
Theory Methodology Practice



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The Role of Using CAMELS Model in Analyzing the Factors Affecting the Performance of The Jordanian Commercial Banks (2014-2019)

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SUMMARY

In this study, the factors affecting the performance of Jordanian commercial banks have been analyzed using the elements of the CAMELS model, along with identifying the most important factors. The study targeted the impact of twenty Jordanian commercial banks on performance-; these banks were listed on the Amman Stock Exchange during the period of 2014-2019. The researcher used the Data Pooled Regression Method, due to its relevance to the nature of the data used in the study, where this method is used in the case of a time series and cross-sectorial data. The Rate of Return on Assets and the Rate of Return on Equity were used as the two variables on which the banks' performance was measured. However, the independent variables included the CAMELS model elements which are capital adequacy, asset quality, management efficiency, earnings, liquidity, and sensitivity to market risks, in addition to macroeconomic variables, which include the rate of economic growth and the rate of inflation. The study concluded that capital adequacy, asset quality, management efficiency, and earnings are among the most important and most influential factors with regards to the Jordanian commercial banks, which - are is represented by the Rate of Return on Assets and the Rate of Return on Equity. Moreover, the study also concluded that it is possible to derive a miniature model from the CAMELS model called the CAME model, which has a great ability to explain and measure the performance of commercial banks in Jordan. Finally, the study recommended the Central Bank of Jordan to use the CAMELS model to evaluate Jordanian commercial banks.

Keywords: Performance Evaluation, CAMELS model, Return on Equity, Return on Assets, Jordanian Banks.

Journal of Economic Literature (JEL) codes: F65, G21

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INTRODUCTIONS

Banks have a great importance in the economies of developed and developing countries alike, due to several reasons, such as the large proportion of banks compared to other types of companies, and the multiplicity of Stakeholders who have a relationship with the Bank as shareholders, depositors and borrowers. The country's economic situation along with the effectiveness of the monetary policy depends on the situation of the financial system, - in particular of the banks (Swyngedouw et al ,2002). In light of the crucial

role of banks, and in view of the multiplicity of banks' stakeholders, it has become necessary to impose direct monitoring over banks in order to ensure their safety and durability, and to avoid exposing the banks to any undesirable events that may affect them, the stakeholders, and the economy as a whole. Hence it has increased the importance of banks monitoring by authorities, since-it plays an important role in protecting the rights of depositors, shareholders, customers and various stakeholders in the bank-.n addition - it strengthen-s the confidence in the banking sector-and - enhances the monetary and - banking stability. (Mishkin ,2001) and (Noy ,2004) indicated

that the weakness of the monitoring and supervisory systems in - banks is regarded as one of the most important factors- which leads to bank failure and generate banking crises. Central banks are one of the most important supervisory bodies over banks due to the existence of a legal basis that enables them to exercise monitoring over banks- this field banks usually use a group of monitoring tools in both the field and the office. One of the most important tools is the CAMELS Model, which evaluates the whole bank situation and identifies its strengths and weaknesses. The CAMELS model is defined as a comprehensive assessment tool used by oversight bodies to assess the financial strength of banking institutions. This model includes six basic dimensions, which are the Capital Adequacy, Assets Quality, -Management -Efficiency, Earnings, Liquidity, and Sensitivity to market risk. The name of the model reflects the first letter of each of the above dimensions. Based on the foregoing, this study comes to analyze the factors affecting the performance of the Jordanian commercial banks using the elements of the CAMELS model, and to determine the factors that most affect the performance of these banks. In this regard, it is noted that many previous studies that examined the performance of banks used macroeconomic variables as intermediate variables, due to the presence of a significant impact of the country's economic condition on the bank's performance indicators. Therefore, the current study will use two variables of the macroeconomic, the rate of economic growth and the rate of inflation in order to extract the net effect of the CAMELS model elements on the banks performance indicators. The importance of this study stems from the fact that it links the elements of -the CAMELS model, and the performance of Jordanian commercial banks, -as the CAMELS model, is one of the most important tools that Central banks use to evaluate and - monitor banks to -ensure (Thagunna and Poudel ,2013), the integrity and durability of the banking system. Moreover, the central bank of Jordan uses this method to evaluate the performance of banks in Jordan. Therefore, the results obtained by this study is of great importance to banking regulators because it gives them more understanding of the impact of the CAMELS model elements on the performance of banks, and it also gives the benefit of determining the most influential elements of the model on the banks performance. This study also adds to the previous studies and opens new horizons for future studies, because it follows the same methodology used by the regulatory authorities for the purposes of bank performance assessment. This study is trying to answer the following questions:

- What is the effect of the bank specific variables represented in Elements of the

CAMELS model on the performance of the Jordanian banks?

- What is the impact of macroeconomic variables on the performance of the Jordanian commercial banks?

THEORETICAL-FRAMEWORK OF THE STUDY

Evaluation of bank performance

The Bank's performance evaluation aims to ensure that the resources available -for it are used efficiently, therefore it is a comprehensive process in which all Data, accounting, etc., determine the financial situation of the bank, and specifying how its resources were managed during a specified period of time. The financial performance of banks is defined as all the activities and efforts made by the banks to play their role and carry out their functions to provide banking services (Berger et al, 2005). The financial performance of the bank is an important mean for diagnosing weakness and strength -in the performance and the various activities of the bank, which are aimed at providing the necessary information to take appropriate measures to guarantee the bank's achieving revenues and profits and to remain in the competitive market (Nadiri, et al ,2009).

Also, the evaluation of financial performance is also an important and necessary process to know the extent to which the bank has achieved its plans and objectives, which are an imperative pillar of its work monitoring. The importance of evaluating the performance of banks stem from several aspects, most notably that it constitutes the basis for measuring the bank success and the extent to which it seeks to follow up on its activity to achieve its objectives, and that it provides an information system for the purpose of planning, monitoring and decision making (Soana ,2011). For a successful performance assessment three pillars must be taken into consideration:

1. Economy in the use of resources: -The bank is efficient when -obtaining good economic resources at the lowest possible cost, and this requires the existence of an effective monitoring system within the bank (Buyya& Venugopal, 2005).
2. Efficiency: Is the optimal use of available resources to achieve a certain volume or level of output at the lowest costs, and it is one of the most important measures of success for organizations in achieving their goals (Gunasekaran & Kobu ,2007).
3. Effectiveness: This reflects the extent to which the bank has achieved its main and minor

objectives, and the consistency of the achieved objectives with the planned objectives-. It also reveals -deviations, their causes, and the ways to correct and avoid them in the future. (Dibbern et al ,2004).

Performance evaluation criteria are based on a set of criteria that can be used to measure and compare the level of performance, which includes the following (Hashimoto et al ,1982).

1. Historical criteria: They are based on a comparison between the current financial indicators and the historical indicators of the bank and determine the extent of improvement or decline in those indicators.
2. Targeted criteria: It is based on comparing the bank's performance with the planned standards.
3. Industry criteria: These are based on the comparison between the bank's performance with the rest of the banks.

CLASSIFICATION SYSTEM (CAMELS)

The CAMELS system is one of the most important classification systems -used by the world's supervisory bodies to assess safety of banks-. The history of this system dates back to November of 1979 when it was first used by the American Federation Council for the Examination of Financial Institutions, after which this system was adopted by the National Credit Union Administration (NCUA) in the USA in October of the year 1987 (Cole & Gunther ,1998). The word indicates (CAMELS) the first letters of the components of this system, which includes six elements, Capital Adequacy ,Asset Quality, Management, Earnings, Liquidity, and Sensitivity to Market Risk (Guan et al ,2019). The CAMELS system is based on a quintuple classification -ranging from one to five, as the following : Rating 1 is the best rating and reflects the soundness of the bank's operations and the presence of strong performance and risk management practices, while rating (5) is the worst rating for the bank because it reflects that the bank's performance is not satisfactory and indicates a high probability of bank failure, and also the presence of significant challenges -to be faced by the management-.Usually the following procedures here carried out by the supervisory authorities-are to liquidate the bank, or resort to merger and acquisition(Hashemi et al ,1998).

METHODOLOGY

By going through the methodologies of previous studies, which aimed at knowing the effect of the CAMELS model elements on the performance of

commercial banks including studies such as (Nguyen et al ,2020) and (Sangmi et al ,2010). In light of the objectives of this study to be achieved, a standard model for the current study was developed, which tests the effect of CAMELS model elements and the macroeconomic variables on the performance of the Jordanian commercial banks. This form is formulated as follow:

$$Performance = (CAMELS, Macroeconomic, \epsilon) . \dots (1)$$

Whereas, performance refers to the performance measures of Jordanian commercial banks, which include the Rate of Return on Assets (ROA), and the Rate of Return on Equity (ROE). CAMELS refers to the elements of the CAMELS model, where Macroeconomic is the macroeconomic variable, and ϵ is the random error coefficient. Through the previous model, two sub-models of the study can be formulated as follows:

$$ROAi, = \beta_1 + \beta_2Ci, + \beta_3Ai, + \beta_4Mi, + \beta_5Ei, + \beta_6Li, + \beta_7Si, + \beta_8GRTHt + \beta_8Inft + \epsilon, \dots (2)$$

$$ROEi, = \beta_1 + \beta_2Ci, + \beta_3Ai, + \beta_4Mi, + \beta_5Ei, + \beta_6Li, + \beta_7Si, + \beta_8GRTHt + \beta_8Inft + \epsilon, \dots (3)$$

Whereas $ROAi$, is the rate of Return on Assets for the bank i per year t , and $ROEi, t$ is the Return on Equity for the bank i per year t . The independent variables however, include elements of the six CAMELS model, Ci,t is the bank's capital adequacy i per year t , and Ai,t is the quality of the bank's assets for the Bank i per year t , Mi,t is the bank management efficiency i per year t , Ei,t is the bank earnings i per year t , Li,t is the bank liquidity i per year t , Si,t is the sensitivity to market risk of the bank i per year t , the macroeconomic variables include two variables, $GRTHt$ -which reflects the rate of economic growth per year t , and $Inft$ which is the inflation rate per year t .

PROCEDURAL DEFINITIONS OF STUDY VARIABLES

The Dependent variables

Previous studies include several measures of bank performance, including the most important ones, which are the Return on Assets and the Return on Equity and these measures will be used in the current study.

1. The Rate of Return on Equity: This scale refers to the achieved net profit on the investors' money in the bank. It also refers to the return achieved by investors in the bank, and it shows the bank effectiveness in using the investors' money (Arditti ,1967). The rate of Return on Equity is estimated through dividing the after tax on the total Equity.

2. The Rate of Return on Assets: The rate of Return on Assets measures the achieved net profit on assets invested in the bank, and it shows how much profit is achieved by a company for every JOD of its assets, therefore it is considered as an important indicator of the administrative efficiency in the bank. Moreover, this scale presents the extent of Effectiveness of managing the bank's assets to achieve profits (Burton et al ,2002). The Rate of Return on Equity will be calculated through dividing the net profit after tax on the total Equity of the bank.

THE INDEPENDENT VARIABLES

CAMELS model elements

The study will rely on the six elements of the CAMELS model to explain the financial performance of banks, and these elements include the following:

1. Capital Adequacy Ratio: The capital adequacy ratio reflects the ability of the bank's capital to afford the unexpected losses and to satisfy the obligations, and Capital Adequacy Ratio will be measured in accordance with the instruction - regarding capital adequacy issued by the Jordan central bank. (Moyer ,1990). The capital adequacy ratio according to (Fouche et al,2006) is defined as a measurement of a bank's available capital expressed as a percentage of a bank's risk-weighted credit exposures. The capital adequacy ratio, also known as capital to risk weighted assets ratio, is used to protect depositors and promote the stability and efficiency of financial systems around the world.
2. Asset Quality: is of particular importance in the appraisal system because it is the critical part of a bank's business that leads its operations towards generating revenues, because the bank's possession of good assets will mean generating more income and better valuation both for liquidity, management and for capital-. Asset Quality is measured by dividing the non-performing loans by the bank's total loans. (Chan et al ,1986). The quality of assets is classified based on the study of the following issues:
 - a) The size and severity of non-performing assets in relation to the total capital.
 - b) The size and trends of the loan repayment terms that are past due, and the measures taken to reschedule them.
 - c) Large credit concentrations and the risks of the single borrower or related borrowers.
 - d) Amount and management's treatment of employee loans.
3. Management Quality: This element includes the analysis of five qualitative indicators, which are mainly: governance, human resources, procedures, control, audit, information system and strategic planning (Saraph et al ,1989). Therefore, the quality of the bank's management is evaluated through the following criteria:
 - a) Governance: where the work of the board of directors is evaluated on the basis of the diversity of technical expertise and its ability to make decisions independently of management, effectively and flexibly (Tushman & Nadler ,1986).
 - b) Human Resources: It constitutes the second criterion that evaluates whether the Human Resources Department provides advice and guidance and has a clear impact on users, through the recruitment and training criterion as well as the workers' motivation system and the performance appraisal system (Diallo et al ,2003).
 - c) Monitoring and auditing process: where the degree of formation of the basic processes and their effectiveness in managing risks at the organization level -are evaluated, through an evaluation of the internal control system and the quality of internal and external audits. (Dipper ,1998).
 - d) Information system: which evaluates the efficiency and effectiveness of the information system in providing accurate and timely annual reports (Narasimhan & Kim ,2001).
 - e) Strategic planning: which determines whether the organization has developed an integrated approach to short- and long-term financial projections (Kotler& Murphy ,1981).
4. Earnings: is one of the most important ratios that measure the performance of the bank. Earnings is the main objective of the banks and the prime source of increase in capital of a bank. The ratio that is used to evaluate the earnings is the interest margin to gross income (Sayed, G & Sayed, N,2013). The bank's earnings through net interest margin will be calculated by dividing the difference between the interest received and the interest paid by the total income. (Maudos & De Guevara, 2004).
5. Liquidity Position: Liquidity in the bank is one of the most important indicators that customers rely on in comparing banks, as it represents Liquidity is the most important means of protecting the bank from the risk of bankruptcy through its ability to meet the obligations that are distinguished with immediate payment, banks have this feature without other institutions because they cannot postpone cashing a check drawee, or postpone the payment of a deposit payable, and it cannot demand the debtors to pay loans -that they owe -and financing which have not yet matured, in addition, it is difficult to predict the

size and timing of the movement of funds from and to the bank, and which constitutes a great difficulty for the management of the bank (Qin & Pastory ,2012). Liquidity can be defined in general as the ability to convert assets into cash quickly and without realizing -loss (Arif & Anees ,2012). As for liquidity in the bank, it can be defined as the bank's ability to meet depositors' withdrawals and meet the needs of financiers in a timely manner and without having to sell securities at large losses or borrow with high interest, Liquidity is measured by dividing the bank's liquid assets by the total assets (Acharya et al ,2012).

6. Market risk sensitivity: In light of the financial and banking developments that occurred at the international level, which made banks more vulnerable to financial crises, it is necessary to focus on many topics in this regard, including the sensitivity of the bank's net profits to different expectations of changes in interest rates, fluctuations in foreign exchange centers, and in prices securities, in addition to measuring and following up on many risks, the most important of which are: Credit risk, Price risk -and Marketing-risks.

Macroeconomic variables: the study will depend on two macroeconomic variables, namely the economy growth rate and the rate of inflation. The economic growth rate will be measured by the annual rate of change in the GDP at constant market prices, while -inflation rate will be measured by calculating the annual rate of changes in the Consumer Price Index.

STUDY POPULATION AND SAMPLE

The study population consists of all Jordanian commercial banks listed on the Amman Stock Exchange, which were 20 at the end of 2019, and the study will be based on all Jordanian commercial banks that make up the study population, after excluding Islamic banks -because of the difference in its structure and the laws followed within Islamic banks. The data, which is the annual financial statements of these banks has been acquired for calculating the variables based on the companies guide issued by the Amman Stock Exchange during the period 2014-2019, -in addition to the annual reports issued by the banks included in the study sample.

DESCRIPTIVE STATISTICS

Table (1) shows the specific descriptive statistics with the variables of the study, and through the previous

table, it can be noted that the average rate of return on assets for the Jordanian commercial banks during the study period -amounted to about 1.3%. This rate ranged from 0.0% to 2.5%, with a standard deviation of 0.5 %. Previous statistics indicate that there is a clear discrepancy in the rate of return on assets among commercial banks-, while the average rate of return on equity for the Jordanian commercial banks during the study period was about 9.0%. This rate ranged from 1.4-% to 16.9%, with a standard deviation of 3.6%. Previous statistics indicate a clear discrepancy in the rate of return on equity among commercial banks. As for the components of the CAMELS model, the average capital adequacy ratio of the Jordanian commercial banks during the study period was about 16.7%, and the ratio ranged from 13.0% to 24.2%, with a standard deviation of 2.1%. The previous statistics indicate that the Jordanian commercial banks enjoy high capital adequacy ratios that exceed the minimum required by the Central Bank of Jordan of 12%, as well as the minimum required by the Basel Committee of 8%. The average asset quality which was measured by the ratio of inactive loans to the Jordanian commercial banks was about 9.9%, the percentage ranged from 2.6% to 22.4%, with a standard deviation of 4.3%. The ratios of inactive loans are generally accepted as they are less than 10%, which reflects the high quality of the assets of the Jordanian commercial banks in general, but it is noted that the banks suffer from a rise in the inactive loan's ratio, which indicates the low-quality assets. As for the management, the average operating expenses ratio to the total assets of the Jordanian commercial banks is about 2.6%, and this percentage ranged from 1.3% to 4.3% with a standard deviation of 0.7%. From the above, it is clear that the Jordanian commercial banks are characterized by similar levels of operational expenses, with no significant fluctuation in the ratio during the study period, which indicates the efficiency of the Jordanian commercial banks departments. As for earnings, the average net interest margin ratio to the total assets of Jordanian commercial banks during the study period, is about 69.3 %, and this rate ranged from 51.8% to 81.9%, with a standard deviation of 5.8%. From the above, it is noted that the Jordanian commercial banks are characterized with-relatively high interest rates, as it constitutes more than two-thirds of its sources of income. The average liquidity ratio of the Jordanian commercial banks during the study period was about 24%, and the percentage ranged from 12.5% to 36.7% with a standard deviation of 5.9 %. From the above, it is noted that the Jordanian commercial banks maintained good liquidity ratios and enough to meet any unexpected needs. The average sensitivity to market risk was measured by the ratio of securities to total assets of the Jordanian commercial banks during the study period,

which was about 25%, the percentage ranged from 11.1% to 37.9 %, with a standard deviation of 6.3%. Previous statistics indicate that about a quarter of the Jordanian commercial bank's assets are exposed to market risks, which - reflects their high sensitivity to these risks. With regard to macroeconomic variables, the average economic growth rate during the study period was 3.2%, and the growth rate ranged from 2.3 % to 5.5% with a standard deviation of 1.6%. The average inflation rate was 3.4%, which ranged from -

0.7% to 4.8%. Other statistics including Skewness and Kurtosis indicate that the shape of the distribution of the dependent variables is close to the shape of the normal distribution, this is confirmed by the Jarque_Bera statistic, which reflects that the distribution of the two dependent variables follows a normal distribution, and the number of observations reached 91 views, which reflects the data of 20 banks over the six years' period.

Table 1
Descriptive statistics for the study variables during the period 2014-2019

	Capital Adequacy Ratio	Return on Equity	Return on Assets	Assets Quality	Inflation	Liquidity	Earnings	Sensitivity to market risk	average economic growth rate	Management Efficiency
Minimum	0.12876	-0.01451	-0.00157	0.02610	-0.73974	0.12482	0.51771	0.11111	2.31150	0.01258
Maximum	0.24160	0.16964	0.02526	0.22400	4.83933	0.36652	0.81938	0.37881	5.47708	0.04293
Mean	0.16720	0.09013	0.01313	0.09901	3.41793	0.23993	0.69283	0.24893	3.15854	0.02645
Median	0.16816	0.09073	0.01386	0.09000	4.34224	0.23512	0.68637	0.24160	2.73980	0.02590
Std. Dev	0.02080	0.03563	0.00510	0.04322	1.98435	0.05874	0.05790	0.06302	1.07074	0.00671
Kurtosis	3.98040	3.48407	3.48203	3.50032	3.40444	2.26164	3.37598	2.32691	3.86010	2.72851
Skewness	0.69732	-0.29150	-0.58931	0.87833	-1.40506	0.20204	-0.32086	0.32696	1.59210	0.30613
Probability	0.00981	0.39509	0.10638	0.00442	0.00000	0.31624	0.40702	0.23905	0.00000	0.48243
Jarque-Bera	9.4586	1.8724	4.4637	10.9125	26.1961	2.3025	1.7978	2.8622	35.3264	1.4578
Observations	91	91	91	91	91	91	91	91	91	91
Cross-sections	20	20	20	20	20	20	20	20	20	20

Source: Central Bank of Jordan, annual report, various issues.

Source: Association of Banks in Jordan, annual report, various issues.

Source: Amman Stock Exchange, annual report, various issues.

REGRESSION ANALYSIS RESULTS

This part aims to test the effect of the elements of the CAMELS model on the performance Jordanian commercial banks, commercial banks, and will use the Data Pooled Regression Method, due to its relevance to the nature of the data used in the study, where this method is used in the case of a time series and cross-

sectorial data. Table (2) shows the regression analysis outputs for the study models, based on this table, it can be seen that the ratio of capital adequacy, management efficiency and earnings have positive and statistically significant effect at 5% level on the rate of return on assets and the rate of return on equity, which indicates that a high capital adequacy, high management efficiency and high earnings will help improve the bank's performance. However, the assets quality has a

negative and significant statistical effect at the 5% level on the rate of return on assets and the rate of Return on Equity, which indicates that the bank's asset quality rises from the decline in the ratio of inactive loans will contribute to improving bank performance (Jha and Hui ,2012). The table also shows that the liquidity ratio or Sensitivity to Market Risk have no effect with a

statistical significance on Return on Assets or Return on Equity. Moreover, the macroeconomic variables - represented in the rate of economic growth and the rate of -inflation had no statistically significant effect on the rate of return on assets or the rate of return on equity (Onjala,2012).

Table (2)
The results of the regression analysis () of the study model*

Variable	Model 1: Return on Equity			Model 2: Return on Assets		
	t-Statistic	Coefficient	Prob.	t-Statistic	Coefficient	Prob.
Constant	1.2738	0.0845	0.2255	-0.3088	-0.0033	0.7614
Capital Adequacy Ratio	2.2852	0.1355	0.0426	4.6681	0.0764	0.0000
Assets Quality	-4.8866	-0.4548	0.0000	-7.1113	-0.0759	0.0000
Management Efficiency	2.8721	1.4811	0.0050	3.1065	0.2016	0.0027
Earnings	2.5929	0.0907	0.0236	2.3140	0.1131	0.0352
Liquidity	1.3966	0.0566	0.1732	1.6947	0.0095	0.0946
Sensitivity	-0.4591	-0.0182	0.6690	0.5154	0.0033	0.6079
Average Economic Growth Rate	-1.0249	-0.0093	0.3156	-0.9908	-0.0013	0.3253
Inflation	-0.5879	-0.0027	0.5771	-0.5275	-0.0004	0.5996
R-squared	0.5123			0.6521		
Adjusted R-squared	0.5571			0.5417		
Durbin-Watson Stat	1.8112			1.9449		
F-statistic	9.119			11.846		
Prob(F-statistic)	0.0000			0.0000		

(*) Method: Pooled EGLS (Cross-section weights)

- White diagonal standard errors & covariance (d.f. corrected).

Source: Own calculations

CONCLUSION AND RECOMMENDATION

This study aimed at analysing the factors affecting the performance of the Jordanian commercial banks using CAMELS model elements, and to determine the factors that most affect the performance of these banks. The results indicated that Jordanian commercial banks are characterized by high capital adequacy ratios that exceed the minimum required by the Central Bank of Jordan and the Basel Committee, it is also distinguished by the high quality of its assets, the efficiency of its management, and their ability to

achieve relatively high profit margins-.In addition, the Jordanian commercial banks maintain a good and sufficient liquidity ratios to meet any unexpected needs, -however, there has been an increase in their Sensitivity to Market Risk. The results also indicated that capital adequacy, asset quality, efficiency of management and earnings are among the most important and influential factors on the performance measures of the Jordanian commercial banks, represented by the rate of return on assets and rate of return on equity. For the purposes of evaluating the performance of the Jordanian commercial banks, this study recommend that it is possible to rely on a miniature model of the CAMELS model, which is the CAME model, which has a great ability in interpreting and measuring the performance of the Jordanian

commercial banks, and this model includes four components, namely, capital adequacy, asset quality, management efficiency, and earnings. This, however, does not mean that the rest of the elements should be neglected, because they have effects on the other aspects of the banks such as risks of all kinds. The study also recommends the Central Bank of Jordan,

when evaluating the performance of banks, to give importance to the four most influential elements on the performance of banks, which includes CAME elements in order to reach a more suitable tool for the assessment of the Jordanian commercial bank's performance.

