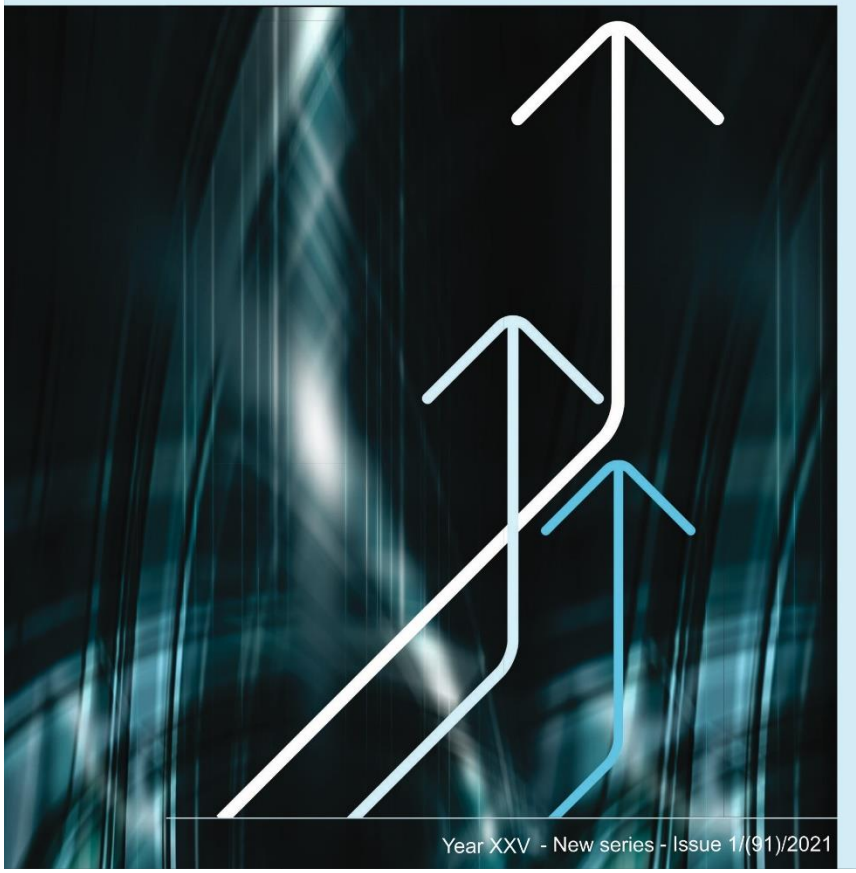

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"VICTOR SLĂVESCU" CENTRE FOR FINANCIAL
AND MONETARY RESEARCH

FINANCIAL STUDIES

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Contents

THE IMPACTS OF SPEECHES ON NOWCASTING GDP: A CASE STUDY ON EURO AREA MARKETS

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Abstract

The use of speech data in nowcasting models is a new topic while the use of sentiment and emotion indicators from microblogs and internet platforms in nowcasting models has been discussed in the literature. The effect of the speech data of European Central Bank's (ECB) officials on nowcasting Euro Area GDP is investigated in this paper. After performing a detailed descriptive analysis of the speech data, five emotion indicators are obtained as a result of the emotion analysis. The contribution of these emotion indicators is examined to a nowcasting model including indicators from the real sector and household/business surveys related to the Euro Area for the period of 1995:01-2019:12. The effects of emotion indicators on model are analysed root mean squared error (RMSE), impulse-response functions, variance decomposition analysis and revision analysis. Findings show that emotion indicators provide a decrease in RMSE of nowcasting model. It is found out that the shocks in the emotion indicators are significant on the GDP in the long term, and the emotion indicators are effective in explaining the variance of the forecast error variance of GDP. Revision analysis indicates that emotion indicators do not increase the revision of GDP nowcasts. As a result, it can be claimed that the emotion indicators obtained from the speeches of ECB officials have a noticeable effect on the nowcasting the Euro Area GDP.

Keywords: Emotion analysis, ECB speeches, Nowcasting, Euro Area

JEL Classification: C33; E52; E58

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1. Introduction

Gross domestic product (GDP) is the most important economic indicator which shows the general economic situation of a country. Especially, the underlying dynamics of the quarterly GDP have always been the subject of research because it is very important to know its possible future value to assess or steer of the economy in the short-term. In recent years, it has been more desirable to estimate the current value of the quarterly GDP than to forecast future values of the quarterly GDP by using the nowcasting techniques since the quarterly GDP has a relatively delayed publication schedule (*t*+45 *days* in average) compared to the reference quarter (*t*) (Combes et al., 2018).

There is a vast literature on nowcasting GDP, and the main purpose of the studies is generally to find the best method and variable combination to nowcast the quarterly GDP. The literature shows that the variables to be used in a nowcasting model are mainly chosen from the real, financial or (household/business) survey indicators, i.e. structured data. On the other hand, the use of unstructured data (simply text data) in a nowcasting model is relatively new topic in the literature (Basselier et al. (2017), and Kaminski and Gloor (2014)).

In addition to sentiments or emotions extracted from microblogs and the internet, it may be the case that the speeches of monetary authorities (i.e., central banks) can be effective economic indicators since they may affect the economic agents' behaviours, such as expectations, saving-consumption decision, investment risk appetite. Although it may be thought to focus on the impact of central banks' speeches on price stability (inflation) at first glance, the question of how much the effect of the speeches on a real indicator is still important.

This paper investigates the impacts of ECB speeches on nowcasting Euro Area quarterly GDP in this paper. The emotion analysis is applied to ECB's speeches, and construct several emotion indicators to be contained in a multivariate nowcasting model. Then, the effect of emotion indicators on Euro area quarterly GDP is examined by three dimensions. First, it is analysed how much the emotion indicators make the contribution to decrease the estimation error of nowcasting model for quarterly GDP. Second, it is tried to measure the impact of emotion indicators on the explaining the variance of the quarterly GDP. The third dimension is to measure the impact of emotions indicators on the revisions of the GDP nowcasts.

The rest of this paper is organized as follows. Section 1 presents a summary of related studies in the literature. Section 2

defines the unstructured (ECB speeches) and the structured (economic and survey indicators) data for nowcasting quarterly Euro Area GDP. The method to obtain emotion indicators by analysing unstructured data, and the nowcasting methodology are explained in Section 3. Besides, several approaches to measure the impact of emotions of speeches on nowcasting quarterly Euro Area GDP are also explained in the Section 3. The complete findings of the paper are presented in the Section 4. Final remarks are provided in the conclusion.

2. Literature review

A summary of related literature is given in Table 1 (in the Appendix). The studies of Varian and Choi (2009), McLaren and Shanbhogue (2011), Fondeur and Karamé (2013), Bortoli and Combes (2015), Baker et al. (2016), and Francesco and Marcucci (2017) tries to improve the nowcasting/forecasting models by including the unstructured data available on the internet. Specifically, word-search characteristics over searching platforms are often treated as unstructured data. It has been also becoming popular in the literature to analyse emotions and associate them with economic indicators.

However, there are very few studies that try to analyse the nowcasting models by including the sentiments or emotions. Combes et al. (2018) is a visionary paper which differs from the literature in terms of the data source used in the nowcasting model. They extracted several sentiment indicators from the newspapers to use in the nowcasting model for France GDP, and they investigated the effect of sentiment indicators on the nowcasting model.

The paper of Kaminski and Gloor (2014) is another visionary paper in terms of analysing emotions rather than sentiments. They examined the micro-blog data to extract several emotion indicators, and they analysed the effect of the indicators on the crypto-currencies. The studies of Bollen et al. (2010), Zhang et al. (2011), and Si et al. (2013) can also be given as the examples of associating economic analysis with emotion indicators obtained from micro-blog platforms.

There are several studies in the literature about examining the relationship between the communication of central banks and economic indicators. The studies of Lucca and Trebbi (2009), Hansen and McMahon (2015) and Eskici and Koçak (2018) are good examples for pointing out the relationship, however it seems that there is a scarcity of literature in which the emotions extracted from the central

banks' speeches and quarterly GDP have been considered together in a nowcasting model.

Varian and Choi (2009), Francesco and Marcucci (2017), Baker et al. (2016), Bollen et al. (2010), Lucca and Trebbi (2009), Hansen and McMahon (2015) studied the nowcasting of US economic indicators such as GDP, short-term interest rate, stock-exchange market index, initial claims. On the other hand, McLaren and Shanbhogue (2011), Fondeur and Karamé (2013), Combes et al. (2018) examined the nowcasting of real and financial variables. The common way to study nowcasting is seen as univariate or multivariate regression methods from the literature.

Unlike the literature, this paper tries to use semantic information such as ECB speeches in nowcasting model which is available to use mixed frequency data and to handle missing observations.

3. Data

3.1. Unstructured data

ECB (2019) provides speech data with metadata containing the content of all speeches made by ECB to assist researchers in the field of central bank communication. The data is currently updated every two months and presented in comma-separated-value format. All related information can be found in ECB (2019).

The data, which is downloaded as of 7 July 2020, consist of 2383 speeches record. The speeches are combined in the same date, so it is obtained a total of 2328 speeches in unique dates. The data contains speeches in several languages, but mostly in English. 92.7% of speeches are in English. There are also speeches in German, Spanish, French, Italian, Catalan and Dutch languages. Only English speeches are taken into consideration. In detail, 5 variables are included in the data.

These are *date, speakers, title, subtitle,* and *contents*. *date* variable extends from 1997-02-07 to 2020-01-27 in daily format, and the time span is restricted until the end of 2019 for this paper. This is due to avoid including the disruptive effects of COVID-19 pandemic to the nowcasting model. *Speakers* variable includes 23 speakers with their names and surnames. In addition to the ECB presidents', the presentations and speeches of other officials from the ECB are included in the data. The speeches made by all speakers are taken into consideration due to vice presidents, chief economists and other officials deliver a significant number of speeches. *subtitle* variable is

excluded because it is unnecessary information for the analysis. The *contents* variable provides the textual information of the speeches.

3.2. Structured data

Mixed-frequency data is used for nowcasting GDP. A summary information for data is given in Table 2 (in the Appendix) and the data is accessible at https://tinyurl.com/yyvxo2tp.

By the following approach from the papers Kaminski and Gloor (2014) and Combes et al. (2018), the data can be explained by three groups such as real, survey, and emotions. Real indicators group include four variables. The first one is the Euro Area quarterly GDP which is the target variable of the nowcasting model. Flash estimates of quarterly GDP are usually published with a delay of 45 days compared to the reference period. The second variable is the final estimates of quarterly GDP which is generally finalized after two years from the reference period. The third variable is Euro area monthly industrial production index. The last variable in this group is Euro area total turnover index. The latter two variables are published with a minimum delay of 30 days compared to reference periods. All real indicators cover the period between 1995 and 2019, and they are obtained from ECB.

Similar to Bańbura and Modugno (2014) approaches, two variables are used in the survey indicators group in this paper. The Purchasing Managers Index™ (PMI™) related to the manufacturing sector at the monthly frequency by IHS-MARKIT. PMI™ variable covers the period between February 2008 and the end of 2019. The Eurozone Business and Consumer Survey (BCS) sentiment index, which is published at monthly frequency by European Commission, is released 7 days before the end of the reference period. BCS index covers the period between January 1995 and the end of 2019.

Five emotion indicators (structured) are calculated using the unstructured ECB speeches data described in the part 3.1 of this section. The emotion indicators are at monthly frequency and cover the period between February 1997 and December 2019.

In summary, the mixed-type data includes 11 variables which are at monthly or quarterly frequencies, and it covers the time period between January 1995 and December 2019 with missing observations. The data entirely consists of the first estimation of the variables. It is ignored the subsequent revisions on the indicators.

4. Method

4.1. Text analysis and construction of emotion indicators

It is explained how the unstructured ECB speeches data (defined in Section 2.1) is analysed to obtain emotion indicators those represent the emotions of ECB speeches. The approach can be summarized as follows:

- Pre-processing
- n-gram analysis (descriptive)
- Extraction emotions from the data
- Time aggregation

Pre-processing is a technique which aims to prepare the text data for text analysis. It comprises two stage, i.e. tokenization and cleaning text data. Tokenization is the process of breaking down a text document into those tokens, i.e. words (Welbers et al., 2017). The second stage of pre-processing is the determination of the words (stop-words) to be excluded from the text data. This is a recursive process (Loughran and McDonald, 2016). This paper uses the stopword lists which are already available in Benoit et al. (2018), Rinker (2018), Rinker (2020), Benoit et al. (2019), Silge and Robinson (2016) and Feinerer et al. (2008) studies in addition to a long user-defined stop-words list.

The n-gram analysis, which it is observed the use of words together and the change of these uses over time, can provide important information about text data. Although it does not contribute to the process of obtaining emotion indicators, it provides important descriptive information for the ECB speech data. It is examined the group of two or three words (bigram and trigram, respectively) as well as a single word (unigram) by n-gram analysis. An *n−gram* is a sequence of *n* adjacent elements from a string of words (Jurafsky and Martin, 2008). A bigram is an *n−gram* for *n* = 2 and a trigram is an *n−gram* for *n* = 3. For simplicity, the relationship of Bayesian conditional probability is given in Eq.(1) only for a bigram which provides the conditional probability of a word given the preceding word.

$$P(W_n|W_{n-1}) = \frac{P(W_{n-1}, Wn)}{P(W_{n-1})} \quad (1)$$

That is, the probability $P()$ of a word W_n given the preceding word W_n-1 is equal to the probability of their bigram, or the co-occurrence of the two words $P(W_n-1,Wn)$ divided by the probability of the preceding word.

It is performed the emotion analysis which aims to categorize words in the text data regarding several pre-defined emotions to extract emotions from the ECB speech data. It is a different approach from sentiment analysis which categorize words into symmetric measures such as "positive", "neutral", and "negative". In general, a pre-defined dictionary is used in the emotions' analysis however, a new comprehensive dictionary, which is a harmonization of mainly financial-purpose lexicons, are considered in this paper. The lexicons are following:

- bing dictionary (Hu and Liu, 2004),
- National Research Council of Canada (NRC) dictionary (Mohammad and Turney, 2013),
- Lexicoder Sentiment Dictionary (Young and Soroka, 2012),
- Harvard-IV dictionary as used in the General Inquirer software (Harvard, 2000),
- Henry's Financial dictionary (Henry, 2008),
- Loughran-McDonald Financial dictionary (Loughran and McDonald, 2011),
- AFINN dictionary (Nielsen, 2011)

All mentioned lexicons are based on unigrams. They contain many English words, and the words are assigned to emotions. The Loughran and McDonald (2011) and Mohammad and Turney (2013) lexicons categorize words into emotions, the remaining lexicons are for sentiments. The AFINN lexicon only assigns words with a score that runs between -5 and 5, with negative scores indicating negative sentiment and positive scores indicating positive sentiment. Due to the scale problem, it is excluded the AFINN dictionary from the scope of the analysis.

After harmonization of all available lexicons, there are 17695 (15186 of them are unique) words in the new dictionary, and the number of total emotions is 7. These emotions can be listed as positive, negative, uncertainty, anticipation, and constraining. The distribution of

words to emotions is given in Table 3. It is seen that the words are mostly flagged as negative-positive separation according to the distribution.

Table 3

Properties of the dictionary used in emotion analysis

Emotions	Number of words
Negative	9439
Positive	5171
Anticipation	839
Uncertainty	297
Constraining	184

Source: Author's own calculations from ECB (2019).

Emotions are extracted from ECB speech data using the methods explained in the studies of Plutchik (1962), Plutchik (2001) and Rinker (2019) through the dictionary explained above. The emotion analysis is done at the sentence level in the text data. Emotion's score is calculated at the sentence level. The scores are between 0 (no emotion in the sentence) and 1 (all vocabulary used in the sentence represent emotions). It should be noted that emotion words prefixed with an 'un-' are treated as a negation. For example, "unhappy" would be treated as "not happy".

The emotion's score is obtained in daily basis since ECB speech data is at daily frequency. The daily scores should be aggregated to the monthly frequency since monthly emotion indicators are used in the nowcasting model defined in Section 3.2. Various approaches can be used in the aggregation process. For instance, daily speech texts in the relevant month can be evaluated as a single text if a speech is made once a month. However, there is a disadvantage that the score of the speech at the end of any month are only reflected to that month in this approach. For this reason, it is assumed the emotion's score to show an exponential decay process running from the date of a speech until the next one. Afterward, the aggregation is performed by taking monthly averages on each emotion. Finally, the monthly emotion indicators are rescaled from 0 to 100.

4.2. Nowcasting model and estimation

The dynamic factor model (DFM) specification is used to build a nowcasting model (Stock and Watson, 2005) in this paper. In a DFM, a large amount of time series are represented by a smaller number of factors, both by carrying the time series features and by reducing their dimensions. A DFM can be represented as given in Eq.(2)-(4):

$$x_{i,t} = \Lambda_i f_t + \epsilon_{i,t};\ i = 1, \dots, n, \quad (2)$$

$$f_t = \varphi(L) f_{t-1} + \eta_t; \quad \eta_t \sim i.i.d.\mathcal{N}(0, \sigma_i^2) \quad (3)$$

$$\epsilon_{i,t} = \alpha_i \epsilon_{i,t-1} + \upsilon_{i,t}; \quad \upsilon_{i,t} \sim i.i.d.\mathcal{N}(0, Q) \quad (4)$$

Let *x* represent the standardized variables in terms of mean and variance, Λ is the *nxr* dimension matrix and represents the effects of *x*'s on invisible factors (*f*), which represents the loadings. There are three factors, namely real variables factor, survey variables and emotion variables. These factors are assumed to be followed by a VAR process in *p* lag. ϵ_t shows idiosyncratic residuals and they are assumed to be AR(1) process.

Mixed-frequency data can be used in DFM by following the method explained in the paper of Camacho and Perez-Quiros (2010). The DFM also allows to use unbalanced data, which contains missing observations, following the method in the paper of Bańbura and Modugno (2014). The authors suggest a solution for the problems of estimating missing observations in the system estimation in the case of mixed frequency data. The transformations of variables in DFM are given in relevant column of Table 2.

This paper uses the expectation-maximization (EM) algorithm as defined by Marta and Michele (2010) is used to estimate DFM. The lag length is determined as three for the factors according to the Akaike information criterion. As proposed by Doz et al. (2012), the restriction of the effects of variables on the factors is applied in a subjective approach in the form of real/survey/emotion separation explained in Section 2.2.

4.3. Impulse-response functions and variance decomposition analysis

Impulse-response functions are examined to present the evolution of GDP in reaction to shocks in the three factors estimated in Emotion-Included model. It measures the changes in the future responses of GDP in the Emotion-Included model when the factors are

shocked by an impulse in one standard deviation unit. Impulse-response functions are obtained by Cholesky factorization of *Q*, i.e. *Q* = *AA′* which is the innovations of equation (2). First, moving average (MA) representation of equation (2) are obtained. Then, it is defined a new error vector $\tilde{\epsilon}_t$ as (linear transformation of old error vector ϵ_t). The coefficient in the MA representation measures the impulse-response which are defined in equations (5)-(7).

$$x_{i,t} = \epsilon_{i,t} + \phi\epsilon_{i,t-1} + \phi^2\epsilon_{i,t-2} + \cdots + \phi^j\epsilon_{i,t-j} \tag{5}$$

$$x_{i,t} = AA^{-1}\epsilon_{i,t} + \phi AA^{-1}\epsilon_{i,t-1} + \phi^2 AA^{-1}\epsilon_{i,t-2} + \cdots + \phi^j AA^{-1}\epsilon_{i,t-j} \tag{6}$$

$$x_{i,t} = A\tilde{\epsilon}_{i,t} + \phi A\tilde{\epsilon}_{i,t-1} + \phi^2 A\tilde{\epsilon}_{i,t-2} + \cdots + \phi^j A\tilde{\epsilon}_{i,t-j} \tag{7}$$

Equations (5)-(7) implies that the impulse-response to the orthogonal error $\tilde{\epsilon}_t$ after *j* periods is j^{th} orthogonal impulse-response which equals $\phi^j A$ where A in $Q = AA'$.

The variance decomposition analysis measures the amount of information each factor contributes to the GDP in the Emotion-Included model. It determines how much the forecast error variance of GDP can be explained by exogenous shocks to the three factors. Variance decomposition of forecast errors are calculated as follows. The amount of forecast error variance of factor *i* accounted for by exogenous shocks to *GDP* is measured by $\omega_{i,GDP,h}$ for *h*-step as shown in equation (8).

$$\sum_{j=o}^{h-1} (\phi_i A\tilde{\epsilon}_i \phi_{GDP})^2 / MSE[x_{i,t}(h)] \tag{8}$$

where the mean squared error of the h-step forecast of variable *i* is given in equation (9).

$$MSE[x_{i,t}(h)] = (\sum_{j=o}^{h-1} \phi_i \, Q \phi_i') \tag{9}$$

4.4. Revision analysis

The revision analysis is important to show the changes in the nowcast/forecast values regarding the upcoming information in new data releases. It is tried to measure the effect of emotion indicators group to the revisions of GDP nowcasts. It is followed the approach suggested by Basselier et al. (2017) to extract model-based revisions in the nowcasting framework. In this case, y_t^Q is quarterly GDP growth at time t, and Ω_v is the data set at time v. Hence, the quarterly GDP growth nowcast is the expected value of y_t^Q using the available information, $E[y_t^Q|\Omega_v]$. The new nowcast value can be decomposed by:

$$\underbrace{E[y_t^Q|\Omega_{v+1}]}_{\text{New nowcast}} = \underbrace{E[y_t^Q|\Omega_v]}_{\text{Old nowcast}} + \underbrace{E[y_t^Q|I_{v+1}]}_{\text{Revision}} \quad (10)$$

where I_{v+1} is the new information, and it is orthogonal to Ω_v.