REFERENCES

- ACHARYA, V. V., GROMB, D., & YORULMAZER, T. (2012). Imperfect competition in the interbank market for liquidity as a rationale for central banking. *American Economic Journal: Macroeconomics*, 4(2), 184-217. DOI: [10.1257/mac.4.2.184](https://doi.org/10.1257/mac.4.2.184)
- ARDITTI, F. D. (1967). Risk and the required return on equity. *The Journal of Finance*, 22(1), 19-36. <https://doi.org/10.2307/2977297>
- ARIF, A., & ANEES, A. N. (2012). Liquidity risk and performance of banking system. *Journal of Financial Regulation and Compliance*. <https://doi.org/10.1108/13581981211218342>
- Association of Banks in Jordan, annual report, various issues. <https://uabonline.org/the-association-of-banks-in-jordan>.
- BERGER, A. N., MILLER, N. H., PETERSEN, M. A., RAJAN, R. G., & STEIN, J. C. (2005). Does function follow organizational form? Evidence from the lending practices of large and small banks. *Journal of Financial Economics*, 76(2), 237-269. <https://doi.org/10.1016/j.jfineco.2004.06.003>
- BURTON, R. M., LAURIDSEN, J., & OBEL, B. (2002). Return on assets loss from situational and contingency misfits. *Management science*, 48(11), 1461-1485. <https://doi.org/10.1287/mnsc.48.11.1461.262>
- BUYAYA, R., ABRAMSON, D., & VENUGOPAL, S. (2005). The grid economy. *Proceedings of the IEEE*, 93(3), 698-714. doi: 10.1109/JPROC.2004.842784.
- Central Bank of Jordan, annual report, various issues. <https://www.cbj.gov.jo/Pages/viewpage.aspx?pageID=176>
- CHAN, Y. S., GREENBAUM, S. I., & THAKOR, A. V. (1986). Information reusability, competition and bank asset quality. *Journal of Banking & Finance*, 10(2), 243-253. [https://doi.org/10.1016/0378-4266\(86\)90008-7](https://doi.org/10.1016/0378-4266(86)90008-7)
- COLE, R. A., & GUNTHER, J. W. (1998). Predicting bank failures: A comparison of on-and off-site monitoring systems. *Journal of Financial Services Research*, 13(2), 103-117. <https://doi.org/10.1023/A:1007954718966>
- DIALLO, K., ZURN, P., GUPTA, N., & DAL POZ, M. (2003). Monitoring and evaluation of human resources for health: an international perspective. *Human resources for health*, 1(1), 1-13. <https://doi.org/10.1186/1478-4491-1-3>
- DIBBERN, J., GOLES, T., HIRSCHHEIM, R., & JAYATILAKA, B. (2004). Information systems outsourcing: a survey and analysis of the literature. *ACM SIGMIS Database: the DATABASE for Advances in Information Systems*, 35(4), 6-102. <https://doi.org/10.1145/1035233.1035236>
- DIPPER, B. (1998). Monitoring and post-auditing in environmental impact assessment: a review. *Journal of environmental planning and management*, 41(6), 731-747. <https://doi.org/10.1080/09640569811399>
- FETHI, M. D., & PASIOURAS, F. (2010). Assessing bank efficiency and performance with operational research and artificial intelligence techniques: A survey. *European journal of operational research*, 204(2), 189-198. <https://doi.org/10.1016/j.ejor.2009.08.003>
- FOUCHE, C. H., MUKUDDEN-PETERSEN, J., & PETERSEN, M. A. (2006). Continuous-time stochastic modelling of capital adequacy ratios for banks. *Applied Stochastic Models in Business and Industry*, 22(1), 41-71. <https://doi.org/10.1002/asmb.609>
- GUAN, F., LIU, C., XIE, F., & CHEN, H. (2019). Evaluation of the competitiveness of China's commercial banks based on the G-CAMELS evaluation system. *Sustainability*, 11(6), 1791. <https://doi.org/10.3390/su11061791>
- GUNASEKARAN, A., & KOBU, B. (2007). Performance measures and metrics in logistics and supply chain management: a review of recent literature (1995-2004) for research and applications. *International journal of production research*, 45(12), 2819-2840. <https://doi.org/10.1080/00207540600806513>
- HASHEMI, R. R., LE BLANC, L. A., RUCKS, C. T., & RAJARATNAM, A. (1998). A hybrid intelligent system for predicting bank holding structures. *European Journal of Operational Research*, 109(2), 390-402. [https://doi.org/10.1016/S0377-2217\(98\)00065-4](https://doi.org/10.1016/S0377-2217(98)00065-4)

- HASHIMOTO, T., STEDINGER, J. R., & LOUCKS, D. P. (1982). Reliability, resiliency, and vulnerability criteria for water resource system performance evaluation. *Water resources research*, 18(1), 14-20. <https://doi.org/10.1029/WR018i001p00014>.
- JHA, S., & HUI, X. (2012). A comparison of financial performance of commercial banks: A case study of Nepal. *African Journal of Business Management*, 6(25), 7601-7611. <https://doi.org/10.5897/AJBM11.3073>.
- KOTLER, P., & MURPHY, P. E. (1981). Strategic planning for higher education. *The journal of higher education*, 52(5), 470-489. <https://doi.org/10.1080/00221546.1981.11778119>.
- MISHKIN F. (2001), Financial Policies and the Prevention of Financial Crises in Emerging Market Countries. NBER Working Papers, No:8087, National Bureau of Economic Research, Inc. <https://doi.org/10.3386/w8087>.
- NADIRI, H., KANDAMPULLY, J., & HUSSAIN, K. (2009). Zone of tolerance for banks: a diagnostic model of service quality. *The Service Industries Journal*, 29(11), 1547-1564. [HTTPS://DOI.ORG/10.1080/02642060902793425](https://doi.org/10.1080/02642060902793425).
- NGUYEN, A. H., NGUYEN, H. T., & PHAM, H. T. (2020). Applying the CAMEL model to assess performance of commercial banks: Empirical evidence from Vietnam. *Banks and Bank Systems*, 15(2), 177-186. [http://dx.doi.org/10.21511/bbs.15\(2\).2020.16](http://dx.doi.org/10.21511/bbs.15(2).2020.16).
- NOY I. (2004), Financial Liberalization, Prudential Supervision and the Onset of Banking Crises. *Emerging Markets Review*, No. 5: 341-359. <https://doi.org/10.1016/j.ememar.2004.05.001>.
- ONJALA, V. N. (2012). *Determinants of financial performance of commercial Banks in Kenya* (Doctoral dissertation). <http://erepository.uonbi.ac.ke:8080/xmlui/handle/123456789/14225>.
- SANGMI, M. U. D., & NAZIR, T. (2010). Analyzing financial performance of commercial banks in India: Application of CAMEL model. *Pakistan Journal of Commerce and Social Sciences (PJCSS)*, 4(1), 40-55. <http://hdl.handle.net/10419/187999>.
- SARAPH, J. V., BENSON, P. G., & SCHROEDER, R. G. (1989). An instrument for measuring the critical factors of quality management. *Decision sciences*, 20(4), 810-829. <https://doi.org/10.1111/j.1540-5915.1989.tb01421.x>.
- SOANA, M. G. (2011). The relationship between corporate social performance and corporate financial performance in the banking sector. *Journal of business ethics*, 104(1), 133-148. <https://doi.org/10.1007/s10551-011-0894-x>.
- SAYED, G. J., & SAYED, N. S. (2013). Comparative analysis of four private sector banks as per CAMEL rating. *Business Perspectives and Research*, 1(2), 31-46. <https://doi.org/10.1177/2278533720130204>.
- SWYNGEDOUW, E., MOULAERT, F., & RODRIGUEZ, A. (2002). Neoliberal urbanization in Europe: large-scale urban development projects and the new urban policy. *Antipode*, 34(3), 542-577. <https://doi.org/10.1111/1467-8330.00254>.
- MAUDOS, J., & DE GUEVARA, J. F. (2004). Factors explaining the interest margin in the banking sectors of the European Union. *Journal of Banking & Finance*, 28(9), 2259-2281. <https://doi.org/10.1016/j.jbankfin.2003.09.004>.
- MOYER, S. E. (1990). Capital adequacy ratio regulations and accounting choices in commercial banks. *Journal of accounting and economics*, 13(2), 123-154. [https://doi.org/10.1016/0165-4101\(90\)90027-2](https://doi.org/10.1016/0165-4101(90)90027-2).
- NARASIMHAN, R., & KIM, S. W. (2001). Information system utilization strategy for supply chain integration. *Journal of business logistics*, 22(2), 51-75. <https://doi.org/10.1002/j.2158-1592.2001.tb00003.x>.
- QIN, X., & PASTORY, D. (2012). Comparative analysis of commercial banks liquidity position: The Case of Tanzania. <http://dspace.cbe.ac.tz:8080/xmlui/handle/123456789/239>.
- THAGUNNA, K., AND POUDEL, S., (2013), Measuring Bank Performance of Nepali Banks: A Data Envelopment Analysis (DEA) Perspective. *International Journal of Economics and Financial Issues*, 3(1): 2013, pp.54-65. <https://www.proquest.com/scholarly-journals/measuring-bank-performance-nepali-banks-data/docview/1266465918/se-2?accountid=28062>
- Tushman, M., & Nadler, D. (1986). Organizing for innovation. *California management review*, 28(3), 74-92. <https://doi.org/10.2307/41165203>.

Trade impacts of the New Silk Road in Africa: Insight from Neural Networks Analysis

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SUMMARY

The Belt and Road Initiative (BRI) is aimed to strengthen the preferential reciprocal trade between China and the Belt-Road nations. Quantitative evaluations of BRI to determine whether it can explicitly provide more insight into China's bilateral trade among its partners are needed. Hence, improving prediction accuracy while using more superior algorithms for sustainable decision-making remains essential since decision-makers have been interested in predicting the future. Machine learning algorithms, such as supervised artificial neural networks (ANN), outperform several econometric procedures in predictions; therefore, they are potentially powerful techniques to evaluate BRI. This study uses detailed China's bilateral export data from 1990 to 2017 to analyze and evaluate the impact of BRI on bilateral trade using gravity model estimations and ANN analysis techniques. The finding suggests that China's bilateral export flow among the BRI countries results in a slight increase in inter-regional trade. The study provides a comparison view on the different estimation procedures of the gravity model – ordinary least squares (OLS) and Poisson pseudo-maximum likelihood (PPML) with the ANN. The ANN associated with fixed country effects reveals a more accurate estimation compared to a baseline model and with country-year fixed effects. Contrarily, the OLS estimator and PPML showed mixed results. Grounded on the study dataset, the ANN estimation of the gravity equation was superior over the other procedures to explain the variability of the dependent variable (export) regarding the prediction accuracy using root mean squared error (RMSE) and R-square.

Keywords: China's Belt and Road Initiative; Bilateral Trade; Gravity Model; Artificial Neural Network methodology; African Countries.

Journal of Economic Literature (JEL) codes: B17; F14; N77

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INTRODUCTION

The Belt and Road Initiative (BRI), regarded as “China's grand connectivity blueprint,” remains the most ambitious economic project that China has introduced since 2013 (Chung, 2018) (Khan et al., 2018) (Flint & Zhu, 2019). This project is designed to promote economic growth by reinforcing inter-regional cooperation over a vast area entailing sub-regions in Asia, Europe, and Africa. It has emphasized five priorities for China and the BRI participating nations, including policy coordination, unimpeded trade, facility connectivity, financial integration, and the bond

between people (Khan et al., 2018). Moreover, the project target to support infrastructure, trade, and investment links between China and some 65 other nations that can reach together over 30% of global GDP, 62% of the population, and 75% of known energy reserves (Huang, 2016). Therefore, the BRI initiative brings about a greater diversity of trade partners and trade patterns, giving the industry new opportunities to transform and upgrade itself. Throughout the past seven years, China's economic cooperation with the Belt-Road countries has attained substantial results. In the same vein, the bilateral trade between China and Belt-Road countries has considerably improved. As such, the total trade value

of goods between China and Belt-Road countries had exceeded \$7.8 trillion from 2013 to 2019, grounded on the data revealed by the Ministry of Commerce of China (*China's Trade with BRI Countries Surges to \$1.34 Trillion in 2019*, 2020). The Belt and Road Initiative, with unimpeded trade as one crucial objective, has become a principal new-round opening up plan and is considered as a tool for boosting China's foreign trade, especially with countries along the BRI (Boffa, 2018). Considering the indicated intention to encourage trade flows among economies included in the BRI, bilateral trade flow is an important economic indicator adopted by economists and policy-makers. It explains the value of goods and services that have been exported from one country to another, inducing international trade policy along with domestic economic policy in both countries.

Supporters stress that the New Silk Road, or BIR initiative, allows building novel infrastructure and providing economic assistance to needy economies. Critics of the projects argue that the initiative instead eases the Chinese economic and strategic dominion over the countries along these routes. However, trade facilitation may mitigate transaction costs, simplify trade procedures, and improve customs efficiency as a common rule (Moisé & Sorescu, 2013). Earlier studies that have attempted to build analysis systems for trade facilitation vary significantly regarding the indicators to be used. From this perspective, Raven (2001) argued that the indicators should include the customs environment, payment system efficiency, and business credibility. For Wilson et al. (2003), the indicators comprised four elements: port efficiency, customs environment, institutional environment, and e-commerce to find their evaluation system. Li & Duan (2014) selected six indicators, entailing port efficiency, customs environment, institutional environment, business environment, e-commerce, and market access, into the evaluation system, and used the entropy method to compute the trade facilitation scores of 109 countries in the World. Zhu & Lu (2015) used indicators based on five areas, including infrastructure and services, port efficiency, customs environment, information and communication technologies, and business environment, then adopted the Delphi method and analytic hierarchy process (AHP) to determine the weight of each indicator.

In connection with these, integrating a multi-analytic technique revealed how merging two diverse data analysis approaches in either methodology or analysis can support the validity and confidence in the output (Gbongli, 2017; Gbongli et al., 2019; Scott & Walczak, 2009; Gbongli et al., 2020). Regarding the various methods, a series of gravity models or computable general equilibrium (CGE) models have been extensively adopted to assess the effect of trade facilitation on trade flows (Dennis, 2006; Iwanow & Kirkpatrick, 2009; ZAKI, 2014). For instance, Y. B. Zhang & Liu (2016) took the extended trade gravity model to research the trade facilitation along “the Silk

Road Economic Belt.” Their finding showed a U-shaped distribution since Europe has demonstrated the highest levels of trade facilitation, east Asia revealed the middle levels. In contrast, countries in the middle of the belt presented the lowest levels, and the impact of trade facilitation on diverse regions disclosed notable heterogeneity (Y. B. Zhang & Liu, 2016). Traditionally, the multiplicative gravity model has been linearized and evaluated using either ordinary least squares (OLS) to assume that the error variance is constant across observations (homoscedasticity) or using panel techniques that the error is constant across countries as an alternative country-pairs. However, as Santos et al. (Silva & Tenreyro, 2006), when the issues of heteroscedasticity arise, OLS estimation may not be consistent and non-linear estimators should be adopted.

From this end, the combined methodology such as gravity model and artificial neural network (ANN) was applied in human mobility, particularly to predict human mobility within cities based on traditional and Twitter data (Pourebahim et al., 2018) to compare their performance and results. Conversely, there is a lack of this technique in studying bilateral trade flow amongst various countries. During the last decades, with the fast advancements in computer and information communication technologies (ICTs), adopting artificial intelligence-based techniques in time series or panel data forecasting has become a common practice among researchers. Analytical methods that embody complex computational algorithms may offer the most practical approach for assessing a multivariate response of a BIR project amongst various countries. Mainly, neural network models use computer-based learning methods that mimic the human brain's neuronal structure (Garson, 1991; Ripley, 1996). Therefore, artificial neural network-based models could predict international trade estimation as a promising forecasting tool.

In light of the above discussion, this paper aims to offer a quantitative analysis of the existing bilateral export linkages among economies regarding gross trade, mainly the bilateral trade flow between China and African Countries. Since the BRI is presented as an open arrangement in which all countries are welcome to participate, there is no official list of “BRI countries.” Different versions of unofficial lists of countries along the Belt and Road exist, none of which received confirmation from China (Boffa, 2018). The study proposes evaluating and predicting this bilateral trade using the hybrid methodology such as gravity model and ANNs. The non-linear and non-parametric model (i.e., ANN) is mainly assessed against the international model estimated using OLS regression and Poisson Pseudo Maximum Likelihood (PPML) precisely. The input to our algorithms is a set of economic and geographic variables as well as regional trade agreements, such as GDP, distance, and infrastructure between the importer and exporter countries. Our input space will be discussed extensively in the feature section. We use linear regression with raw and

logarithmic features, kernelized linear regression, and a neural network with various architectures. The output of these algorithms is the bilateral export value measured in billion U.S. dollars (\$). The study intends to offer new insights into African policy-makers in charge of relations with China. Holslag (2017) stressed that an assessment of the BRI and the objectives and tools to improve it is undoubtedly crucial for academic debates about the international political economy.

This research contributes to understanding the potential impacts of further opening up of the Chinese economy with the development of BRI practice. It is added to the various effects of BRI on improving developing countries' exports to high-profit markets. Academically, this is amongst the central attempts to adopt the combined gravity model and artificial neural model in assessing the potential effect of trade liberalization on the Chinese economy, making room for the future economic analysis of the BRI project. In doing so, this research provides an alternative to time-series predictions and expert judgment assessment by relying on neural networks and boosting methodologies that enable alternative and robust specifications of complex economic relationships (Baxter, 2017).

The remainder of the paper is structured as follows: The following section provides the literature on bilateral trade associated with the combined method viewed as related work. Section 3 gives an overview of gravity and neural network models; Section 4 introduces the data sources and methodology; Section 5 presents the analysis and discussion, including neural network predictions with actual trade among China and its selected BRI members. In the final section, the conclusion remark entailing implications and future research are discussed.

LITERATURE REVIEW

This section discusses the standard gravity model and neural networks estimation on bilateral trade perspectives among the member countries of the BRI. The section highlights different methods used by studies that put the trade effects of the BRI at the center of their investigation. This is to justify the application of augmented gravity and neural networks estimation in this study.

Since Tinbergen (1962) and Pöyhönen (1963) published critical articles, many implementations of the gravity model of international commerce have been suggested in the literature (Yotov et al., 2016). In its reduced form, the gravity equation demonstrates how the value of trade flows between two nations is directly proportional to their economic size and inversely proportional to their distance and other variables influencing the cost of bilateral commerce, such as trade regulations. At first, the gravity model's empirical effectiveness in describing the geographical distribution of commerce was accompanied by a dearth of theoretical backing. Following Anderson's (1979)

work, many writers developed a variety of theoretically grounded versions of the model (Bergstrand, 1989); Deardorff (1998); Eaton & Kortum (2002). Anderson & van Wincoop (2003) proposed an enhanced gravity equation that included variables for multilateral trade resistance (MTR). These words convey the notion that trade flows between two nations are determined not just by their bilateral trade resistance (i.e., trade costs associated with distance and other bilateral trade obstacles), but also by the expenses associated with dealing with each country's other trading partners (MTR). Neglecting MTR in the gravity equation is referred to as a "gold medal error" (Baldwin & Taglioni, 2006), which may be avoided using a variety of econometric methods (Yotov et al., 2016). Feenstra (2015) suggested the use of country-specific fixed effects, Baier & Bergstrand (2009) used a first-order Taylor series approximation to account for MTR, and, more recently, Metulini et al. (2018) posited the use of origin- and destination-specific spatial filters.

Among recent studies on the association between trade and infrastructure, Donaubaauer et al. (2018) modified Feenstra et al.'s, (2001) approach to examine the effect of infrastructure on bilateral trade between 150 established and developing countries. In a similar vein, Lee & Itakura (2018) and Kim & Mariano (2020) examined the effect of increased infrastructure on China's trade with Central Asian nations and the impact of infrastructure quality on bilateral trade ties in the Central Asia Regional Economic Cooperation (CAREC) area, respectively. Herrero & Xu (2017) examined the impact of infrastructure investment on trade-in BRI-eligible countries, using the model specification proposed by Baier & Bergstrand (2009) and Hussain et al. (2019) used the same methodology to examine the relationship between exports and infrastructure indicators in 46 Asian countries.

Although there is a substantial body of literature on gravity models, the use of machine learning techniques such as artificial neural networks (ANNs) to predict trade flows remains a novel field of study (Dumor & Yao (2019), Gopinath et al., 2021). Studies have compared the forecasting performance of ANNs with univariate time series models, macroeconomic fundamentals-based models estimated by ordinary least squares (OLS), and multivariate time series models. Wu (1995), G. P. Zhang (2003), and Khashei et al. (2013) compared the forecasting performance of autoregressive integrated moving average (ARIMA) models and ANNs in terms of RMSE and MAE. The ANNs performed substantially better than the ARIMA models. Lisi & Schiavo (1999) and Leung et al. (2000) employed ANNs for forecasting various exchange rates concerning the Random Walk (R.W.) model by adopting normalized mean square error (NMSE) and RMSE as performance criteria.

In their study, Wohl & Kennedy (2018) exhibited an extremely starter endeavor to examine international trade with neural networks and the traditional trade gravity model approach. The findings showed that the

neural network has high prediction accuracy compared to RMSE within the gravity model. Further, Athey (2018), in his research paper, presented an appraisal of the early commitments of machine learning to economics, and likewise, expectations about its future contribution. He also investigated a few features from the developing econometric consolidating machine learning and causal inference, including its impacts on the nature of collaboration on research tools and research questions. A research work performed by Nummelin & Hänninen (2016) utilized the support vector machine (SVM) to break down and conjecture reciprocal exchange streams of soft sawn wood.

More applicable to our target, Nuroglu (2014) demonstrated that neural networks achieve a lower MSE when contrasted with panel data models by using data from 15 E.U. countries. Tkacz & Hu (1999) also showed that financial and monetary variables could be improved using artificial neural network (ANN) techniques. Given the combined ANN and market microstructure approaches to investigate exchange rate fluctuations, the work of Gradojevic & Yang (2000) revealed that macroeconomic and microeconomic variables are valuable to forecast high-frequency exchange rate variations. Similarly, Varian (2014) and Circlaeys et al. (2017) provided an overview of machine learning tools and techniques, including their effect on econometrics. Furthermore, Bajari et al. (2015) presented an overview and applied a few statistics and computer science methods to issues of interest estimation. The findings showed that machine learning combined with econometrics anticipates the request out of the test in standard measurements considerably more precisely than a panel data model.

As departing from the earlier works, the ANN techniques are applied to the gravity model of bilateral trade flows in this study. The gravity model is often discussed as the workhorse in international trade since its popularity and success in quantifying the effects of various determinants of international trade. Therefore, the two-stage approaches are adopted by estimating and forecasting China's export with a New Silk Road Initiative member countries using a large dataset from UN-Comtrade that includes 163 countries based on the two-stage approaches gravity model-ANN analysis.

RESEARCH MODEL

Gravity Models

Initiated by Pöyhönen (1963) and Salette & Tinbergen (1965), the gravity model is one of the most successful empirical approaches in trade. Longtime remained with the traditional economic theories of trade; the gravity model is now deeply integrated with the theoretical foundations in economics with literature rich in contributions and perspective (Anderson & Van

Wincoop, 2003). Gravity models are regarded as a workhorse technique of international trade analysis. Their fundamental perception is that trade between two countries is anticipated to be correlated with their respective sizes (assessed by their GDPs) and the distance between them. These models remain intuitive, flexible, have solid theoretical bases, and can reasonably forecast international trade. Empirical studies of bilateral trade often rely on the traditional gravity model, which relates the trade volume between cities, countries, or regions to their economic scales and the distance between them. The basic model for trade between two countries (*i and j*) can take the following form:

$$T_{ij} = \alpha \frac{GDP_i^{\theta_1} \times GDP_j^{\theta_2}}{D_{ij}^{\theta_3}} \quad (1)$$

Where T_{ij} represents the trade volume between areas *i* and *j*; GDP_i and GDP_j are the gross domestic product of the countries (*i and j*) that are being measured; D_{ij} is the distance between areas *i* and *j*; For $\alpha, \theta_1, \theta_2$ and θ_3 , they are the parameters to be estimated.

This model is intuitive, adaptable, has a substantial hypothetical establishment, and can make reasonably accurate predictions of international trade (Wohl & Kennedy, 2018). Gravity models have encountered various feedbacks. For instance, most gravity display estimations have discovered a determinedly substantial negative impact of distance on bilateral trade since the 1950s, despite exact proof on falling transport cost and globalization. Notwithstanding, Yotov (2012) showed that gravity models demonstrate a declining impact of distance on trade after some time when they represent internal trade costs; a straightforward gravity model can be enlarged differently. Gravity models regularly contain dummy variables that determine whether the trade partners share a border, a language, a colonial relationship, or a regional trade agreement. Anderson & Van Wincoop (2003) indicated that the gravity models should represent multilateral resistance since relative trade costs do not only matter outright costs. The gravity models can catch multilateral resistance and another country's particular historical, cultural, and geographic component by utilizing country fixed effects: dummy factors for individual country exporters and individual country importers. Although one weakness of this approach is that country-fixed effects will ingest whenever invariant country-specific factor of intrigue (Baier & Bergstrand, 2009), some gravity models employ country-year fixed effects, country-pair fixed effects, or both. Gravity models can appear as ordinary least squares (OLS) estimators and computed as follow:

$$\begin{aligned}
\ln X_{ij,t} = & \theta_0 + \theta_1 \ln GDP_{i,t} + \theta_2 \ln GDP_{j,t} + \theta_3 \ln Dist_{ij} + \theta_4 Contig_{ij} + \theta_5 Comlang_{ij} + \theta_6 Col_{ij} \\
& + \theta_7 \ln Infra_{it} + \theta_8 \ln Infra_{jt} + \theta_9 OBOR_{ijt} + \theta_{10} ASEAN_{ijt} + \theta_{11} EAC_{ijt} + \theta_{12} SADC_{ijt} \\
& + \epsilon_{ij,t}
\end{aligned} \tag{2}$$

where $X_{ij,t}$ represents the bilateral export between country i and country j , $GDP_{i,t}$ and $GDP_{j,t}$, the gross domestic product of partners' i and j , the distance between i and j , $Dist_{ij}$, and dummy variables entail a common border ($Contig_{ij}$), a common language ($Comlang_{ij}$), a common colony (Col_{ij}), an infrastructure index of the partner countries ($Infra_{it}$ and $Infra_{jt}$), and regional trade agreements ($OBOR_{ijt}$, $ASEAN_{ijt}$, EAC_{ijt} , $SADC_{ijt}$). For $\epsilon_{ij,t}$, it is an error term for a pair of i^{th} country and j^{th} in the year t . Based on the analogy of equation 2, both the country-fixed effects and country-year fixed effects can be computed and used directly through the data analysis.

Estimating the zero trade flows between the countries' pairs has been a big challenge. Adopting the OLS estimator in logarithmic form, the zero trade flows will be merely dumped from the estimation sample. Nevertheless, they can retain critical information. To overcome this concern, we also apply the multiplicative form of the gravity equation by the non-linear Poisson Pseudo-Maximum Likelihood (PPML) estimator, which is supported as the best solution in the earlier works (Silva & Tenreyro, 2011) (Silva & Tenreyro, 2006). Piermartini & Yotov (2016) highlighted the additional advantage of the PPML estimator, such as it offers unbiased and consistent estimates even with significant heteroscedasticity in the data and a large proportion of zero trade values. Since the trade data are full of heteroscedasticity, applying the log-linear OLS estimator provides biased outcomes and inconsistent estimates, whereas the PPML estimator accounts for heteroscedasticity.

Unlike the various challenges in producing the hypothetically adjusted models for causal inference, this research attempts to attain a significant bilateral trade flow predictive capacity. This approach is a blend of econometrics through the evaluating and deducting technique while focusing on time series econometrics. The study ponders on the time series models such as A.R., MA, and ARMA types models. This is paramount to provide hypothetical support for the usefulness of our models in assessing the fundamental mechanisms of bilateral export flow. However, we consent that this is an important research objective because the measure of exports influences the governments' domestic and trade arrangements as well the model that offers more trade volume prediction would be beneficial for policy and decision-makers.

Artificial Neural Network (ANN) Analysis

The applications of intelligent methods have emerged exponentially in recent days to research most of the non-linear parameters. Artificial neural networks (also ANNs or neural nets) are similar to non-parametric and non-linear statistical regression models (Azizi et al., 2019; Gbongli et al., 2019). ANNs represent a general class of non-linear models that have been successfully applied to various problems such as pattern recognition, natural language processing, medical diagnostics, functional synthesis, forecasting (e.g., econometrics), and exchange rate forecasting (Gradojevic & Yang, 2000). Neural networks are mainly appropriate to learn patterns and remember complex relationships in large datasets. Fully Connected Layers are fundamental but yet compelling neural network types. Their structure is primarily an array of weighted values that is recalculated and balanced iteratively. They can implement activation layers or functions to modify the output within a specific range or list of values.

ANNs are composed of simple computational elements, including an input layer, hidden layers, and an output layer. The input layer receives the input data, i.e., the set of independent variables, while the output layer computes the final values. The hidden layers enable the neural network to combine inputs in complex non-linear ways, allowing computations that would not be possible with a single layer.

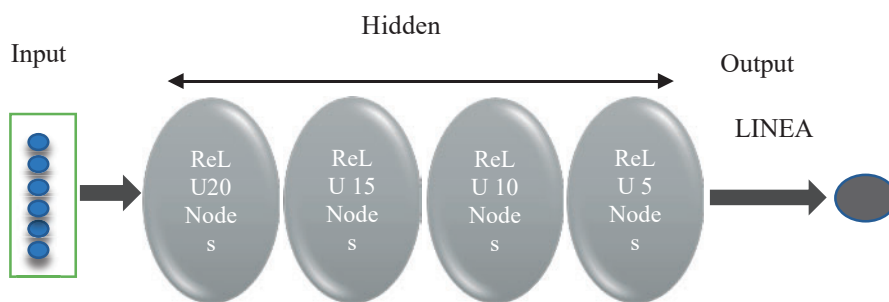
Assessing the number of neurons in the hidden layers is important for the overall neural network architecture decision. There is no heuristic technique to identify the number of hidden nodes in an ANN, so the trial-and-error and rules-of-thumb are usually used (Chan & Chong, 2012) (Chong, 2013). In most cases, the network that achieves best during the testing set with the least number of hidden neurons should be considered. Moreover, many other elements can affect the selection of the number of hidden neurons, such as the number of hidden layers, the sample size, the neural network architecture, the complexity of the activation function, the training algorithm, etc. (Sheela & Deepa, 2013).

In this research, the number of neurons in a hidden layer was varied to observe the impact of the hidden layers on the neural network's performance. The results revealed that a Fully Connected Network made of $20 \times 15 \times 10 \times 5$ nodes with four hidden layers was optimal and therefore they were chosen to train the networks as illustrated in Figure 1.

This work uses a Fully Connected Network made of $20 \times 15 \times 10 \times 5$ nodes with four hidden layers, as illustrated in Figure 1. The input features of the network are standard gravity model variables such as

GDP, distance, border, colonial relationship, and trade agreement, to mention a few, as summarized in Table 1

below.



Source: Own work.

Figure 1. Fully connected feedforward artificial neural network

Panel data estimation approach

This study conducts a regression analysis with panel data PPML through econometric gravity model—described as the workhorse of international trade and one of the most successful empirical models in economics (Anderson & van Wincoop, 2003) and statistical software—Stata 15.1. Cross-sectional or pooled ordinary least squares (OLS) regression is often used to estimate the gravity trade model. Yet, biased results may be created by these estimation approaches (Cheng & Wall, 2005). This is because heterogeneity is not allowed in the error term for standard cross-sectional regression equations, thus yielding overestimated results. An advantage of using the panel data estimation method is that it can increase the

volume of informative data in variability with less collinearity among the variables (Leitão, 2010), which allows more degrees of freedom and efficiency. Following Wohl & Kennedy (2018) and Gopinath et al. (2021), in this study, the panel data from 1990 to 2017 is analyzed to estimate the regression coefficients with the PPML estimation of the gravity model. The econometric results from using the variables suggested by NNA indicate a high R-square for most parameters (Table A4). Most of the variables in the econometric model are statistically significant, and at the 0.01% level, but similarities and differences are visible from the R-square. The out-of-sample forecast error of root mean squared error (RMSE) is computed and compared with that of the best ANN (see Table 4).

Table 1
Features

Variable name	Representation	Feature description
$\ln X_{ij,t}$	Exports from China to the World (millions of US. dollars)	The logarithm of China’s bilateral exports to partner country at year t
$\ln GDP_{\text{exporter}}$	GDP, Annual %	The logarithm of GDP of China at year t
$\ln GDP_{\text{importer}}$	GDP, Annual %	The logarithm of GDP of partner country j at year t
$\ln \text{distance}$	Bilateral distance	The logarithm of the distance between China and partner country
$Contig$	Contiguity	1 if the two trading partners share a border a common border, 0 otherwise
$Comlang_off$	Common Language	1 if the two trading partners share a common official or primary language, 0 otherwise
$Colony$	Colonial relationship	1 if one of the trading partners for origin and destination ever in a colonial relationship
$\ln fra_{jt}$	Infrastructure index	The logarithm of the infrastructure of China
$\ln fra_{jt}$	Infrastructure Index	The logarithm of the infrastructure of partner country j at year t
$OBOR$	One Belt One Road, Dummy	1 if the origin country is a OBOR member
$ASEAN$	Association of Southeast Asian Nations, Dummy	1 if the origin country is an ASEAN member
EAC	East African Community, Dummy	1 if the origin country is an EAC member
$SADC$	Southern African Development Community, Dummy	1 if the origin country is a SADC member

The output neuron can be computed as follow:

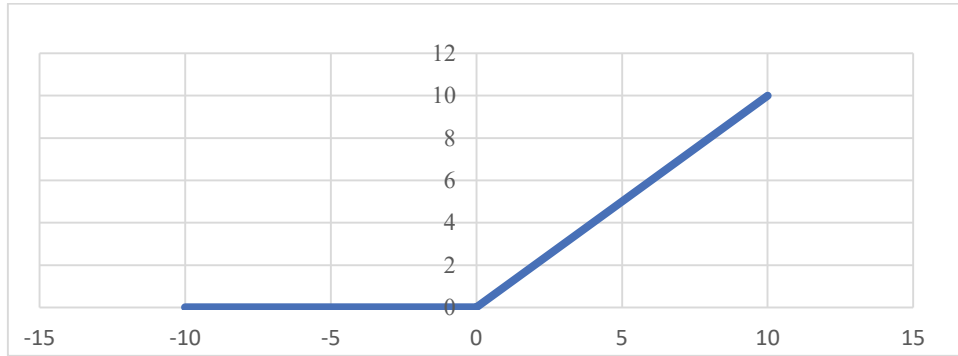
$$\alpha = f\left(\sum_{i=0}^N w_i x_i\right) \quad (3)$$

Where f is the activation function, x_i denoted the numerical input, and the weights are represented by w_i . There have been various activation functions that are applied in the context of ANNs. One commonly used activation function is the sigmoid function, which takes a value between 0 and 1 by applying a threshold. However, we will be using the rectified linear unit

(ReLU) as the activation function. ReLU function refers to the type of activation function returning to the $\max(0, x)$. In the perspective of artificial neural networks, the rectifier or ReLU activation function (Brownlee, 2019) is an activation function denoted as the positive part of its argument:

$$f(x) = x^+ = \max(0, x) \quad (4)$$

Where x is the input to a neuron. The rectified linear unit activations function is depicted in Figure 2.



Source: Own work.

Figure 2. Line plot of rectified linear activation for negative and positive inputs

Over-fitting is a possible problem with ANN models. In order to avoid it, cross-validation was applied, whereas the dataset was divided randomly into training observations (70 percent of the dataset) and testing observations (30 percent of the dataset). We applied the training dataset to develop the estimators, then fed the independent variables from the test dataset into those estimators to engender predicted trade values for the out-of-sample observations. The root-mean-square error (RMSE) is used to measure the accuracy of the out-of-sample prediction. RMSE values are computed as the square root of the average of squared errors between the predicted values and the actual values as seen from the Equation below:

$$RMSE = \sqrt{\frac{1}{n} \sum_{i=1}^n (\hat{y}_i - y_i)^2} \quad (5)$$

Where \hat{y}_i is the predicted observation, y_i is the actual observation considered equal to the model, and n represents the number of observations or data sets for the study.

DATA SOURCES AND METHODOLOGY

Dataset

The study uses the data, which covers a panel data set of 162 countries from 1990 to 2017. Therefore, our data set entails 4536 observations of bilateral export flows (162×161 country pairs). There are various sources of data that were applied for data analysis. UN-Comtrade database was used to obtain the data for bilateral trade (exports). At the same time, the World Development Indicators (WDI, 2018) database was utilized as a source for GDP (importer, exporter) in billions of current U.S. dollars. Data on location and dummies indicating contiguity (common border), common language (official language), and colony (colonial relationship) were taken from the Centre d'Etudes Prospectives et d'Informations Internationales (CEPII). The Bilateral Distance between China and its partners was taken from the CEPII distance database. The Infrastructure index grounded in Carrere & Grigoriou (2011), and Limao (2001) approach is computed by applying four variables proxying the transport infrastructure from the IRF world road statistics and WDI (W.B., 2018): total roads network, total paved roads, railway network, and the number of telephones mainline per person. The model was

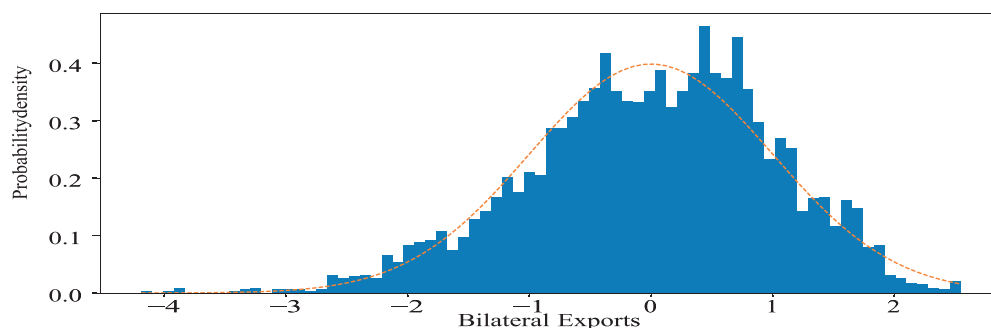
estimated using China’s bilateral exports between its new Silk Road partners. The summary of the 13 economic features that are used in the model is presented in Table 1 (Features). GDP and the amount of exports are reported in current U.S. \$. Most of these features are commonly applied in Gravity Model and are all deemed well-defined, based on a solid background, and then suitable for this study. Implementing these features for the prediction purpose allows us to compare our performance against the Gravity Model (i.e., our baseline model).

Cleaning Techniques and Features

To avoid deviations in data and potential obstacles in the prediction procedure, we had applied several data cleaning techniques before the analysis started.

First, we extrapolate the missing data using the preprocessing methods. Second, we removed incomplete data from the data set. That is, we did not work with data points that have missing feature values. Third, we removed all trade flow values with no values, as they are not economically significant and cause outlier problems. Fourth, we took the log of data to achieve a smoother distribution of the data, as shown in Figure 3. At last, we removed data from 1990 to 1991 as our focus is to predict current trade flows. For the neural network, we standardize the continuous variables (exporter’s GDP, importer’s GDP), scaling them so that their means equal zero and their standard deviations equal one using Equation 6 below.

$$X_s = \frac{x_i - \text{mean}(x)}{\text{stdev}(x)} \quad (6)$$



Source: Own work.

Figure 3. Histogram of feature space distribution of bilateral exports

ANALYSIS AND DISCUSSION

The gravity model is considered as the workhorse tool in examining international trade. It measures the relationship between the trading behavior of two countries based on their GDPs and distances. It offers accurate predictions of international trade and has solid theoretical foundations (Wohl & Kennedy, 2018). The outputs of gravity model estimations are compared to those of neural networks using the MSE (mean squared error) and RMSE (root mean squared error) together with other metrics that may be used. MSE is a squared RMSE, an absolute measure of fit, and is reported in the same unit as the response variable.

Table 2 shows the results of the evaluations. For the baseline dataset, the OLS estimator has an out-of-sample root mean squared error of \$16.05 billion, the PPML estimator has an out-of-sample RMSE of \$6.53 billion, and the neural network has an out-of-sample RMSE of \$3.83 billion. For the dataset with country fixed effects, the OLS estimator has an out-of-sample RMSE of \$11.30 billion, the PPML estimator has an out-of-sample RMSE of \$9.79 billion, and the neural network has an out-of-sample RMSE of \$1.91 billion. For the dataset with country-year fixed effects, the

OLS estimator has an out-of-sample RMSE of \$6.66 billion, the PPML has an out-of-sample RMSE of \$8.17 billion, and the neural network has an out-of-sample RMSE of \$1.89 billion. These analyses were repeated several times, allowing for variation in the random training-test division and the neural network development, and these outcomes are representative. For illustrating the forecasting application of our model, the neural network has been trained on the full dataset with country fixed from 1990 to 2012 and applied to predict bilateral trade export between China and its major trading partners in the Silk and Road Initiative. The estimation covers the period from 2013 to 2017. The neural network’s estimates seem reasonably close to the actual trade values to some extent, particularly around 2013 and 2015.

The accuracy of the network models is measured by RMSE (Chong, 2013; Gbongli et al., 2019), which is calculated as the difference between actual and predicted values of the dependent constructs, i.e., export in the present context. We provided the result of the neural network with the actual GDPs of China and its BRI partners, as seen from Figure 4 and Table 3. The neural network’s estimations are reasonably close to actual trade values even five years beyond the training period.

Table 2
Trade predictions using estimators in respect to generated RMSE (In Millions of US \$)

Models	OLS	PPML	Neural Networks
Baseline Model	\$16.05	\$6.53	\$3.83
Country-fixed effects	\$11.30	\$9.79	\$0.1908
Country-year fixed effects	\$6.66	\$8.17	\$1.89
Adjustment and architecture	Dependent variable: $\ln(X_{ij} + 1)$	Dependent variable $X_{ij,t}$	Exports, distance, infrastructure, GDP, (standardized mean = 0) (Std.Dev. = 1)

Source: Own work.

Table 3
Neural network predictions versus actual trade values (in Millions Us \$)

Countries	Predictions	2013	2014	2015	2016	2017
Kenya	Actual	6.5075	6.6929	6.7719	6.7472	6.7472
	Predicted	6.5595	6.6094	6.6306	6.6550	6.6911
Rwanda	Actual	5.1275	5.0606	5.0873	5.0356	5.0356
	Predicted	5.02705	5.0700	5.0933	5.0966	5.1489
Zimbabwe	Actual	5.6168	5.6062	5.7351	5.5883	5.5882
	Predicted	5.8410	5.8689	5.8860	5.8881	5.9284

Source: Own work.

Table 4 below presents a summary of the models' performances. The table reports both the average RMSE values as well as the values of R^2 . These values were used to predict the correctness of the Gravity and ANN models. The smaller the value of RMSE, the better the accurateness of the prediction. R^2 ranges from 0 to 1: If $R^2 = 0$, the model always fails to predict the target variable, and if $R^2 = 1$ the model perfectly predicts the target variable. Any value between 0 and 1 signposts what percentage of the target variable, applying the model, can be elucidated by the features. If $R^2 < 0$ it reveals that the model is no better than one that continually predicts the mean of the target variable.

The traditional gravity model (OLS) output was used to compare those of neural networks to some extent. However, particular attention was put on the PPML (considered the more robust estimator to deal with the panel data and non-linearity data set) to compare with ANN outputs. From Table 4, the gravity model result is assessed against the ANN model in terms of RMSE and R^2 . The neural network with country-fixed effects has the most significant

predictive accuracy among the models. It attains a 98.05 percent reduction in out-of-sample RMSE compared to the PPML estimator on the same dataset and a 98.32 percent reduction compared to the OLS estimator.

Moreover, using the identical set of features as the Gravity model (baseline model) based on the OLS estimator, the ANN technique (baseline model) achieves a notable improvement of above 0.49 in the test set's R^2 score. Similarly, using the identical set of features as the Gravity model (baseline model) grounded in the PPML estimator, the ANN technique (baseline model) achieves a remarkable improvement of above 0.03 in the test set's R^2 score. This signifies that neural networks successfully discover non-linear interactions between features compared to the Gravity model, mainly with the OLS estimator, a purely linear model of logarithmic features. Using the same dataset, this result discloses that we were able to achieve higher predictive ability without calling into time series models, which was one of the purposes of the research work.



Source: Own work.

Figure 4. Neural network predictions compared to actual trade

CONCLUDING REMARKS

The study aims to examine the macroeconomic effects of China's BRI quantitatively. It remains essential to understand why trade happens the way it arises and to expand economic ties between countries, a theoretical question that can be facilitated through gravity models employing traditional specifications. Moreover, predicting trade between two countries (i.e., China and African countries with a high degree of accuracy is an essential and practical inquiry that neural networks can patronize. Using a gravity model and neural network technique and focusing more on the area of trade investment under the BRI, our quantitative exercises suggest critical potential advantages of the BRI to the economies.

Drawing upon the results of panel data regression and ANN, this research offers two insights. The first is that China's bilateral export flow under the new Silk Road initiatives significantly positively affects the countries involved. This finding is important since it supports the concept that the BRI could bring trade opportunities to developing countries by improving their bilateral trade with China.

Second, our simulations have shown that using neural networks is a promising approach in predicting bilateral trade flow when making predictions with other economic variables of the same period. Neural network techniques are a sound methodology for making predictions about economic data. This paper compares the various estimation procedures of the gravity model – OLS and PPML – with the neural network. Employing the same set of features as the Gravity model (baseline model) based on the OLS estimator, the ANN technique (baseline model) achieves a notable improvement of above 0.49 in the test set's R^2 score. In a similar vein with the same set of features as the Gravity model (baseline model) grounded in the PPML estimator, the ANN technique (baseline model) attains a remarkable improvement of above 0.03 in the test set's R^2 score. The neural networks associated with fixed country effects showed a more accurate estimation than a baseline model even with country-year fixed effects. Regarding the OLS

estimator and Poisson Pseudo-Maximum Likelihood (PPML), however, they showed mixed results. It appears that the ANN estimation of the gravity equation was superior over the other procedures to enlighten the variability of the dependent variable (export) towards the prediction accuracy based on root mean squared error (RMSE) and R-square. The scope of the gap in predictive accuracy recommends that neural networks capture non-linear interactions of independent constructs that influence trade in ways not captured by OLS or PPML models. Therefore, the results stress that we were able to achieve higher predictive ability without calling into time series models, which was one of the purposes of the research work.

The implication drawn from findings for policymakers is that developing nations in East Africa could enhance exports performance by partaking in the BRI, which brings FDI to improve trade-supporting infrastructure and expand and upgrade local production capacity. Policy-makers, analysts, and businesses would all be able to profit by exact scales about China's bilateral exports among its new Silk Road members. To entirely grasp the BRI's potential, policymakers need to assess country-specific barriers for building links to global value chains, which could be high costs and key natural resources, lacking high-skill workforce, inefficient customs operations, outdated transport systems, inadequate information, and communication technology infrastructure, poor governance, and corruption, to mention few. Therefore, they require to formulate appropriate policies and measures to address the issues and work in close cooperation with other B&R nations and key stakeholders to co-create value for all as to searching for sustainable development.

One heading for future research is to use neural networks to anticipate the impacts of intra-regional trade or regional integration. Future research subjects could apply alternative artificial neural network structures such as radial basis function neural networks and recurrent neural networks instead of multilayer perceptron neural networks and use the output of the PPML model as inputs to artificial neural networks.