Therefore, the revision can be explained as a weighted sum of revisions from the updated variables at time $v + 1$.

$$E[y_t^Q|I_{v+1}] = \sum_{j \in J_{v+1}} b_{j,v+1}\,(x_{i_j,t_j} - E[x_{i_j,t_j}|\Omega_v]) \quad (11)$$

where $b_{j,v+1}$ represents the weights which measure the marginal contribution of every release of indicators in the new value of the nowcast.

Using the Emotion-Included model structure, the model is refreshed in terms of loadings by adding new data for each month starting from January 2019 until December 2019.

5. Findings

Descriptive statistics for ECB's speech data are presented in Table 4. It is observed that the number of speeches has increased over the years. On the other hand, it has been observed that the annual mean of the number of words used per speech has not changed much over the years.

Table 4

Number of Words in Speeches by Year

Year	Number of speeches	Minimum number of words	Mean of words	Maximum number of words
1997	19	1109	2975	4252
1998	37	428	3560	7578
1999	90	642	4611	18863
2000	70	224	4449	21697
2001	64	1030	3985	16619
2002	64	1242	3714	12517
2003	62	1021	3842	11254
2004	89	50	3545	9627
2005	81	1100	3920	8707
2006	93	48	3994	11032
2007	115	35	4052	13638
2008	130	63	3655	11099
2009	105	222	3918	14089
2010	112	50	3514	10005
2011	117	42	3371	8823
2012	89	54	3245	9777
2013	132	44	3001	7233
2014	101	41	3430	9048
2015	103	39	3284	14809
2016	106	43	3068	11565
2017	142	44	2990	13739
2018	111	51	3288	14300
2019	105	328	3075	10346

Source: Author's own calculations

Table 5 presents the unigrams, bigrams and trigrams together over the years. When n-grams are analysed by years, it is easy to understand which economic topics are discussed in the relevant year. According to Table 5, the words “stability” and “foreign exchange” were the most frequently used during the 1997 Asian financial crisis. Also, it is underlined the phrases “stability”, “foreign exchange markets”, and “cross border payments” during and after the 1998 Russian financial crisis. It is emphasized “growth”, “securities”, and “structural reforms” between the years 2000 to 2003. During the years from 2003 to 2005, Trichet used the terms “real GDP growth” and “integration”, but an important point that draws attention is the emphasis on “labour productivity growth” and “cross border” in the years before the 2009 global economic crisis (2005-2008).

Table 5
Most used unigrams, bigrams and trigrams in the ECB speeches by year

YEAR	UNIGRAM-BIGRAM-TRIGRAM
1997	STABILITY-FOREIGN EXCHANGE-FINE TUNING OPERATIONS
1998	STABILITY-STABILITY ORIENTED-CFA FRANC ZONE
1999	STABILITY-CROSS BORDER-FOREIGN EXCHANGE MARKETS
2000	GROWTH-CROSS BORDER-PROFESSOR OTMAR ISSING
2001	GROWTH-CASH CHANGEOVER-CROSS BORDER PAYMENTS
2002	SECURITIES-SECURITIES ACTIVITIES-TOMMASO PADOA SCHIOPPA
2003	GROWTH-STRUCTURAL REFORMS-CURRENT ACCOUNT DEFICIT
2004	STABILITY-STRUCTURAL REFORMS-REAL GDP GROWTH
2005	INTEGRATION-CROSS BORDER-CURRENT ACCOUNT DEFICIT
2006	GROWTH-PRODUCTIVITY GROWTH-LABOUR PRODUCTIVITY GROWTH
2007	GROWTH-PRODUCTIVITY GROWTH-LABOUR PRODUCTIVITY GROWTH
2008	LIQUIDITY-CROSS BORDER-SEPA DIRECT DEBIT
2009	CRISIS-SYSTEMIC RISK-MACRO PRUDENTIAL SUPERVISION
2010	CRISIS-MACRO PRUDENTIAL-MACRO PRUDENTIAL OVERSIGHT
2011	CRISIS-BANKING SECTOR-SOVEREIGN DEBT CRISIS
2012	LIQUIDITY-MACRO PRUDENTIAL-SOVEREIGN DEBT CRISIS
2013	CRISIS-BANKING UNION-SINGLE RESOLUTION MECHANISM
2014	BANKING-MACRO PRUDENTIAL-MACRO PRUDENTIAL POLICIES
2015	CAPITAL-MACRO PRUDENTIAL-SHADOW BANKING SECTOR
2016	FISCAL-MEDIUM SIZED-MEDIUM SIZED INSTITUTIONS
2017	CONDITIONS-CAPITAL MARKETS-ASSET PURCHASE PROGRAMMES
2018	GROWTH-ASSET PURCHASES-CAPITAL MARKETS UNION
2019	INTERNATIONAL-YIELD CURVE-CAPITAL MARKETS UNION

Source: Author's own calculations

Then, the global economic crisis and the measures taken are frequently mentioned and it is used “systemic risk”, “macroprudential supervision” and “sovereign debt crisis” during the years between the years 2009 and 2011. it is emphasized “fiscal” issues, the speeches are made on “macro prudential”, “banking union”, “liquidity” in the years between 2012-2016. Most frequently n-grams are “asset purchase programmes”, “capital markets union”.

Two DFMs models are estimated to measure the marginal contribution of the emotion indicators group to the nowcasting model for Euro Area GDP. The “Benchmark” model is the base model which the emotion indicators group is not included, that is, only real and survey group of indicators are represented as two factors in the model. The second is the “Emotion-Included” model in which the emotion indicators group is included as a single factor in addition to two factors

of Benchmark model. The two models are estimated over full-time span which is from January 1995 to December 2019. Table 6 presents RMSE values for two DFMs and gain of the Emotion-Included model respect to Benchmark model. The RMSE value is 0.0019 in the Benchmark model while the RMSE value is 0.00171 in the Emotion-Included model. Thus, 9.7% gain is achieved by the Emotion-Included model comparing with the Benchmark model. This result indicates that the error of the nowcasting model can be expected to decrease by approximately 10% in case of the emotion indicators obtained from ECB speeches are included in the model compared with non-included one.

Table 6

Comparison of the Model's RMSE

Models	Number of Factors	RMSE	Gain in RMSE (respect to Benchmark)
Benchmark	2	0.0019	-
Emotion-Included	3	0.00171	9.7%

Source: Author's own calculations

Furthermore, these two DFMs are estimated by increasing the number of observations in a recursive basis (one-period-ahead) from January-2019 to December 2019 to directly observe the contribution of the emotion indicators to the nowcast figures. Table 7 presents the quarterly GDP growth rates and nowcasted figures produces by the Benchmark model and the Emotion-Included model for the 2019 by recursive estimation. It is seen that nowcast values of the Emotion-Included model seems to closer to the published quarterly GDP growth rates in comparison with the Benchmark model. It is calculated from Table 7 that RMSE of Emotion-Included model (0.00249) is lower than the Benchmark Model's (0.00269).

As a result of the evaluation of Table 6 and 7 together, it can be claimed that the inclusion of the emotion indicators group as a single factor to the Benchmark model creates a noticeable gain in RMSE and in the nowcasting performance for GDP. From the perspective of policy makers, the use of emotion indicators implied by ECB speeches will make a tangible contribution to in the process of nowcasting Euro Area GDP growth by reducing the RMSE. It can be said that the contribution of the emotion indicators group to the real and survey groups is not

very high in terms of RMSE, as expected, but it affects positively in terms of proximity to flash estimates.

Table 7

Comparison of the nowcasting model performances

Month	Reference Quarter	Quarterly GDP growth rate (%)	Benchmark Model Nowcasts (%)	Emotion-Included Model Nowcasts (%)
2019-M1	2019-Q1	0.49	0.33	0.43
2019-M2	2019-Q1	0.49	0.38	0.44
2019-M3	2019-Q1	0.49	0.46	0.50
2019-M4	2019-Q2	0.10	0.48	0.52
2019-M5	2019-Q2	0.10	0.53	0.53
2019-M6	2019-Q2	0.10	0.51	0.52
2019-M7	2019-Q3	0.30	0.29	0.32
2019-M8	2019-Q3	0.30	0.28	0.31
2019-M9	2019-Q3	0.30	0.35	0.30
2019-M10	2019-Q4	0.06	0.37	0.36
2019-M11	2019-Q4	0.06	0.34	0.28
2019-M12	2019-Q4	0.06	0.45	0.31

Source: Author's own calculations

The impulse-response functions and the forecast error variance decomposition analysis are examined using the Emotion-Included model estimation results. Figure 1 presents the impulse-response analysis results. Each graph in Figure 1 provides the response of quarterly GDP growth rate to one standard deviation innovations in relevant factor i.e., real variables factor, survey variables factor and emotion variables factor. It is understood from two graphs in the upper part of the Figure 1 that the responses of the quarterly GDP growth rate to the real and survey variables factors are positively significant in the short term. In contrast, an impulse in the emotion variables factor causes a significant response in the quarterly GDP growth rate in the longer periods. The sign of the response is not one-way due to the factor of emotion variables include opposite emotions such as positive-negative.

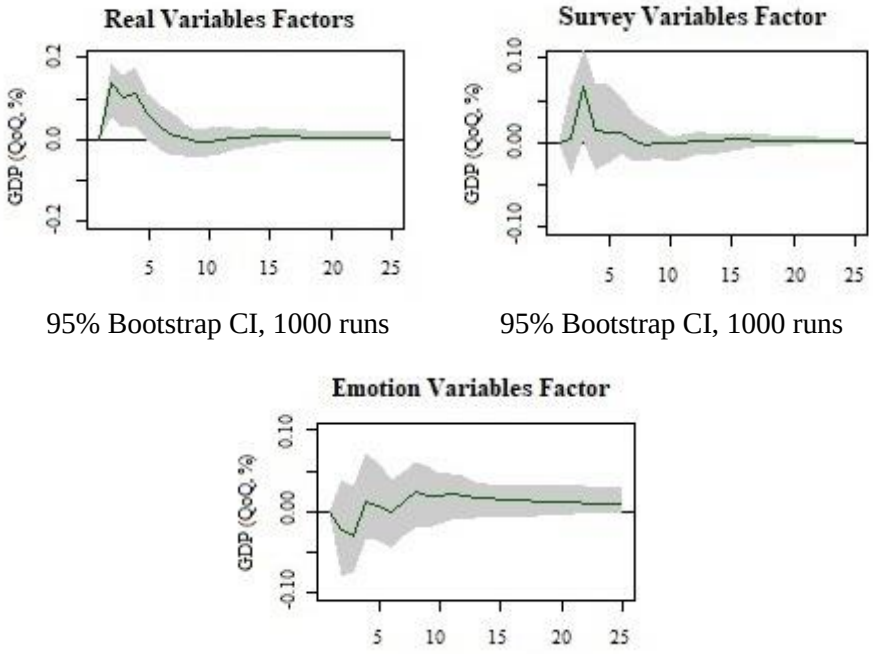
The forecast error variances decomposition of the quarterly GDP growth rate is presented in Figure 2 using the estimates of Emotion-Included model. The forecast error variances of quarterly GDP growth rate are mainly explained by itself, real variables and

survey variables and emotion variables, respectively. The ratio of explanation of the variance by emotion variables factor is minimal but noticeable and increases in longer forecast horizon.

Finally, the revision analysis results are given in Table 8 using by Emotion Included model estimates. The first column in Table 8 shows the month in which Emotion-Included model run using the available dataset until that month. The second column represents the quarter for which the nowcast of quarterly GDP growth are produced. The third column shows the nowcast value produced in the previous month. The columns between 4 and 7 represents the amount of the total revision in the nowcast value of quarterly GDP growth and the source of the revision by the factors due to the new information available in the variables. The last column is the final value of the nowcast for the relevant quarter in that month.

Figure 1

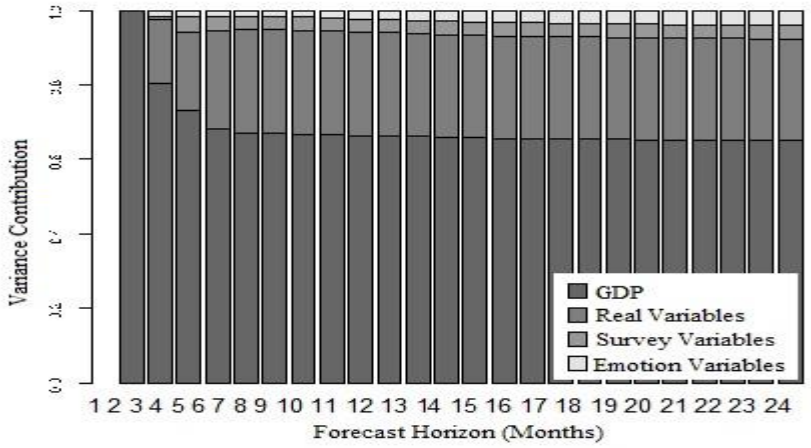
Orthogonal Impulse-responses from Factors to GDP



Source: Author's own calculations

Figure 2

Orthogonal Forecast Error Variance Decomposition of GDP



Source: Author's own calculations

Table 8

Revision analysis results for GDP nowcasts

Month	Quarter	Old Nowcast Value (O,%)	Total Revision (R=R1+R2+R3) (%)	Real Variables (R1,%)	Survey Variables Factor (R2,%)	Emotion Variables Factor (R3,%)	New Nowcast Value (N=O+R,%)
Jan-2019	**2019-Q1**	0.368	0.066	0.053	0.010	0.003	0.434
Feb-2019	**2019-Q1**	0.434	-0.088	-0.070	-0.013	-0.004	0.439
Mar-2019	**2019-Q1**	0.439	-0.074	-0.059	-0.011	-0.004	0.499
Apr-2019	**2019-Q2**	0.499	-0.037	-0.030	-0.006	-0.002	0.517
May-2019	**2019-Q2**	0.517	-0.086	-0.069	-0.013	-0.004	0.527
Jun-2019	**2019-Q2**	0.527	0.098	0.078	0.015	0.005	0.517
Jul-2019	**2019-Q3**	0.517	0.082	0.066	0.012	0.004	0.323
Agu-2019	**2019-Q3**	0.323	-0.080	-0.064	-0.012	-0.004	0.309
Sep-2019	**2019-Q3**	0.309	0.063	0.050	0.009	0.003	0.302
Oct-2019	**2019-Q4**	0.302	0.033	0.026	0.005	0.002	0.364
Nov-2019	**2019-Q4**	0.364	-0.018	-0.014	-0.003	-0.001	0.282
Dec-2019	**2019-Q4**	0.282	0.021	0.017	0.003	0.001	0.315

Source: Author's own calculations

Table 8 shows that the effects of emotional indicators are negligible in the revision of quarterly GDP growth rate nowcasts. The main source of the revision is the real variables group. Therefore, it can be suggested that adding emotion indicators to the nowcast model does not have an effect to increase the variance of nowcast values.

6. Conclusion

Recently, it has been discussed that inclusion of information extracted from microblogs and internet platforms into forecast or nowcast models for economic variables in the literature. On the other hand, it seems that the evaluating the impact of speech information on the economic models is a new subject.

In this paper, it is investigated the effect of speeches made by ECB officials on nowcasting Euro Area quarterly GDP. As a result of the descriptive analysis of the speech data, it is seen that the number of speeches increased over the years between 1997-2019, and it can be claimed that the words and word groups frequently used in the speeches may reflect the economic conditions of those periods. Then, five emotion indicators (indices between 0 and 100) are calculated by applying the emotion analysis method on the speech data.

It is observed that the marginal contribution of emotion indicators is found effective in terms of reduction of RMSE of the nowcasting model established in dynamic factor model representation for Euro Area quarterly GDP. The emotion indicators also provide a noticeable improvement in the nowcasts. Impulse-response functions and forecast error variance decomposition analysis have shown that the impact of emotion indicators on nowcasts is noticeable in the long term, not in the short term. Finally, revision analysis indicates that emotion indicators cause a negligible effect in the revision of the nowcasts.

The findings of the study show that the forward-guidance practices of central banks can affect real indicators as well as monetary conditions such as monetary policy and inflation. The findings of the study show that the advanced guideline practices of central banks may have an effect on real indicators, as well as monetary conditions such as monetary policy and inflation. In addition to the fact that central bank speeches can be included in nowcasting models, it is thought that using the speeches of the press and government officials can increase the performance of nowcast models.

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APPENDIX

Table 1

Brief summary of the related literature

Studies	Target Variable	Input Variables	Analysis Period	Model & Estimation Method	Main Findings
Varian and Choi (2009)	Retail Sales, Automotive Sales, Home Sales, Travel data of USA	Internet search data	From January 2004 to August 2008	Regression & Ordinary Least Squares	Predictions can be significantly improved by the inclusion of Internet search data
McLaren and Shanbhogue (2011)	Labor and housing market of UK	Internet search data	From June 2004 to January 2011	Regression & Ordinary Least Squares	Internet search data can help predict changes in unemployment in the United Kingdom
Fondeur and Karamé (2013)	Youth Unemployment of France	Internet search data	from January 2004 to July 2011	Unobserved Component Model & Model & Kalman Filter	including Internet search data improves unemployment predictions relative to a restricted model.
Francesco and Marcucci (2017)	Initial Claims of USA	Internet search data	From July 1997 to February 2014	Standard autoregressive model with explanatory variables & Ordinary Least Squares	Google-based models are better to predict at the turning points, not for whole sample.
Bortoli and Combes (2015)	Household consumption of goods	Internet search data	From March 2004 to December 2014	Multiple regression & Bayesian Approach	Internet search data does not improve the forecasting of monthly household expenditure.
Baker et al. (2016)	Several short-term economic indicators	US newspapers Uncertainty Index	From January 1985 to December 2014	Vector Auto Regression & Ordinary Least Squares	It can be suggested that there are negative economic effects of uncertainty shocks of newspapers.
Combes et al. (2018)	GDP of France	Media Sentiment from newspapers	From second quarter of 2000 to third quarter of 2017	Multiple Regression & Ordinary Least Squares	Media information can be a tool for economic analysis.
Kaminski and Gloor (2014)	Bitcoin market indicators	Microblog emotions	From November 23, 2013 to March 7, 2014	Granger causality	The microblogging platform emotionally reflecting Bitcoin trading dynamics

Studies	Target Variable	Input Variables	Analysis Period	Model & Estimation Method	Main Findings
Bollen et al. (2010)	Dow Jones Industrial Average of USA	Microblog emotions & Data from Internet-search platforms	From February 28, 2008 to November 3, 2008	Granger causality	DJIA predictions can be significantly improved by the inclusion of specific public mood dimensions but not Microblog emotions.
Lucca and Trebbi (2009)	Short Term Interest Rates of USA	Semantic scores from FOMC Statements	From May 1999 December 2008	Regression & Ordinary Least Squares	Longer-dated Treasury yields mainly react to changes in FOMC statements.
Hansen and McMahon (2015)	76 economic variables of USA	Semantic scores from FOMC Statements	From January 1998 to December 2014	Factor-Augmented Vector Auto Regression	FOMC Statements has not particularly strong effects on real economic variables
Eskici and Koçak (2018)	Consumer Price index of Turkey	Topics of Monthly Price Developments Report	From June 2006 and January 2018	3-way ANOVA	The clusters of MPDRs can help to explain the movements in the annual CPI figures.

Source: Author's own review

Table 2

Description of the data for nowcasting

Series ID	Series Name	Frequency	Units	Time Span	Transformation	Delay (in days, "-" means leading)
GDP	Calendar and seasonally adjusted chain linked Euro area Flash Gross domestic product	Quarterly	2015=100 Index	1995Q1-2019Q4	Quarterly rate of change	45
GDP_FINAL	Calendar and seasonally adjusted chain linked Euro area Gross domestic product (Final Estimates	Quarterly	Millions of Chained 2010 Euros	1995Q1-2017Q4	Quarterly rate of change	720
IPI	Working day and seasonally adjusted Euro area Industrial Production Index	Monthly	2015=100 Index	Jan.1995-Dec.2019	Monthly rate of change	40
RS	Working day and seasonally adjusted Euro area Total Turnover Index	Monthly	2015=100 Index	Jan.1995-Dec.2019	Monthly rate of change	30
PMI-M	Markit PMI (Manufacturing) by IHS Markit	Monthly	Index (0,100)	Feb.2008-Dec.2019	Monthly rate of change	-7

Series ID	Series Name	Frequency	Units	Time Span	Transformation	Delay (in days, "-" means leading)
BCS	Eurozone Business and Consumer Survey Sentiment Indicator	Monthly	Index (0,200)	Jan.1995-Dec.2019	Monthly rate of change	-7
ANTICIPATION	Anticipation index of ECB speeches	Monthly	Index (0,100)	Feb.1997-Dec.2019	Original values	0
CONSTRAINING	Constraining index of ECB speeches	Monthly	Index (0,100)	Feb.1997-Dec.2019	Original values	0
NEGATIVE	Negativity index of ECB speeches	Monthly	Index (0,100)	Feb.1997-Dec.2019	Original values	0
POSITIVE	Positivity index of ECB speeches	Monthly	Index (0,100)	Feb.1997-Dec.2019	Original values	0
UNCERTAINTY	Uncertainty index of ECB speeches	Monthly	Index (0,100)	Feb.1997-Dec.2019	Original values	0

[*] *All the indicators in the data are taken from the source as seasonally adjusted. Emotion indicators have no significant seasonality.*

Source: Author's own calculations

EFFECT OF INTER-INDUSTRY COMPETITION AND FINANCIAL FREEDOM ON COMPETITIVENESS OF COMMERCIAL BANKING SECTOR

Champika LIYANAGAMAGE, PhD*

Abstract

This paper provides some interesting insight into the impact of financial freedom and inter-industry competition on commercial banking sector competition in Sri Lanka. The study used a broader set of panel data and employed Panzar-Rosse approach to estimate the degree of bank competition. The size of the country's stock market capitalization and non- banking financial sector performance were used to measure inter- industry competition, whereas financial freedom index was used to measure the freedom of financial institution to contest in the market. The sample covered the whole commercial banking sector which includes 25 banks over the period from 1996 to 2018. Surprisingly, the results did not provide evidence for direct impact of financial freedom on bank competition in the country. However, study found a strong evidence for positive implications of non-banking sector performance on bank competition. The stock market performance is found to be negatively associating with bank competition. Hence formulating policies enabling competitiveness within financial market could be suggestive as it would certainly cause positive implications on the banking sector competitiveness.

Keywords: bank competition, contestability, financial freedom, inter-industry competition, H- statistics

JEL Classification: C51; G21; G28; E32

1. Introduction

The financial system carries out the vital financial intermediation function of borrowing from surplus units and lending to

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deficit units (Central Bank of Sri Lanka, 2020). The financial system of a country consists of components which can differ from one economy to another. There are three main components of a financial system: 1) Financial intermediaries, 2) Financial Markets, and 3) Regulators. A financial system is recognized as repressed when the financial system is subject to controls and limits are deliberately imposed on financial prices (mainly interest rates) (Shaw, 1973). The necessity of financial liberalization for economic growth in developing countries was clearly recognized in the economic theories presented by McKinnon (1973) and Shaw (1973). Since then, most underdeveloped countries in South America, Africa and Asia which were regarded as repressed economies in terms of financial policies, undertook financial reforms to liberalize their economies. Financial sector reforms are important not only to establish a modern financial system which can act as the "brain of the economy" but also to allocate the economy's savings in the most productive way among different potential investments. These financial reforms then enable economic growth and thereafter welfare, with improved competition.

Sri Lanka has not been an exception in this liberalization process and underwent a series of financial sector reforms along with the economic liberalization policies introduced in 1977. At present, licensed banking sector dominates the banking sector in Sri Lanka, which comprises Licensed Commercial Banks (LCB) and Licensed Specialized Banks (LSB). As far as the asset base and the magnitude of services provided are concerned, LCBs are the single most imperative category of financial institutions within the Sri Lankan banking sector. According to the statistics as at end December 2018, the LCBs dominated the financial system with a market share of 54.9 per cent of the entire financial system's assets. Therefore, the soundness of the LCBs determines the health of the financial system of the country. Hence, the banking sector competition is crucial for the financial sector development of Sri Lanka.

The performance of the industries in financial sector other than commercial banks would impose a considerable impact on the competitiveness in the commercial banking sector. As New Empirical Industrial Organization literature posits, factors other than market structure may affect competitive behaviour. Hence, the emerging contestability literature in banking suggests that the competition coming from the industries in the financial sector other than commercial banks and the freedom to contest as a financial institution in the

economy will accelerate banking sector competitiveness (Claessens & Laeven, 2003).

Theoretically, state ownership of financial institutions such as banks, insurers and capital markets and state control over them reduce competition lowering the availability of services. Therefore, minimum government interference and regulations on financial institutions said to be creating a conducive environment for financial institutions to provide efficient service and banks to freely allocate and extend credit and accept deposits. However, a common obstacle can be observed in many developing countries. That is, banks in the developing countries are competing in an environment where the financial infrastructure or the prerequisites for such competition is lacking. Consequently, the combined net result of recent liberalization efforts on financial market development in emerging economies including Sri Lanka, is uncertain and insufficiently revealed in the existing literature.

Hence, the main objective of present study is to investigate the nexus among financial freedom, inter-industry competition and bank competition in the context of Sri Lanka. Analyzing the issue of bank competition is of vital importance for Sri Lanka as it can help understanding the welfare effect of changes happen in the banking sector. Understanding anticompetitive behavior in the financial sector would be vital since the banking sector can enforce severe costs on an economy. As stated in Fernandez de Guevara and Maudos (2007), from the regulator's point of view, knowledge and understanding of the degree of competition may be limited. But finding the main causes of market power complements this limitation and help to carry out the reforms which are necessary to reduce the social costs connected with the existence of monopoly market power. Thus, the present study is justifiable and significant.

2. Literature Review

Financial liberalization theory that emerged in 1970's stresses the importance of greater liberalization in the banking industry in order to achieve economic growth. The theoretical underpinning of greater liberalization in the banking industry is the McKinnon-Shaw hypothesis. Many in this literature, McKinnon (1973), Shaw (1973), advocate the desirability of financial liberalization measures to free banks from financial repression. In many developing countries, the financial systems were highly regulated up to about the 1980s. The government

regulated the interest rates and imposed credit ceilings, owned banks and financial institutions and framed regulations with a view to making it easy for the government to acquire the financial resources at a cheap rate (Shrestha & Chowdhury, 2007). The financial sectors of those countries could not therefore mobilize the necessary funds due to the interest rate distortions and tight regulations. Thus, the desired level of economic growth would not be achieved due to low investment associated with higher interest rates. McKinnon and Shaw termed this state of affair as "financial repression".

Main argument of McKinnon-Shaw hypothesis was that suppressive regulations in the financial markets lead to financial repression and distort incentives of savers and investors in an economy. With such artificial ceilings on interest rates, efficient allocation of resources would be discouraged due to the lower savings and capital accumulation. Thus, MacKinnon (1973) pointed out other two major effects of financial repression approach. First is dualism, in which firms that have access to subsidized funding will tend to choose relatively capital-intensive technologies, whereas those not favoured by policy will only be able to implement high-yield projects with short maturity. The second is "credit rationing" effect, which results from excessive government intervention in money and credit markets in developing countries. Since the interest rates are not decided by demand and supply which can screen the applicants, other non-market forms of clearing must take their place. These consist of "queuing" arrangements to allocate the available credit in a variety of forms such as auctions, quantitative restrictions as well as different types of "bidding" systems. This ultimately affects not only the quantity of credit but also the quality of borrowers (Gemech & Struthers, 2003).

A liberalized banking sector on the other hand will see banks competing with one another for deposits, putting upward pressure on the deposit rate of interest and thus increasing the quantity of deposits mobilized. By allowing the market to allocate credit, it is also claimed that loans will then be directed toward those investments that offer the highest risk-adjusted rates of return. McKinnon (1973) and Shaw (1973) further assert that the liberalized banking sector also helps channel the funds to the most productive enterprises and facilitate technological innovation and development. Therefore, Mackinnon-Shaw paradigm strongly advocated the liberalization of financial sector to improve the competitiveness in the banking sector to support the growth process of the economy.

With these arguments, MacKinnon (1973) and Shaw (1973) paradigm too supports the predictions of industrial organization theory. Generally, the models based on industrial organization predict positive implications of bank competition. However, as far as developing countries are concerned McKinnon-Shaw paradigm is far from reality. First, credit rationing can be affected by many reasons such as asymmetric information and other market imperfections. Hence financial repression is only one cause of credit rationing. Second, though financial liberalization works in the context of developed countries, it is not very easy to fully liberalize the financial system in developing countries. The reason is that financial repression may be the only option for financing government when there is no government bond market or efficient tax system. Third, unlike in developed countries, the relation between interest rate, saving and investment is quite complex in developing countries. Therefore, the expected outcome of financial liberalization and competition is questionable.

The traditional approach on competition claims that higher the number of firms in the market higher will be the price competition and vice versa (this approach is also called 'structural approach'). This definition comes from a classic Industrial Organization argument, called the Structure-Conduct-Performance paradigm (SCP), which assumes that there is a causal relationship running from the structure of the market to pricing behaviour, profits, and the degree of market power of the firm. In SCP paradigm competition or the market structure is reflected in concentration ratios. The non-structural approaches posit that factors other than market structure (concentration) may affect competitive behaviour. This approach has been developed in the context of the New Empirical Industrial Organisation (NEIO) literature. The contradictory results of the concentration approach together with the results of the emerging contestability literature, propose that the banks' competitive behaviour is not necessarily related to the number of banks in a market or to their concentration but related to other factors such as entry-exit barriers and the general contestability of the market (Baumol et al. 1982; Rosse and Panzar, 1977; Panzar and Rosse, 1987; Northcott, 2004). The most remarkable contribution of non-structural approaches is that they assume concentrated markets are not necessarily less competitive. This is because the ability to contest in the market determined by the competitive climate in the industry and not necessarily on the number of banks in the market (Casu & Girardone, 2006). Further, contradictory to the common criticism,

Liyanagamage (2016), found a significant positive impact of bank market concentration on banking sector competition in Sri Lanka. Thus, as per the contestability literature, the structure of the market is only cause of competition.

Contestability is not necessarily related to concentration or the number of banks (Northcott, 2004). The very valid and significant role played by open entry to the market has adequately been recognized in the contestability literature. The rising agreement in this area is that competitiveness in the market is enabled with less-severe entry barriers, operation of foreign banks in the local context, less restrictions on banking operations and well-developed financial systems. The last two factors i.e., less restrictions on banking operations and well-developed financial systems may indicate that competition from the non-bank sector or inter-industry is important.

In a study done by using 107 countries Barth, Caprio and Levine (2001) concluded that many regulatory controls place in 1999 on commercial banks, including various entry and exit restrictions and practices have affected the degree of competitiveness in the banking sectors. The authors further explain this in another paper and reveal that restricting bank activities is associated with negative bank performance and stability, as compared to a situation when banks can diversify into other financial activities (Barth, Caprio and Levine, 2003). These results further confirm the notion that strong banking powers permit banks to diversify income sources and boost stability. What they have tried to confirm through their study was that the ability of the banks to compete in the market when unrestricted practices of banks improved. The impact of bank regulations, concentration, and institutions on bank net interest margins and overhead expenditures was investigated in a more rigorous way by Demirguc-Kunt, Laeven, and Levine, (2004). For this, they used bank level data across 72 countries while controlling the impact of broader set of macroeconomic, financial, and bank specific traits. One major finding of their study was that tighter regulations on bank entry, restrictions on bank activities, and regulations that inhibit the openness of bankers to conduct their business, boost bank net interest margins. These may be confirmations of the theoretical predictions of the literature, McKinnon (1993), Shaw (1973). They advocate the desirability of financial liberalization measures to free banks from financial repression which may also encourage greater competition among financial institutions.

Mattig (2008) studied on the effect of entry barriers on bank competition in Swiss banking industry during the first phase of globalization and thereafter. They show that market entry efficiency is strongly related to the individual bank's cost of capital and hence the competitiveness of the banking industry. Their findings further revealed a significant pattern in respect of the interaction of industry structure, regulatory reforms and financial market development. The study of Liyanagamage (2018) also reveals that macro environment which characterized with developed capital markets, higher Central Bank policy rates, higher state bank efficiency and high inflationary pressure would restrain the ability of the banking sector to compete in the market. Hence, these empirical findings suggest that not only regulatory reforms or financial liberalization but also general developments in the financial market erode the entry barriers while promoting competition.

Regarding the effect of contestability on bank competition, Claessens & Laeven (2003) study further identified differences among countries in activity restrictions. Their findings reveal that competition enhanced with fewer restrictions. The similar kind of effect was also revealed for the severity of entry restrictions. Accordingly, less severe entry restrictions were found as positively affecting banking system competition. Their findings suggest that more contestable systems are highly competitive. In terms of inter-industry competition, Shrieves, Dahl and Spivey, (2007) provide evidence, by using bank-level data from 13 European countries, that the capital market regime in which banks operate, as determined by features of their national financial markets and securities laws, as well as by the choices that bank owners make regarding use of public equity markets, will influence competitive outcomes in European banking. However, Claessens & Laeven, (2003) find no evidence that there is an impact of the development of the stock markets or insurance industry on the competitiveness of the banking system. Claessens & Laeven, (2003) further investigated the effect of general level of development of a country on the competitiveness in the banking sector. In terms of the general level of development, we find that the GDP per capita and the inflation rate are never statistically significant, and the signs of the coefficients are not always the same. This suggests that there are no general patterns in the degree of competition across countries of different levels of development.

3. Methodology

The initial step of the analysis of this study is to identify the most applicable measurement technique to assess the competitive climate in the Sri Lankan banking sector. By evaluating the well-established competition measurements in the literature, the study used the approach developed by Panzar and Rosse (1987). They define a measure of competition, the *H* as the sum of the elasticities of the reduced-form revenue equation relating gross revenue to a vector of input prices and other control variables. According to them, this statistic can reflect both the structure and the conduct of the market to which the firm belongs; it represents the percentage variation of the equilibrium revenue derived from the unit percent increase in price of all factors used by the bank. With the assumption a production function of *n* number of inputs and single output, the empirical reduced-form equation of the Panzar-Ross model can be written as follows.

$$log\ T\ R_{it} = \alpha + \sum_{i=1}^{n} \beta_i\ log\ W_i + \sum_{J} \lambda_J\ log\ C\ F_j + e \qquad (1)$$

The total interest revenue to total assets (proxy for output price of loans), regressed against input price of labour, input price of deposits and input price of capital. Panzar and Rosse (1987), show that the sum of input price elasticities, $H = \sum_{i=1}^{n} \beta_i$ reflects the competitive structure of the market.

Next step of the analysis is focused on analysing nexus among the financial freedom, inter-industry competition and bank competition in Sri Lanka. Here, the study applies a structural, contestability approach. Hence, like other industries, the level of competition in the banking system is decided to measure by considering the actual behaviour of (marginal) bank conduct. Because, the severity of activity restrictions, as those can restrain the competitive behaviour of banks and limit the degree of intra-industry competition. As Claessens & Laeven, (2003) states the degree of competition from other forms of financial intermediation (capital markets, non-bank financial institutions, insurance companies), will play a role in determining banking system competitiveness. Though one cannot expect to address all these issues, concern with some of these issues will help to get an overall understanding of an economy's competitive climate. Hence, primary focus of the present study is to do an in-depth analysis

on the interaction of financial freedom, inter-industry competition and bank competition.

Thus, the average H-statistic was regressed on the financial freedom and inter-industry competition and can be stated as follows:

$$H_t = \propto_0 + \propto_1 FinFreedom_t + \propto_2 InterInd_t + e_t \quad (2)$$

In the above equation, financial freedom index used as the proxy for financial freedom since it indicates the ability to contest as a free financial institution in the economy. To capture the competition coming from inter- industry, the size of the country's stock market capitalization to GDP, the cumulative asset share of licensed specialized banks, registered finance companies and specialized leasing companies as a percentage of total banking sector assets were used. In Equation 2 H_t the average H-statistic for year *t*, based on individual bank data for the period 1996-2018, and α_0 is the year specific unobservable effect on bank competition in the country. Annual Interest rate also included to the econometrics model to control any macro level impact that can have on the financial markets in the country. Hence Equation 2 can be re-written more specifically as follows.

$$H_t = \alpha_0 + \alpha_1 F\,inf\,r\,eedom_t + \alpha_2 Noncom\,bank_t + \alpha_3 StMkt_t + \alpha_4 IntRate_t + e_t \quad (3)$$

Both accounting data and macro level data were employed in this study. In terms of bank types, the study considers only commercial banks and excluded saving banks from the sample. The study uses an extensive bank level set of panel data and macro data for the period from 1996 to 2018. The sample covers 25 commercial banks. Specifically, bank level panel data was used to run Equation 1 in estimating the H statistics. Then the annual average H statistics was regressed against annual statistics of financial freedom, stock market capitalization and assets share of non-commercial banking sector. The sample of banks is not constant, i.e., we do not require a bank to have existed throughout the sample period to be included in the sample. Thus, in the unbalanced panel the number of banks across years varies during the sample period. The main source of data is the Annual Reports of banks and data obtained from annual reports of Central Bank. The data were analysed using computer statistical package E-views.

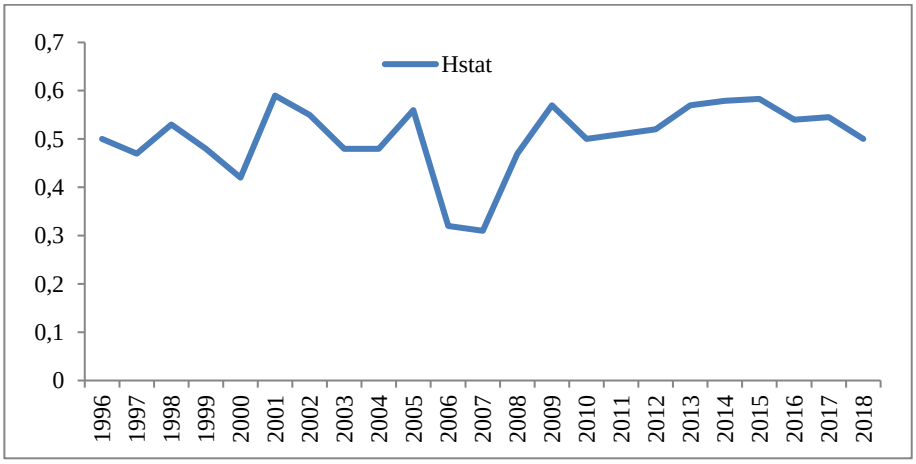
4. Results and Discussion

4.1. Dynamic nature of explanatory variables

Before estimating the parameters for the above equation some dynamics in relation to independent variables has been illustrated to provide a general understanding about the behaviour of the variables in the context of Sri Lanka. The average level of bank competition for the sample period measured with H statistics was stood at 0.5 indicating a moderate level of competition in Sri Lankan banking sector. The time series behaviour of the degree of bank competition however shows a pattern, giving more insight in to the nature of bank competition in Sri Lanka. This behavioural pattern is more clearly observable in Figure 1.

Figure 1

H - Statistics for the sample period

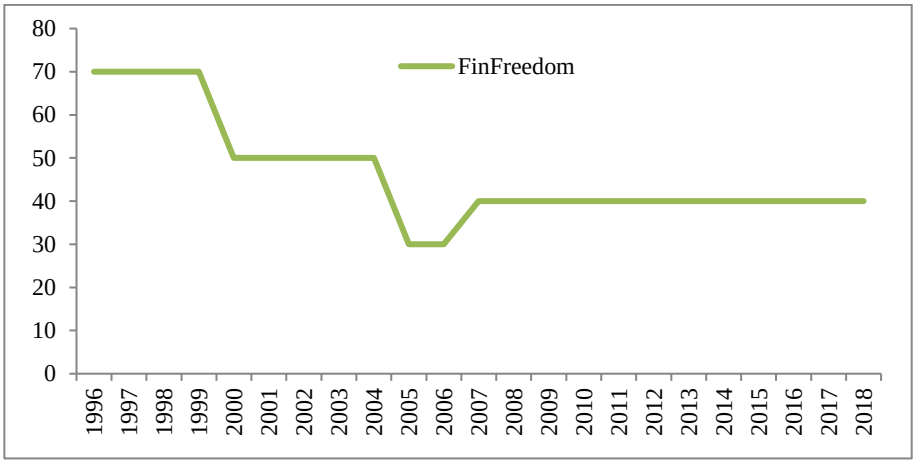


Source: Own calculation based on Panzar - Ross H statistics

Bank competitive behaviour during the period from 1996 to 2018 does not shows any trend, however, shows some ups and downs along the way. Perhaps due to the economic fluctuations and its effect on financial markets are evidenced in this analysis. This evidence indicates that the level of economic development matters for banking sector competitiveness. Specifically, banks are less competitive with price stability, perhaps since interest rates become an unreliable benchmark to price financial services. High and constantly fluctuating interest rates during the period could also have discouraged banks from competing in the market.