REFERENCES

- ANDERSON, J. E. (1979). A Theoretical Foundation for the Gravity Equation. *American Economic Review*, 69(1), 106–116. <https://doi.org/10.1126/science.151.3712.867-a>
- ANDERSON, J. E. & VAN WINCOOP, E. (2003). Gravity with Gravitas: A Solution to the Border Puzzle. *American Economic Review*, 93(1), 170–192. <https://doi.org/10.1257/000282803321455214>
- ANDERSON, J. E. & VAN WINCOOP, E. (2003). Gravity with gravitas: A solution to the border puzzle. *American Economic Review*, 93(1), 170–192.
- ATHEY, S. (2018). The Impact of Machine Learning on Economics. *The Economics of Artificial Intelligence: An Agenda*.
- AZIZI, N., REZAKAZEMI, M. & ZAREI, M. M. (2019). An intelligent approach to predict gas compressibility factor using neural network model. *Neural Computing and Applications*, 31(1), 55–64. <https://doi.org/10.1007/s00521-017-2979-7>
- BAIER, S. L. & BERGSTRAND, J. H. (2009). Bonus vetus OLS: A simple method for approximating international

- trade-cost effects using the gravity equation. *Journal of International Economics*, 77(1), 77–85. <https://doi.org/https://doi.org/10.1016/j.jinteco.2008.10.004>
- BAJARI, P., NEKIPELOV, D., RYAN, S. P. & YANG, M. (2015). Machine Learning Methods for Demand Estimation. *American Economic Review*, 105(5), 481–485. <https://doi.org/10.1257/aer.p20151021>
- BALDWIN, R. & TAGLIONI, D. (2006). *Gravity for dummies and dummies for gravity equations*.
- BAXTER, M. (2017). Robust Determinants of Bilateral Trade. *Society for Economic Dynamics.*, 591.
- BERGSTRAND, J. H. (1989). The Generalized Gravity Equation, Monopolistic Competition, and the Factor-Proportions Theory in International Trade. *Source: The Review of Economics and Statistics*, 71(1), 143–153. <https://doi.org/10.2307/1928061>
- BOFFA, M. (2018). Trade Linkages Between the Belt and Road Economies (English). *Policy Research Working Paper*. <https://doi.org/10.1596/1813-9450-8423>
- BROWNLEE, J. (2019). *A Gentle Introduction to the Rectified Linear Unit (ReLU)*. Machine Learning Mastery.
- CARRERE, C. & GRIGORIOU, C. (2011). *Landlockedness, Infrastructure and Trade: New Estimates for Central Asian Countries*. ffhalshs-00556941.
- CHAN, F. T. S. & CHONG, A. Y. L. (2012). A SEM–neural network approach for understanding determinants of interorganizational system standard adoption and performances. *Decision Support Systems*, 54(1), 621–630. <https://doi.org/10.1016/j.dss.2012.08.009>
- CHENG, I. & WALL, H. J. (2005). Controlling for Heterogeneity in Gravity Models of Trade and Integration. *Federal Reserve Bank of St. Louis Review*, 87(1), 49–64. <https://doi.org/10.3886/ICPSR01313>
- CHINA'S TRADE WITH BRI COUNTRIES SURGES TO \$1.34 TRILLION IN 2019. (2020). The Economic Times, 15 January 2020.
- CHONG, A. Y. L. (2013). A two-staged SEM-neural network approach for understanding and predicting the determinants of m-commerce adoption. *Expert Systems with Applications*, 40(4), 1240–1247. <https://doi.org/10.1016/j.eswa.2012.08.067>
- CHUNG, C. (C. P. . (2018). What are the strategic and economic implications for South Asia of China's Maritime Silk Road initiative? *The Pacific Review*, 31(3), 315–332. <https://doi.org/10.1080/09512748.2017.1375000>
- DEARDORFF, A. V. (1998). Determinants of Bilateral Trade: Does Gravity Work in a Neoclassical World? *NBER Working Paper No. W5377*, January, 7–32. <https://doi.org/10.3386/w5377>
- DENNIS, A. (2006). The Impact of Regional Trade Agreements and Trade Facilitation in the Middle East North Africa Region. In *Policy Research Working Paper*.
- DONAUBAUER, J., GLAS, A., MEYER, B. & NUNNENKAMP, P. (2018). Disentangling the impact of infrastructure on trade using a new index of infrastructure. *Review of World Economics*, 154(4), 745–784.
- DUMOR, K. & YAO, L. (2019). Estimating China's Trade with Its Partner Countries within the Belt and Road Initiative Using Neural Network Analysis. *Sustainability*, 11(5), 1449. <https://doi.org/10.3390/su11051449>
- EATON, J. & KORTUM, S. (2002). Technology, Geography, and Trade. *Econometrica*, 70(5), 1741–1779.
- ELIF, N. (2014). Estimating And Forecasting Trade Flows By Panel Data Analysis And Neural Networks. *Journal of the Faculty of Economics*, 64(1), 85–111.
- FEENSTRA, R. C. (2015). *Advanced international trade: theory and evidence*. Princeton university press.
- FEENSTRA, R. C., MARKUSEN, J. R. & ROSE, A. K. (2001). Using the gravity equation to differentiate among alternative theories of trade. *Canadian Journal of Economics/Revue Canadienne D'Économique*, 34(2), 430–447.
- FLINT, C. & ZHU, C. (2019). The geopolitics of connectivity, cooperation, and hegemonic competition: The Belt and Road Initiative. *Geoforum*, 99. <https://doi.org/10.1016/j.geoforum.2018.12.008>
- GARSON, G. . (1991). Interpreting neural network connection weights. *Artif. Intell. Expert*, 6, 46–51.
- GBONGLI, K. (2017). A two-staged SEM-AHP technique for understanding and prioritizing mobile financial services perspectives adoption. *European Journal of Business and Management*, 9(30), 107–120.
- GBONGLI, K., XU, Y. & AMEDJONEKOU, K. M. (2019). Extended Technology Acceptance Model to Predict Mobile-Based Money Acceptance and Sustainability: A Multi-Analytical Structural Equation Modeling and Neural Network Approach. *Sustainability*, 11(13), 3639. <https://doi.org/10.3390/su11133639>
- GBONGLI, K., XU, Y., AMEDJONEKOU, K. M. & KOVÁCS, L. (2020). Evaluation and Classification of Mobile Financial Services Sustainability Using Structural Equation Modeling and Multiple Criteria Decision-Making Methods. *Sustainability*, 12(4), 1288. <https://doi.org/10.3390/su12041288>
- GOPINATH, M., BATARSEH, F. A., BECKMAN, J., KULKARNI, A. & JEONG, S. (2021). International agricultural trade forecasting using machine learning. *Data & Policy*, 3.
- GRADOJEVIC, N. & YANG, J. (2000). The Application of Artificial Neural Networks to Exchange Rate Forecasting: The Role of Market Microstructure Variables. *Bank of Canada*.
- HERRERO, A. G. & XU, J. (2017). China's Belt and Road Initiative: Can Europe Expect Trade Gains? *China & World Economy*, 25(6), 84–99.
- HOLSLAG, J. (2017). How China's New Silk Road Threatens European Trade. *The International Spectator*, 52(1), 46–60. <https://doi.org/10.1080/03932729.2017.1261517>
- HUANG, Y. (2016). Understanding China's Belt & Road Initiative: Motivation, framework and assessment. *China*

- Economic Review*. <https://doi.org/10.1016/j.chieco.2016.07.007>
- HUSSAIN, Z., HANIF, N., SHAHEEN, W. A. & NADEEM, M. (2019). Empirical analysis of multiple infrastructural covariates: an application of gravity model on Asian economies. *Asian Economic and Financial Review*, 9(3), 299.
- IWANOW, T. & KIRKPATRICK, C. (2009). Trade facilitation and manufactured exports: Is Africa different? *World Development*, 37(6), 1039–1050.
- KHAN, M. K., SANDANO, I. A., PRATT, C. B. & FARID, T. (2018). China's Belt and Road Initiative: A global model for an evolving approach to sustainable regional development. *Sustainability (Switzerland)*, 10(11). <https://doi.org/10.3390/su10114234>
- KHASHEI, M., RAFIEI, F. M. & BIJARI, M. (2013). Hybrid Fuzzy Auto-Regressive Integrated Moving Average (FARIMAH) Model for Forecasting the Foreign Exchange Markets. *International Journal of Computational Intelligence Systems*, 6(5), 954–968. <https://doi.org/10.1080/18756891.2013.809937>
- KIM, K. & MARIANO, P. (2020). *Trade Impact of Reducing Time and Costs at Borders in the Central Asia Regional Economic Cooperation Region*.
- LEE, H. & ITAKURA, K. (2018). The welfare and sectoral adjustment effects of mega-regional trade agreements on ASEAN countries. *Journal of Asian Economics*, 55, 20–32. <https://doi.org/10.1016/j.asieco.2017.09.001>
- LEITÃO, N. C. (2010). The gravity model and United States' trade. *European Journal of Economics, Finance and Administrative Sciences*, 21, 92–100. <http://www.scopus.com/inward/record.url?eid=2-s2.0-77955031213&partnerID=40&md5=d5f6b4e2e21db6849172cb4624970d9a>
- LEUNG, M. T., CHEN, A.-S. & DAOUK, H. (2000). Forecasting exchange rates using general regression neural networks. *Computers & Operations Research*, 27(11–12), 1093–1110. [https://doi.org/10.1016/S0305-0548\(99\)00144-6](https://doi.org/10.1016/S0305-0548(99)00144-6)
- LI, B. & DUAN, Y. (2014). Trade facilitation assessment and its impact on China's service trade exports: Based on transnational panel data empirical research (in Chinese). *Int. Bus*, 1, 5–13.
- LIMAO, N. (2001). Infrastructure, Geographical Disadvantage, Transport Costs, and Trade. *The World Bank Economic Review*. <https://doi.org/10.1093/wber/15.3.451>
- LISI, F. & SCHIAVO, R. A. (1999). A comparison between neural networks and chaotic models for exchange rate prediction. *Computational Statistics & Data Analysis*, 30(1), 87–102. [https://doi.org/10.1016/S0167-9473\(98\)00067-X](https://doi.org/10.1016/S0167-9473(98)00067-X)
- METULINI, R., PATUELLI, R. & GRIFFITH, D. A. (2018). A spatial-filtering zero-inflated approach to the estimation of the gravity model of trade. *Econometrics*, 6(1), 9.
- MOJŠE, E. & SORESCU, S. (2013). Trade Facilitation Indicators. In *OECD Trade Policy Papers no.144*. <https://doi.org/10.1787/5k4bw6kg6ws2-en>
- NUMMELIN, T., HÄNNINEN, R. & OTHERS. (2016). Model for international trade of sawnwood using machine learning models. *Natural Resources and Bioeconomy Studies*, 74.
- PIERMARTINI, R. & YOTOV, Y. (2016). *Estimating Trade Policy Effects with Structural Gravity*. 2016–10.
- POUREBRAHIM, N., SULTANA, S., THILL, J. C. & MOHANTY, S. (2018). Enhancing trip distribution prediction with Twitter data: Comparison of neural network and gravity models. *Proceedings of the 2nd ACM SIGSPATIAL International Workshop on AI for Geographic Knowledge Discovery, GeoAI 2018*. <https://doi.org/10.1145/3281548.3281555>
- PÖYHÖNEN, P. (1963). A Tentative Model for the Volume of Trade between Countries. *Weltwirtschaftliches Archiv*, 90, 93–100.
- RAVEN, J. (2001). *Trade and Transport Facilitation : A Toolkit for Audit, Analysis, and Remedial Action*.
- RIPLEY, B. D. (1996). Pattern Recognition and Neural Networks. In *Pattern Recognition and Neural Networks*. Cambridge University Press. <https://doi.org/10.1017/CBO9780511812651>
- SALETTE, G. & TINBERGEN, J. (1965). Shaping the World Economy. Suggestions for an International Economic Policy. *Revue Économique*. <https://doi.org/10.2307/3498790>
- SCOTT, J. E. & WALCZAK, S. (2009). Cognitive engagement with a multimedia ERP training tool: Assessing computer self-efficacy and technology acceptance. *Information and Management*, 46(4), 221–232. <https://doi.org/10.1016/j.im.2008.10.003>
- SHEELA, K. G. & DEEPA, S. N. (2013). Review on Methods to Fix Number of Hidden Neurons in Neural Networks. *Mathematical Problems in Engineering*, 2013, 1–11. <https://doi.org/10.1155/2013/425740>
- SILVA, J. M. C. S. & TENREYRO, S. (2006). The Log of Gravity. *Review of Economics and Statistics*, 88(4), 641–658. <https://doi.org/10.1162/rest.88.4.641>
- SILVA, J. M. C. S. & TENREYRO, S. (2011). Further simulation evidence on the performance of the Poisson pseudo-maximum likelihood estimator. *Economics Letters*, 112(2), 220–222.
- SONIA CIRCLAÉYS, C. K. & KUMAZAWA, D. (2017). Bilateral Trade Flow Prediction. *Stanford Final Reports*.
- TINBERGEN, J. (1962). *Shaping the world economy; suggestions for an international economic policy*.
- TKACZ, G., HU, S. & OTHERS. (1999). *Forecasting GDP growth using artificial neural networks*. Bank of Canada Ottawa.
- VARIAN, H. R. (2014). Big Data: New Tricks for Econometrics. *Journal of Economic Perspectives*, 28(2), 3–28.

<https://doi.org/10.1257/jep.28.2.3>

- WILSON, J. S., MANN, C. L. & OTSUKI, T. (2003). Trade Facilitation and Economic Development: A New Approach to Quantifying the Impact. *The World Bank Economic Review*, 17(3), 367–389. <https://doi.org/10.1093/wber/lhg027>
- WOHL, I. & KENNEDY, J. (2018). Neural Network Analysis of International Trade. *Office of Industries. U.S. International Trade Commission (USITC)*.
- WU, B. (1995). Model-free forecasting for nonlinear time-series (with application to exchange rates). *Computational Statistics & Data Analysis*, 19(4), 433–459.
- YOTOV, Y. V. (2012). A simple solution to the distance puzzle in international trade. *Economics Letters*, 117(3), 794–798. <https://doi.org/https://doi.org/10.1016/j.econlet.2012.08.032>
- YOTOV, Y. V, Piermartini, R., Monteiro, J.-A. & Larch, M. (2016). *An advanced guide to trade policy analysis: The structural gravity model*.
- ZAKI, C. (2014). An empirical assessment of the trade facilitation initiative: econometric evidence and global economic effects. *World Trade Review*, 13(1), 103–130. <https://doi.org/10.1017/S1474745613000256>
- ZHANG, G. P. (2003). Time series forecasting using a hybrid ARIMA and neural network model. *Neurocomputing*, 50, 159–175. [https://doi.org/10.1016/S0925-2312\(01\)00702-0](https://doi.org/10.1016/S0925-2312(01)00702-0)
- ZHANG, Y. B. & LIU, J. (2016). Trade facilitation measurement of the “Silk Road Economic Belt” and China’s trade potential (in Chinese). *Finance. Sci.*, 5, 112–122.
- ZHU, J. B. & LU, J. (2015). Research and application of trade facilitation evaluation indicator system (in Chinese). *J. Hunan University*, 6, 70–75.

A Critical Review of the Characteristics of Presumptive Tax Systems in Developing Countries

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SUMMARY

This paper considers the effect of the presumptive tax system characteristics on the tax compliance behaviour of small businesses in developing countries. Since the concept of presumptive taxation involves several features influencing the formalisation of small businesses, this paper seeks to survey three key areas of literature: targeted taxpayers, thresholds and timeframe. This paper differs fundamentally from previous studies in that it analyses presumptive tax system characteristics. A descriptive review approach was followed in evaluating the empirical literature on presumptive tax system characteristics. A content analysis was then performed on literature about categories and sub-categories provided in the classification framework. The review highlights similarities and conflicting evidence of presumptive tax system characteristics in transforming the compliance behaviour of small businesses. It was concluded that the blended use of information technology and existing presumptive tax systems can facilitate the movement of small businesses from the informal to the formal sector.

Keywords: presumptive tax system; targeted taxpayers; threshold; timeframe; tax compliance behaviour

Journal of Economic Literature (JEL) codes: H25; H71; O1

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INTRODUCTION

A large informal economy is often considered to be a major obstacle in the implementation of income taxes in developing countries (Memon, 2013:40). A lack of appropriate compliance management and a voluntary compliance tradition facilitated the rapid development of the underground economy in many developing countries (Engelschalk 2015:277). The idea that small businesses have a greater opportunity for tax evasion than formal businesses is also well documented (Ogembo 2018:4). Estimations indicate that in several countries in the world, most of small business activities are carried out in the informal economy (Engelschalk 2015:277). Small businesses have adopted several strategies to evade compliance, including the payment of bribes to tax authorities (Nyamwanza *et al.*, 2014:3). In certain situations, some small businesses use political influence to remain outside of the scope of the tax legislation, while others simply cheat by claiming improper deductions or under-reporting income and

sales (Bird & Wallace, 2015:121). Ogembo (2018:4) observed that small businesses normally do not register voluntarily with the tax authority, do not keep proper books of accounts, are not prompt in filing tax returns and have a significantly higher rate of evasion.

Some tax authorities have succeeded, but with difficulty while others lack control in fostering voluntary tax compliance in particular among small businesses, the so-called hard-to-tax firms (Bucci 2019:1). Vaillancourt and Clemens (2008:56) argued that tax compliance leads to the incurrence of additional non-production time and expenses such as employing personnel to undertake the tax activities, time and effort required to understand tax procedures. As a result, non-compliance is high amongst small businesses.

For these reasons, changing and simplifying the tax system for small businesses has become an obvious element of tax reform in many developing countries (Engelschalk 2015:278). Many countries have switched to a presumptive form of tax and such tax systems are

now an integral component of the tax systems of many countries (Memon 2013:41). Besides, Memon (2013:43) contends that presumptive tax systems are recommended for their simplicity to facilitate taxpayers' compliance and enforcement by the tax administration. The rationale behind the use of presumptive tax systems is to reduce taxpayers' compliance costs, reducing administration costs of compliance and enforcement management, and bridging the way from informal to formal activities (Pashev 2006:401).

Presumptive tax system characteristics vary greatly concerning their design, coverage, and implementation (Kundt, 2017:9). A good presumptive tax system should include a transition mechanism to link itself to the general tax system (Bird & Wallace, 2015:127).

Presumptive taxation involves the use of proxies for ascertaining an income tax and is expressly designed to sacrifice accuracy of measurement to achieve substantially better compliance or lower enforcement costs (Logue & Vettori 2010:31). Similarly, Thuronyi (2015:103) suggests that presumptive taxation involves the use of indirect means to ascertain tax liability, which differs from the usual rules, based on the taxpayers' account. The concept covers a wide variety of alternative means of determining the tax base, ranging from methods of reconstructing income based on administrative practice, which can be rebutted by the taxpayer, to true minimum taxes with tax bases specified in the legislation (Thuronyi 2015:103). In its common application as a proxy for income tax, the tax liability is based on the presumed capacity to earn income rather than on actual income (Pashev 2006:399). Besides, presumptive taxation is applied when the tax base is too small or hard to verify, owing to limited administrative resources or improper accounting practices (Pashev 2006:399). Logue and Vettori (2010:31) arrived at a similar conclusion by suggesting that the more closely the approximation to the idealised distributional consequences of the target base, the more equitable the tax system will be. Generally, the term presumptive taxation covers several procedures under which the desired base for taxation is not measured but is inferred from some simple indicators which are more easily measured than the base itself (Bucci 2019:2).

Presumptive tax systems entail various design characteristics including thresholds, the taxpayers targeted or the timeframe of use. Thresholds can be used to minimise the number of taxpayers that the system has to deal with in the first place (Thuronyi 2015:107). The appropriate threshold for a presumptive tax system has to take into consideration the small business development strategy of the country and the actual capacity of its tax administration (Engleschalk 2015:288). Those with income lower than the entry threshold can be exempted (Thuronyi 2015:107). This is in line with the philosophy of progressive taxation that calls for exempting those with low incomes from tax (Thuronyi, 2015:107). Below some thresholds,

small businesses are untaxed and above the minimum threshold, they are in the presumptive tax system (Bird & Wallace 2015:143). If the turnover or assets value exceed the ceiling of a presumptive tax system, the small business operator is deemed to be out of the system and should move to the standard tax system (Bird & Wallace 2015:143). With improving clarity and quality of tax policy and an increasing capacity of tax administration, the threshold should eventually be lowered, and more taxpayers brought into the standard tax system (Engleschalk 2015:289). Besides, either clear thresholds for presumptive tax systems are based exclusively on the business turnover, or turnover combined with other criteria, for example, the number of employees or value of assets (Bird & Wallace 2015; Engleschalk 2015:290). However, the threshold must not necessarily be constant in the long run (Engleschalk 2015:289). Thus, thresholds should be revised systematically so that they continue to achieve their goals. For instance, inflation may be rampant and the exit threshold in real terms may become so low that the presumptive tax system is effectively eliminated (Bird & Wallace 2015:143).

Presumptive tax systems are targeted at self-employed and small to medium-sized enterprises in the informal sector (Pashev, 2006:414; Dube & Casile 2019:54). This is because they are simpler to administer than direct taxes on income as informal sector operators are not required to keep detailed records of their activities, as is required under the standard tax system (Dube & Casile 2019:48). Small businesses form the core cluster of the informal sector. The small business sector includes farmers, traders, small-scale manufacturers, service sectors such as lawyers, doctors, repair workshops and restaurants (Memon 2013:42). Similarly, Pashev (2006:399) noted that taxpayers targeted under presumptive tax systems can include those with a high propensity to evade taxes such as small businesses, agriculture, the service sector and the self-employed. The variations lie in the definition of what exactly is a small business (Pashev 2006:414). The common reference to the legal definition of small businesses is hardly useful for the design of the presumptive tax system, as it includes fairly heterogeneous groups with widely differing abilities to pay and related compliance costs and risks (Pashev 2006:414). The informal sector is hard to tax and presumptive tax systems are recommended for their simplicity to facilitate the compliance of small businesses by simplifying income tax procedures and consequently reducing compliance costs (Memon 2013:43). As a result, many developing countries have introduced some form of simple presumptive taxation for small businesses that are not registered under the standard tax system (Dube & Casile 2019:54).

Unlike thresholds and targeted taxpayers, the timeframe involves placing limits on the number of years that a taxpayer can be taxed under the presumptive tax system (Bird & Wallace 2015:143). A major flaw of most presumptive tax systems is that

they do not include explicit plans for leading taxpayers out of the special system into the standard tax system (Bird & Wallace 2015:143). In principle, a country may choose to phase out the eligibility of special taxpayers for instance by establishing a limited period of eligibility for a simplified system, or it may phase out the presumptive tax system entirely (Bird & Wallace 2015:144). The presumptive tax system timeframe should be defined, and a taxpayer should not be allowed to make use of the system indefinitely; otherwise the prolonged availability of a presumptive tax system creates a new class of taxpayers who tend to remain forever and avoid the transition to the formal sector (Memon 2010:79). It is, therefore, a pertinent goal of a presumptive tax system that those in the presumptive tax system might perhaps be assumed to graduate automatically after a certain number of years (Bird & Wallace 2015:144). Generally, most presumptive tax systems do not specify an exact number of years a small business can be taxed under the system (Bird & Wallace 2015:79).

Presumptive tax systems face some challenges. Aditya (2020:54) claims that presumptive tax systems can be subject to abuse that comes from the differential treatment of small businesses to any other common taxpayers. Besides, a poorly designed system for small businesses becomes an obstacle to increase their turnover above the threshold, which creates an obstacle to migrating upward out of the system (Aditya 2020:54). Another serious problem is how to exclude large and medium enterprises from operating under the presumptive tax systems by deceiving the tax office in the name of small enterprises (Bird & Wallace 2015:128). The apparent intentions of presumptive tax systems may not be attained owing to their imprecise goals, the lack of follow-up and the general disconnect created between them and the standard tax system (Bird & Wallace 2015:127; Aditya 2020:54).

This paper provides some policy implications revealing which presumptive tax system design characteristics could be effective in influencing the behaviour of small businesses towards voluntary compliance and reducing the informal economy in a simplified manner. We aim to provide a wide overview of the presumptive tax system and consider how different design characteristics of presumptive tax systems could affect the tax compliance behaviour of small businesses. To achieve this, we evaluate the implications when small businesses move from the informal sector to the formal sector. In this case, the design characteristics of presumptive tax systems can play a significant role in the reduction of the informal sector and an increase in the voluntary tax compliance of small businesses.

This paper is organised into four sections. The first section provides a background to the characteristics of presumptive tax systems. Besides, this section discusses the purpose of a presumptive tax system and its limitations. The second section presents the methodology adopted in this paper. In the third section

an analysis of presumptive tax systems thresholds, taxpayers targeted and a timeframe for system use is provided. Finally, Section 4 provides concluding remarks and suggests recommendations for future research.

In the above discussion, an overview of presumptive tax system design characteristics and their purposes and limitations has been considered. It is important, however, to also explain the methodology adopted in this paper.

METHODOLOGY

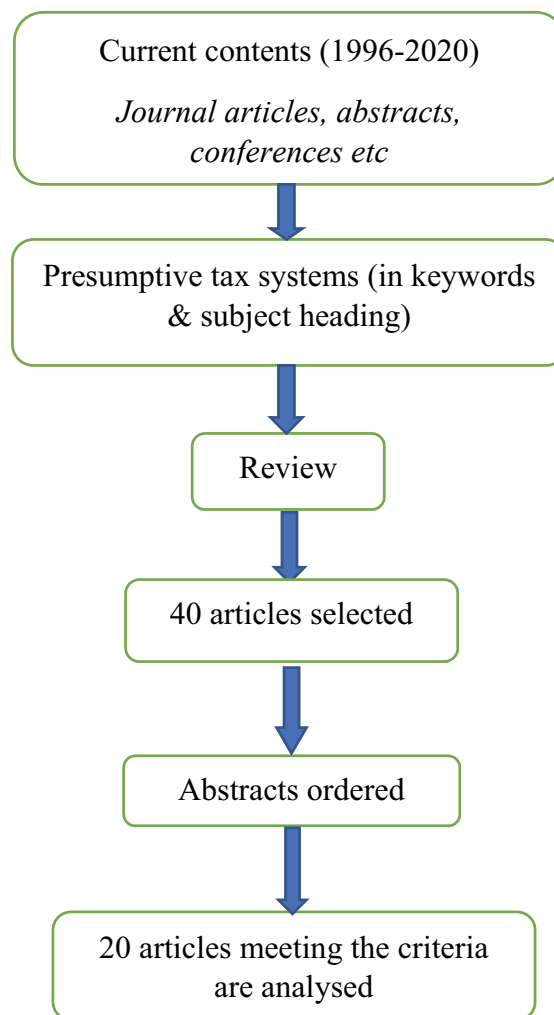
The purpose of the paper is to evaluate the design characteristics of presumptive tax systems using a descriptive review research method. Descriptive reviews are used to reveal interpretable patterns from existing literature (Schlagenhauser & Amberg, 2015:3). According to Yang and Tate (2009:41) a descriptive review produces some quantification often inform of frequency analysis, such as publication time, research methodology and research outcome. Descriptive reviews summarise individual papers/studies and provide details of the research methods and results of cited studies (Jaidka et al. 2013). Such a review method often has a systematic procedure including searching, filtering and classifying processes (Yang & Tate 2009:41).