Figure 2

Financial Freedom for the sample period



Source: Own construction based on Heritage Foundation

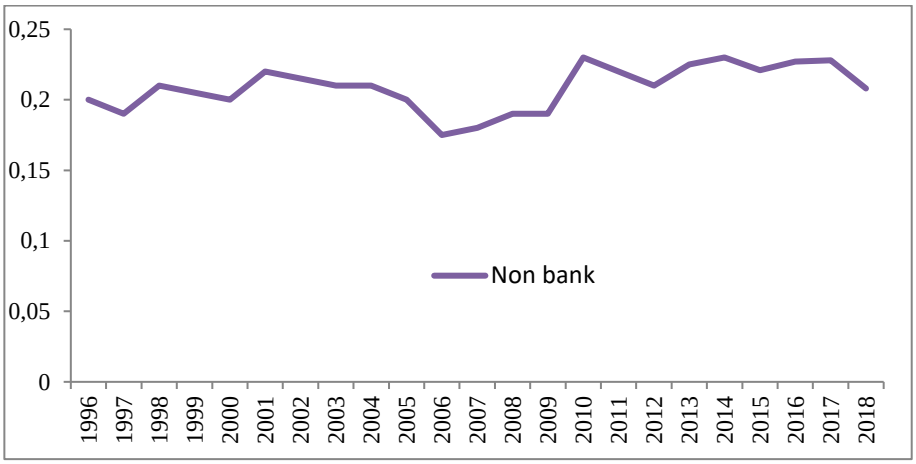
Financial freedom index (compiled by Heritage Foundation) measures the degree of independence of financial institutions from government control and interference. The score is on a scale from 0 to 100 representing highest value to an economy with the highest financial freedom. According to their classification if the index score ranges from '**Negligible government interference' (if the score is 100) and 'Repressive' (if the score is 0)**

According to the Heritage Foundation, an accessible and well-functioning formal financial system ensures the availability of diversified savings, credit, payment, and investment services to individuals. An open banking environment generally expected to encourage competition by expanding financing opportunities and promoting entrepreneurship. So that banks can be the most efficient financial intermediator between depositors and borrowers. The index shows step wise decline during the sample period. It had been comparatively higher in period 1996-1999 and has declined thereafter until year 2006. The index has again improved after 2006 and remained unchanged until 2018. This means (according to the interpretations of Heritage Foundation) that financial freedom of the country has declined from ***'**Limited government interference' from 'Considerable government interference' in year 2000, and further declined to 'Extensive government interference' in 2005. This has*

slightly improved again until it reaches a level of 'Strong government interference' in 2010. The current score of the country is comparatively lower than developed countries such as Hong Kong, Australia and Canada and developing countries such as Malaysia, Peru, Singapore, and South Korea.

Figure 3

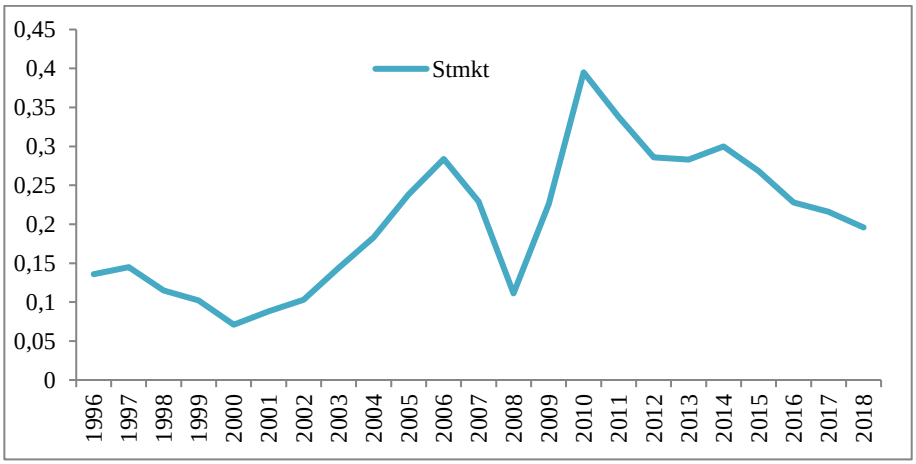
Non-commercial bank assets share for the sample period



Source: Own calculations based on Central Bank Annual Reports

Figure 4

Stock Market performance for the sample period



Source: Own calculations based on Central Bank Annual Reports

Non-commercial bank financial institutions and stock market capitalization also show some noticeable pattern in their time series (Figure 3 and 4). The stock market capitalization as a percentage of GDP shows a significant growth during 2000 to 2006 period and a fall thereafter, until year 2008. This has again started to rise until year 2010 and decline thereafter. The assets share of non-commercial banks however shows some ups and downs along the sample period. However, a closer look at the trend shows a slight decrease in 2008-2009 and 2004 and gradually downward from 2011 to 2018.

4.2. Nexus among Bank Competition, Inter-industry competition and Financial Freedom

To identify how inter-industry competition and financial freedom contribute to the variations in the degree of bank competition in Sri Lanka, the Equation 3 was analysed as a multiple regression analysis with a constant. The results of the initial analysis are given in Table 1.

Table 1

Regression results (Equation 3)

Variable	Coefficient
C	0.1696
Financial Freedom	-0.0423
Inter-industry competition:	
Non-commercial banking sector	2.3943*** (3.102)
Stock Market development	-0.3050** (-2.245)
Macro Impact: Interest rate	-0.7859** (-2.228)
Ad R-squared	*0.59*
F-statistics	*9.22***
Durbin-Watson stat	*2.07*

*Note: The dependent variable is the competition measured with H statistics. t values for coefficients are in parentheses. *** and ** indicate a significant difference from zero at 1% and 5%, respectively.*

As a start, it is useful to note that regression coefficients pertaining to all the variables except financial freedom are statistically significant. The effect of inter-industry competition on the level of bank competition had been measured with the performance growth of non-commercial banking financial sector and stock market. Both variables were statistically significant with a positive sign of non-commercial banking sector and a negative sign of stock market development. The positive sign of non-commercial banking sector performance suggests a need of tough competition by the commercial banking sector to face

the competition coming from such industries. Specially, the competition from leasing and specialized finance companies intensified during the last decade in Sri Lanka. This would force the commercial banking sector to be more competitive in providing financial services and moving towards more diversified financial products. Thus, these results provide significant evidence on positive contribution of non-commercial banking sector performance on bank competition. The coefficient found in relation to stock market development on bank competition is negative, suggesting higher the stock market development lesser the degree of competition. Generally, stock market is the primary source for any company to raise funds for their business expansions. Thus, stock markets are long term financial markets in any economy. However, in most developing countries like Sri Lankan the stock markets are not much developed to raise funds for companies. Therefore traditionally, the banking sector has been the major suppliers of debt capital for Sri Lankan firms. However, when and where the stock markets are developed the firms go for the stock market to raise funds for their investments. This would challenge the ability of commercial banks to compete for corporate loans in the market. Thus, the market for long term debt for the banking sector becomes meagre resulting in less competitiveness on the supply side of the debt capital. Therefore, the found negative effect of stock market development may be particularly true in the context of Sri Lanka.

The study also included annual interest rate to assess if there is any effect this would have on the level of bank competition in the country. The found coefficient is negative, yet statistically significant, revealing a negative effect of constantly fluctuating interest rate in the level of bank competition in the country. High interest rate which often equals more volatile inflation in the country during the sample period discourages banks' ability and willingness to compete in the market. High interest rates make it more costly to borrow and invest. The negative relationship between bank competition and inflation may explain the decrease of appetite of borrowers for debt financing during the recession period. On the other hand, from the supply side banks must take extra risk for lending at high interest rates. Both forces discourage banks to compete in the market during high inflation due to their fear of extra risk taking. This suggests that general patterns of the degree of competition over the period change with the different levels of economic development.

Surprisingly, the financial freedom index does not support a straightforward relationship to the banking sector competition in the country. This is contradictory to McKinnon-Shaw hypothesis. Rather, financial freedom might have indirectly affected the degree of competition in the bank market. Its wider scope of definition may have affected the degree of competition indirectly rather than directly. However, nothing much can be explained here as, this needs further analysis on the other driving forces of bank competition and their interactions with financial freedom of the country.

4.3. Model fit Statistics

The study also reports here the results of some robustness test to assess the statistical robustness of the estimated model. The estimation procedure employed White's correction for heteroscedasticity consistent estimates. The purpose here was to keep the estimators efficient. Table 1 also provides more information on the explanatory power of the econometric model tested in this study. The adjusted R^2 s specified that the model generally explains 59% of the time series variations in the degree of commercial bank competitiveness in Sri Lanka. The F statistics were also significant at 1% level, indicating high collective power of the variables included in the model in explaining changes in bank competition over time. Durbin-Watson stat for the sample period should was also within the range and confirms that model is free from autocorrelation.

5. Conclusion

This study analysed the impact of financial freedom and inter-industry competition in the financial markets to the degree of commercial banking sector competition in Sri Lanka. One of the important observations noted in this analysis was that the positive contribution of the non-commercial banking sector performance on commercial banking sector competition in Sri Lanka. Allowing the non-commercial banking financial sector to engage in traditional banking activities would in turn enhance the whole financial system's capacity for competition thereby fostering efficiency in financial resource allocation. Therefore, there is no need to raise the nominal interest rate to maintain large positive differences between deposit and lending rates in future. Hence formulating policies enabling competitiveness in the financial market would certainly cause positive implications on the banking sector competitiveness.

The second most important observation found in this study is the insignificant impact that financial freedom (index) of the country has on the level of bank competition. Financial Freedom Index showed deterioration and consistent during the recent years, and statistical evidence of the present study does not directly support any significant effect on competition in commercial bank of the country. This perhaps question about the pure application of McKinnon-Shaw paradigm in the context of developing countries. This is because, credit rationing of a banking system is happened not only due to financial repression but also due to many reasons. It might be due to the reasons such as asymmetric information and other market imperfections. Financial repression is therefore only one cause of credit rationing. Further, there is no government bond market or efficient tax system operate in most of the developing countries including Sri Lanka. In such kind of situations financial repression perhaps the only option available for these countries to finance the government. Therefore, it is not very easy to fully liberalize the financial system in countries like Sri Lanka although financial liberalization works quite well in the context of developed countries, Furthermore, unlike in developed countries, the relationship between interest rate, saving and investment is quite complex in developing countries. However, time series analysis of a single country and the static nature of financial freedom index of Sri Lanka observed during the sample period perhaps limit the scope of this research for further commenting on financial freedom-competitiveness nexus.

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EMPIRICAL ANALYSIS OF THE FACTORS DETERMINING THE PROFITABILITY OF INSURANCE COMPANIES IN THE REPUBLIC OF NORTH MACEDONIA

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Abstract

The aim of this paper is to identify and assess industry-specific and macroeconomic variables that determine the profitability of insurance companies in the Republic of North Macedonia through panel data for fourteen, life and non-life insurance companies. In the model specification, ROA was chosen as a measure of profitability and is set to be a dependent variable while GDP, inflation rate, underwriting risk, growth, financial investment growth rate, combined ratio, market share and leverage are set to be explanatory variables. Results from the use of dynamic panel analysis show that growth, leverage, combined ratio, underwriting risk, lagged return on assets and inflation rate have a negative and statistically significant impact on firm performance. On the other side, market share and financial investments have statistically positive relationship with the profitability. Based on the results, policy recommendations are provided for improving the profitability of insurance companies.

Keywords: insurance companies, financial performance, GMM model, Republic of North Macedonia, profitability.

JEL Classification: C23, G22, L25

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1. Introduction

Profitability is an essential tool for measuring the financial performance of companies. Over the years various financial performance ratios were developed such as ROA, ROE, ROCE etc. These indicators allow policyholders to gain an understanding of the profitability structure, track faulty segments in the business activity that can be further a subject for enhancement, give an overview of the financial state of the company or serve as a forecasting tool for profitability to investors of insurance companies. In a developing industry such as Macedonian insurance industry, an increasing need for finding ways to better management policies, develop long term strategies to gain competitive advantage and increase overall profitability of the company, has appealed. Macedonian insurance industry counts five life and fourteen non-life insurance companies. It is from paramount importance for the Macedonian insurance industry to determine which company-specific factors such as liquidity, assets growth rate, company size, tangibility and macroeconomic determinants have significant impact on the profitability of companies and gain a thoughtful insight of the possibilities that lead to improved financial performance. Theoretical and empirical evidence from various studies has been summarized in the segment of literature overview to help us form the hypothesis of the study; detect significant linking between ROA as dependent variable and other explanatory variables. Once the data has been extracted from annual financial statements of fourteen Macedonian insurance companies and necessary calculations have been conducted, a proper model specification and hypothesis foundation is presented. Generally, firm-specific and macroeconomic factors that influence profitability vary across studies. Hence, it is mandatory to identify which these factors are, how they affect profitability and, in that manner, propose segments that underlie improvements in the financial performance, give recommendations for developing long term strategies and possibly offer ways to increase the profitability of insurance companies in Republic of North Macedonia.

2. Literature overview

Over the past years, determinants of insurance companies' profitability have gained increased recognition amongst researchers and have been considered as one of the most discussed subjects in the insurance. It is important for companies to acquire knowledge and

profound understanding of the factors that affect profitability in order to obtain competitive advantage and survival of the business.

Firm specific factors that explain profitability of insurance companies vary across conducted studies. For instance, Doğan (2013) investigates the age, size, loss ratio, leverage and liquidity of insurance companies in Turkey over the period of 2005-2011 as company-specific factors that influence profitability using multiple regression analysis. The results show negative relationship between age, loss ratio, current ratio, leverage ratio and positive and statistically significant relationship between the size and profitability. Similarly, positive correlation between size and profitability is found in numerous studies (Athanasoglou et al., 2005; Swiss Re, 2008; Malik, 2011) due to the fact that large companies have greater capacity to form coping mechanisms for the occurring market risks and most likely, surpass smaller insurers.

Regardless, Yuqi (2007) states that it is possible for companies with higher growth in assets than the optimal ratio to have negative effects on profitability, caused by increased bureaucracy. Consequently, it is possible for this relationship to appear non-linear.

Results from the research conducted by Malik (2011) who examines profitability of insurance companies in Pakistan over the period of 2005 to 2009, show inverse relationship between loss ratio, leverage ratio and profitability and significant and positively related relationship between volume of capital and size with profitability.

Doumpos et al. (2012) use equity to assets ratio as a general indicator of an insurer's capital strength (in our research abbreviated as CA or capital adequacy - the higher the equity to asset ratio the higher is insurer's capital) alongside with other variable's and macroeconomic indicators. They find that GDP growth, inflation, and income inequality have statistically significant impact on firm performance. On the contrary, the results from the research exhibit insignificant relationship between other indicators of the banking and capital market development, the institutional development and the overall freedom in the financial services industry on the firm performance.

Daare (2016) finds positive relationship between size, liquidity, age, loss ratio, GDP and ROA, whereas capital adequacy, premium growth and inflation show negative impact on ROA. In regards with the exogenous factors, Feyen et al. (2011) and Beck and Webb (2003) determine positive relationship between GDP, income per capita and

insurance penetration, but negative impact of inflation. Positive and statistically significant relationship between capital volume and profitability is found in the insurance companies in Albania (Kripa and Ajasllari 2016). Santomero and Babbel (1997) claim that investment income is an essential part of describing profitability due to the fact that great extent of insurance companies' income hail from investments.

Accurate analysis and interpretation of investments portfolio is from critical importance for insurers' financial solidity. Kim et al. (1995) and Kramer (1996) discover that negative correlation exists between investment performance and insolvency rate.

There is, also, empirical evidence that instantaneous growth of premium volume is one of the causal factors in insurers' insolvency and consequently, leads to self-sabotaging effect (Kim et al. 1995; Chen and Wong 2004). Kramaric et al. (2017) conduct a study of the impact of company-specific and macroeconomic indicators on the profitability of insurance companies over the period of 2010 to 2014 in Central and Eastern European countries. The results show that there is significant and positive relationship between age and financial performance of insurance companies in both ROA and ROE models. Similarly, they found positive and significant impact of real GDP per capita growth on profitability in the ROE model.

Multiple research studies reveal that there is a negative effect of the loss ratio and expense ratio on the profitability of companies (Pervan and Kramaric 2010; Malik, 2011; Kaya, 2015). Researchers argue that variables such as liabilities and liquidities have a negative effect on the profitability (Chen and Wong, 2004; Onaolapo and Kajola, 2010; Burca and Batrinca, 2014). Liu et al. (2016) advise that companies should consider less liquid assets whose purchase less reinsurance because of its negative impact on underwriting risk as well as liquidity risk, which consequently, increased insolvency risk of the company. Furthermore, underwriting risk and size show a negative relationship with ROA, out of which underwriting risk has a moderately significant impact (Ullah et al. 2016).

By using the least square regression model and two-panel data model, Shiu (2004) reports that interest rate, ROE, liquidity, and solvency margin positively affect the financial performance of companies.

Similarly, a positive effect of leverage ratio, liquidity, size, and management competence on the financial performance of insurance

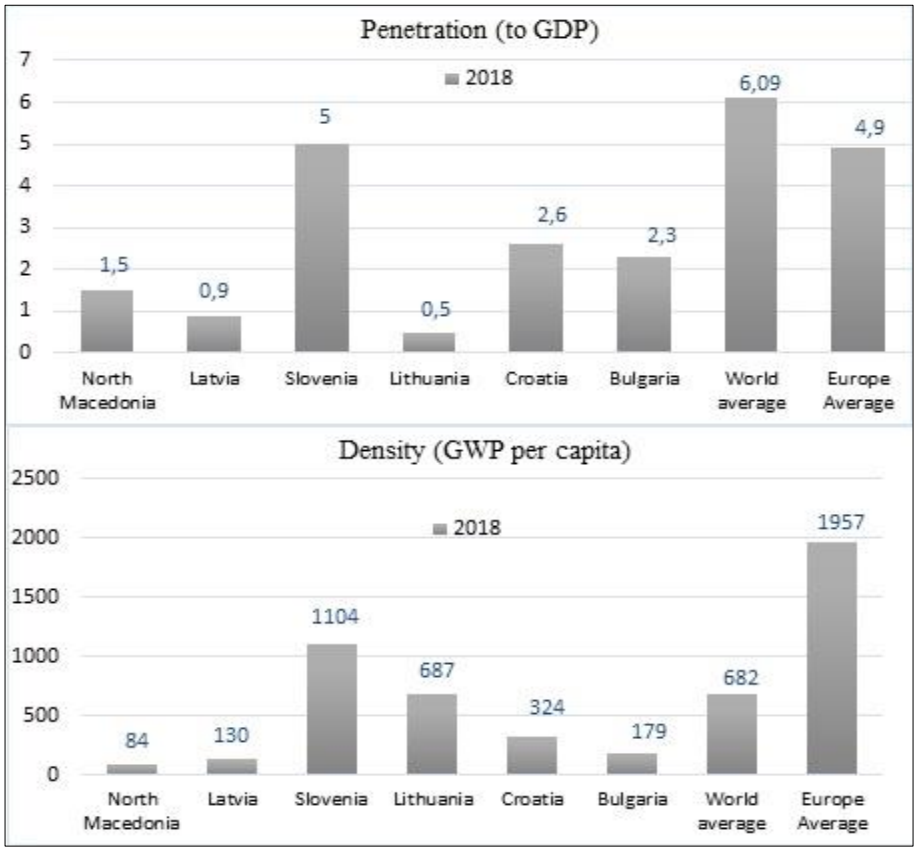
companies in Jordan was found in the research conducted by Amal et al. (2012).

Batool and Sahi (2019) investigate factors that affect profitability of insurance companies in the USA and the UK during the global financial crisis using quarterly data for period of 2007 to 2016. It is shown that internal factors (size, leverage and asset turnover) are positively correlated with both ROA and ROE in the USA. Furthermore, positive and significant relationship is found between liquidity and profitability in both ROA and ROE models in the UK insurance industry. Pervan et al. (2012) dynamic panel analysis to determine the impact of various factors on the profitability of insurance companies in Bosnia and Herzegovina as of the period 2005 to 2010. A positive and significant relationship has been found between the age, market share, previous performance and current profitability, while claims ratio has shown negative effect on the profitability.

3. Main indicators of the Macedonian insurance industry

The insurance market in Republic of North Macedonia has been growing in recent years, however, it is a developing market and far from the level reached in insurance markets in developed economies. Penetration and density rates of the insurance industry in Republic of North Macedonia are analysed in the following section in order to get a better understanding of the current level of development of the insurance industry in Republic of Macedonia. The degree of penetration measures the contribution of gross written premiums (GWP) in the gross domestic product (GDP) of the country. The penetration rate in the Republic of North Macedonia is 1.5% in 2018 and it is lower compared to most of the countries analysed in Figure 1. Slovenia, Croatia and Bulgaria have higher penetration rates, while the penetration rate in Europe (4.9%) is more than 3 times higher in relation to North Macedonia.

Figure 1
Insurance penetration rates and density in selected countries (2018)



Source: ISA (2018), Swiss Re (2020) and Insurance Europe, European insurance industry database, https://www.insuranceeurope.eu/insurancedata

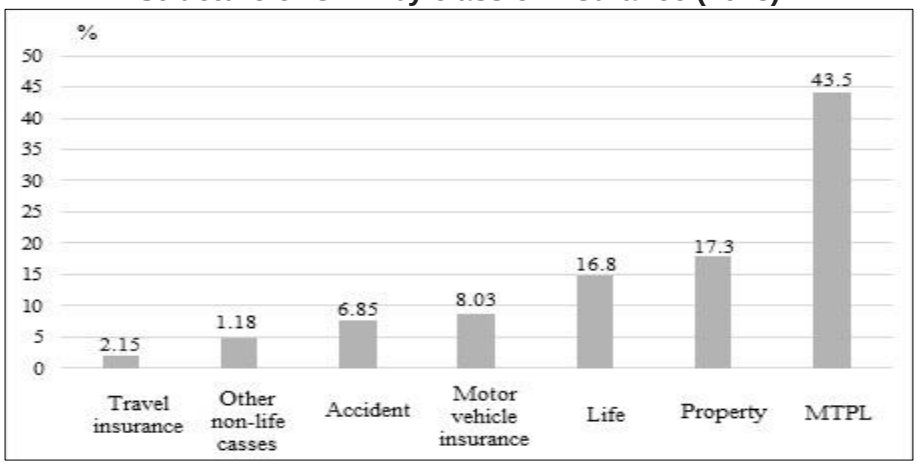
Density is calculated as a ratio between gross written premium (GWP) and the number of residents in the country, therefore this indicator shows gross written premium (GWP) per capita. Density ratio in the Republic of North Macedonia ($84 in 2018) is significantly lower compared to the other countries included in the analysis (Slovenia - $1104, Croatia - $324, Bulgaria - $179, Europe - $1957). One of the reasons for the current phase of the Macedonian insurance market is insufficient awareness, low insurance culture and lack of information

among potential clients for the wide range of opportunities offered by insurance.

According to the law on Compulsory Traffic Insurance, motor vehicle owner and/or users are obligated to have motor third-party liability (MTPL) insurance for losses to third parties resulting in death, bodily injury, deteriorated health, or in property damage. Analyzing the structure of GWP by classes, compulsory MTPL is a mandatory type of insurance, and as a result, it is the most represented class in the total GWP in the Republic of North Macedonia (share of 43.5% in total GWP in 2018). Property insurance is the second most represented class in the Republic of North Macedonia with share of 17.3%, while the share of life insurance is 16.8% (Figure 2). This data suggests that there is low awareness of the insurance among the population, and it is often considered an expensive and unnecessary product, not an investment for a secure future. To overcome this obstacle, Macedonian insurance companies must focus on developing innovative approaches for distribution of optional classes of insurance to target consumers, introducing new products and better existing ones, and educating the population in order to increase awareness about the opportunities offered by the insurance itself.

Figure 2

Structure of GWP by class of insurance (2018)



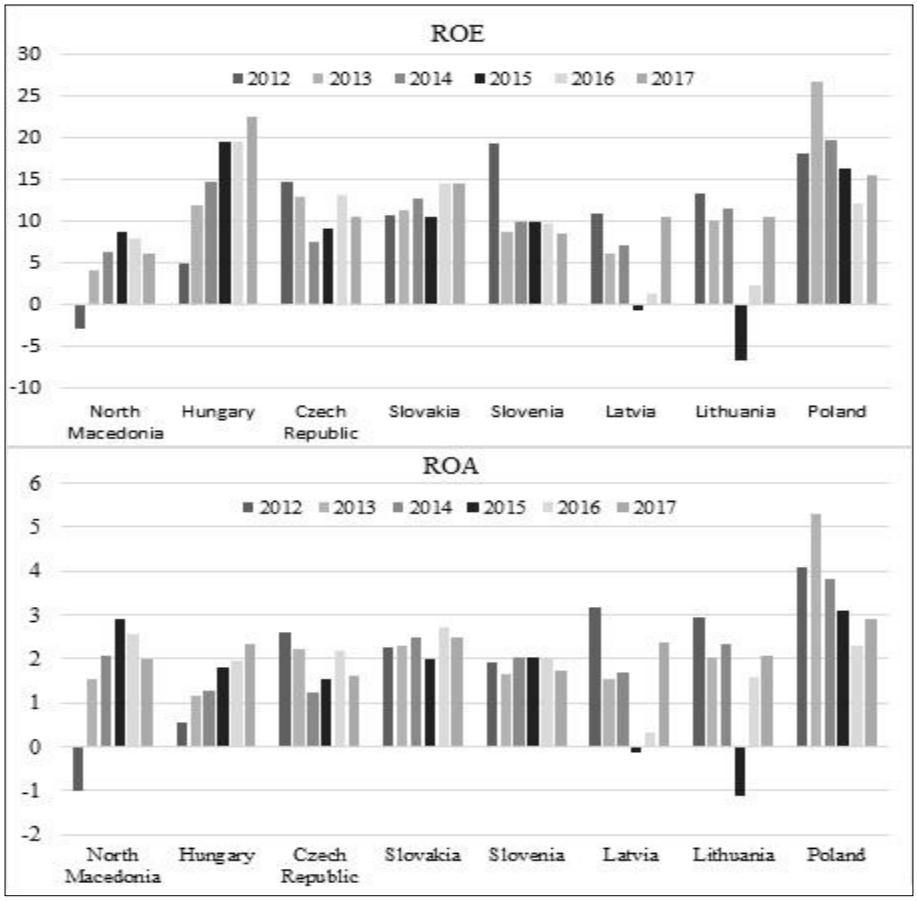
Source: ISA (2018)

Figure 3 shows the trend of profitability measured by ROE and ROA in selected countries from 2012 to 2017. ROE in the Macedonian

insurance industry in 2017 is 6.1%, which is significantly lower compared to Hungary (22.6%), Czech Republic (10.6%), Slovakia (14.5%), Slovenia (8.6%), Latvia (10.6%), Lithuania (10.5%) and Poland (15.6%). This can be explained by the relatively high capitalization of the Macedonian insurance companies in terms of poorly developed insurance market in the country.

Figure 3

ROE and ROA in selected countries (2012-2017)



Source: ISA (2018), RAEX (2018) calculations based on data from the IMF, OECD, Hungarian National Bank, Czech National Bank, The National Bank of Slovakia, Slovak Insurance Association, Slovenian Insurance Supervision Agency, Latvian Insurers Association, Statistics Estonia, Polish Insurance Association, National Bank of the Republic of Belarus and Ministry of Finance of the Republic of Belarus.

Regarding the ROA, in 2017 the profitability of the Macedonian insurance industry is 2.0% and is slightly lower compared to Hungary (2.3%), Slovakia (2.5%), Latvia (2.4%), Lithuania (2.1%) and Poland (2.9%). A slight decline of ROA in Slovenia and Czech Republic in 2017 compared to 2016 can be observed on Figure 3, which result in lower profitability ratio in comparison with the Republic of North Macedonia.

4. Data and methodology

Data was collected and extracted from annual financial statements and the Insurance Supervisory Agency (ISA) and The National Bank of the Republic of North Macedonia (NBRNM). After conducting adjustments for incomplete data and due to information unavailability, our sample includes 14 out of 19 life and non-life insurance companies operating in Republic of North Macedonia, as over the period of 2012 to 2018. Required calculations for the purpose of this research were conducted and are based on the yearly financial statements of the insurance companies.

In recent years, the generalized methods of moments (GMM) panel estimator gains dominantly attention in the banking industry, remaining unexplored in the insurance sector. The mechanics of the GMM methodology allows us to make coalescence between the observed economic data and the information in population moment condition, resulting in estimates of the unknown parameters of the model (Zsohar, 2012), administering a unique approach to the econometrics. Due to the fact that the profitability of insurance companies is dependent on its past realizations, it is safe to conclude that the use of the GMM is more adequate for the research, prompting a scientific discourse of its future consideration. The system GMM estimator efficiently deals with the issues caused by serial correlation, heteroskedasticity and endogeneity of variables (Leitao, 2010), which is not the case with the static panel data models. This methodology was developed by Arellano and Bond (1991) and in later years Blundell and Bond (1998, 2000) refined it. The correlation matrix is used to determine if any issue regarding the multicollinearity of the variables in the model is present. Furthermore, the Hansen test allows us to examine the validity of the over-identifying restrictions. In order to prove the validity of the instruments, one ought to accept the null hypothesis. In direction of inspecting the first order (*m1*) and second order (*m2*) serial correlation in the residuals, a Arellano and Bond test

is carried out. If the null hypothesis is accepted, we can come to conclusion that the proposed model is consistent.

On Figure 4 the dependent variable and in total of eight independent variables alongside with their abbreviation, measurement and expected sign are presented. Return on assets (ROA) is defined to be dependent variable in the model as a proxy for profitability. Additionally, the market share, growth, leverage and financial investment growth rate are set to be firm-specific variables, while combined ratio and underwriting risk are industry-specific ratios. Lastly, the inflation rate and GDP belong to the group of macroeconomic factors.

Figure 4

Description of variables

Variables	Abbreviation	Measurement	Expected sign
Dependent variable			
Return on asset	ROA	The ratio of earnings after tax and interest to total assets	
Independent variables			
Market share	MS	The ratio between firm's revenue and industry earnings	+/-
Inflation rate	INF	Inflation rate	-
Gross domestic product	GDP	Nominal GDP growth rate	+
Leverage	Lev	The ratio between EBIT and EBT	+/-
Combined ratio	CR	Sum of loss ratio and expense ratio	-
Growth	GR	Yearly change in percentage of firm's total assets	+/-
Financial investments growth	FIGR	Financial investments growth rate	+/-
Underwriting risk	UR	Underwriting risk	-

Source: Authors calculation

The pairwise correlation matrix allows us to discover if any multicollinearity in the proposed model exist. Figure 5 reveals that the correlation coefficients have values lower than 0.7 (Gujarati, 1995), which implies the absence of multicollinearity issue between the variables.

Figure 5

Pairwise correlation matrix

	ROA	CR	FIGR	GR	LEV	UR	MS	GDP	INF
ROA	1.0000								
CR	-0.5685	1.0000							
FIGR	0.1746	-0.2114	1.0000						
GR	-0.2896	0.2048	0.1568	1.0000					
LEV	0.1385	-0.3758	0.1108	-0.0277	1.0000				
UR	0.2274	-0.3338	-0.0973	-0.2456	0.1466	1.0000			
MS	0.4477	-0.4492	0.0292	-0.2899	0.2112	0.5134	1.0000		
GDP	0.0710	-0.0650	0.0079	-0.1620	-0.0298	0.0660	0.0040	1.0000	
INF	-0.1725	0.0948	-0.1034	0.0937	0.0002	-0.0510	-0.0049	-0.4182	1.0000

Source: Authors calculation

5. Model specification

In order to examine the effects on profitability of insurance companies in Republic of North Macedonia, a two-step Generalized Methods of Moments (GMM) is applied as a method for analysis of dynamic panel data (Arellano and Bond,1991; Blundell and Bond, 1998):

$$ROA_{it} = \alpha + \delta ROA_{i,t-1} + \sum_{f=1}^{F} \beta_f X_{it}^{f} + \sum_{i=1}^{I} \beta_i X_{it}^{i} \sum_{m=1}^{M} \beta_m X_{it}^{m} + \varepsilon_{it} \quad (1)$$

$$\varepsilon_{it} = \nu_{it} + u_{it} \quad (2)$$

where ROA_{it} is the profitability of firm *i* at time *t*, with i = 1, …, N, and t = 1, . ., T, α is a constant term, δ is the speed of adjustment to equilibrium, $ROA_{i,t-1}$ is the firm's lagged profitability for one-period, βf, βm represent vectors of coefficients to be estimated, X^{f}_{it} is a set of firm-specific variables, , X^{i}_{it} is a set of industry-specific variables, X^{m}_{it} is a set of macroeconomic variables, ε_{it} is error term, v_i firm-specific time-invariant effect and u_{it} the idiosyncratic error.

6. Results and findings

The estimation results obtained from the generalized methods of moments (GMM) are demonstrated in Figure 6. The value of the Arellano-Bond test for AR(1) in first differences is 0.392, while the value of the Arellano-Bond test for AR(2) in first differences is 0.529, implying that that no second-order serial correlation in disturbances in the proposed model exist. In order to determine if the overidentifying restrictions in the model are valid, the p-value of the Hansen test ought to be greater than 5% (0.05). In our case, this value is 0.619 which prove the validity of the overidentifying restrictions in the model.

Figure 6

Dynamic panel data estimation results

	Dependent variable: ROA
Explanatory variables	**Coefficients (Standard errors) [a]**
Constant	.0638656** (.0269487)
L.ROA	.0166708* (.1505873)
CR	-.0712722*** (.0206775)
FIGR	.000914* (.0004972)
GR	-.1085218*** (.0306596)
Lev	-.0020588 (.0023358)
UR	-.0007463 (.0022096)
MS	.3322189* (.1479321)
GDP	.0010724 (.0028437)
INF	-.0031053** (.0014741)
Number of observations	84
Number of instruments	14
Arellano-Bond test for AR (1) (p-value)	z = -0.86 Pr > z = 0.392
Arellano-Bond test for AR (2) (p-value)	z = -0.63 Pr > z = 0.529
Hansen test of overid. restrictions. chi2(4) = 2.64	Prob > chi2 = 0.619

****statistically significant at 1% level, **statistically significant at 5% level, *statistically significant at 10% level.*

The significant coefficient of the lagged profitability (L.ROA) at 10% significance level proves that the dynamic model specification is appropriate for the research. The obtained results exhibit statistically significant and positive effect of market share, financial investments growth rate on profitability, and significant and negative relationship between combined ratio, inflation, growth rate and the profitability of insurance companies.

7. Conclusion

The research contributes to the literature by expanding the understanding of which determinants have significant effect on the profitability of insurance companies in the Republic of North Macedonia. Results show that combined ratio as industry-specific variable has statistically significant (1% level) and negative impact on the profitability. This confirms the hypotheses developed from the empirical and theoretical findings that combined ratio negatively affect the profitability of insurers. It further demonstrates the increased need for operational efficiency in the Macedonian insurance companies. Next, the positive and statistically significant at 10% level effect of financial investments growth rate on profitability. Thus, it is highly recommended for financial managers to strengthen their capacity and to focus more on optimizing the investment portfolio in order to increase the investment performance of the companies. The statistically significant and negative impact of the growth rate on the profitability of insurers may be a result of the higher growth in assets than the optimal ratio. This can easily cause an increase in insurers' insolvency and can lead to self-sabotaging effect. The positive effect of market share on insurers' profitability is due to the generally accepted hypothesis. Said differently, as the firm's total sales increase in relation to the total industry revenues for certain period of time, the better competitive advantage the company has, which can manifest in an increased success in the market and demonstrate higher market power. Lastly, the results show that inflation rate is negatively correlated with the profitability. As the inflation rate increases the total costs of the company increase, leading to decrease in the profits. Hence, it is recommended for the management to develop mechanisms and strategies in the financial planning that will counter the negative effects of inflation, smooth the effect of increased inflation on the profitability and increase the total earnings at a higher rate than inflation.

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THE IMPACT OF FEES ON THE RETURN OF THE SECOND PENSION PILLAR IN ROMANIA

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Abstract

Setting an adequate level for the fees charged by pension fund administrators is a key design element for policymakers when establishing a second pension pillar. A proper balance between the interest of future pensioners and the ones of administrators is required, but an optimal level of fees is not straightforward. The main objective of this paper is to provide the public and policymakers a numerical reference when judging the level of fees charged by pension funds administrators in relationship with the returns generated for the participants. In this respect, the paper assesses the impact of fees on the money weighted rate of return of the second pension pillar in Romania calculated since its inception in May 2008 until December 2020. The results point to a 1.06 pp reduction in the return attributable to the two types of main fees existent in Romania, while the net return in the absence of commissions is found to have been at a level of 6.99%. The overall reduction of the return of the second pension pillar in Romania attributable to the fees is expected to further decline given the recent reduction in fees decided by the Government.

Keywords: pension funds, fees, money weighted rate of return

JEL Classification: G23, J26, J32

1. Introduction

Population aging poses a number of important challenges in many countries throughout the world, both in terms in ensuring fair and

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adequate benefits to pensioners, but also coping with the budgetary impact of public pensions. At the level of the EU, the 2021 Aging Report elaborated by the European Commission points to unfavourable developments in terms of demography. More exactly, the old-age dependency ratio defined as the ration between people aged above 65 and people aged 20-64 advanced in the EU between 2010 and 2019 from 29% to 34%, being projected also to gradually increase to 59% in 2070. In Romania the situation is projected to be even worse, with the old-age dependency ratio expected to rise from 31.1% in 2019 to 62.1% in 2070.

The pension incomes represent the main source of income for the elderly and the unfavourable demographic developments mentioned above will definitely exert strong pressures on public pension systems. In these conditions, it is difficult to imagine that public pension systems will be able to ensure the same level benefits as today (i.e. the same replacement rate), which will generate challenges for ensuring a decent standard of living for future pensioners. Moreover, some pension systems are characterized by inefficiencies like for example the one of Romania. To this point, Dumitrescu and Draghia (2019a) have showed that the introduction of the correction index in the determination of pension benefits in Romania in 2013 has led to different pensions for people with the same number of points that retired in different years.

In this context, many institutions and stakeholders like for example the World Bank in the report “Averting the Old Age Crisis” (1994) proposed the creation of a pension system composed of three pillars: public pensions as the first pillar, mandatory privately managed pensions as the second pillar and voluntary, privately managed pension as the third pillar.

In Romania the second pension pillar was created in 2007, with the first contributions being transferred to pension fund administrators in May 2008 – corresponding to salaries earned by participants in March 2008, the system operating with a lag of 2 months. Through law, entering the system was mandatory for people aged 35 or less and optional for people aged 35 to 45, with the option being final. The contribution to the second pension pillar in Romania was set to reach 6% of the gross wage, starting with 2% in 2008 and increasing at a yearly pace of 0.5 pp onwards. Thus, in 2008 the ratio of contributions transferred to Pillar 2 out of total pension contributions was around 6.4% while the final target was 19.2%. However, the initial calendar of

increasing the contributions transferred to Pillar 2 was not respected due to budgetary constraints, with the contribution reaching 5.1% in 2016. Moreover, the level of contributions to the second pension pillar was reduced to 3.75% in 2018 (corresponding to a share of pension contributions transferred to the second pension pillar of 15%), but it has to be taken into consideration that this change was operated in the context of modifying labour taxation in Romania (transferring the social contributions from the employer to the employee) which meant that the reduction was in fact only about 10%. Basically, in the new context the initial target of 6% of the gross wage corresponds now to a target of 5% of the gross wage (20% of the amounts collected as pension contributions).

The level of fees charged by pension funds administrators is an important parameter of a privately managed pension pillar. A high level of fees can have a significant negative weight on the total level of assets which will be distributed to participant upon retirement. However, an adequate level of fees is necessary for the pension funds administrators to be profitable and also to create proper incentives in terms of risk taking. An adequate balance is therefore required in terms of level of fees to ensure that both the interests of future pensioners and those of pension funds administrators are rightfully met. In general, the impact of fees on the performance of investment funds is not negligible.

In Romania the main fees charged by pension funds administrators – those having the greatest impact of administrators' revenues and on participants – are represented by the fees applied to gross contributions transferred and the monthly fees applied to assets. Over the long term, more important for the participants are the fees on assets as they are applied recurrently, while the fees on contributions are applied only once. The law establishes the maximum level of fees, but so far in the quasi-totality of cases administrators chose to charge this maximum level. Regarding the level of the fees applied on gross contributions, the maximum level was set at 2.5% from May 2008-February 2019 (all administrators charged this level except for market share leader during April 2018-Feburary 2019 who charged 1.7%), to 1% from March 2019-February 2020 and to 0.5% onwards. Thus, this type of fee was significantly reduced in Romania recently, a decision which has some ground in the fact usually this type of fee is more important when assets are low, but as the system develops it becomes less important or justified. In what concerns the fees applied monthly

on assets, the maximum level was set at 0.05% (equivalent to a yearly level of 0.6%) during May 2008-February 2019 while onwards its level became variable, between 0.02% and 0.07%, being linked to the real return – measured as the evolution of the net asset value per share corrected by the level of inflation. More precisely, it starts from 0.02% per month for a negative real return and then adding 0.01% for each percentage point of positive real return, the maximum level of 0.07% being achieved when the real return exceeds 4%.

Against this background, this paper is proposing to assess the impact of fees charged by the pension administrators active on the second pension pillar in Romania in terms of returns generated to the participants to the system. This will allow to put in balance the costs supported by the participants in conjunction with the return obtained so far. Although, the return must be judged over the long term, almost 13 years of existence of the second pension pillar in Romania allows us to have a reasonable picture of the cost-benefits ratio for the participants. Therefore, the main contribution of the paper is to provide a reference for policymakers and the public when judging the level of fees applicable on the second pension pillar.

The rest of the paper is organized as follows: next section provides references in relation with the studied topic, section 3 presents the data and methodology, section 4 discusses the results while section 5 concludes and refers to future directions of research.

2. Literature review

The literature regarding pension funds is quite extensive, the ways to ensure for the elderly persons the minimum living standard or the living standard similar with the one from the active period being a concern for both economists and policy makers. After the issuing of 1994 World Bank study regarding the ageing of population, the interest regarding pensions pillars increased tremendously. The article proposes the 3 pillars pension scheme, having non-contributory (basic pension), contributory (mandatory savings) and contributory (voluntary savings) pensions for ensuring decent standard of living.

The role of the first pillar is to ensure a minimum living standard (sometimes only at the border of poverty), while the second and third pillar role is to maintain actual (or near actual) living standard. The difference between the second and third pillar is the way in that

contribution is paid: voluntary for the third pillar ang mandatory, as part of monthly wages taxes for the third pillar.