A descriptive review follows a systematic and transparent procedure including searching, screening and classifying studies (Petersen, et al. 2015). Grant and Booth (2009) argue that descriptive reviews map out and categorise existing literature from which to commission further reviews and or primary research by identifying gaps in the research literature. Initially, the reviewer needs to conduct a comprehensive literature search to collect as many relevant papers as possible in an investigated area (Yang & Tate 2009:41). The completeness of searching is determined by time or scope constraints, with a synthesis of research evidence summarised in graphical or tabular form (Grant & Booth 2009:94). An individual paper is treated by the reviewer as one data record and identifies trends, patterns among the articles surveyed. In addition, a descriptive review incorporates coding of all relevant papers within a target area on certain characteristics (King & He 2005). In essence, each study included in a descriptive review is treated as a unit of analysis and the published literature as a whole provides a database from which authors attempt to identify any interpretable trends or draw conclusions about the merits of existing conceptualisations, propositions, methods or findings (Pare et al. 2015). Thus, the outcome of such a review is often claimed to be representative of the current state of the research domain (Yang & Tate 2009).

In the context of this paper, the procedure for conducting the descriptive review of literature is described in detail after the schematic strategy adopted, which is shown in Figure 1. The schematic strategy

reflects the road map of the critical review for the empirical literature on presumptive tax systems and their design characteristics as used in developing countries. In Figure 1, the descriptive review of the literature was carried out in two phases: article selection and article analysis. The research articles were selected in a four-step process (searching for relevant journal articles, abstracts and conferences; use of keywords in searching; review of articles; and article selection). Then the second phase (analysis) was completed in a three-step process (articles were selected on the basis of the title; abstracts obtained, and analysis of articles meeting the criteria) as shown in Figure 1. The reviewers first searched for relevant articles using keywords and titles targeting research

papers, abstracts and conferences published from 1996 to 2020. The title alone was used to determine whether to accept or reject the research papers or whether the abstracts should be obtained. By comparing the results, the reviewers then reach a consensus to include or exclude the research paper in the analysis. This gave a total of 40 articles selected for meeting the criteria of the study. These were further examined in the second phase by ranking abstracts and 20 articles were left for analysis. During the analysis phase, the content of the selected research papers was analysed using a checklist from the classification framework shown in Table 2. Four dimensions were analysed: presumptive tax systems in use, taxpayers targeted by the system, thresholds in use and finally the timeframe of use.



Source: Durand et al. 2007:126

Figure 1. Strategy used for literature review

The review process involved three phases that include filtering, classification and the evaluation of the selected articles.

Filtering process

To identify relevant articles within the domain of presumptive tax systems and their design characteristics, research papers were included in the review if they reported on empirical research and their focus fitted that of presumptive tax systems. Identification and location of relevant articles were done using a search engine known as Google Scholar.

Using online database searches as a primary literature collecting approach has become an emerging culture for modern researchers (Yang & Tate 2009:40). The electronic search refines the inclusion and exclusion criteria on issues of journal articles. From the articles identified, keywords ‘presumptive tax systems/methods’ and ‘presumptive tax system design characteristics’ were used for search purposes. Forty articles were identified for detailed review and the articles were imported directly into an Endnote database. This was done to check for duplicate articles; here, those without author names or written by anonymous authors were discarded (Yang & Tate 2009:40). Furthermore, following further review and discussion twenty publications were eliminated because they did not focus on presumptive tax systems and their characteristics but rather on different facets of presumptive taxation. This process left 20 research papers for review. The publication dates of the twenty articles reviewed ranged from 1996 to 2020. The filtering process required the reviewer to make more decisions for inclusion and exclusion by first reading all research papers (Schlagenhauser & Amberg 2015:5) on presumptive taxation.

A literature classification was developed based on categorisation of the research focusing on the twenty articles which remained after the filtering process. Specific sub-categories were assigned to each article. The first step was an initial reading of the twenty research papers. Codes were generated from article keywords, analysis of article abstracts and, where deemed necessary, to explicate the content of the paper further (Yang & Tate 2009:41). Furthermore, axial coding was applied, which involved inductive as well as deductive procedures in order to correlate the located concepts and categories found in the first stage further into categories and sub-categories (Schlagenhauser & Amberg 2015:6). The next step was to further group the content of the selected twenty articles into three dimensions: thresholds, taxpayers targeted and timeframe. This grouping is based on assigning the single most applicable topic category to a group of related sub-categories (Yang & Tate 2009:42). The content analysis furthermore targeted the intervention that was carried out in promoting voluntary tax compliance among small businesses taxable under the presumptive tax system. The content of the selected articles is analysed using the checklist in Table 1.

Classification process

*Table 1
Classification of topics in presumptive taxation*

Topics	Sub-topics
Presumptive taxation	Presumptive tax systems, design characteristics
Presumptive tax systems	Lump-sum, turnover/gross receipts, indirect assessments, third-party reporting, asset-based
Design characteristics of presumptive tax systems	Rebuttable/irrebuttable, minimum/maximum, thresholds, taxpayers targeted, timeframe

Source: Compiled by authors

Following a descriptive review approach, we provide an overview of the current developments in the design characteristics of various presumptive tax systems by conducting a systematic literature classification using the classification scheme. A descriptive review of literature is deemed as the most appropriate to support the creation of a classification framework (Schlagenhauser & Amberg 2015:3).

RESULTS AND ANALYSIS

Based on the classification framework shown in Table 2, four top categories were identified and 13 subcategories were developed for the top categories. For meeting the inclusion criteria, papers needed to focus on presumptive tax systems and their design characteristics in developing countries: 20 articles qualified. Categories and sub-categories were described, and attention was given to avoid overlapping of sub-categories. For a better understanding of presumptive tax system design

characteristics, sub-categories were introduced. The results are reported in terms of four components on the analysis checklist: presumptive tax systems, taxpayers targeted, thresholds and timeframe.

Presumptive tax systems (PT)

The articles were reviewed to determine the specific presumptive tax systems in developing countries. As presented in Table 2, the presumptive tax systems from 20 articles selected were analysed. Three

main types of presumptive tax systems were identified: (1) lump-sum tax system, (2) turnover/gross income tax system and (3) third-party reporting system.

Lump-sum tax system

This system is prescribed for a wide range of trades and professions (Memon 2010:83). It is normally introduced by enacting a separate tax law where a different economic base is used and the tax law is titled accordingly and the system is given different names from country to country for example lump-sum, license fee and patents (Memon 2010:83). Under a lump-sum tax system (PT1), taxpayers pay a fixed amount per period (quarterly, semi-annually or annually) based on an individual's profession or trade (Memon 2010:116; Dube & Casile 2019). Taxpayers can be divided into categories based on the type and amount of capital equipment used in the business, location, type of activity, or the number of years a person has been out of school (Memon 2010:117). Bird and Wallace (2015:133) argue that the estimate maybe applied on some specific basis on an individual basis and the amount assessed maybe a simple lump-sum tax based on the average income of a particular trade or profession or on sales, employees, assets and location information. The main aim of a lump-sum tax system is to achieve some degree of equity through differentiation among groups of taxpayers (Pashev 2006:404). Groups are delineated by economic activity or profession and the tax liability is set according to the average income potential of the respective group (Pashev 2006:404). The basic idea is to take advantage of data that are easier for tax officials to obtain than the information required to calculate actual taxable income as specified by law (Bird & Wallace 2015:137).

Turnover/gross income tax system

For turnover/gross income tax systems (PT2), the reviewers sought to identify taxpayers targeted, thresholds used, and the timeframe of system use for qualifying small businesses. Turnover or gross income-based tax systems can be structured in different ways (Engelschalk 2015:283). One alternative is to apply the same tax rate to all businesses subject to the tax, irrespective of the business activity (Engelschalk 2015:283). A second alternative is to divide the small business community into a number of business segments with different tax rates for individual segments. This takes into account the different profit margins in business segments, although the number of segments under a turnover-based system is relatively small (Engelschalk 2015:283). A third alternative is to introduce a progressive tax on gross income where different tax rates are applicable to different levels of gross income (Engelschalk 2015:284). The legislation in the case of gross income or turnover tax provides a minimum-tax type of presumption, whereby the taxable income of a business can be less than a specified

percentage of gross receipts of the business (Thuronyi 2015:108). For this basis, the tax has the same economic benefits as a turnover tax rather than a net income tax (Thuronyi 2015:114). Gross receipts are levies on an identifiable component of a business activity and have been used in many countries (Bird & Wallace 2015:138). Memon (2010:82) contents that under a gross income or turnover tax system, the actual tax base is replaced by a proxy base for example turnover and gross income substitute for income respectively. Both turnover and gross income are then subjected to the prescribed tax rates. The substitution of the actual base with a proxy base is legislated either through inserting or deeming a provision in the tax code, or by enacting a separate law (Memon 2010:82). Presumed turnover tax on the same component of a business activity or on the one source or class of income is then subjected to the prescribed tax rate (Thuronyi 2015:116; Memon 2010:82). The tax rate is charged on turnover or gross income generated for example per year.

Third-party reporting system

Finally, the third-party reporting (PT3), was evaluated against the characteristics of taxpayers targeted, thresholds in place and the timeframe of use. Since small business records are usually not available, the demand has increased gradually to reach third-party information to reconstruct small business income. With a global revolution in information technology, the adoption of indirect tax assessments based on third-party reporting information in both developed and developing countries has increased (Slemrod et al. 2017, cited in Bucci 2019:8). This tax system has been in use in countries such as United States of America, Chile, Ecuador, Denmark and Brazil (Bucci 2019:19). In such a case, the tax authority verifies the accuracy of taxpayer's reports using information reported by third party. Third parties that the tax authority can address to obtain information are employees, banks, investment funds, pension funds or companies' trading partners (Bucci 2019:10). The revenue authority originates pre-populated returns that are sent to taxpayers in either paper form or electronically for their confirmation, or if necessary, to obtain any additional information required to enable a final assessment to be made (Forum on Tax Administration 2006:4). Third-party information reporting is a tool used to address the problem of asymmetrical information between fiscal authorities and taxpayers (Bucci 2019:9). Information reported by third parties under the law is processed for matching with tax records to detect cases of inaccurate returns or return non-filing (Forum on Tax Administration 2006:5). Slemrod et al. (2017:155) pointed out that, the possibility to match reported data with information reported by disinterested third parties allows to obtain higher compliance rates at fair costs. Information reported by third parties can concern the overall taxable income achieved by individuals or

companies or only a component of taxable income such as the value of revenues earned by taxpayers (Bucci 2019:10). Third-party reporting is an effective enforcement device and the adoption of such an instrument strongly simplifies tax collection (Bucci 2019:11). The assessment of third-party information is normally done once per year.

Taxpayers targeted (TT)

The taxpayers targeted gave a general view on the categorisation of small businesses taxable under several presumptive tax systems in developing countries. Sub-categories aggregating multiple taxpayers targeted include micro-businesses (TT1), small businesses (TT2) and medium-sized enterprises (TT3). Micro, small and medium-sized enterprises cover different types of taxpayers under the presumptive tax systems. The distinction is by the size of the business, which can be identified using several bases. Different definitions were used to define and group taxpayers as micro, small or medium-sized enterprises in different developing countries. For tax purposes, often a single criterion or a combination of a number of criteria is used to specify small businesses (Haque 2013:64). The most common criteria that are used for defining small businesses include gross turnover, gross income, net assets, taxable income, number of employees and equity (Haque 2013:64). In Zimbabwe, small businesses are defined in terms of the Small and Medium Enterprise Act and the tax legislation. The Small to Medium Enterprise Association of Zimbabwe (2018) defines a small business as a business with turnover of less than US\$240,000 or assets of less than US\$100,000 while those with assets and turnover above US\$100,000 and US\$240,000 but less than US\$1 million should register as medium enterprises. The Small and Medium Enterprise Act (6th of 2011) defines small businesses by classifying them as micro, small and medium enterprises according to the number of employees, total annual turnover and gross value of assets excluding immovable property. The SMEs Act classifies a business as micro if it has less than five employees, an annual turnover of up to US\$30,000 or has a gross value of assets of up to US\$10,000. It further classifies a business as small if it has 6 to 20 employees, an annual turnover of US\$30,001 to US\$500,000 or assets with a gross value of US\$10,001 to US\$250,000. In addition, the SMEs Act classifies a business as medium if it has 31 to 75 employees, an annual turnover of US\$500,001 to US\$1,000,000 or assets with a gross value of US\$250,001 to US\$500,000. The Zimbabwe Revenue Authority (ZIMRA 2019) defines a small business as an enterprise with 6 to 40 employees, annual turnover of US\$50,000 to US\$500,000 or assets valued between US\$50,000 to US\$1 million, while a medium-sized entity is treated as a business with 41 to 75 employees, annual turnover and assets between US\$1 million and US\$2 million. There are conceptual

similarities in the definition of small businesses by the SME Association of Zimbabwe, SMEs ACT and ZIMRA. The SME Association of Zimbabwe focuses on turnover and assets while the SMEs ACT and ZIMRA focus on number of employees, turnover and assets. However, differences are noted in the values attached to the indicators used in identifying and defining small businesses. All the three sources have disregarded the legal structures and degree of formalisation, factors which are principal in defining small businesses (Munyanyi 2018:31).

Thresholds (TH)

Based on the classification framework, thresholds constitute the different inclusion and exclusion criteria that are used for identifying micro, small and medium-sized enterprises taxable under different presumptive tax systems. From the 20 articles selected, thresholds used for the inclusion or exclusion of enterprises include turnover/gross income level (TH1), the value of assets (TH2), the number of employees (TH3) and business trade (TH4). A turnover/gross income threshold (TH1) category identifies the lower limit and the upper limit of turnover/gross income level for the inclusion or exclusion of micro, small and medium enterprises in the presumptive tax system. The value of assets (TH2) measures the monetary value of physical and intangible assets owned by the micro, small or medium business operator. This is used to estimate the size of the business and its tax liability. The number of employees category (TH3) is popular in many developing countries for the estimation of the tax liability of micro, small and medium enterprises in developing countries. Presumptive tax systems sometimes use the number of employees to classify a business as a micro, small or medium operator. In this case, the number of employees is associated with the presumptive tax payable. Finally, a business trade (TH4) can be used in estimating the turnover/gross income of micro, small or medium enterprise under a presumptive tax system. A business trade relates to the economic sector to which the micro, small or medium-sized entity undertakes its activities. Thus, a presumptive tax system can use a small business's line of trade to approximate its tax liability.

Timeframe (TF)

The timeframe (TF) is used to define the specified length of the period in which a micro, small or medium-sized enterprise is taxable under a presumptive tax system. From the review of the selected papers, the timeframe was expressed as: definite (TF1), or silent (TF2). A definite category (TF1) refers to a presumptive tax system where enterprises are taxable for a limited or specified period. Finally, a silent timeframe (TF2) serves that a presumptive tax system does not pronounce the maximum period an enterprise can stay in the

presumptive tax system. Table 2 summarises the classification framework with a matrix of results from

the 20 reviewed research papers.

Table 2
Matrix of results on presumptive tax system design characteristics for developing countries

Author(s)	Paper number	Country/ Year	Presumptive tax systems			Presumptive tax system characteristics									
			Lump-sum	Turnover/GI	Third-party	Taxpayers targeted			Thresholds				Timeframe		
						Micro	Small	Medium	Turnover/GI	Assets	No. of employees	Business trade	Definite	Silent	
Bongwa	1	Ethiopia/ 2009	x	x			x			x		x			x
Boonzaaier et al.	2	South Africa/ 2019		x			x	x	x						x
Danquah & Osei-Assibey	3	Ghana/ 2018	x			x	x	x				x			x
Dube & Casile	4	Zimbabwe/ 2019	x			x	x	x	x	x	x	x			x
Getachew	5	Ethiopia/ 2019	x	x		x			x		x				x
Haji & Haji	6	Tanzania/ 2015	x	x		x	x	x	x						x
Iordachi & Tirlea	7	Romania/ 2016		x		x			x		x		x		
Joshi et al.	8	Ghana/ 2014	x			x	x	x		x		x			x
Megacom	9	Egypt/ 2005		x		x	x	x	x						x
Memon	10	Pakistan/ 2013		x		x	x	x	x						x
Nabaweesi & Nakku	11	Uganda/ 2013		x			x		x						x
Ogembo	12	Kenya/ 2018		x		x	x	x	x						x
Oladipupo & Obazee	13	Nigeria/ 2016		x		x	x	x	x						x
Saleheen	14	Bangladesh/ 2012	x	x			x		x						x
Schutte et al.	15	South Africa/ 2019		x		x	x		x		x		x		
Sebele-Mpofu & Mususa	16	Zimbabwe/ 2019	x			x	x	x		x	x	x			x
Sebikari	17	Uganda/ 2014		x			x		x						x
Taube & Tadesse	18	Ghana/ 1996	x			x	x					x			x
Udoh	19	Nigeria/ 2015			x	x	x		x						x
Zulaikha & Basuki	20	Indonesia/ 2017		x		x	x	x	x				x		
			10	14	1	15	18	11	16	3	6	5	3		17

The categories were sorted alphabetically with a count of findings used to sort sub-categories within each category. The individual articles were numbered from 1

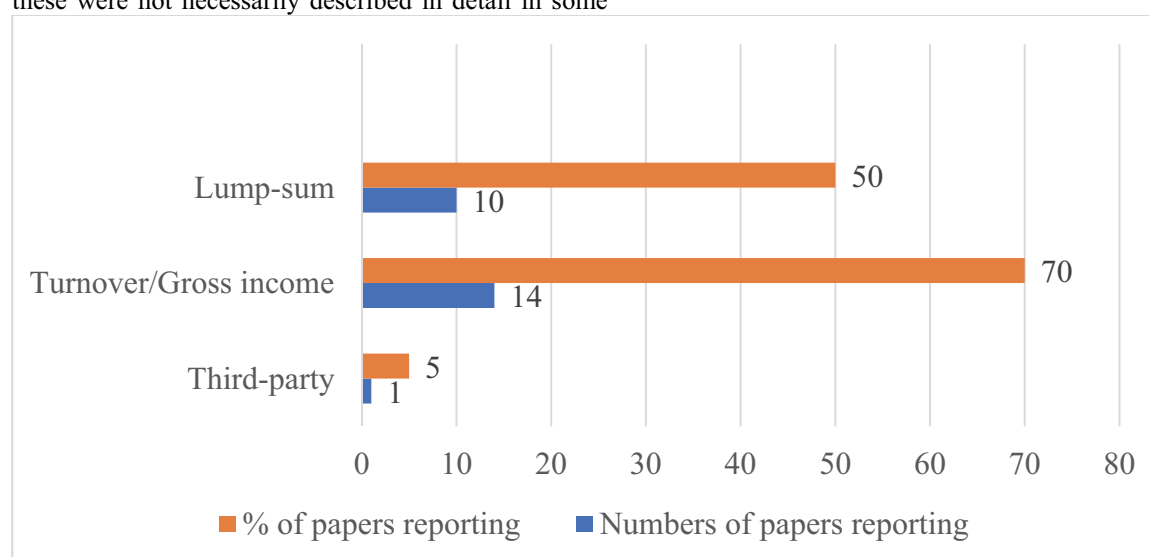
to 20 for easier reference. The content analysis of the papers reviewed provided additional information that aids in the understanding of how taxpayers are targeted

and how thresholds and timeframes can be conceptualised and assessed. The matrix of results shows the findings for each research paper analysed in this study using the three categories of presumptive tax systems (taxpayers targeted, thresholds and timeframe). It is evident that all the papers analysed reported some scores on some of the sub-categories with the lowest number of findings recorded in Paper 11 (Ogembo 2018) and the highest findings reported in Paper 4 (Dube & Casile 2019). The papers contained between four and nine findings. Hence, the research papers in this direction took an evaluative standpoint and describe potentially effective approaches designed to establish the tax compliance of small businesses. The papers reviewed showed a tendency to include some, but not necessarily all, of the specific categories of design characteristics of presumptive tax systems. In addition, the analysis of the papers also revealed the design characteristics of presumptive tax systems as critical in influencing the tax compliance behaviour of small businesses. However, it should be noted that although a paper-by-paper analysis revealed the characteristics of categories such as presumptive tax system, taxpayers targeted, thresholds and timeframe, these were not necessarily described in detail in some

instances. The reviewers analysed the articles by the presumptive tax system, taxpayers targeted, thresholds and timeframe.

Distribution of the articles by presumptive tax systems

In the majority of the articles reviewed, the results show that the lump-sum tax system (10 papers, 50% of the reviewed papers), turnover/gross income tax system (14 papers, 70%) are common presumptive tax systems employed in developing countries with third-party reporting system (1 paper, 5%) being the least infrequently written about in the academic literature. The turnover/gross income tax system might be the leading system due to its proximity to the estimated tax liability of small businesses. Besides, a lump-sum tax system proved to be also popular in the taxation of small businesses in developing countries, with third-party reporting named by Paper 19 (Udoh 2015) being viewed as uncommon in most developing countries.



Source: Compiled by authors

Figure 2. Distribution by the type of presumptive tax system

Design characteristics are an important feature in any presumptive tax system. However, regardless of their differences in structure and characteristics, all presumptive tax systems are meant to bring non-compliant small businesses into the normal tax system. Several presumptive tax methods adopted by developing countries are not useful policy tools in increasing tax revenues, formal registration or voluntary tax compliance of small businesses (Bucci 2019). This is attributed to the limited enforcement power of fiscal authorities, often accompanied by the unsuitability of presumptive tax policy tools, which are not well designed and not fully integrated into the general tax system (Bucci 2019). The articles that were

reviewed mostly focus on the presumptive tax systems and the variables that affect their design issues were not much emphasised (Bucci 2019; Dube & Casile 2016; Taube & Tadesse 1996).

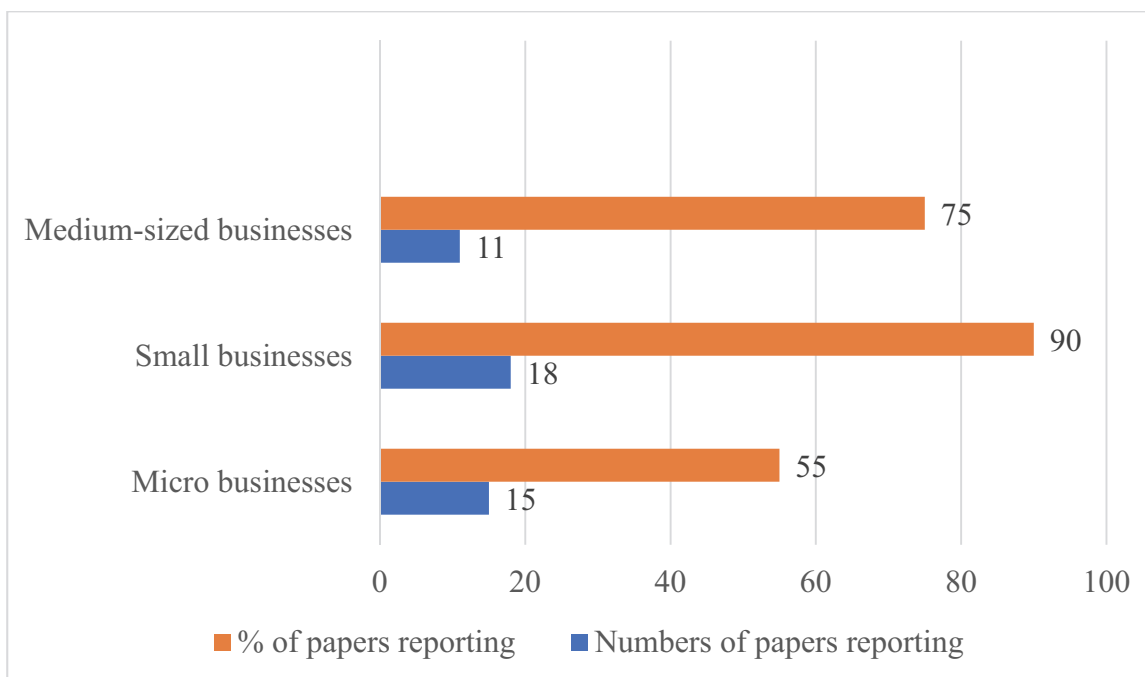
Figure 2 reveals the distribution of articles for each presumptive tax system sub-category. Clearly, turnover tax and lump-sum tax systems are two major methods used in the taxation of small businesses in developing countries. This is unsurprising. Their simplicity and relatively low administrative costs have always been an important reason for developing countries to adopt them. However, a very small number of papers regarded a third-party reporting system as an infrequent method in the taxation of small businesses in

developing countries. This may be because the value and the implications of a third-party reporting system are still under-recognised in facilitating the tax compliance of small businesses.