Even if the contribution is mandatory and part of the country system of taxes, the second pillar is privately administrated and this mixture between public and private rises a lot of controversy. Willmore (2000) concludes that the second pillar is needed, but a voluntary second pillar must be in place. He argues that is not necessary that the state should not care whether a worker has the means to consume well above subsistence levels during retirement. Orszag and Stiglitz (1999) point out that the underfunded public pension systems represent a potential threat to the fiscal health and to the economic stability of a country. The Orszag and Stiglitz opinions are in line with the vision underlined by the World Bank: the second pillar can contribute to the increase of economic growth, to the easing of burden for public pension and to the protection of pensioners against the political decisions.

Orszag and Stiglitz (1999) examine ten myths regarding to the old age pensions in a "deliberately provocative manner" and demonstrate that, for a dynamically efficient economy, even if the returns obtained by the private pensions fund administrators seems to be higher than for the public pension system it is not always the case. The displayed rate of returns often are not considering the administration fees for the privately managed pension funds. The administrative fees reduce the returns offered for the privately administrated individual accounts and, according to the authors, competition between the providers will not necessarily have as a result a fees reduction.

Analysing the second pension pillar for seven Central and East European countries, including Romania, Fultz and Hirose (2018) point out that the development of the second pillar is the reflection of the transition from the former socialist economic system to the market economy. For all the analysed countries, the pensions monthly payments are guaranteed for the entire lifetime of the pensioners (with no risk of outliving of the benefits), are equitable for man and women (equal pension for equal contribution) and the monthly payments are indexed according to the medium wage and the price index evolution. The requirement of the lifetime benefits should also be maintained also for the second pillar pensions (exception in the case of anticipated withdraws accepted in Croatia, Estonia, Latvia, Macedonia and Slovakia). The weakness of the second pillar comparing to the public pension is that the monthly payments are not adjusted with the inflation

and wage evolution (exception Croatia) and the contribution to the second pillar is not guaranteeing the same living standard as in the active period. In this light, the analysis of the second pillar returns and fees which decrease the return is more and more interesting for the subscribers.

On the charged fees are focusing also Tapia and Yermo (2008). Using data from Latin America, Central and Eastern Europe, Australia, and Sweden, they demonstrated that fees are influenced by many factors including the size and maturity of the system, market structure, competition, investment strategy and regulations. Even if Romania is not included into the data, the conclusions obtained for the Central and East-European countries, can be extrapolated for our country. The fees in our Region (like the ones from Latin America) were higher than the fees from the rest of the analysed countries. The explanation can be the fact that a newly established system needs higher funds in order to cover the costs and also that scale economies are not achieved. Once the system reaches its maturity, the fees will decrease, and higher returns will be achieved. The competition existing in a mature market will be also a factor which will generate higher returns. An impediment to obtaining higher returns in newly established markets can be represented also by the limits imposed by the local supervisory authorities for the risk assumed by the pension funds managers; limits that have the scope to prevent benefits loosing for the pensioners.

A comprehensive analysis on fees charged by the pension founds is the one prepared by Han and Stanko (2018) which uses 88 pension schemes from 145 countries, including Romania. The paper is, in fact, the follow up for 2008 and 2014 papers. According to the authors, for the majority of countries, the fees decreased since 2014, with four exceptions, including Romania for which the fees for voluntary pensions plans slightly increased from 1.79% to 1.85%). Using the charge ratio, the actual account return is compared with the return obtained in hypothesis of no charges and considering a 3% investment return, the results for Romanian second pillar are 8.7% for 20 years projection period, 12% for 30 years and 15.3% for 40 years. The paper draws once again an attention signal for the supervisory authorities about the fees on the pension plans and about the returns that must be computed not only using the assets development, but also considering the fees charged.

The common indicators used to assess the performance of investments in general and of pension funds in particular are

represented by the time weighted rate of return (TWRR) and the money weighted rate of return (MWRR). Considering pension funds, the first indicator refers to the increase in the net asset value per share, while the second is an internal rate of return, taking into consideration also the flow of contributions. Feibel (2003) shows that TWRR reflects the decision of fund managers to select various assets and is a good measure to assess the return obtained these administrators, while MWRR is a better indicator for assessing the return generated to participants as it considers also the moment of investment. TWRR can be used to compare the performance of various fund managers while MWRR cannot be used for that purpose as it is influenced by the moment of investment. Considering the characteristics of the two return indicators and the objective of the current paper, we will opt to use the MWRR as a return indicator in order to assess the impact of fees paid by the participants on the second pension pillar in Romania.

Dumitrescu and Draghia (2019b) have computed the TWRR and MWRR of the second pension pillar in Romania for the period 2008-2018 and pointed the advantages and limitations of each indicator but the impact of fees charged by pension fund administrators on these indicators was not assessed.

3. Data and methodology

This research uses monthly data having as source the Financial Supervisory Authority (FSA), while the covered period is May 2008-December 2020, as the second pension pillar in Romania became operational in May 2008. The raw data monthly series used are represented by the gross contributions transferred on behalf of the participants, the net asset value per share of the pension funds, total assets at end of each period. The data are compiled at the aggregate level, with the average net asset value per share being calculated as a weighted average and for weights are used the market share of each fund administrator. Other inputs are represented by the fees charged by fund administrators, and they are established through laws.

In order to determine the impact on fees charged by administrators active on the second pension pillar in Romania on the returns obtained by the participants we will calculate the MWRR in 3 variants: 1) in the presence of both fees on gross contributions and fees on assets – the actual return generated to the participants; 2) in the absence of both types of fees – to investigate the negative impact

on returns generated by the fees; 3) in the absence of fees on gross contributions – to quantify separately the impact on returns of both types of fees.

The 3 MWRR indicators will be calculated in a couple of steps, which will involve calculating some intermediate indicators like the compounding factor and the final amount at the end of the period generated by each monthly contribution. The general formulas used for these indicators are described in relationships (1) and (2) below, while the MWRR is the solution of the equation from relationship (3) below:

$$Compounding\ factor_t = \frac{Average\ NAVPS_{december\ 2020}}{Average\ NAVPS_t} \quad (1)$$

$$Final\ amount_{\ t} = Compounding\ factor_t\ x\ Contributions_t \quad (2)$$

$$Total\ final\ amount = \sum_{t=1}^{N} Final\ amount_{\ t} = \sum_{t=1}^{N} Contributions_t\ x\ (1 + MWRR)^{n_t} \quad (3)$$

Where NAVPS stands for net asset value per share, N is the total number of months until December 2020, t represents the month, with t being from 1 to N, n_t is the investment period measured in years from month t until December 2020.

In essence, MWRR is an internal rate of return, i.e. the interest rate at which must be invested the monthly contributions for their sum to equal the accumulated amounts at the end of the period.

In order to calculate MWRR in variant 1 the contributions net of the fees applied on them are used, while for MWRR in variant 3 the gross contributions are used in the computations. Variant 2 of the MWRR is more complicated to be determined as, besides using the gross contributions, a solution must be identified in order to eliminate the fees on assets which are already embedded in the data as the average NAVPS is already net of these fees. Thus, we have computed subsequently the average NAVPS in each period in the absence of the fees on assets – by dividing by (1 – the monthly commission) -, while these values were used further to compute the compounding factor of each contribution in the absence of the management fee applied on assets.

4. Results

The data and the intermediate indicators used in computing the 3 MWRR are presented, in a synthetized manner, in the next tables:

Table 1

Computation of MWRR in variants 1,2,3

Month	Gross monthly contributions (mil. RON)	Net monthly contributions (mil. RON)	Investing period until December 2020 (years)	Compounding factor December 2020 / month t	Compounding factor December 2020 / month t (no fee on assets)
may 08	88	86	12,58	2,6827	2,8844
jun 08	103	101	12,50	2,6747	2,8744
july 08	98	95	12,42	2,6394	2,8351
aug.08	109	106	12,33	2,6171	2,8098
sep.08	105	103	12,25	2,6057	2,7961
oct.08	104	101	12,17	2,6114	2,8008
nov 08	104	102	12,08	2,5481	2,7316
dec.08	111	108	12,00	2,5215	2,7017
....	....	....	....	....	....
jan 20	704	697	0,92	1,0558	1,0612
feb.20	795	787	0,83	1,0720	1,0769
mar.20	782	778	0,75	1,1346	1,1394
apr.20	729	725	0,67	1,1161	1,1203
may 20	749	745	0,58	1,0809	1,0845
jun 20	664	661	0,50	1,0700	1,0730
july 20	658	655	0,42	1,0743	1,0769
aug.20	849	845	0,33	1,0526	1,0547
sep.20	747	743	0,25	1,0439	1,0454
oct.20	733	730	0,17	1,0483	1,0494
nov 20	753	749	0,08	1,0172	1,0178
dec.20	748	744	0,00	1,0000	1,0000
Total	58.273,1	57.114,1	-	-	-

Source: Financial Supervisory Authority and own calculations

Table 2

Computation of MWRR in variants 1,2,3 (continued)

Month	Final amount December 2020 net contributions from month t	Final amount December 2020 net contributions from month t by using MWRR 1	Final amount December 2020 net contributions from month t by using MWRR 2	Final amount December 2020 net contributions from month t by using MWRR 3
may 08	230,7	187,6	206,3	182,0
jun 08	269,2	218,5	240,1	212,0
july 08	251,2	205,5	225,8	199,5
aug.08	277,6	227,8	250,2	221,3
sep.08	267,8	219,6	241,0	213,4
oct.08	264,4	215,3	236,2	209,3
nov 08	259,0	215,0	235,8	209,1
dec.08	272,0	227,0	248,8	220,8
....	....	....	....	....
jan 20	736,2	738,0	749,3	742,5
feb.20	843,9	828,9	841,2	834,2
mar.20	883,2	815,5	823,0	816,9
apr.20	809,6	756,0	762,6	757,5
may 20	805,6	772,7	779,1	774,6
jun 20	707,4	681,9	687,3	683,8
july 20	703,6	672,1	677,0	674,2
aug.20	889,4	862,5	868,5	865,6
sep.20	775,7	754,7	759,5	757,7
oct.20	765,0	737,3	741,7	740,5
nov 20	761,7	752,7	756,8	756,2
dec.20	744,0	744,0	747,8	747,8
Total	75.317,4	75.317,4	79.011,2	75.317,4

Source: Financial Supervisory Authority and own calculations

During May 2008-Dec 2020 for the participants to the second pension pillar in Romania were transferred gross contributions amounting around 58.3 billion RON, out of which were invested around 98% or 57.1 billion RON, the difference of 1.2 billion RON being represented by the fees applied to gross contributions. Total assets at the end of the analysed period amounted approximately 75.3 billion RON, higher with 29.2% compared to the gross contributions and with 31.9% compared to the net contributions. It has to be mentioned that the level of assets at the end of 2020 is net of the paid fees on assets,

those being deducted each month. In fact, for the calculations of MWRR was determined the hypothetical level of assets at the end of the analysed period in the absence of all fees and the result was roughly 79 billion RON, higher with 35.6% compared to the gross contributions. From a different perspective, the assets accumulated by the participant in the absence of commissions charged by administrators would have been with about 4.9% higher compared with the existing situation.

Based on an internal rate of return calculations – described in equation (3) - we have obtained for the 3 MWRR values of 6.4%, 6.99% and 5.93%. Thus, the return generated to the participants by investing their contributions, after deducting the fees applied to them, in the period May 2008 – December 2020 was about 6.4% per year. However, one might argue that the actual return generated to the participants must take into consideration the gross contributions, as they represent the amounts actually transferred. This is obtained by determining MWRR 3. Thus, we can conclude that that the return considering gross contributions was about 5.93% per year in the analysed period, with the fees on commissions contributing negatively to the yearly return with 0.47 pp. By also eliminating the fees on assets, already included in the monthly calculation of NAVPS, we obtain a value of 6.99% for variant 2 of MWRR, which is a hypothetical return generated to the participant in the absence of all fees. It can be concluded that the monthly fees on assets negatively contributed with 0.59 pp to the overall return generated to the participants. Summing the impact of both commissions on the return of the second pension pillar in Romania during May 2008-December 2020 we obtain a negative contribution of 1.06 pp. As the fees on contributions are charged only once and also considering their reduction in recent years, the relative importance of this category of fees in the reduction of return is expected to gradually decline, while the one of the fees on assets will depend on the level of real returns generated as their level depends on that factor.

5. Conclusions and future research

This paper assessed the impact of fees charged by fund administrators on the return of the second pension pillar in Romania, by using the money weighted rate of return. The results point to a 1.06 pp reduction in the return attributable to the two types of main fees

existent in Romania – 0.47 pp due to the fees applied on gross contributions and 0.59 pp due to the fees applied on assets. The overall reduction of the return probably will further decline given the recent reduction in fees decided by the Government. Appreciating in a qualitative manner the level of fees charged by fund administrators operating on the second pension Pilar in Romania is beyond the scope of this paper and constitutes directions for future research. However, it is important to find a proper balance between a level of fees which does not weighs disproportionately on the level of the future pension received by the participants to the system, while also ensuring a fair environment for fund administrators, allowing them to operate efficiently and creating proper incentives for the well-functioning of the system.

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THE ROLE OF CORPORATE GOVERNANCE IN MANAGING SMALL INCOME IN INDONESIAN STATE-OWNED ENTERPRISE

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Abstract

Earnings management is a behaviour that is difficult to avoid because of the impact of accruals in preparing financial statements. Earnings management occurs due to information asymmetry in a company. One way to prevent information asymmetry from occurring so as to reduce earnings management is corporate governance. It aims to determine manager accountability through existing mechanisms to reduce problems between agents and principals. The purpose of this study is to examine the effect of information asymmetry on earnings management through the role of corporate governance in State-Owned Enterprise (SOE) in Indonesia. The focus of this study is on information asymmetry, the proportion of the board of commissioners, the size of the board of commissioners and its effect on earnings management. The result showed that information asymmetry has no effect on the earnings management through the proportion of the board of commissioners and the size of the board of commissioners. The result does not significantly affect earnings management since the capital of SOE is dominated by state assets related to public funds. So company's agent should acknowledge the boundaries of ethical, moral, law, government policies, environmental, social, cultural, political, and economic issues in making decisions. Therefore, earnings management actions in SOE companies in Indonesia cannot be minimized by the proportion of the board of commissioners and the size of the board of commissioners. This study offers the importance of

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corporate governance to build reputation and strength on SOEs in Indonesia.

Keywords: information asymmetry, board of commissioners, earnings management

JEL Classification: B26, C22, G38

1. Introduction

Financial reports presented by companies for public interest should meet the usual standards. Information asymmetry is debatable among academics today. This is because information asymmetry is the result of conservatism in which recognition is acknowledged after the incident and eventually creates bias (Givoly & Hayn, 2002). Lafond & Watss (2008) suggest that accounting is better applied because it can reduce incentives and ability of managers to manipulate financial report numbers and minimize information asymmetry. Information asymmetry is closely related to earnings management, where it is known as phenomenon that is difficult to avoid due to the impact of accruals in preparing financial statements.

Scott (2006) states that earnings management is the choice of accounting policies by managers from existing accounting standards and naturally maximizes the utility or market value of the company. Healy & Wahlen (1999) also revealed that earnings management itself occurs when management uses certain decisions in financial reports and transactions to change financial statements as basis for company performance that aims to mislead owners or shareholders or to influence contractual results that rely on accounting numbers which are reported in the financial statements. Richardson (1998) states that there is systematic relationship between information asymmetry and the level of earnings management. Information asymmetry will encourage managers to present information that is not true, especially if the information is related to the manager's performance measurement. Earnings management occurs because of the information asymmetry where the agent has more and more accurate information than the principal. The agent will tend to convey good company conditions even though the reality is less supportive (Rahmawati, et al., 2006). A similar thing is also explained by Scott (2006) that information asymmetry is a condition in which managers have access to get information on company prospects that are not

owned by outsiders, consisting of moral hazard and adverse selection. One can be used to reduce the existence of earnings management is corporate governance.

Corporate governance aims to determine the accountability of managers through the existing mechanisms in order to reduce problems between agents and principals. The role of corporate governance in financial reporting received a lot of attention, especially after the enactment of the Sarbanes Oxley Act 2002 (SOX). Many studies debate whether some characteristics of corporate governance can effectively limit earnings management, such as managers enforcing corporate governance system for financial reporting at their own risk. Managers can control reported earnings by making discretionary choices in accounting or operating decisions. Graham, et al. (2004) and Cohen, et al. (2008) showed in their research that managers change the method to control reported earnings from accounting choices to discretionary operating decisions. When earnings management occurs, it will affect the company's performance and ultimately sacrifice the principal's wealth.

However, if corporate governance is carried out without limiting operational decisions, the company's performance will be damaged by the personal interests of managers. The action of earnings management has occurred in Indonesia State Owned Enterprises. According to the Law No 19 Year 2003 Article 1, the meaning of SOE is the business entities whose capital is wholly or partly owned by the State through direct participation originating from State assets. The examples of SOEs are PT. Pertamina and PT. Garuda. The indication of earning management occurred at SOEs namely PT. Garuda Indonesia, which presents a net profit in the 2018 financial statements of USD 809,846 or Rp. 11.49 billions (exchange rate Rp. 14,200/ USD). Even though the third quarter of 2018, the company's losses were still USD 114.08 millions or IDR 1.63 trillions. This is inversely proportional to the conditions in 2017, where PT. Garuda Indonesia suffered a loss of USD 216.58 millions or equivalent to Rp. 3.09 trillions. Similar conditions also occurred at PT. PLN Pesero which delivered a net profit of Rp. 11.56 trillions in 2018. This profit increased by Rp. 4.42 trillions or 162.30% compared to the profit in 2017. Even though in the third quarter of 2018, PLN still suffered a loss of Rp. 18.48 trillions due to foreign exchange loss of Rp. 17.32 trillions PT. Pertamina Persero also revealed similar things related to the net profit achieved in 2018, namely USD 2.53 billions or Rp. 35.99 trillions whereas in the third

quarter of 2018, the net profit achieved was only Rp. 5 trillions. Profit in 2018 has decreased compared to 2017, amounting to USD 2.54 billions[1].

This behaviour if related to Agency theory suggests that earnings management problems can be minimized through corporate governance. Kang & Han Kim (2011) revealed that earnings management can be controlled effectively by a corporate governance mechanism where corporate governance has a strong relationship with company performance. The corporate governance component in minimizing earnings management practices can be carried out through a monitoring mechanism to harmonize differences in the interests of owners and management, among others, with:

(1) institutional ownership because it is considered a sophisticated investor with a significant amount of ownership that can monitor management which has a reduced impact managers' motivation to perform earnings management (Midiastuty & Machfoedz, 2003);

(2) increasing the company's share ownership by management (managerial ownership) (Jensen & Meckling, 1976);

(3) the proportion of independent board of commissioners that limits management to perform earnings management (Peasnell, et al., 2001);

(4) the size of the board of commissioners, where a smaller number of commissioners will be able to reduce the indication of earnings management (Midiastuty & Machfoedz, 2003); and

(5) the existence of an audit committee that can reduce earnings management activity which in turn will affect financial reporting, one of which is the quality of earnings (Wilopo, 2004).

Uwuigbe, et al. (2014) consider that the size of the board of commissioners and independent commissioners can reduce earnings management performed by managers, where CEO duality has a positive and significant effect on earnings management.

Mashitoh & Irma (2013) prove that the board of commissioners and audit quality can improve financial performance, while Hermiyetti & Manik (2013) reveal that the Good Corporate Governance mechanism has no effect on financial performance. Masulis, et al. (2007) also stated that the system of corporate governance is designed to oversee the risk management through monitoring and reducing

[1]*These information are taken from https://www.cnbcindonesia.com.*

managerial actions that harm shareholders. However, Sun & Al Farooque (2018) showed the difference in their research, that is the amount of earnings management does not experience a decrease after the corporate governance reform. In addition, earnings management has developed overtime and become a positive trend. Alareeni (2017) stated that earnings management has a negative correlation to the size of the board of commissioners, so it said that the higher the structure of the board of commissioners, the higher the practice of earnings management.

Although there are a lot of studies on information asymmetry, corporate governance and earnings management carried out in Indonesia both in conventional and Islamic companies, those related on the asymmetry and earnings management through corporate governance as an intervening variable in SOE companies, are rarely found. The assumption of corporate governance is used as an intervening variable because if corporate governance is implemented effectively, discretionary operating decisions can be minimized, thereby reducing earnings management.

This study aims to examine information asymmetry on earnings management through the role of corporate governance. The time period starts in 2017-2018 since during those years, the behaviour indication of earnings management in SOE companies occurred and, in those year, there was a change in regulations related to the board of commissioners of SOE companies in Indonesia.

This study can serve to investors as basis input and consideration in making stock investment decisions, especially in assessing the quality of earnings in financial statements. For capital market managers, it can be used as a reference to encourage companies to present higher quality information to stakeholders. For the government, through the Capital Market Supervisory Agency and Financial Institution (BAPEPAM), it supports and supervises company operations through stock market activities. For companies, the results of this study could help the corporate administrators in understanding the mechanisms and models of corporate governance and earnings management practices. For academics, this study is expected to be an additional literature on roles of corporate governance in minimizing the practice of earnings management on SOE companies in Indonesia and it could give a brief description about the practice of earnings management in various interested parties.