For the purpose of this study, taxpayers targeted, thresholds and timeframe are of great interest in influencing the compliance behaviour of small businesses under a presumptive tax system. Taube and Tadesse (1996) recommended that presumptive tax systems that make use of indicators seem to work best when they use information and documentation from third parties, especially from government agencies. Results from certain papers (20%) show that some developing countries employ a combination of two different presumptive tax systems for the taxation of small businesses. This is common where small businesses are segmented into specific categories using various bases and thus a presumptive tax system is specifically designed targeting a specific small business group. In such countries, the presumptive tax liability is determined using the level of turnover and a fixed amount.

Distribution of the articles by taxpayers targeted

The reviewed articles showed that micro (15 papers, 75% of the reviewed papers), small (18 papers, 90%) and medium-sized (11 papers, 55%) businesses are the taxpayers targeted by presumptive tax systems implemented in developing countries. Small and micro businesses are the most frequently named groups, with medium-sized enterprises completing the groups targeted by presumptive tax systems. Haji and Haji (2015) and Dube and Casile (2019) provided different groups taxable under presumptive tax systems, as shown in Table 2. Other views were noted in Megacom (2005) and Joshi et al. (2014). It is worth mentioning that some papers employed one definition for small businesses to refer to micro, small and medium-sized enterprises (Saleheen 2012; Sebinenko 2016; Nabaweesi & Nakku 2013). Various definitions and terms were therefore used to describe micro, small and medium-sized enterprises.



Source: Compiled by authors

Figure 3. Distribution of the articles by taxpayers targeted

One significant finding of the study evidenced by taxpayers targeted under presumptive tax systems was the various groups that meet the inclusion criteria. Further, data from the papers reviewed confirm the complexity of classification and definition of businesses taxable under presumptive tax systems. However, there was a consistent pattern of research confirming taxpayers targeted by different presumptive tax systems as micro, small and medium-sized businesses, as shown in Figure 3. The application of

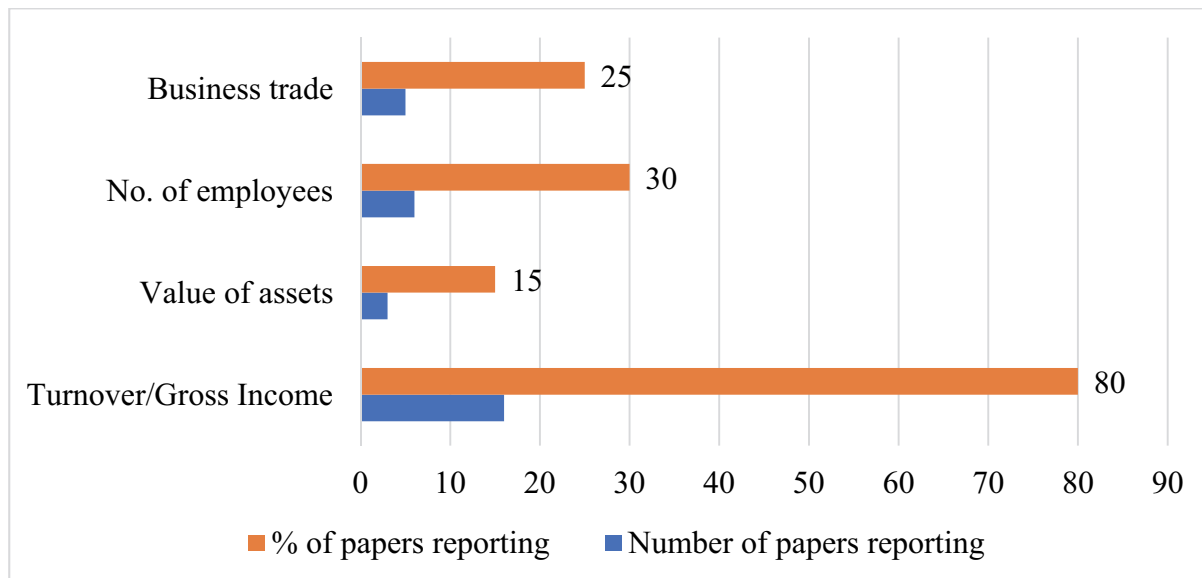
the presumptive tax system has been limited to small and medium-scale businesses having difficulties in keeping formal or proper books and records (Haji & Haji 2015). The analysis also revealed that most papers agreed that the design and implementation of presumptive tax systems are meant for encouraging the tax compliance of micro and small businesses. The extent to which presumptive tax systems are used varies from country to country (Iordachi & Tirlea 2016). This is because the appropriate design of

presumptive tax systems will depend on the problems the government desires to solve, for example, what types of taxpayers form the source of problems under the normal rules (Iordachi & Tirlea 2016). Several papers demonstrated that sources of information and bases used to identify and classify taxpayers targeted as micro, small or medium-sized vary across countries and presumptive tax methods in use. Additionally, most of the papers reviewed reflected that a clear definition of taxpayers targeted by the presumptive tax system reduces abuse of the system by large organisations or capable small businesses which should be taxable under the normal tax system. This demonstrates that directing a presumptive tax system towards a specific group of taxpayers has the potential to influence their tax compliance behaviour.

Distribution of the articles by thresholds

Turnover/gross income level [16 papers, 80% of analysed papers], number of employees [6 papers, 30%], business trade [5 papers, 25%] and value of assets [3 papers, 15%] were identified as thresholds used for the inclusion and the exclusion criteria of small businesses taxable under presumptive tax systems in developing countries. Figure 4 shows that most of the papers identified turnover/gross income level as the common threshold used in setting the upper limit of turnover when moving small businesses from the presumptive tax system to the standard tax system.

The literature showed that several presumptive tax systems use more than one threshold beside turnover level [Papers 1,4,5,7,8,15,16] for the inclusion criteria of small businesses in the tax system. However, most of the selected articles do not discuss specifically the design of thresholds of presumptive tax systems, but rather focus on the implementation of presumptive tax systems in general. In 9 out of the 20 papers, the authors were interested in presumptive tax systems more directly related to intervention in developing countries [Papers 1,4,5,6,7,10,13,16,18]. The main variable measured was the implementation and the use of several presumptive tax systems. The evaluation of the literature shows that the presumptive tax methods, turnover/gross income level, asset values, number of employees vary from country to country. For instance, it is optional for small businesses to choose whether to be taxable under presumptive tax systems [15,20], whilst it is mandatory for any small business that meets the set thresholds to be taxable under the presumptive tax system [Papers 1,2,3,4,5,6,7,8,9,10,11,12,13,14,16,17,18,19]. It was discovered that indicators like the value of assets, number of employees and business location/trade are mainly used in lump-sum presumptive tax systems [Papers 1,3,4,5,6,7,8,16,18]. These papers also indicated that a fixed presumptive tax charge is levied on small businesses in similar circumstances [Papers 4,5].



Source: Compiled by authors

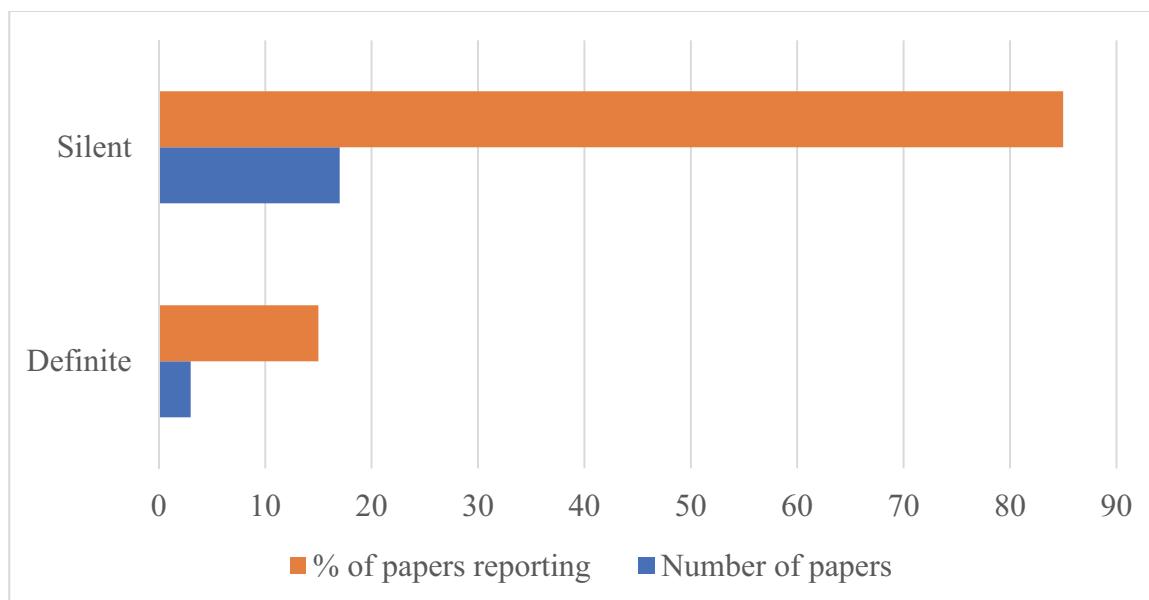
Figure 4. Distribution of the articles by thresholds

One of the major patterns that emerged from the review of papers selected was the frequent use of turnover as a threshold for the inclusion criteria of small businesses in the presumptive tax systems. The establishment of a tax threshold has, therefore, the potential to remove a large portion of the hard-to-tax small businesses from the income tax net (Thuronyi

2015). The rapid growth in the use of turnover as a threshold suggests that developing countries consider it as a better reflection of the tax liability of small businesses. Additionally, the use of business trade, the number of employees and the value of assets are also common in some developing countries, despite being on the decline side. The lower use of these thresholds

may imply an inaccurate estimation of small businesses' tax liability. This lack of clearly defined thresholds makes it hard for presumptive tax systems to improve the tax compliance of small businesses. The lump-sum presumptive taxes implemented in developing countries have no entry thresholds and they tend to be regressive by taxing those with lower incomes proportionately more (Dube & Casile 2016). Several papers reveal that thresholds vary from country to country (Rajaraman & Bhende 1998, Bird & Wallace 2015, Thuronyi 2015, Bongwa 2009).

Distribution of the articles by timeframe



Source: Compiled by authors

Figure 5. Distribution of the articles by timeframe

In many of the research papers reviewed, the specification of the variable timeframe was missing or incomplete. For example, the timeframe was specified in less than a quarter of the studies utilised. Those studies revealed that in South Africa, micro-businesses remain locked in for three years once they have opted for the turnover tax and this acts as a restrictive measure (Visser 2016). The evidence on the timeframe for presumptive tax systems revealed that particularly where the tax liability is much less than that in the normal tax system should be defined and a taxpayer should not be allowed to make use of the system indefinitely (Memon 2010). However, in most of the papers reviewed, the timeframe was unspecified or silent. This lack of timeframe information in most papers reviewed makes the interpretation of results and comparison of presumptive tax system features impossible. The analysis of the presumptive tax system

Only 3 of the reviewed articles (15%) gave information on a definite timeline concerning the length of period small businesses can stay in the presumptive systems used in developing countries, as illustrated in Figure 5. In analysing a definite timeframe, papers [7,15,20] revealed that if the small business records income above the upper limit of the threshold, then it has automatically been taxable under the normal income tax. In Papers 1,2,3,4,5,6,8,9,10,11,12,13,14,16,17,18 and 19 no timeframe is mentioned for the small businesses under the presumptive tax systems in use. For instance, Getachew (2019) reported that small businesses have been operating from as less than two years to more than 10 years under the turnover and lump-sum presumptive tax systems in Ethiopia. This has been caused by the non-existence of a time-limit (Ogembo 2018) on how long a taxpayer can benefit from the presumptive tax system.

without a defined timeframe in many developing countries revealed the lack of monitoring of small businesses under the system. The current presumptive tax systems in place do not stipulate the time limit on how long the small business can stay in the presumptive tax system (Ogembo 2018). As a result, the thresholds that are in place are not capable of moving businesses that grow out of the presumptive tax system into the normal tax system. This implies that small businesses can stay or hide under the presumptive tax for a very long period or the entire duration of their lifespan. This undermines the objective of moving small businesses from the informal to the formal sector.

Analysis of small business taxation problems in selected developing countries

In Zimbabwe, the presumptive tax system is mostly a lump-sum system differentiated by economic activity sector and levied on a quarterly basis (Dube & Casile 2019). Furthermore, in the transportation industry, the presumptive tax system tries to differentiate income-earning capability by using indications such as the number of seats or the size of the vehicle in tonnes. As a result, the tax system is presumed to be progressive. The difficulty with Zimbabwe's lump-sum presumptive tax system is that it is horizontally inequitable, with effective rates ranging from 10% to 20% at the lowest income level across all activity classifications (Dube & Casile 2019). The presumptive tax system is regressive in terms of vertical equity. Because other activity classifications pay lump-sum payments regardless of income level, people with lower incomes pay a higher proportion of their income in presumptive taxes than people with higher incomes (Dube & Casile 2019). Countries such as Romania, Tanzania, and South Africa, on the other hand, employ a turnover tax system to tax small firms. Tanzania's turnover tax system employs a segmental organisation of the tax administration with separate departments to deal with small businesses. In Tanzania, the Block Management System (BMS) is a method that is suited to the demands of particular sorts of small businesses (Haji & Haji 2015). However, the lack of records for registered small businesses has hampered Tanzania's implementation of the turnover tax system. Like Tanzania, South Africa has a progressive turnover tax regime. Tanzania's turnover tax structure ensures a minimum of vertical and horizontal equity (Haji & Haji 2015). The presumptive tax system in Tanzania has the disadvantage of favouring small businesses with strong profit margins, as well as some small businesses under-declaring their revenue (Haji & Haji 2015). Similarly, despite the advent of the South African turnover tax system, small firms are not necessarily using it as intended (Schutte et al. 2019). This is due to a lack of understanding of the turnover tax scheme. Furthermore, because small businesses are expected to maintain a sophisticated accounting system to assess their cashflows, profit or loss positions, the turnover tax system raises their tax compliance expenses (Schutte et al. 2019; Haji & Haji 2015). Generally, small firms contribute very little to overall tax revenues and do not graduate into the normal tax system in either the lump-sum (Zimbabwe and Ghana) and turnover tax systems (South Africa and Tanzania) (Dube & Casile 2019; Schutte et al. 2019; Danquah & Osei-Assibey; 2018; Haji & Haji 2015).

Ethiopian experience has demonstrated that it employs both a turnover-based and an indicator-based presumptive tax system (Getachew 2019). Nigeria, too, employs a mix of turnover-based systems and third-party reporting (Udoh 2015). The progressive turnover presumptive tax system lowers the tax burden between the upper and lower bands of the presumptive tax system, smoothing the transition to the regular regime (Getachew 2019). The problem with Ethiopia's

turnover-based system is that it is inefficient, and it discourages efficient enterprises by increasing their expenses (Getachew 2019). The lag time for daily sales estimating is another issue with the turnover-based method, since small firms tend to underestimate their income through their sales register devices (Getachew 2019). Furthermore, Ethiopia's turnover tax system contains several turnover bands, resulting in convoluted tax ratings that are difficult for small enterprises to understand and that generate a high administrative burden. The dilemma is similar in Nigeria and Zimbabwe, where no statistics databases exist due to small business operators' failure to register (Dube & Casile 2019; Udoh 2015). When it came to taxing small enterprises in Ethiopia, the combination of both turnover-based and indicator-based systems yielded benefits, such as when gross revenue was understated. The indicator elements are employed in this case in the turnover-based system as obvious counter-evasion elements from the perspective of the tax collector (Getachew 2019).

CONCLUSION

In this paper we discussed presumptive tax system design characteristics and their relative importance in the tax compliance of small businesses in developing countries. First, relevant presumptive taxation literature was collected, analysed and filtered from 40 research articles. A classification framework was developed to organise and systemise existing academic knowledge about presumptive tax system design characteristics. Literature was mapped to the classification framework and the review made it possible to work with 20 articles describing several presumptive tax systems used in developing countries and their design characteristics. This paper analysed the results of research papers that presented literature on presumptive tax systems used in developing countries with a focus on three design characteristics: taxpayers targeted, thresholds and timeframe. It further analysed presumptive tax system experiences in developing countries.

The question remains whether the characteristics examined in this paper – taxpayers targeted, thresholds and timeframe – are sufficient prerequisite design characteristics to guarantee the tax compliance of small businesses. In terms of taxpayers targeted, generally, there was a consensus from the papers reviewed that the presumptive tax systems are enforced on small businesses, professionals and individuals who carry out economic activities. It was also observed that the categorisation of the taxpayers targeted as micro, small or medium-sized varies from country to country and this complexity in definition made it difficult to evaluate the appropriateness of most presumptive tax systems in facilitating the tax compliance of small businesses in developing countries. It was found that despite directing presumptive tax systems to micro, small and medium-sized businesses, there was no

significant change in their tax compliance behaviour. Regarding thresholds, there is some evidence that presumptive tax systems in most developing countries pronounce some upper limit threshold for moving small businesses from the presumptive tax system to the standard tax system. Several of them do not specify the lower limit threshold. Furthermore, the turnover threshold proved to be common in most developing countries. Despite its use, many small businesses in developing countries underreport their turnover and thus tax compliance is reduced. In addition, the value of assets, business trade and the number of employees provides at least some degree of compliance, as small businesses pay some form of tax regardless of their turnover level. However, many studies proved that they are not accurate in the estimation of presumptive tax liability and this in turn reduces tax compliance of small businesses. To make matters worse, most of the systems are silent about the length of period a small business should stay in the presumptive tax system. This implies that without properly designed features, the presumptive tax systems appear to be abused by capable small businesses and large organisations. This results in low tax revenues due to weak supervision and a lack of resources in monitoring small businesses' activities in developing countries. Therefore, many small businesses remain permanently in the presumptive tax system and there is no transition to the normal tax system. The literature acknowledged that the characteristics of presumptive tax systems play a significant role in the formalisation and tax compliance of small business operators in developing countries, if properly implemented and monitored. In a nutshell, although the taxpayers targeted, thresholds and timeframe exist to some extent in presumptive tax systems, their influence on the tax compliance of small businesses is still very low in developing countries. In summary, most presumptive tax schemes used in developing countries yield low revenue in comparison with other tax types and the uptake by small businesses is very insignificant.

RECOMMENDATIONS

There are no universal methods for designing and implementing presumptive tax systems. The characteristics of presumptive tax regimes vary from each country (Danquah & Osei-Assibey 2018). Nonetheless, this paper recommends the need for future research in blending existing lump-sum and turnover/gross income presumptive tax system with third-party reporting information systems that make use of information technology for the taxation of small businesses. The inference made is that the infusion of technology could divert presumptive tax systems that rely on cash-based transaction information to information that can be generated using technology, for instance through banking systems and mobile devices. This recommendation could lead to improved tax compliance of small businesses taxable under

presumptive tax systems. Additionally, there is a need for more outreach programs to equip small businesses with basic bookkeeping skills and compliance issues. Further, the time limit should be clearly stated to eliminate businesses that intend to stay forever in the presumptive tax systems.

It is also suggested that the amount of presumptive taxes levied be supported by good research on sub-sector profitability, so that erroneous amounts are not levied on grounds of limited capacity. This is because segmenting the small business community enables distinct policies to be applied to each sub-group, and this trustworthy data will improve the tax system's fairness. Furthermore, for better planning, an emphasis on the database for effective assessment and collection from the small business sector is required, as this sector is difficult to catch within any country's tax net. More importantly, it is imperative for the government to create incentives for small enterprises to keep books and records, such as exempting a certain proportion of tax liabilities in exchange for thorough accounting. In a nutshell, the payment system should be automated and linked to bank payment modes to support a good presumptive tax system design, which necessitates the involvement of both the tax and banking authorities.

POLICY IMPLICATIONS

In general, the usefulness and practicality of the policymakers' recommendations for continued development of presumptive tax systems in developing and middle-income nations is fundamental to the study's success. Small businesses account for a higher percentage of tax defaulters, resulting in an increase in tax evasion and revenue leakage (Udoh 2015). The turnover-based approach can ease the transition to the conventional tax system, according to research findings and conclusions. This is because decreased turnover bands make it easier for small firms to grasp the tax system. In addition, lower rates for those who keep complete records of sales and costs may encourage small business owners to adhere to the presumptive tax. It is also critical for tax policymakers to recognise the need for tailoring a presumptive tax system to the needs of small enterprises. As a result, the presumed tax policy would be aligned with the capacity of the taxpayer, improving the system's fairness. While presumptive tax generates minimal income in the short term, it serves to bring businesses into the tax net, ensuring that they comply with the law as they grow. Adopting the study's recommendations could assist the further development of tax systems for small firms and expand the revenue base in developing and middle-income countries.

LIMITATIONS AND FUTURE RESEARCH

Despite the article's theoretical insights and contributions to the evolution of tax policy, the study has limits. The research was qualitative, and while this approach has some advantages, it falls short of capturing all of the design aspects of a good tax system. Only related literature on the design and implementation of presumptive tax systems in selected developing countries was considered. If analysis of existing literature is combined with primary data, the study could reveal a wealth of information about small business perspectives on presumptive tax compliance, which could be useful in further developments of presumptive tax systems. Despite the limitations mentioned, the insights brought about by this paper are enough to stimulate future research on further developments of presumptive tax systems. Thus, future research can focus on a comparative analysis of characteristics of presumptive tax systems and small

businesses' tax perceptions in both developed and developing countries. This can facilitate further developments of taxation approaches for small businesses in developing, middle-income and developed countries through sharing experiences.

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REFERENCES

- ADITYA, C. 2020. The presumptive tax regime on micro, small and medium enterprises in Indonesia. *Syntax Literate*, 5(6):50-63.
- BIRD, R. M. & WALLACE, S. 2015. The context and role of presumptive taxes in taxing the hard-to-tax: lessons from theory and practice. *Emerald Insight*, 121-158.
- BONGWA, A. 2009. Informality in Ethiopia: taxing the hard to tax. HIS Working papers, No. 22, Institute for Housing and Urban Development Studies, Rotterdam. Available at: https://www.ihs.nl/sites/corporate/files/IHS_WP_022_Bongwa_Aloysius_Informality_in_Ethiopia_Taxing_the_Hard_to_Tax_2009.pdf, Accessed 13 Oct. 2020.
- BOONZAAIER, W., HARJU, J., MATIKKA, T. & PIRTILA, J. 2019. How do small firms respond to tax schedule discontinuities? Evidence from South African tax registers. *International Tax and Public Finance*, 26:1104-1136.
- BUCCI, V. 2019. Presumptive taxation methods: a review of the empirical literature. *Journal of Economic Survey*, 00(0):1-26.
- DANQUAH, M. & OSEI-ASSIBEY, E. 2018. The extent and determinants of tax gap in the informal sector: evidence from Ghana. *Journal of International Development*, 30:992-1005.
- DUBE, G. & CASILE, D. 2016. The implementation of informal sector taxation: Evidence from selected African countries. *eJournal of Tax Research*, 14(3):601-623.
- DUBE, G. & CASILE, D. 2019. Informal sector taxes and equity: Evidence from presumptive taxation in Zimbabwe. *Development Policy Review*, 37:47-66.
- DURAND, M.J., VEZINA, N., LOISEL, P., BARIL, R., RICHARD, M.C., & DIALLO, B. 2007. Workplace interventions for workers with musculoskeletal disabilities: A descriptive review of content. *Journal of Occupational Rehabilitation*, 17:123-136.
- ENGELSCHALK, M. 2015. Creating a Favourable Tax Environment for Small Business. In: Alm, J.R., Martinez-Vayquez, J. and Wallace, S. (Eds.), *Taxing the Hard-to-tax: Lessons from Theory and Practice* (Contributions to Economic Analysis, Vol. 268). Bingley, UK: Emerald Group Publishing Limited. pp. 275-311.
- FORUM ON TAX ADMINISTRATION, 2006. Using third party information reports to assist taxpayers meet their return filing obligations— country experiences with the use of pre-populated personal tax returns. Organisation for Economic Co-operation and Development, available at: <https://www.oecd.org/tax/administration/36280368.pdf> accessed on 26 Oct. 2021.
- GETACHEW, A. 2019. Turnover-based presumptive taxation and taxpayers' perceptions in Ethiopia. African Tax Administration Paper 7, available at: <http://www.ictd.ac/publication>, accessed on 16 Oct. 2020.
- GRANT, M.G. & BOOTH, A. 2009. A typology of reviews: an analysis of 14 review types and associated methodologies. *Health Information and Libraries Journal*, 26:91-108.
- HAJI, S. & HAJI, H. 2015. Presumptive tax system and its influence of the ways informal entrepreneurs behave in Tanzania. *Tanzanian Economic Review*, 5 (1&2):72-90.
- HAQUE, A.A. 2013. The taxation of small business in developing countries. PhD thesis, Monash University.
- IORDACHI, V. & TIRLEA, M.R. 2016. Use of presumptive taxation in facilitating small business tax compliance. *Economy and Sociology: Theoretical and Scientific Journal*, 3:11-19.

- JAIDKA, K., KHOO, C.S.G. & Na, J. 2013. Literature review: how information is selected and transformed. *Aslib Proceedings* 65(3):303-325.
- JOSHI, A., PRICHARD, W. & HEADY, C. 2014. Taxing the Informal Economy: The Current State of Knowledge and Agendas for Future Research. *Political Communication*, 50(10). DOI: 10.1080/00220388.2014.940910
- KING, W.R. & HE, J. 2005. Understanding the Role and Methods of Meta-Analysis in IS Research, *Communications of the Association for Information Systems*, 16(32):665-686.
- KUNDT, T.C. 2017. Opportunities and challenges for taxing the informal economy and subnational taxation. K4D emerging issues report. Brighton, United Kingdom: Institute of Development Studies.
- LOGUE, K.D. & VETTORI, G.G. 2010. Narrowing the tax gap through presumptive taxation. *Law & Economics Working Papers*. Paper 8.
http://repository.law.umich.edu/law_econ_current/art8 Date of access: 10 Jan. 2020.
- MEGACOM, 2005. Applying patent system on micro enterprises in Egypt. Canada/ Egypt Small and Medium Enterprises Policy Development Project, Available at: <https://idl-bnc-idrc.dspacedirect.org/bitstream/handle/10625/26742/124046.pdf>, Accessed on 11 Oct. 2020.
- MEMON, N. 2013. Looking at Pakistani presumptive income tax through principles of a good tax? *eJournal of Tax Research*, 11(1):40-78.
- MEMON, N.A. 2010. Analysis of presumptive income tax for small business in informal economies: a case of Pakistan. PhD dissertation, The University of New South Wales.
- NABAWEESE, J. & NAKKU, V.B. 2013. Tax morale and tax compliance among small business enterprises in Uganda. *TIJ's Research Journal of Economics & Business Studies*, 28(11): 8 pages.
- NYAMWANZA, T., MAVHIKI, S., MAPETERE, D. & NYAMWANZA, L. 2014. An analysis of SMEs' attitudes and practices towards tax compliance in Zimbabwe. *SAGE Open*: 4(3): 6 pages.
- OGEMBO, D. 2018. *Are presumptive taxes a good option for taxing self-employed professionals in developing countries?* Working Paper Series No. 18/14. Centre for Business Taxation: Oxford University. <http://eureka.sbs.ox.ac.uk/7253/1/WP1814.pdf> Date of access: 29 Apr. 2020.
- OLADIPUPO, A.O. & OBAZEE, U. 2016. Tax knowledge, penalties and tax compliance in small and medium scale enterprises in Nigeria. *iBusiness*, 8:1-9. <http://dx.doi.org/10.4236/ib.2016.81001>.
- PARE, G., TRUDEL, M.C., JAANA, M. & KITSIOU, S. 2015. Synthesising information systems knowledge: a typology of literature reviews. *Information & Management*, 52(2):183-199.
- PASHEV, K.V. 2006. Presumptive taxation: lessons from Bulgaria. *Post-Communist Economics*, 18(4):399-418.
- PETERSEN, K. VAKKALANKA, S. & KUZRIARZ, L. 2015. Guidelines for conducting systematic mapping studies in software engineering: an update. *Information & Software Technology*, 64:1-18.
- RAJARAMAN, I. & BHENDE, M.J. 1998. A land-based agricultural presumptive tax designed for levy by panchayats. *Economic and Political Weekly*, 33(14): 765-778.
- SALEHEEN, A.M. 2012. Presumptive taxation under Bangladesh VAT. *International VAT Monitor*, 23(5): 316-321.
- SCHLAGENHAUFER, C. & AMBERG, M. 2015. A descriptive literature review and classification framework for Gamification in Information Systems. *ECIS 2015 Completed Research Papers*. Paper 161.
- SCHUTTE, D., LABUSCHAGNE, D., GEORGESCU, M.A. & Pop, C. 2019. An evaluation of the turnover tax system in South Africa. *Theoretical and Applied Economics*, 26(3):59-70.
- SEBELE-MPOFU, F.Y. & MUSUSA, A. 2019. How successful is presumptive tax in bringing informal operators into the tax net in Zimbabwe? A study of transport operators in Bulawayo. *International Journal of Innovative Science Research Technology*, 4(3):79-88.
- SEBIKARI, K.V. 2014. Critical analysis of the taxation policy on small businesses and enterpreneurial enterprises in Uganda. *Journal of Economics & Sustainable Development*, 5(10).
- SEBINENKO, I. 2016. Presumptive Taxation in Ukraine assessment of previous and current systems from the fiscal perspective. *International Journal of Accounting and Taxation*, 4(2):56-78.
- SLEMLROD, J., COLLINS, B., HOOPS, J.L., RECK, D. & SEBASTIANI, M. 2017. Does credit-card information reporting improve small business tax compliance? *Journal of Public Economics*: 149-179.
- SMALL AND MEDIUM ENTERPRISE ASSOCIATION OF ZIMBABWE. 2018. Presumptive tax explained. <https://www.smeaz.org.zw/about-us/96-smeaz-information/smeaz-blog-zone/489-presumptive-tax-explained> Date of access: 10 Jan: 2020.
- TAUBE, G & TADESSE, H. 1996. Presumptive taxation in Sub-Saharan Africa: experiences and prospects. International Monetary Fund. Working paper 96/5. <https://www.imf.org/external/pubs/ft/wp/wp9605.pdf> Date of access: 22 Mar. 2016.
- THURONYI, V. 2015. Presumptive taxation of the hard-to-tax. In: Alm, J.R., Martinez-Vayquez, J. and Wallace, S. (Eds.), *Taxing the Hard-to-tax: Lessons from Theory and Practice* (Contributions to Economic Analysis, Vol. 268). Bingley, UK: Emerald Group Publishing Limited. pp. 101-120.
- UDOH, J.E. 2015. Taxing the informal economy in Nigeria: Issues, challenges and opportunities. *International Journal of Business and Social Science*, 6(10):160-175.

- VAILLANCOURT, F., & CLEMENS, J. 2008. Compliance and administrative costs of taxation in Canada. In J. Clemens (Ed.), *The Impact and Cost of Taxation in Canada: The Case for Flat Tax Reform* (pp. 55–102). Canada: The Fraser Institute.
- VISSER, A. 2016. Uptake of turnover tax regime remains minimum. Opinion, 7 April. South African Institute of Taxation. <https://www.thesait.org.za/news/283333/Uptake-of-turnover-tax-regime-remains-minimal-.htm> Date of access: 21 Jan. 2020.
- YANG, H. & TATE, M. 2012. A descriptive literature review and classification of Cloud Computing Research. *Communications of the Association for Information Systems*, 31, Article 2: 35-60.
- ZIMBABWE. 2011. Small and Medium Enterprise Act 6th of 2011.
- ZIMBABWE. ZIMBABWE REVENUE AUTHORITY. 2019. Presumptive tax. Harare.
- ZULAIKHA, P.T. & BASUKI, H. 2017. Presumptive taxation scheme: its impact on tax expense and taxpayer's compliance. *The Indonesian Journal of Accounting Research*, 20(1):1-32.

Total Quality Management and its Implementation in the Context of Pakistan

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SUMMARY

This research paper focuses on the practices of TQM which are being implemented in Pakistan and finds out the relationship between the quality implementation and the performance of the organizations. There is a significant impact of TQM on performance of organizational operations especially in larger firms that have specialized processes of manufacturing. In Pakistan, TQM is implemented by 3 types of methods: Assurance of Quality, Consistent Improvement and Control of Quality. The results indicate that Total Quality Management has two effects on the performance of organizations: First, the practices of TQM may affect the performance of the organization; or it may halt the firms to achieve the goals which has a negative impact on their performance. One limitation of this research is that it is limited to Pakistan only. So the future researchers can base their studies on different context.

Keywords: Quality Management; Firm Performance; Productivity

Journal of Economic Literature (JEL) codes: L15; M11

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INTRODUCTION

There have been enormous changes and quality improvement in the corporate environment and it has become one of the most significant strategies that an organization can implement for the purpose of achieving sustainable competitive edge. Moreover, due to the enhancement of the worldwide labor market, firms should enhance the quality of their products and services so that they can survive the global competition. For the purpose of improving the performance of organizations, and in order to enhance customer satisfaction, many practices of Total Quality Management are being implemented. The basis for TQM (Total Quality Management) is that the whole staff of an organization must coordinate with each other in order to produce products and services of high quality for the purpose of meeting the demands of the customers. One of the strategies of TQM that is considered to be effective in minimizing the errors is the Control Process in the manufacturing sector.

There are different types of quality techniques and instruments in Total Quality Management, other than several beliefs and values that are shared by the staff within an organization (Taheri & Gharakhani, 2013). Total Quality Management is defined as a strategy which serves the purpose of generating and transferring more superior and efficient services by gaining

coordination between the members of an organization (Khadhraoui et al., 2016).

However there are various scholars who directly controlled the practices of Total Quality Management but those practices are still said to be vague (Dean & Bowen, 1994). This can be justified by the fact that TQM has various definitions, each having a specific perspective about the term. Several researches were performed for the purpose of differentiating the correlation between the TQM practices and the performance of the firms. The scope of the research consists of different types of areas such as operational, marketing, financial and quality performance. These researches conclude that there is positive impact of Total Quality Management on the performance of the organizations if implemented effectively, such that if a firm effectively implements the TQM, it will result in the decrease in its operational costs, increase in the productivity (Lam, 1995), and the performance of its employees and the organization itself (Prajogo et al., 2004).

There is a significant impact of TQM on performance of organizational operations especially in larger firms that have specialized processes of manufacturing (Samson & Terziovski, 1999). Various types of TQM are considered as important performance indicators such as customer focus, leadership and individual management. This research paper focuses on

practices of Total Quality Management and its impact on the performance of the organizations.

PROBLEM STATEMENT

For many employees, managers and organizations, the concept of Total Quality Management is still perceived as a new idea and its tools and standards are still unknown. The current literature on Total Quality Management is still not adequate to establish a deeper insight into the definition of TQM (Thiagarajan & Zairi, 1997).

There are multiple strategies such as globalization which directly increase the quality interest for developing countries, so the attention is focused on Total Quality Management in order to achieve financial gains in these countries. Furthermore, customers have been demanding goods and services of good quality features in different countries. All of these causes create a new interest of quality at multiple firms around the world.

However there are multiple researches about Total Quality Management and its link with the performance of the firms (Baidoun & Zairi, 2003), but this paper is primarily focused on specific techniques and practices of TQM and its effect on the performance of the firms.

RESEARCH OBJECTIVES AND AIMS:

The objectives and aims of this research are the following:

1. To study the techniques and practices of TQM
2. To find out the effect of implementation of TQM on the performance of the firms
3. To establish procedures for the efficient implementation of practices of TQM in firms

REVIEW OF LITERATURE

Total Quality Management:

The concept of Total Quality Management has been familiar since 1930 in Japan, especially after World War II. Later, many organizations of the manufacturing industries focused on increasing the quality and using techniques whose sole purpose was quality control in these organizations (Demirbag et al., 2006; Talib & Rahman, 2010). Subsequently, both the UK and USA acknowledged the concept of QM (Quality Management), especially in these countries' manufacturing sector. Afterwards, Quality Management has been widely recognized in many international standards for example ISO 9000 and these standards have widely accepted the concept of Quality Management (Moynihan & Sachdeva, 2013).

For the practices of Quality Management, several techniques and methods were devised in which TQM is perceived to be a method of enhancing the efficiency and quality of goods and services of various industries. One such globally accepted approach of Quality Management is Total Quality Management (TQM) in which this method tends to establish a complete cooperation among all the functions of an organizations in order to meet demands of their customers effectively and to achieve the goal of the firms.

Total Quality Management (TQM) involves all the members of an organization in order to meet the expectations of the customers with the help of problem solving methods to the quality of goods and services provided by a firm. The philosophy of Total Quality Management focuses on a widespread cooperation between the functions and staff members of an organization to better quality preservation, progress and enhancement of goods and services to satisfy the customers (Bon & Mustafa, 2013).

This philosophy of management directly pays attention to enhancing quality of business and management satisfaction by increasing the involvement of employees in the process of decision making by using quality enhancement teams and strategies of quality circle (Yusuf et al., 2007).

Multiple concepts have been provided by past literature on Total Quality Management whereas all of these concepts have similar elements. For instance, all concepts of TQM consider the customer as the basic element of the strategy of the management. Additionally, managerial commitment is considered to be one of the most significant components that ensure the achievement of practices of TQM. Other important situations in the firms for achieving the success of TQM are firm alterations and culture. Thus, Total Quality Management (TQM) is the strategy of the management whose purpose is to improve the performance and efficiency of the organizations by improving the quality of goods and services of an organization (Ooi et al., 2008).

In the past two years, the interest in the practices of TQM (Total Quality Management) was widely increased and it is perceived to be an important field of study for many researchers (Yusuf & Aspinwall, 1999; Ooi et al., 2008). (Gharakhani et al., 2013) found that Total Quality Management has widely acknowledged as a management strategy in various industrial sectors which efficiently aims to improve the performance of the firms. Furthermore, Total Quality Management is known to be a comprehensive cooperation among various individuals, models, processes and procedures of communication to meet all demands of the customers (Van Ho, 2011).

A model of Total Quality Management as proposed by (Talib & Rahman, 2010) is widely known as the model of 'TQM Components'. They explained the main principles that may improve the performance of firms (Figure 1). Practices of Total Quality

Management include ‘customer focus, employees’ motivation and involvement, top management commitment, management of suppliers, quality performance and information, benchmarking, and constant improvement. The outcomes include improved quality and productivity, customer loyalty

and a high level of customer satisfaction as well as the delivery of products on time. Usually, all models of TQM showed that each action of management is composed of ‘planning’, ‘implementation’, and ‘evaluation’ processes.

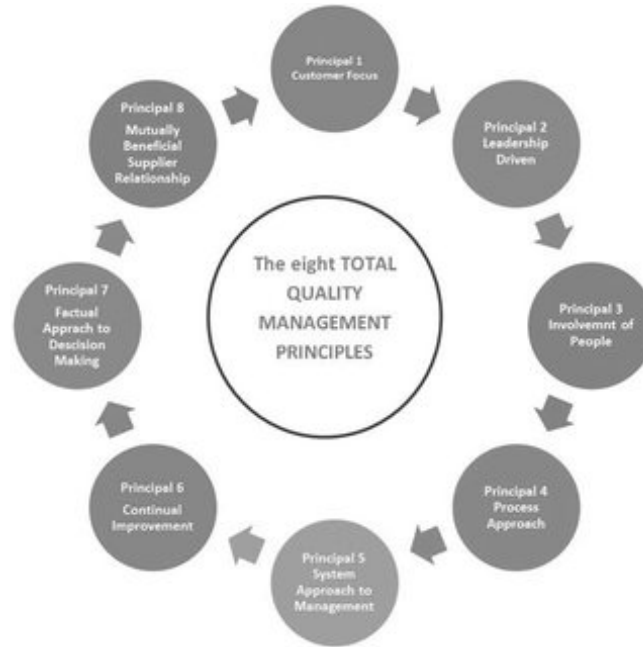


Figure 1. Principles of TQM

Performance of Firms:

One of the most important elements to gain efficient managerial processes of the firms is the measurement of performance. The performance of one firm can be directly linked to its capability to gain their financial and strategic objectives (Xiaodong & Xinmo, 2006). The performance of firms was widely ignored in the previous researches, however few researches were done in which performance of the firm was linked to the financial performance (Katou & Budbwar, 2008). The performance of the firms as discussed by (Arunachalam et al., 2016) is measured through both market and financial performance which consists the progress of market share, measures of ROI (Return on Investment), and sales profit.

One point that cannot be avoided in this research is that the performance of the firms can be calculated with the help of the performance of firm operations which refers to the total performance of a firm that consists of the customer satisfaction, economic performance and product quality efficiency (Brah et al., 2000). Performance of a firm’s operations is directly controlled with improved flexibility, process productivity, performance of delivery and reducing errors and costs (Nunnally, 1978).

Performance of Firms and Total Quality Management:

One of the most important elements in all management approaches is Performance Measurement. The performance of the firms are measured by the quality and cost which are the two significant measuring tools that are directly impacted by the practices of Total Quality Management. According to (Brun, 2011), the performance of the employees is influenced by applying different practices of TQM such as the management of processes and customers and the training of employees which consequently affects the performance of the whole firm. As indicated by (Gharakhani et al., 2013), Total Quality management largely influences the performance of the firms especially in their economic performance.

Keeping in view the increasing demands of the customers for high quality goods and services, firms realized the significance of applying practices of Total Quality Management to the processes of the production for the purpose of reducing costs and to produce high quality products. Total Quality Management is known to be a strategy that considers consumers as the significant focus, in that it aims directly to offer them with services and goods of high quality by combining constant improvements in the processes of production (Harmon, 1994; Peterson, 1998). Other studies directly

intended to discuss the argument which was present among the perceptions of top and middle management on Total Quality Management. According to (Soltani & Wilkinson, 2020), there are four key propositions of Total Quality Management which are Top Management functions, quality affirmation, firm and individual. The significant conclusion derived from the research of (Soltani & Wilkinson, 2020) was that Total Quality Management is still perceived to be a new concept, and the generally used method to execute Total Quality Management is the approach of 'Quality Control' (Soltani & Wilkinson, 2020).

The effect of the practices of Total Quality Management was also clarified by (Sit et al., 2009) on customer satisfaction level most importantly in the public sector and from the perspective of management. The emphasis was on employee and process management, strategic planning, customer focus, leadership and calculating internal and external level of customer satisfaction for the quality of services and goods. The research has discussed that there is a positive association between focus on employees, practices of TQM and consumer satisfaction. The findings of the study also indicate that there is a close connection between among management commitment and satisfaction of customers. Whereas, some practices of TQM such as management of processes and strategic planning has a low impact on the satisfaction of consumers.

According to (Lord, B. R. & Kawrence, 2013), quality process management must start at the founding stage of the firm i.e. at the start of the project, and must end after gaining the desired standards of quality. Each member of the firm must be held accountable to some degree for the improvements in the firm. Quality can be explained as the capability of the services and goods to meet needs and desires of the customers and attain high satisfaction levels of the customers (Waldman et al., 1998). As indicated (Lakhal, 2014; Talha, 2004), the practices of Total Quality Management directly influences the performance of the firms by reducing costs, improving the performance of the firm's employees, and enhancing the satisfaction level of consumers.

Whereas (Iñaki et al., 2006) in their study found that the performance of the firms is directly affected by the Total Quality Management in a positive manner, however according to (Shin et al., 1998), in some situations, the implementation of Total Quality Management does not attain the firm's targets.

IMPLEMENTATION OF TQM METHODS IN PAKISTAN

Various methods are used to implement TQM at firms, and we have chosen Pakistan as an instance while explaining these methods of implementation as Pakistan is one of the few countries that used practices

of Total Quality Management and implement them at large number of the firms by using various methods of implementation (Raja et al., 2011).

The five key categories of TQM implementation methods are explained below:

Zero Level: Zero customer focus/Zero Control:

The main concern of these firms is the goods and services they provide, most importantly the characteristics related to their quality rather than concentrating on attaining the satisfaction of their customers. In few countries like Pakistan, there is no penalty for the firms that have a poor performance, and this mostly occurs in the dissatisfaction of the customers

First Level: Quality Control:

At this stage, firms most often control various departments of measurements and laboratories for the purpose of continuous enhancement of their goods and services' quality with the help of testing and development of management systems. The most commonly used method to conduct these measurements at firms is 'statistical process control' (Singh & Smith, 2004). The methods of Quality Control are widely used in the manufacturing sector of Pakistan for the purpose of implementing strategies and practices of Total Quality Management as discussed by (Moosa & Sajid, 2010).

Second Level: Quality Assurance:

Firms that use such methods consider that product is an outcome of various processes and the quality of such products cannot be attained without separately regulating each of these processes. 'Quality Assurance' is widely operated in various firms by implementation of some methods that focus on quality for example ISO 900-2000 and ISO 9000; whereas some management tools are used for quality assurance which include Pareto Charts, Affinity Diagrams etc (Brun, 2011). According to (Awan et al., 2008), a large number of firms in Pakistan initially used ISO-9000 to attain efficient processes of 'quality control' and afterwards to ascertain quality in the firm. And the process of implementation of this method varies according to the type of business firms.

Third Level: Constant Improvements in Quality:

Firms that are present at this stage consider that the quality improvement of the firms is directly associated to the commitment and efficiency of employees and presence of spirit of team work within the members of the firm. Various programs were organized in these

firms for the purpose of enhancing capabilities of quality management of functional staff members by organizing some techniques such as assigning tasks monthly or weekly. In a TQ organization, constant improvement applies to every component in the value chain, including costs, defects, response time, and product characteristics, among many others. A quality organization focuses on two types of improvement approaches. The first is a step-by-step approach for incremental improvements. The other approach is a breakthrough approach, which results in radical change and quantum improvements in the process or product. In a quality organization, both approaches are pursued concurrently. Incremental improvements, on the other hand, produce visible results almost immediately and are more common, whereas breakthrough improvements are less common and generally take much longer to be visible (Khan, 2003). Various methods were used in the manufacturing sector of Australia for attaining constant improvements in quality for example techniques such as ‘Zero-Defect Mentality’, ‘Quality Circle’, and ‘Just-In-Time (JIT) (Sadikoglu & Zehir, 2010). But there are only a few firms in Pakistan that are included in this category (Khan, 2003).

Forth Level: Quality Award Paradigms/Models:

The firms at this stage are said to be market dominant and global champion firms in terms of the goods and services they provide. These firms tend to provide other firms in the market a standard for the efficient performance in terms of quality, and firms that follow this category define quality as the way of attaining total satisfaction of their customers. (Kaluarachchi, 2010) performed research on the impact of paradigms of quality award on service sector firms and they explained that these firms used various tools like ‘process reengineering’ and computer software packaging for improving the performance of firms with regard to the characteristics of their quality. Firms that implement methods of TQM by models of ‘quality award’ are not present in Pakistan (Khan, 2003).

EMPIRICAL DATA

The empirical data on the implementation of TQM practices in the context of Pakistan was studied by (Khan, 2003). By number, there were a total of six successful attempts to implement Total Quality Management methods by the organizations in Pakistan, with each one of these belonging to different industrial sectors. Table 1 provides the data on the number of companies (based on their industrial sector) which attempted to implement TQM methods successfully.

*Table 1.
Number of Companies who successfully implemented TQM methods (based on their industry)*

Industry	No. of Firms
Automotive	1
Textile	1
FMCG	1
Pharmaceutical	1
Engineering goods	2

CONCLUSION

This research directly focuses on explaining the association among the Total Quality Management (TQM) and performance of firms. Various previous studies have shown the link between TQM and the performance of firms, most importantly the performance of the firms in financial terms. These studies clarified that when one firm implements TQM in an efficient manner, then its performance would be highly improved from various outlooks (Ittner & Larcker, 1998; Hendricks & Singhal, 1999). In reviewing the past literature which explained the effect of Total Quality Management on performance of the firms, (Iñaki et al., 2006) found that there is a direct positive link between performance of the firms and TQM. Whereas, according to (Shin et al., 1998), the practices of TQM may somehow prevent the firms to attain their targets. However, the important results that were drawn from this study are that ‘quality performance of services and goods and satisfaction of customers can be improved by the implementation of various initiatives of quality at the firms. The TQM strategy that focuses on improving the level of satisfaction of consumers can directly enhance the performance of the firms and that commitment of leadership is perceived to be significant aspect in terms of successfully implementing the practices of TQM at the firms. While this study directly pays attention on differentiating the link between firms’ performance and TQM, but various aspects that directly impacted performance of the firms were ignored in the past researches such as firm culture, size and innovation level. Hence, researches in the future can discuss the effect of TQM on performance of the firms in a broad scope by finding out the impact of these aspects on performance of the firms. Another focus of research could be in regard to implementation of practices of TQM in industrial sector in order to provide a better insight into implementation of Total Quality Management.