2. Literature review and hypothesis development

2.1 Agency theory

Jensen & Meckling (1976) revealed that there is a relationship between management and shareholders where management is the agent and shareholders are the principal. Agency relationship allows a conflict of interest between agent and principal. Agency theory implies the occurrence of information asymmetry between agent and principal where the agent has more and more accurate information than the principal. The agent tends to convey a good company condition even though sometimes the reality is less supportive. Based on these reasons, it is indicated that agents undertake earnings management. Therefore, one of the ways used to oversee these problems between agent and principal. Furthermore, it is used to limit the opportunistic behaviour of management is through the implementation of corporate governance. When the corporate governance mechanism is implemented effectively, the agent's discretional operating decisions can be minimized so that earnings management will also decrease.

One of the components of corporate governance is the board of commissioners, having an important role in controlling and supervising management and the formulation of strategies in the company (Hillman & Dalziel, 2003). The board of commissioners can be said to be the decision maker to replace or reshuffle management (Fama, 1980). With the board of commissioners, management can obtain information to minimize information asymmetry and ultimately reduce earnings management (Rutherford, & Buchholtz, 2007).

2.2 Information asymmetry

Rahmawati, et al. (2006) state that information asymmetry is a condition where the agent has more information about the company and the company's prospects in the future than the principal. Management who wants to show good performance can be motivated to modify the financial statements in order to generate profits as desired by the owner. Information asymmetry between agent and principal can provide opportunities for managers to carry out earnings management.

However, Kusumawati, et al. (2013) revealed that information asymmetry has no effect on earnings management practices. Likewise, with the study of Suhendah & Imelda (2012) it revealed that information asymmetry has no effect on earnings management. Based on the above expectations, the research hypothesis is:

- H1: Information asymmetry has a positive and significant effect on earnings management.

2.3 Corporate governance

The Organization for Economic Cooperation and Development (OECD) states that corporate governance is a system that regulates and controls a company's business activities. Meanwhile, Boediono (2005) presents corporate governance as a set of regulations that establishes the relationship between principals, managers, creditors, government, employees, and the roles of internal or external stakeholders with respect to rights and obligations, in other words the system that directs and controls the company. The corporate governance elements consist of the proportion of the board of commissioners, the size of the board of commissioners and the existence of the audit committee.

The board of commissioner functions as a supervisor of the information quality contained in financial reports. Peasnell, et al. (2001) and Midiastuty & Machfoedz (2003) said that the existence of a board of commissioners could reduce earnings management practices. Similarly, it was revealed that the size of the board of commissioners had a negative effect on earnings management (Scott, 2006). Conversely, Midiastuty & Machfoedz (2003) asserted that the size of the board of commissioners has a significant positive effect on earnings management. Instead, Veronica & Utama (2005) and Boediono (2005) stated that the proportion of commissioners has no effect on earnings management practices.

In accordance with the Decree of the Chairman of the Indonesian Capital Market Supervisory Board no Kep. 29 / PM / 2004 dated September 24th, 2004 concerning the Establishment and Guidelines for the Implementation of the Audit Committee's Work was revoked and declared no longer valid. Meanwhile, the audit committee was by the established by the board of commissioners to oversee the company's management. Veronica & Bachtiar (2004), and Wilopo (2004) argue that the presence of an audit committee can effectively hinder the increase in earnings management in the company. In other words, the audit committee is able to negatively influence earnings management practices in the company.

Kamran & Shah (2014) also conveyed in their research that the GCG (Good Corporate Governance) mechanism has a negative and significant effect on earnings management. The effectiveness of GCG

is through the supervisory role carried out by the board of commissioners who has high independence. This is stated in the agency theory that independent commissioners are used as alerts to see management performance and behaviour. This supervision can prevent and reduce earnings management. This study is different from the research of Hermiyetti & Manik (2013), which stated that the size of the board of commissioners and the proportion of the board of commissioners have no significant effect on earnings management. The similar result is also shown by Al-Thuneibat, et al. (2016), which underline that corporate governance mechanism has no effect on earnings management. Based on the above expectations, the research hypotheses are:

- H2: Information asymmetry has a negative and significant effect on earnings management through the proportion of the board of commissioners.
- H3: Information asymmetry has a negative and significant effect on earnings management through board size.

2.4 Earnings management

Schipper (1989) states earnings management as disclosure management in the sense that management intervenes with a specific purpose in the external financial reporting process on purpose for personal gain. Positive accounting theory explains three hypotheses that encourage companies to implement earnings management, namely:

1. The bonus plan hypothesis reveals that company managers have a bonus program related to accounting figures that tends to adopt accounting procedures that shift earnings reporting from future periods to current year periods (increasing current reported earnings).
2. The debt covenant hypothesis is a condition in which companies that are threatened with violating debt covenant conventions tend to have accounting procedures that shift earnings reporting from the future period to the current year period.
3. The political cost hypothesis is a condition in which the greater the political costs faced by a company, the managers tend to choose accounting procedures that defer future earnings reporting to the current year period or reducing reported earnings now (Rahmawati, et al., 2006).

3. Operational Definition of Variables

3.1 Information asymmetry

Information asymmetry is a situation where managers have access to information on company prospects that are not owned by outsiders. Information asymmetry is measured using the difference between previous earnings and current year's earnings. So that it can be formulated as follows:

$$IA=P_t - P_{t-1} \quad (1)$$

Notes:
IA - Information Asymmetry
P_t – Profit, year *t*
P_{t-1} – Profit, year *t-1*

3.2 Corporate governance

Corporate governance uses 2 indicators, namely the proportion of the board of commissioners and the size of the board of commissioners. The proportion of commissioners is measured using the percentage of the number of independent commissioners to the total number of commissioners in the board of commissioners of the sample companies. It can be formulated as follows:

$$PBC = \% \sum NIC \times \sum TNC \quad (2)$$

Notes:
PBC - Proportion of the Board of Commissioners
ΣNIC - Number of Independent Commissioners
ΣTNC - Total Number of Commissioners.

The size of the board of commissioners is the number of members of the company's board of commissioners as measured by the total number of members of the company's board of commissioners. So that it can be formulated as follows:

$$SBC = \sum TNC \quad (3)$$

Notes:
SBC - Size of the Board of Commissioners
ΣTNC - Total Number of Commissioners.

3.3 Earnings Management

Earnings management is measured using working capital accruals to sales or it can be formulated as follows:

$$EM = \frac{WCA}{S} \quad (4)$$

$$WCA = \Delta CA - \Delta CL - \Delta Cash \quad (5)$$

Notes:
EM - Earnings Management
WCA - Working Capital Accrual
S - Sales
ΔCA - Current Asset Change
ΔCL - Current Liabilities Change
ΔCash - Cash Change

4. Research Methodology

4.1 Research Samples

The sample of this research uses state-owned companies in Indonesia period of 2017 and 2018. The data collection technique uses purposive sampling. The criteria for taking the sample are as follows:

State-owned companies that have published annual reports for the years 2017-2018.

Availability of related data that is complete and in accordance with the variables to be studied during the 2017-2018 period.

Based on the characteristics of the sample selection above, 76 state-owned companies in Indonesia were obtained which will be used as samples in this study.

4.2 Methods of Data Analysis and Hypothesis Testing

The data analysis method in this study uses panel data regression analysis where the data used is panel data of state-owned companies in Indonesia period of 2017-2018. Data collection is done through each company website. The data analysis technique used the two-stage least squares (2SLS) method with the E-Views 9 program.

The regression equation in this study is:

$$EM_{it} = \beta_0 + \beta_1 PBC_{it} + \beta_2 SBD_{it} + \varepsilon_{it} \quad (6)$$

Notes:
EM - Earnings Management
PBC - Proportion of the Board of Commissioners
SBD - Size of the Board of Commissioners
AI - Information Asymmetry
ε- error
β_0 - constant
β_1 - coefficient 1
β_2 - coefficient 2
'i - company
't - time

5. Results and Discussion

Following are the results of data processing using the two stage least squares (2SLS) method:

Table 1
Test Results of the Two-Stage Least Squares (2SLS) Method

Variable	Coefficient	*Std. Error*	t-Statistic	Prob.
C	-39634.40	29138.84	-1.360192	0.1779
IA ➔ EM	3.96E-05	0.001576	0.025163	0.9800
AI ➔ PC	-3.04E-10	5.34E-10	-0.568966	0.5711
PC ➔ EM	625893.0	368569.0	1.698171	0.0937
IA ➔ SBC	6.15E-09	9.59E-09	0.641442	0.5232
SBC ➔ EM	27135.10	20533.96	1.321474	0.1905

Source: Data Processing Results of E-Views 9

Based on the results of the hypothesis test, it states that the probability of the variable value of information asymmetry on earnings management is not significant (0.9800> 0.05). This result means that hypothesis 1 (H1) is rejected, which means that information asymmetry has no effect on earnings management.

The results of this study are inconsistent with the research of Halim, et al. (2005) which states that information asymmetry has a positive and significant effect on earnings management. Based on the results of this study, it is found that different results indicate that state-

owned companies used as research samples where the agent and principal can access information with the same power. This results in the principal being able to supervise all activities carried out by agents in managing the management of state-owned companies. Therefore, the agent does not have the opportunity to take earnings management action.

The same thing conveyed by Hillman & Dalziel (2003) that the board of commissioners has an important role in controlling and supervising management and the formulation of company strategies. Fama (1980) also stated that the board of commissioners can be said to be the decision maker to replace or reshuffle top management. With the board of commissioners, management can obtain information to minimize information asymmetry and ultimately reduce earnings management (Rutherford, & Buchholtz, 2007).

The results of further study state that the probability of the variable value of the asymmetry of information on the proportion of the board of commissioners is 0.5711 (prob> 0.05) and the probability of the variable value of the proportion of the board of commissioners to earnings management is 0.0937 (prob> 0.05). This result can be interpreted that hypothesis 2 (H2) is rejected. In other words, the proportion of the board of commissioners cannot mediate the relationship between information asymmetry on earnings management. Therefore, information asymmetry does not affect earnings management through the proportion of the board of commissioners. Based on Agency theory, management consists of a board of commissioners who oversees performance and management behaviour as well as management quality audits. This role is performed to prevent and reduce earnings management practices. However, in relation to state-owned companies, where government ownership is often burdened with special missions beyond the achievement of profits, management must also pay attention to the parties related to the corporation widely so that the number of boards of commissioners in making decisions also considers various aspects of the operating environment.

These results are in line with the research of Veronica & Utama (2005) and Boediono (2005) which states that the proportion of the board of commissioners does not affect earnings management practices. The same thing is also expressed by Kamran & Shah (2014) who convey in their research that the Corporate Governance mechanism has a negative and significant effect on earnings

management. Hermiyetti & Manik (2013) and Al-Thuneibat, et al. (2016) underline that the Corporate Governance mechanism has no effect on earnings management. They explain that the Corporate Governance is carried out only as a form of company compliance with laws and government regulations. Therefore, Corporate Governance mechanism is ineffective and not optimal in the implementation of management supervision. However, the results of this study contradict Peasnell, et al. (2001) and Midiastuty & Machfoedz (2003), which revealed that the existence of a board of commissioners can reduce earnings management practices. In line with Yeung & Lento (2020) which also stated that Corporate Governance is able to decrease the earnings management.

The results of the next study state that the probability of the variable value of information asymmetry on the size of the board of commissioners is 0.5232 (prob> 0.5) and the variable value of the size of the board of commissioners on earnings management is 0.1905 (prob> 0.5). This result means that the size of the board of commissioners cannot mediate the relationship between information asymmetry on earnings management. Therefore, hypothesis 3 (H3) is rejected so that information asymmetry does not affect earnings management through board size. This is because state-owned company ownership is related to public funds so that agents must know the boundaries of ethical and moral, legal, government policies, environmental, social, cultural, political, and economic issues in making decisions. **(**Midiastuty & Machfoedz, 2003) state that the size of the board of commissioners has a significant effect on indications of earnings management carried out by agents. However, the results of this study are consistent with the research of Hermiyetti & Manik (2013) and Al-Thuneibat, et al. (2016) that Corporate Governance mechanism has no effect on earnings management.

5. Conclusion

This study aims to examine the effect of information asymmetry on earnings management through the proportion of the board of commissioners and the size of the board of commissioners as an intervening variable in SOE companies in Indonesia. Regression test result of panel data on 76 SOE companies during 2017-2018 shows that information asymmetry has no effect on earnings management and information asymmetry has no effect on earnings management

through the role of corporate governance, namely the proportion and size of the board of commissioners. Based on these results, it can be stated that the proportion of the board of commissioners and the size of the board of commissioners cannot reduce earnings management practices in SOE companies in Indonesia. This is because the SOEs' ownership is related to the public funds, so that agents must know the boundaries of ethical and moral, legal, government policies, environmental, social, cultural, political and economic issues in making decisions. The results of this study are in line with the study of Hermiyetti & Manik (2013) and the study of Sun & Al Farooque (2018) which stated that corporate governance has no effect on earnings management. However, the result of this study differs to the result of Peasnell, et al. (2001), Midiastuty & Machfoedz (2003), Wilopo (2004), Masulis, et al. (2007), Alareeni (2017) and Yeung & Lento (2020) which state that corporate governance is able to reduce earnings management practices. The limitations of this study refer to the short sample period, only two years, so that the results are not optimal. Therefore, further research should extend the research sample period in order to find out the role of corporate governance before and after the change of board of commissioners' regulations for SOE companies in Indonesia.

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FINANCIAL RATIOS AFFECTING SYSTEMATIC RISK IN JOINT-STOCK COMPANIES: BIST TECHNOLOGY (XUTEK) INDUSTRY COMPANIES CASE IN TURKEY

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Abstract

Systematic risk cannot be controlled by business managers and cannot be eliminated by portfolio diversification. Factors related to the systematic risk may be interest rate, inflation, exchange rate, market risk, and politics. Systematic risk may also mean the magnitude of the correlation between stock price and market return. The measure of this risk is the beta coefficient. This study aimed to help the company managers, investors, and technology sector researchers to understand better systematic risk based on the technology companies operating in Borsa Istanbul. Understanding the risk structure of the technology industry is essential for the effective management of business activities. This study aims to examine firm-specific variables that are thought to be directly related to Beta. Findings obtained by panel data analysis from 14 technology companies traded in the BIST Technology (XUTEK) index for 2011: 1Q-2019: 4Q show that liquidity, debt leverage and current ratio are positively associated with risk. No effect of total assets, return on assets, asset turnover, and return on equity have been determined on systematic risk.

Keywords: Systematic Risk, Panel Data Analysis, Financial Ratio

JEL Classification: C12, D53, E44, L25

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1. Introduction

The term risk generally refers to the variability in the price of a particular security. Investments typically have an associated risk based on their exposure to the markets and internal volatility. The risk of an investment is the probability that the actual return will differ from what was expected. The risk includes the possibility of a lower income from the initial investment. The more the actual return deviates from the expected return, the greater the risk and potential reward. Risk is one of the fundamental elements of investing. Risk and return are the two most important criteria for creating appropriate investment strategies. The risk factor arises when future events are not entirely predictable, and some options should be preferred over others. When firms' risk and return factors are well known or predicted, it is easier to make appropriate investment strategies. In the finance literature, the risk is considered in two contexts: an actual return and an expected return. The first includes some risks associated with the company's internal factors, such as risk management. Non-payment risk and liquidity risk can be given as examples of these types of risks, which express non-systematic risk (controllable risk) elements. The second category is related to general market conditions such as economic, political, and social conditions, mostly known as systematic risk (β), including risks that are not related to the company (Faez & Eslam, 2013). Sharp (1964) defines systematic risk as the risk responding to the investment combination's real risk.

The Capital Asset Pricing Model (CAPM), the pioneer of the asset pricing theory, contributes to the valuation method of risky assets and measures the asset's systematic risk. In CAPM, the systematic risk of risky assets measured by Beta is the covariance of market return and market return divided by the variance of market return (Ross et al., 2009). However, Markowitz first developed the risk scale for a particular portfolio of assets in 1952 and 1959. The portfolio model shows that the portfolio's return rate variance is an essential determinant of portfolio risk under a set of logical assumptions. The Beta of a company stock, which reflects the systematic risk of a stock, can also represent its systematic risk. Logue and Merville (1972) consider that the extent to which a company is affected by macroeconomic conditions can be measured from its stocks' Beta. Its stock returns indicate a company's current and potential earnings power against general economic situations (Jiayi, 2016).

The technology sector is a field related to electronic accounts and information processes and intertwined with information technologies. The technology sector has many different fields such as computer software, hardware, networks, communication technologies, well-equipped workforce, internet, intranet, and communication options (Dumanoğlu & Ergül, 2010). Compared to other sectors, faster changes and transformations in the technology sector have caused it to be among the strategically important sectors in all countries in the world. In today's globalizing and boundaries, people's habits have begun to resemble each other more than ever. This situation has also led to a faster transfer of information and technology than ever before between countries in very different geographies. With the rapid innovations and developments in the technological field, people and companies' routines and forms are rapidly changing. This process also contributes significantly to the reduction of costs and the faster, more effective, and efficient execution of activities (Toker & Çınar, 2018; Cited by Gülençer & Hazar, 2020).

Today, technological developments that change all life and working ways and habits of people play an essential role in developing and institutionalizing societies and companies. Rapid developments in technology worldwide and technological investments in Turkey will be a positive impact leads to a further increase with each passing day (Dumanoglu & Ergül, 2010). As a reflection of these developments in the IT sector and other sectors, foreign direct investors are increasing their Turkey investments.

TUBISAD Informatics Industry Association of information and communication technologies in Turkey in 2019 market data report. Referring to Turkey IT market grew by 14% in TRY terms in 2019 to 152.7 billion TRY while accessing; it decreased by 3% in dollar terms and decreased to 26.8 billion dollars. The sector has been growing at an average of 17% annually since 2015. The exports of the sector have grown since 2015 and reached a level of 1.1 billion USD (TUBISAD, 2019).

On the other hand, an important fact that applies to companies operating in all sectors and technology companies is determining the risk element and its factors. Today, companies faced with more diverse and different risk factors compared to the past. These risks include technology, cyber-attacks, regulation, investment risk, and climate changes. Investors, managers, and researchers need to focus on this phenomenon to understand and manage the risk factor effectively.

Managers need to develop strategies to deal with primary systematic risk rather than unsystematic risk.

This study examines the internal factors affecting systematic risks in technology companies, which were not mentioned in previous studies. For this purpose, 14 of the 19 companies whose data can access completely, according to the Borsa Istanbul technology index transactions, were included in the analysis. Panel regression analysis method was used in the study. The study covers quarterly data between 2011 and 2019.

2. Literature Review

The systematic risk criterion beta coefficient shows the relationship between stock returns changes depending on the market portfolio return rates (Ceylan & Korkmaz, 2000). Portfolio and capital market theories have led to developing this basic concept of systematic risk, also known as Beta, non-diversifiable risk or market risk. This risk factor measures a firm's common stocks' sensitivity or volatility relative to the general market. Many researchers have focused on empirical links between systematic risk and various financial and accounting variables. In some studies, liquidity, leverage, operating efficiency, profitability, dividend payment, firm size, growth, tax rate, the market value of equity, and financial risk were used to determine systematic risk (Dedunu, 2017).

Considering the studies that take the systematic risk and financial ratios into account, it is noteworthy that observations from different sectors were made. Besides, studies have focused on measuring or estimating systematic risk and its relationship with firm financial ratio and firm value. As shown in the literature, the beta coefficient-financial ratios relationship can emerge in quite different sectors, periods, and the country of origin. These differences are observed both in the statistically significant rates and in the rates' coefficients and signs (Uyar & Çağlak, 2019). The differences mentioned above arise from the emergence of indicators affecting firm risk in different ways depending on the sector—some of the studies mentioned above in the literature given below.

Ball and Brown (1969) partially explained the beta coefficient based on the accounting variables of 262 businesses. Beaver et al. (1970) conducted a study to determine which variables related to accounting data affect systematic risk and found that some ratios

obtained from accounting data explained the change in beta coefficient at the level of 44 percent. Mandelker and Rhee (1984) found that activity and financial leverage explained a significant part of the change in companies' systematic risks in the USA. Huffman (1989) repeated the study by Mandelker & Rhee (1984) on the effect of activity and financial leverage on the systematic risk of common stocks and found a positive relationship between systematic risk and financial leverage. Mensah (1992), in his study on the periods 1966-1977 and 1967-1986 and conducted regression analysis, determined the significant effects of the variables of net income, fund inflows and outflows from activities, working capital, cash flows from operations on Beta. He also stated in his study that three accounting flow measures show that the best model in defining market risk is Mandelker and Rhee models.

In a critical study conducted by Ercan et al. (2006), using the data of 169 businesses, a regression analysis applied between beta coefficient and financial ratios, and some statistically significant relationships were determined between financial ratios 5-6 and beta coefficient.

Kim, Ryan, & Ceschini (2007) examined financial rates in 58 fast-food and other restaurant establishments for 1999-2003. In their studies, they detected a negative correlation between return on investment and Beta. While the debt/equity ratio has a significantly positive relationship with Beta in fast-food restaurants, there is no relationship in other restaurants. Also, considering the studies' results, when the restaurant sector, in general, is considered, a positive relationship is detected between the acid-test ratio (as a liquidity indicator) and risk (Beta). The general restaurant industry found that investments negatively correlated with Beta and equity debt positively associated with Beta.

In another study, Lee and Jang (2007) examined airline companies for 1997-2002. They found that debt leverage (to total debt / total assets), profitability (return on assets), firm size (total assets), and EBIT growth were essential determinants of Beta. It turns out that debt leverage and firm size are positively associated with systematic risk (Beta). The study results also showed that profitability and growth negatively correlated with Beta. This situation shows that the profitability rate is effective in reducing the firm risk. On the other hand, in the study, liquidity (acid-test ratio) and activity (asset turnover) ratios do not have a significant effect on systematic risk (Beta).

Akça (2008) was carried out correlation and regression analyses in his study on 2005-2007. Akça found that current and cash ratio, acid test, total debt/assets, total debt/equity, short-term debt / total debt, interest coverage, financial debts / total debt, financial debts/equity, and return on assets have significant effects on the beta values of firms.

Eryiğit and Eryiğit (2009) analyzed the stocks traded on the Istanbul Stock Exchange between 1995-2005, taking into account the financial ratios that affect systematic risk. Five fundamental financial ratios (acid test ratio, debt/equity ratio, return on equity, asset turnover, defense range measurement) are used in the analysis. The panel regression analysis applied by autocorrelation correction, asset turnover, defense range measurement, and acid test ratio were determined as variables affecting systematic risk. The effect of all three variables on systematic risk was determined to be positive.

Considering the study conducted by Usta & Demireli (2010), a hypothetical portfolio consisting of stocks with equal weights created, and the closing prices of three companies operating in the food sector in 12.04.2007–01.12.2008 analyzed. The risk of the mentioned portfolio is measured based on the closing prices. Later, the risk level was calculated by considering the portfolio effect separated into systematic and unsystematic risk. The results show that systematic risk levels on stocks belonging to companies are almost at the same level, while non-systematic risks are calculated at different levels in both companies. Furthermore, whatever the systematic risks are belonging to companies operating in the same sector, the unsystematic risks of the companies may differ because of the decisions arising from their specific activities. Although the systematic risks are the same, the investors' returns increase directly due to the unsystematic risk level.

Repetti and Kim (2010) analysed financial ratios, which are the most critical determinants of Beta, in their study on gaming industry companies. Their studies are based on return on assets, liabilities as a percentage of assets, asset turnover rate, fast rate, EBITDA growth rate, market capitalization rates, and variables. According to their conclusions, it is the only variable that market capitalization has a significant positive impact on Beta both before and during the financial recession after 2007. While asset turnover is a crucial determinant only before a recession, liabilities as a percentage of assets are only an important factor during a recession.

Tanrıöven & Aksoy (2011) analysed the companies traded on the BIST by using annual data for the period 1997-2008, using accounting variables to determine the determinants of systematic risk on a sectoral basis. According to the results, a positive relationship was found between debt ratios and Beta. Also, it was observed that the growth in sales affected the Beta in all sectors except the food and technology sector, the price/earnings ratio was effective only in the stone-soil sectors, and the leverage ratio was only useful in the metal sector.

Alaghi (2011) investigated the effect of financial leverage on companies' systematic risk traded on the Tehran Stock Exchange. Financial leverage as independent variables and systematic risk as the dependent variable are considered in the study. The results revealed that financial leverage impacts the systematic risks of companies traded on the Tehran Stock Exchange.

Karadeniz et al. (2015) tried to find out the factors affecting systematic risk in tourism companies. The authors analysed using the GMM method using the financial variables of eight companies listed on the stock exchange for the period 2003-2012. According to the findings they obtained, systematic risk and assets' size positively correlated in the tourism sector, while systematic risk and assets turnover were negatively correlated. On the other hand, it is observed that acid test, leverage, and profitability ratios of assets do not have a significant relationship with systematic risk.

Hosseinpour & Saeidi (2016) analysed the relationship between financial ratio and systematic risk based on 25 companies operating in the cement industry listed on the Tehran Stock Exchange. According to the studies' results, covering the period 2007-2013, the cement sector's systematic risk and liquidity ratio is not in a meaningful relationship. There is no significant correlation between shareholders' salary income and systematic risk. A relationship has been identified between the return on assets in the cement industry and systematic risk. Systematic risk and stock turnover variables are not in a meaningful relationship in the cement sector. There is a systematic risk between the increase in profit before interest and tax in the cement sector and systematic risks.

Dedunu (2017) tested the relationship between the financial ratios of 50 companies in the manufacturing sector between 2009 and 2016 and systematic risk using correlation analysis and regression analysis. As a result of the analysis, it has been determined that some

ratios show a similar relationship between the systematic risk and financial ratios of companies. In contrast, some ratios show the opposite relationship.

Tepeli (2017) examined the relationship between financial ratios and beta coefficients with panel data analysis in his study on BIST tourism and non-public companies. Also, the model created in the first stage in the study was re-estimated based on non-public companies' data. As a result, non-public company betas were found to be 0.676.

Uyar and Çağlak (2019) investigated the relationship between financial statement data and financial beta values of companies operating in the cement industry in different countries. To this end, Turkey and some other countries with financial ratios of companies operating in the financial year 2007-2017 beta coefficient between the panels subjected to data analysis. According to the results, the beta coefficients of cement companies in Turkey return on equity, current ratio, asset turnover, the operating profit margin, and logarithmic assets are associated in a meaningful way.

Kaygın & Güngör (2019) analysed the relationship between financial ratios and systematic risk, correlation, simple linear regression, and multiple linear regression analysis, based on annual data of 109 companies whose shares traded on BIST and operating in the manufacturing industry between 2010-2018. As a result of the study, they found a significant or opposite relationship between financial ratios and systematic risk. As a result of the analysis, it is determined that the existence, direction, and degree of the relationship between financial ratios and systematic risk varies by year.

Generally, the performance measures are discussed in the studies on technology companies (Dumanoğlu & Ergül, 2010; Tektüfekçi, 2010; Türkmen & Çağıl, 2012; Orçun & Eren, 2017). It is noteworthy that companies operating in the technology sector are generally neglected in the literature on the systematic risk and financial ratios relationship and the measurement of systematic risk. This study aimed to contribute to the completion of this deficiency.

3. Methodology and findings

Borsa Istanbul Technology Index and Public Disclosure Platform (KAP) has been analysed and has determined that 19 companies traded in Borsa Istanbul Technology Index in the analysis

period. These companies are ALCATEL Lucent Teletaş, ARD Information Technologies, ARENA Computer, ARMADA Computer, ASELSAN, DESPEC Computer, DATAGATE Computer, ESCORT Technology, FONET Information Technologies, INDEX Computer, KAREL Electronics, KAFEIN Software, KRON Telecommunication, LINK Computer, LOGO Software, NETAŞ Telecom, PAPILON Defence, PLASTIKKART, SMARTIKS Software. However, since this study covers the period between 2011: 1Q-2019: 4Q and in order to avoid possible lost data problems, the analyzes were carried out with a total of 504 observations using 40 observations of 14 technology companies (ALCATEL, ARENA Computer, ARMADA Computer, ASELSAN, DESPEC Computer, DATAGATE Computer, ESCORT Technology, INDEX Computer, KAREL Electronics, KRON Telecommunication, LINK Computer, LOGO Software, NETAŞ Telecom, PLASTICCARD), whose data were fully accessible during the analysis period.

3.1. Panel data analysis

Econometric studies usually use cross-section or time-series data. The time dimension is emphasized in time-series studies, while the cross-sectional size is taken into consideration in cross-section studies. However, the popularity of studies using panel data has increased more in the 2000s. Panel data studies considered both the time dimension and the cross-sectional dimension (Çetin & Ecevit, 2010). In this study, panel data analysis was preferred because panel data models present time series and cross-section data together. Using panel data models, researchers can increase the number of observations and degrees of freedom and reduce the connection problem between observations and explanatory variables (Baltagi, 2005). Estimates can be made using three main models in panel data analysis. These are the pooled model, fixed-effects, and random-effects models. Generally, in panel data analysis, it is observed that the number of cross-section units *(N)* is more *(N> T)* than the number of periods *(T)*. This study essentially intended to estimate with the "Generalized Method of Moments-GMM," but this was not possible because the number of periods was higher than the number of horizontal sections in the data set.

The panel data set contains equal length time series for each horizontal section, balanced panel; change of time series lengths from horizontal section to horizontal section is called unbalanced panel

(Wooldridge, 2003; as cited in Çetin & Ecevit, 2010). In this study, there is a balanced panel situation. It is seen that panel data regression is estimated in different ways depending on the assumptions made about the constant, slope coefficient, and the error term. It can be assumed that the constant and the slope coefficient are constant between time and horizontal cross-sections and that the error term can capture differences across time and horizontal cross-sections. This model, in which the data of all units collected in a pool and the effects of independent variables on the dependent variable are analyzed, defined as a pooled regression model or a constant coefficient model (Çetin & Ecevit, 2010). In this study, two different pooled regression models were estimated because only one of the variables with high correlation relations was included in the model. The models in question are as follows:

Model 1:

$$Beta_{it} = \alpha_{it} + \beta_1 SIZ_{it} + ROA_{it} + TUR_{it} + CUR_{it} + LEV_{it} + ROE_{it} + AR(1) + u_{it} \quad (1)$$

Model 2:

$$Beta_{it} = \alpha_{it} + \beta_1 SIZ_{it} + ROA_{it} + TUR_{it} + LIQ_{it} + LEV_{it} + ROE_{it} + AR(1) + u_{it} \quad (2)$$

In the above equation:
$Beta_{it}$ - Beta Coefficient (Systematic Risk)
α_{it} - Constant Term
CUR_{it} - Current Ratio (Liquidity$_2$)
ROA_{it} - Return on Assets (Profitability)
ROE_{it} - Return on Equity (Profitability$_2$)
LIQ_{it} - Acid-Test Ratio (Liquidity)
LEV_{it} - Leverage Ratio
TUR_{it} - The Asset Turnover (Operating Efficiency)
SIZ_{it} - Total Assets (The size of company)
u_{it} - Error Term

3.2. Dependent variable (systematic risk-Beta)

The relationship between the return of a financial instrument or security and the return of the market portfolio is shown with the Beta coefficient *(β)* and is a measure of systematic risk (Sharpe, 1963; as cited in Karadeniz et al. 2015). Beta coefficient is statistically the ratio of the covariance between the return *(r_i)* provided by security and the

market portfolio return *(r_m)* to the variance of the market return (Cuthbertson, 1996):

$$\beta_i=\frac{Cov(r_i,r_m)}{Var(r_m)}$$

3.3. Detecting multicollinearity problem

Correlation analysis is used to determine whether there are multiple relationships between variables. According to the analysis results in Table 1, a high rate of correlation was found between *LIQ* and *CUR* variables. At the point of which variable to exclude from the analysis, the probability values of the variables included in the estimated regression model output were examined. As a result, the *LIQ* variable with the highest *p*-value was removed from the analysis.

Table 1

Correlation relations

	BETA	***SIZ***	***ROA***	***TUR***	***CUR***	***LEV***	***LIQ***	***ROE***
BETA	1,0000	-0,1642	-0,0385	-0,0534	0,1459	-0,0618	0,1510	-0,0356
SIZ	-0,1642	1,0000	-0,1717	0,1063	-0,5357	0,6642	-0,5355	0,0775
ROA	-0,0385	-0,1717	1,0000	-0,1072	0,2471	-0,2007	0,2555	0,8288
TUR	-0,0534	0,1063	-0,1072	1,0000	-0,3055	0,5018	-0,3267	0,1248
CUR	0,1459	-0,5357	0,2471	-0,3055	1,0000	-0,7189	0,9893	0,0223
LEV	-0,0618	0,6642	-0,2007	0,5018	-0,7189	1,0000	-0,7096	0,0619
LIQ	0,1510	-0,5355	0,2555	-0,3267	0,9893	-0,7096	1,0000	0,0375
ROE	-0,0356	0,0775	0,8288	0,1248	0,0223	0,0619	0,0375	1,0000

Source: Analysis output. Created by the author.

3.4. Cross section dependence

As a result of the test carried out to determine the cross-section dependency, the *H_0* (Null Hypothesis) hypothesis was rejected. It was concluded that there was a cross-section dependence between the error terms. Table 2 shows the cross-section dependency test results.

Table 2

Cross section dependency results

Test	**Statistic**	**d.f.**	**Prob.**
Breusch-Pagan LM	593.7243	91	0.0000
Pesaran scaled LM	37.26440		0.0000
Pesaran CD	6.688590		0.0000
H_0: There is no cross-sectional dependency between error terms. REJECTED.			

Source: Analysis output. Created by the author.

3.5. Second generation Unit Root Tests

The second-generation unit root test was carried out since the cross-sectional dependency determined between the series. Series considered stationary when the *CIPS (t-bar)* statistic is greater than the critical values. According to Table 3, there is a unit root problem at the level in all series. It has been observed that the series whose first differences taken have become stationary.

Table 3

Second generation Unit Root Test results

	BETA	***SIZ***	***ROA***	***TUR***	***CUR***	***LEV***	***ROE***	***LIQ***
Level-CIPS (t-bar)	-1.06312	-1.98023	-1.66515	-1.38935	-1.78961	-1.37844	-1.99233	-1,95031
First Differences-CIPS (t-bar)	-4.01558	-4.41250	-2.45412	-3.21112	-4.55240	-3.50786	-3.36475	-3.86279
Level (Critical Values)	1% (-2.47); 5% (-2.27); 10% (-2.15)							

Source: Analysis output. Created by the author.

3.6. Autocorrelation problem analysis

In the continuation of the study, it is examined whether there was an autocorrelation problem between the series. The probability value is less than *0.05* in the *Breusch-Pagan LM test* results *(Table 2)* performed in order to determine the cross-section dependency. This result is an indication that there is an autocorrelation problem. *Durbin Watson's value*, one of the estimated regression model outputs, was below two and concluded a positive correlation.

3.7. Heteroscedasticity problem

Another pre-test performed in the study is the heteroscedastic test. For this purpose, the Panel Cross-section Heteroskedasticity LR Test was performed. According to the results below, H0 was rejected. Accordingly, there is a problem of variance in the model.

Table 4

Variable variance test

H₀: *Residuals are homoskedastic*	**Value**	**df**	**Prob.**
Likelihood ratio	150.1423	14	0.0000

Source: Analysis output. Created by the author.

3.8. Model selection

In the next stage of the study, analyses were conducted to decide on the panel regression model. For this purpose, the F test was performed first. Pooled Model - Fixed Effects Model tested with the test

whose results are given in Table 5. According to the results given in Table 5, H_0 could not be rejected because the probability was more significant than *0.05*. H_0 hypothesis states that the pooled model is the most suitable. According to the test results in Table 5, the hypothesis does not reject since this model's probability values are higher than the margin of error *(0.05)* determined in the study. This result shows that no unit or time effects in the model and the *Pooled OLS* model are suitable.

In the second stage of the model selection, Pooled-Random Effects Models were compared using the *LM test,* and the most suitable model was tried to be determined. In Table 5, the probability value is more significant than *0.05*. Therefore, the H_0 hypothesis, which states that the model is suitable for the pooled model, cannot reject. As a result, it was decided that the pooled model is more suitable. According to these results, there is no need to perform the Hausman test.

Table 5

F Test and Breusch-Pagan LM Test results

Test Model	Test Method	Statistics	Possibility
Pooled-Fixed Effects	F Test	1.729065	0.0522
Pooled-Random Effects	LM Test (Breusch-Pagan)	2.521094	0.1123

Source: Analysis output. Created by the author.

3.9. The results of the analysis

Finally, the equation modelled in the study was estimated. The White period test, which enables the use of a resistant estimator that corrects standard errors, is used to overcome the autocorrelation and variance problem. Also, the *AR process* was applied to the model to eliminate the autocorrelation problem detected in the model.

Table 6 contains the estimation results for Model 1. According to Table 6, the analysis result was found to be meaningful. The R^2 value is *0.034223*. In other words, the financial ratios in the model can explain about *3.4%* of the changes in *Beta (systematic risk)*. It has been determined that the current ratio (this ratio has a high level of positive correlation with the acid test ratio, which is considered as the liquidity ratio) and leverage ratios positively affect the beta coefficient at the 5% significance level. However, the analysis results show that the effect of factors other than financial ratios included in this study is more critical on companies' systematic risks.

Table 6

Panel Regression results for Model 1

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.022739	0.009882	2.301084	0.0386
SIZ	-0.132823	0.108988	-1.218695	0.2446
ROA	-0.000889	0.002023	-0.439405	0.6676
TUR	-0.012099	0.028254	-0.428234	0.6755
CUR	0.004406	0.001713	2.572297	0.0232
LEV	0.159674	0.066378	2.405518	0.0318
ROE	0.000563	0.001009	0.557961	0.5864
AR(1)	0.171130	0.076731	2.230273	0.0440
Root MSE	0.144342	R-squared		0.034223
Mean dependent var	0.019884	Adjusted R-squared		0.019778
SD dependent var	0.147031	SE of regression		0.145570
Akaike info criterion	-0.999655	Sum squared resid		9.917222
Schwarz criterion	-0.929647	Log likelihood		245.9178
Hannan-Quinn criter.	-0.972127	F-statistic		2.369142
Durbin-Watson stat	2.040740	Prob(F-statistic)		0.021834
Inverted AR Roots .17				

Source: Analysis output

In *Model 2*, the acid-test ratio is used instead of the current ratio. The results obtained are as shown in Table 7. Accordingly, the results are similar to *Model 1*. Liquidity and leverage ratios at the *5%* significance level have a positive effect on systematic risk.

Table 7

Panel Regression results for Model 2

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LIQ	0.004894	0.001956	2.502030	0.0265
LEV	0.161191	0.066339	2.429794	0.0303
ROE	0.000566	0.001006	0.562608	0.5833
SIZ	-0.136071	0.108759	-1.251123	0.2329
ROA	-0.000884	0.002021	-0.437400	0.6690
TUR	-0.011969	0.028179	-0.424734	0.6780
C	0.022748	0.009833	2.313322	0.0377
AR(1)	0.171382	0.076260	2.247327	0.0426
Root MSE	0.144306	R-squared		0.034698
Mean dependent var	0.019884	Adjusted R-squared		0.020260
SD dependent var	0.147031	SE of regression		0.145534
Akaike info criterion	-1.000147	Sum squared resid		9.912344
Schwarz criterion	-0.930139	Log likelihood		246.0349
Hannan-Quinn criter.	-0.972619	F-statistic		2.403209
Durbin-Watson stat	2.040914	Prob(F-statistic)		0.020054
Inverted AR Roots .17				

Source: Analysis output

4. Conclusion and discussion

There are two essential factors to consider in financial transactions. These are return and risk. In financial literature, two types of risks are generally mentioned. The first is the systematic risk that all companies face, a market risk that cannot avoid or control; the second is the unsystematic risk faced by some companies, which is a preventable or minimized risk.

One of the most important factors to consider in financial decisions is systematic risk. The systematic risk is measured by the beta coefficient *(β)* in this study. This coefficient is also a measure of the closeness of the return rate or profit of stock to the change in the rate of return or profit of the market index. The beta factor has a vital role to play because it enables the relationship between company decisions and the stock market. Incorrect decisions and choices of managers responsible for companies' financial decisions can adversely affect the expectations of all stakeholders of the business, especially investors, regarding the valuation of stocks. Since the systematic risk *(β)* cannot be controlled and reduced, it plays a vital role in company executives' and investors' decisions.

In studies conducted in finance, the relationships between financial ratios such as liquidity ratio, current ratio, leverage, return on assets, asset turnover, firm size, and the Beta coefficient were examined frequently. Generally, significant relationships had been determined in these studies. Findings obtained from this study are in general agreement with the literature mentioned above. Although it has not been addressed in the technology sector, studies on other sectors have intensely examined the relationship between leverage ratio and systematic risk. In these studies, in general, significant relationships between these two financial phenomena have been identified. When all other factors affecting a firm's risk are considered constant, high financial leverage increases its risk level. Hence, higher financial leverage increases the Beta of the firm's equity. Because other factors are equivalent, and a high leverage ratio increases the variability of firms' income. In this study, the findings obtained in the context of leverage ratio are similar to the findings of previous studies by Huffman (1989), Mandelker and Rhee (1984), Tanrıöven and Aksoy (2011), and Alaghi (2011), while Karadeniz et al. (2015), different from the results of the study.

Another finding is the positive relationship between the current and acid-test ratios and the beta coefficient. It is determined, in the correlation analysis section of the study that was performed for multicollinearity research, the acid test and current ratios were highly positively correlated. Therefore, the current ratio and liquidity ratio are included in the analysis separately. As stated in the study by Borde (1998), high liquidity is perceived as an indicator that the available resources are not used wisely; it is a factor that can increase the risk perception of the investors. Therefore, it is significant that the relationship between beta coefficient and liquidity ratios is positive. While the findings obtained in the context of liquidity ratio had similar results to the previous study by Kim et al. (2007) and Uyar and Çağlak (2019), it is different from the results of the study conducted by Lee and Jang (2007), Karadeniz et al. (2015) and Hosseinpour and Saeidi (2016).

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