REFERENCES

- ARUNACHALAM, S., RAMASWAMI, S., & CHAI, L. (2016). Innovation-Oriented Strategic Flexibility and Firm Growth: Does a CEO's Social Ties with Marketing Matter? In *AMA Summer Educators' Conference Proceedings*.
- AWAN, H. M., BHATTI, M. I., BUKHARIC, K., & QURESHI, M. A. (2008). Critical success factors of TQM: Impact on business performance of manufacturing sector in Pakistan. *International Journal of Business and Management Science*.
- BAIDOUN, S., & ZAIRI, M. (2003). A proposed model of TQM implementation in the Palestinian context. *Total Quality Management and Business Excellence*. <https://doi.org/10.1080/1478336032000107744>
- BON, A. T., & MUSTAFA, E. M. A. (2013). Impact of total quality management on innovation in service organizations: Literature review and new conceptual framework. *Procedia Engineering*. <https://doi.org/10.1016/j.proeng.2013.02.067>
- BRAH, S. A., WONG, J. L., & RAO, B. M. (2000). TQM and business performance in the service sector: A Singapore study. *International Journal of Operations and Production Management*. <https://doi.org/10.1108/01443570010348262>
- BRUN, A. (2011). Critical success factors of Six Sigma implementations in Italian companies. *International Journal of Production Economics*. <https://doi.org/10.1016/j.ijpe.2010.05.008>
- DEAN, J. W., & BOWEN, D. E. (1994). MANAGEMENT THEORY AND TOTAL QUALITY: IMPROVING RESEARCH AND PRACTICE THROUGH THEORY DEVELOPMENT. *Academy of Management Review*. <https://doi.org/10.5465/amr.1994.9412271803>
- DEMIRBAG, M., TATOGLU, E., TEKINKUS, M., & ZAIM, S. (2006). An analysis of the relationship between TQM implementation and organizational performance: Evidence from Turkish SMEs. *Journal of Manufacturing Technology Management*. <https://doi.org/10.1108/17410380610678828>
- GHARAKHANI, D., RAHMATI, H., FARROKHI, M. R., & FARAHMANDIAN, A. (2013). Total Quality Management and Organizational Performance. *American Journal of Industrial Engineering*. <https://doi.org/10.12691/ijcn>
- HARMON, J. C. (1994). Eastman kodak company's experience with tqm in hospitals. *Quality Management in Health Care*. <https://doi.org/10.1097/00019514-199402030-00007>
- HENDRICKS, K. B., & SINGHAL, V. R. (1999). Don't count TQM out. *Quality Progress*.
- ĨNAKI, H. S., LANDÍN, G. A., & Fa, M. C. (2006). A Delphi study on motivation for ISO 9000 and EFQM. *International Journal of Quality and Reliability Management*. <https://doi.org/10.1108/02656710610679824>
- ITTNER, C., & LARCKER, D. (1998). Innovations in Performance Measurement: Trends and Research Implications. *Journal of Management Accounting Research*.
- KALUARACHCHI, K. A. S. P. (2010). Organizational culture and total quality management practices: A Sri Lankan case. *TQM Journal*. <https://doi.org/10.1108/17542731011009612>
- KATOU, A. A., & BUDBWAR, P. S. (2008). The effect of business strategies and HRM policies on organizational performance: The Greek experience. *Global Business and Organizational Excellence*. <https://doi.org/10.1002/joe.20235>
- KHADHRAOUI, M., LAKHAL, L., PLAISENT, M., & BERNARD, P. (2016). The impact of entrepreneurial orientation on performance and customer satisfaction: The moderator effect of network capabilities. *Journal of Economic Development, Management, IT, Finance and Marketing*.
- KHAN, J. H. (2003). Impact of total quality management on productivity. *TQM Magazine*. <https://doi.org/10.1108/09544780310502705>
- LAKHAL, L. (2014). The relationship between ISO 9000 certification, TQM practices, and organizational performance. *Quality Management Journal*. <https://doi.org/10.1080/10686967.2014.11918395>
- LAM, S. S. K. (1995). The impact of total quality management on front-line supervisors and their work. *Total Quality Management*. <https://doi.org/10.1080/09544129550035576>
- LORD, B. R. & KAWRENCE, S. (2013). TQM IMPLEMENTATION: A CASE STUDY OF MQT. *Journal of Chemical Information and Modeling*.
- MOOSA, K., & SAJID, A. (2010). Critical analysis of Six Sigma implementation. *Total Quality Management and Business Excellence*. <https://doi.org/10.1080/14783363.2010.483100>
- MOYNIHAN, G. P., & SACHDEVA, R. (2013). Development of an integrated TQM-based system for university accreditation requirements. *International Journal of Productivity and Quality Management*. <https://doi.org/10.1504/IJPQM.2013.054862>
- NUNNALLY, N. R. (1978). Stream renovation: An alternative to channelization. *Environmental Management*. <https://doi.org/10.1007/BF01872915>
- OOI, K. B., ARUMUGAM, V., TEH, P. L., & CHONG, A. Y. L. (2008). TQM practices and its association with production workers. *Industrial Management & Data Systems*. *Industrial Management & Data Systems*.
- PETERSON, R. (1998). Trust for quality. In *TQM Magazine*. <https://doi.org/10.1108/09544789810239128>
- PRAJOGO, D. I., POWER, D. J., & SOHAL, A. S. (2004). The role of trading partner relationships in determining

- innovation performance: An empirical examination. In *European Journal of Innovation Management*.
<https://doi.org/10.1108/14601060410549874>
- RAJA, M. W., BODLA, M. A., & MALIK, S. A. (2011). Evaluating the Effect of Total Quality Management Practices on Business Performance : A Study of Manufacturing Firms of Pakistan. *International Journal of Business and Social Science*.
- SADIKOGLU, E., & ZEHIR, C. (2010). Investigating the effects of innovation and employee performance on the relationship between total quality management practices and firm performance: An empirical study of Turkish firms. *International Journal of Production Economics*. <https://doi.org/10.1016/j.ijpe.2010.02.013>
- SAMSON, D., & TERZIOVSKI, M. (1999). Relationship between total quality management practices and operational performance. *Journal of Operations Management*. [https://doi.org/10.1016/S0272-6963\(98\)00046-1](https://doi.org/10.1016/S0272-6963(98)00046-1)
- SHIN, D., KALINOWSKI, J., & EL-ENEIN, G. A. (1998). Critical Implementation Issues in Total Quality Management. *SAM Advanced Management Journal*.
- SINGH, P. J., & SMITH, A. J. R. (2004). Relationship between TQM and innovation: An empirical study. In *Journal of Manufacturing Technology Management*. <https://doi.org/10.1108/17410380410540381>
- SIT, W. Y., OOI, K. B., LIN, B., & CHONG, A. Y. L. (2009). TQM and customer satisfaction in Malaysia's service sector. *Industrial Management and Data Systems*. <https://doi.org/10.1108/02635570910982300>
- SOLTANI, E., & WILKINSON, A. (2020). TQM and Performance Appraisal: Complementary or Incompatible? *European Management Review*. <https://doi.org/10.1111/emre.12317>
- TAHERI, M., & GHARAKHANI, D. (2013). The application of total quality management and knowledge management in health system. *Research Journal of Applied Sciences, Engineering and Technology*.
<https://doi.org/10.19026/rjaset.5.4791>
- TALHA, M. (2004). Total quality management (TQM): An overview. *The Bottom Line*.
<https://doi.org/10.1108/08880450410519656>
- TALIB, F., & RAHMAN, Z. (2010). Studying the impact of total quality management in service industries. *International Journal of Productivity and Quality Management*. <https://doi.org/10.1504/IJPM.2010.034408>
- THIAGARAJAN, T., & ZAIRI, M. (1997). A review of total quality management in practice: Understanding the fundamentals through examples of best practice applications - part II. *TQM Magazine*.
<https://doi.org/10.1108/09544789710178622>
- VAN HO, P. (2011). Total Quality Management Approach to the Information Systems Development Process: An Empirical Study. *Doctoral Thesis*.
- WALDMAN, D. A., LITUCHY, T., GOPALAKRISHNAN, M., LAFRAMBOISE, K., GALPERIN, B., & KALTSOUNAKIS, Z. (1998). A qualitative analysis of leadership and quality improvement. *Leadership Quarterly*.
[https://doi.org/10.1016/S1048-9843\(98\)90004-2](https://doi.org/10.1016/S1048-9843(98)90004-2)
- XIAODONG, L., & XINMO, F. (2006). Study on Total Quality Management (TQM) of small towns' investment and financing service. *Proceedings of 2006 International Conference on Construction & Real Estate Management, Vols 1 and 2: COLLABORATION AND DEVELOPMENT IN CONSTRUCTION AND REAL ESTATE*.
- YUSOF, S. M., & ASPINWALL, E. (1999). Critical success factors for total quality management implementation in small and medium enterprises. *Total Quality Management*. <https://doi.org/10.1080/0954412997839>
- YUSUF, Y., GUNASEKARAN, A., & DAN, G. (2007). Implementation of TQM in China and organisation performance: An empirical investigation. *Total Quality Management and Business Excellence*.
<https://doi.org/10.1080/14783360701239982>

Fiscal Stability and Macroeconomic Environment in Nigeria: A Further Assessment

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SUMMARY

This paper examines the relationship between fiscal stability and macroeconomic environment in Nigeria using time series data covering the period 1981-2019. As Nigeria's debt appears excessive amid macroeconomic imbalance, different concerns are raised about the capacity of the government to repay the debt. In this regard, several studies are conducted on the sustainability of the country's debt. But then, as a long-run analysis, assessment of debt sustainability is prone to considerable uncertainty and large margins of error. Thus, the relevance and need for a short-run analysis which serves as the basis for assessing fiscal stability. In the process, while multiple structural breaks are revealed in the total revenue, exchange rate, and total debt series, a feedback causal-effect is affirmed between fiscal stability and interest rate. Consequently, the short-run analysis establishes negative impacts from each of debt and exchange rate, as against positive effect from revenue on fiscal stability. As such, given a mixed relationship between fiscal stability and certain macroeconomic factors, an improved revenue collection is suggested with reduction in borrowing.

Keywords: Debt; fiscal stability; macroeconomic environment; revenue; sustainability

Journal of Economic Literature (JEL) Codes: E62; H50

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INTRODUCTION

The need for fiscal soundness has drawn attentions of policy makers and international institutions to the debt profile and macroeconomic imbalance in Nigeria.ⁱ Incidentally, the situation raises specific concerns about interest payments which might consume large part of revenue and consequently make it difficult to create employment and grow the economy. Thus, as global debt climbs, total debt in Nigeria becomes excessive amid rising deficit.ⁱⁱ Although the country's public debt is adjudged to be sustainable at 25% of gross domestic product (GDP), however, due to low revenue collections, total public debt-to-revenue and total debt service-to-revenue are trending upward and appear vulnerable to revenue shocks.ⁱⁱⁱ Meanwhile, as global demand for oil declines, the situation results in slow GDP growths and a recession in 2020 (AfDB, 2021). Nonetheless, in the quest to set the country back on sustainable growth path with the hope of increasing public revenue and stimulate the economy, sustainability plans were introduced.^{iv} But then, despite

the plans' objective to enhance fiscal prudence and achieve transparency in public spending, majority of the states in the country find it difficult to pay salaries as unemployment rises from 14.2% in 2016 to 23.1% in 2019 and 33.3% in 2020. Similarly, public debt increases from ₦7.55 trillion in 2012 to ₦32.915 trillion in 2020, and federal government retained revenue drops from ₦3.99 trillion in 2019 to ₦2.88 trillion in 2020 as against debt service payment well over 50% of federally collected revenue (AfDB, 2021; National Bureau of Statistics [NBS], 2021; Sunnews, 2021). As such, given the gloomy macroeconomic environment, which of the macroeconomic factors drives fiscal stability in Nigeria?

Imperatively, fiscal stability relates to the solvency of an economy as regards its outstanding debt obligation. Therefore, when a country finds itself in a situation when its actual revenues could not match planned expenditure, it is normal to borrow but with the commitment to repay at, or over, a specific period of time. Thus, in this regard, discussions are raging on the sustainability of Nigeria's debt. Prominent among the discussions are Debt Management Office [DMO]

(2017) debt sustainability analysis (DSA)^v and Kolawole (2019) assessment of fiscal financing and sustainability. While Kolawole (2019) establishes that foreign financing could not sustain the country's debt, the DSA reveals that external debt portfolio maintains low risk even as external borrowing is forecast to increase marginally between 2017 and 2033. In addition, DMO's analysis affirms that total public debt-to-GDP ratio is below the threshold of 56% over the period 2017-2037 as debt limit of 19.39% is suggested to be reviewed to 25% in the period 2018-2020. But then, the findings notwithstanding, for the fact that fiscal sustainability is a long-run indicator of government's fulfilment of present value of budget constraint, its assessment is necessarily prone to considerable uncertainty and large margins of error (Giammarioli et al, 2006). As such, owing to the degree of error and uncertainty in the analysis of fiscal sustainability which undoubtedly points to the relevance and need for fiscal stability analysis, this paper, by objective, builds on Kolawole (2019) and answers the above question by assessing the effect of macroeconomic factors on fiscal stability in Nigeria. Essentially, as the assessment serves as contribution to the discussion on fiscal soundness, it ascertains the efficacy of certain macroeconomic factors in maintaining solvency in the short-run.

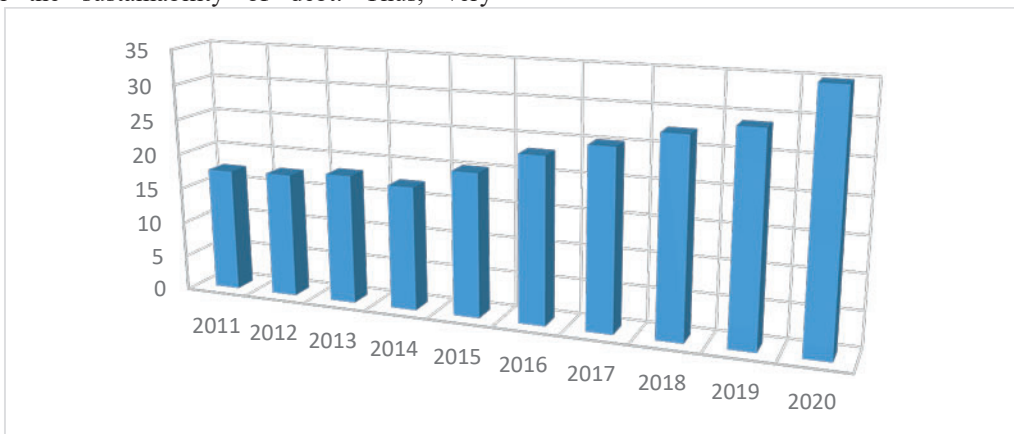
Moreover, the significance of this paper also rests on the desire of the Nigerian government, as well as concerned international institutions, to achieve healthy public finance and a conducive macroeconomic environment in the country. Although the nation is at the verge of recovery from economic downturn and debt overhang necessitated by the corona virus disease 2019 [COVID-19] pandemic, yet, anti-socioeconomic activity of insurgents and bandits is causing addition to the already bloated fiscal spending and thus, casting doubt on the sustainability of debt. Thus, very

imperative is the relevance of this paper as its findings, to a large extent, will sensitise the government and concerned agencies on the importance of macroeconomic factors that can impact fiscal soundness in the short-run.

After this introductory aspect, the other part of the paper is structured as follows. Section two does an overview of the macroeconomic environment in Nigeria as the third section reviews relevant literature. Section four provides the methodology while section five presents and discusses the results. Section six wraps the paper with conclusion and policy implications.

OVERVIEW OF MACROECONOMIC ENVIRONMENT IN NIGERIA

The macroeconomic activities of Nigeria are typical of a middle-income emerging economy broadly divided into three sectors: agriculture, industry and services, with more than 20 sub-sectors. As such, over the years, in the attempt to achieve macroeconomic balance and transparency in government financial management, the medium term expenditure framework (MTEF) and the Fiscal Responsibility Act were introduced as reforms in 2004 and 2007, respectively (African Economic Outlook, 2014). In addition, the Federal Inland Revenue Service (FIRS) and the Federal Ministry of Finance are actively implementing reforms aimed at plugging revenue leakages. The initiatives include the introduction of a tax identification number system, approval of generous incentives for revenue service staff, sustained capacity-building and using information technology in tax administration.



Source: Author's representation using data from NBS (2021).

Figure 1. Debt-to-GDP ratio (% of GDP) in Nigeria, 2011 - 2020.

Also, with the aim of enhancing prudence and transparency in spending, and ultimately to ensure that states keep to fiscal sustainability path, the federal government introduces a 22-point FSP in 2016.

Imperatively, the FSP is strategized around increasing public revenue and sustainable debt management, among others. Despite the existence of the plan, however, majority of the states find it difficult to boost

their internally generated revenue even as debt obligations keep mounting. Moreover, in the attempt to curb revenue losses, the federal government inaugurates the “Revenue Optimisation and Verification Project” in January 2018 to probe revenue leakages in the mines and minerals sector between 2012 and 2017 (Amaefule, 2018). In addition, in its efforts to strengthen public financial management, the government has implemented the treasury single

account (TSA), the integrated payroll and personnel information system (IPPIS), and the government integrated financial management information system (GIFMIS). Nonetheless, as well as issuing the directive that the Nigeria national petroleum corporation (NNPC) to recover all outstanding obligations, the President mandates the deployment of the National Trade Window to enhance efficiency in Customs duty collection from 64 to 90% in the future (Udoma, 2019).

Table 1
Selected factors in the macroeconomic environment in Nigeria, 1981 - 2019.

Variable/Period	1981-1985	1986-1990	1991-1995	1996-2000	2001-2005	2006-2010	2011-2015	2016-2019
Real interest rate (%)	-14.4	1.5	-13.7	4.7	4.2	5.9	9.6	5.8
Growth (%)	-5.2	4.9	0.2	3.1	8.9	7.1	5.03	0.8
Fiscal balance (% of GDP)	-2.4	-3.7	-3.9	-1.8	-1.7	-0.9	-1.5	-3
External debt stock (% of GNI)	16.8	59.4	88.8	56.1	36.8	5.8	5.6	11.6
Total debt service (% of GNI)	3.4	4.4	5.6	2.9	2.7	0.8	0.4	1.1
Gross domestic savings (% of GDP)	72.6	58.9	51.3	45.6	35.3	29.3	23.2	16.7
Gross savings (% of GNI)	72	57.5	49.7	44.3	33.7	32.9	24.5	19.8
Gross national expenditure (% of GDP)	98.7	91.9	91.9	92	93	92.4	92.3	103
Inflation, consumer prices (annual %)	15.4	25.9	48.9	12.3	15.7	10.3	9.7	13.9
Exports (% of GDP)	6.9	15.1	21.2	25.4	23.9	24.1	22.1	13
Imports (% of GDP)	5.5	7.04	13.1	17.5	16.9	16.3	14.2	15.5
Official exchange rate	0.7	5.1	18.6	51.9	125	134	164	293
Current account balance (% of GDP)	-2	2.3	-0.8	2.4	8.2	8.5	1.4	0.7
FDI, net inflow (% of GDP)	0.4	1.5	3	1.2	1.9	2.3	1.3	0.8
Net ODA received (% of GNI)	0.04	0.4	0.7	0.3	1.1	1.5	0.5	0.8
Total reserves (% of total external debt)	15.8	6.7	6.7	23	41.6	283	161	82.5
Oil revenue (₦Billion)	8.6	31.6	178.7	693	2626	4974	6868	4471
Non-oil revenue (₦Billion)	3.7	11.9	50.5	192	651.2	1368	2835	3747

Note: GNI is gross national income; FDI is foreign direct investment; and ODA is official development assistance.

Source: Author's computation using data from Central Bank of Nigeria [CBN] (2019) and World Bank (2021).

Meanwhile, as an oil producing country, Nigeria collects 70% of her revenue and 90% of foreign exchange from oil exports even as average daily production drops to 1.3 million barrels in 2020 from 1.9 million barrels in 2011 (Proshare, 2018; CBN, 2021a). As such, notwithstanding world oil price volatility which settles averagely at \$41.8 per barrel in 2020, Table 1 shows the country's oil revenue, in tandem with non-oil revenue, increasing from ₦8.6 billion in the period 1981-1985 to ₦4,471 billion in the period 2016-2019. Also, non-tax revenue amounts to

3.1% of GDP in 2018 while its highest components of rents and royalties of 66.6% amounts to 2% of GDP as against tax-to-GDP ratio declining from 9.6% in 2011 to 6.3% in 2018 (Organisation for Economic Cooperation and Development [OECD], 2020). Yet, despite the performance in revenue, domestic savings decline consecutively from an average 72.6% of GDP in 1981-1985 to 16.7% in 2016-2019 which is in tandem with decrease in gross savings from an average 72% of GNI to 19.8%, respectively. In addition, FDI inflow declines from 2.3% in 2006-2010 to 1.8% and

0.8% respectively in 2011-2015 and 2016-2019. Also, relative to imports of goods and services, exports drop from 22.1% of GDP in 2011-2015 to 13% in 2016-2019 as against increase in imports from 14.2% to 15.5%, respectively in the same period.

Moreover, gross national expenditure fluctuates over the years from 98.7% to 103% of GDP as fiscal balance rises from 2.4% to 3% of GDP, respectively from 1981-1985 to 2016-2019. But then, as countries are committed to servicing their loan obligations, including interest accrued, the compounding arrangement always makes debt servicing as large as the principal stock. In this regard, Nigeria's foreign debt service payments increases from ₦0.03 billion in the 1970s to ₦415.66 billion in 2010 and continuously to ₦1.06 trillion, ₦1.584 trillion and ₦1.959 trillion in 2015, 2016 and 2017, respectively (CBN, 2019). In effect, as depicted in Figure 1, the country's debt-to-GDP rises steadily from 17.5% in 2014 to 34.98% in 2020 (NBS, 2021).

REVIEW OF LITERATURE

The review of literature is carried out in two subsections. While the first subsection conceptualises and discusses the measures of fiscal stability and sustainability as regard debt-GDP ratio, the second buttresses the justification for conducting the research through the review of several relevant empirical studies as follows.

Concept and Measure of Fiscal Stability and Sustainability

Conceptually, the fiscal stability of an economy implies its ability to meet total public debt obligation in the short-run. This is in contrast to fiscal sustainability which looks at debt obligations in the long-run. Thus, the evaluation of fiscal stability and/or sustainability of a country implies analysis of its fiscal soundness (Giammarioli et al, 2006; IMF, 2006). Moreover, while a healthy public finance rests on government's capacity to raise revenue or reduce expenditure, the short- and long-run soundness are nonetheless connected by market investors. In effect, the ability of government to meet every upcoming obligation in the short-run characterizes a stable public finance or fiscal stability; while maintaining solvency by keeping debt-GDP ratio below a threshold or ceiling, and servicing existing debt with accumulated interest through surpluses characterizes a sustainable public finance or fiscal sustainability. Thus, in a situation when observed debt-GDP ratio could not meet the inter-temporal budget constraint, then there is fiscal unsustainability. Governments and policy makers worry about fiscal sustainability because unsustainability leads to potential vicious circle where increasing debt gives rise to higher interest payments which leads to deficit then to more borrowing and more debt. In essence, fiscal

sustainability refers to a situation when the government is able to achieve a fiscal stance that allows it to service public debt in the medium and long run without debt default or renegotiation, without the need to undertake policy adjustments that are implausible from an economic or political standpoint given financing costs and conditions it faces. Thus, fiscal sustainability implies government's ability to maintain solvency, sustain current spending, and tax policy while promised expenditure or long-term financial obligations are not undermined (Elendu, 2017).

Regarding the measure of fiscal stability and sustainability, both are measured using the same indicator. A commonly used and most straight forward indicator is the debt-GDP ratio which could either be net or gross government debt as percentage of GDP, as the case may be. Thus, the debt ratio is otherwise referred to as net-debt-GDP ratio or gross-debt-to-GDP ratio. By net debt, it represents the difference between gross debt and financial assets such as shares and bonds held by the government. Although this is more relevant to certain extent of selling financial assets to service debts, however, its weakness is the difficulty in assessing the actual availability of an asset as liquid for the settlement of liabilities. In essence, a high and increasing debt ratio signals potential solvency problem. As such, a declining debt-to-GDP ratio is used by governments to regain or signal their ability to maintain long-term solvency. Specifically, to gross debt ratio, some of its potent advantages over other fiscal ratios include the fact that it is easy to interpret and its underlying data are readily available as well as relatively reliable. More importantly, gross debt ratio is an indicator frequently supported by the IMF for stabilization programmes (Giammarioli et al, 2006). A major demerit of the gross debt ratio, however, is the absence of a clear theoretical or practical postulation of what level of debt is acceptable as threat to the fiscal stability and sustainability of an economy. Other drawbacks include the ratio's inability to explain ex ante the sustainability of public finances as gross debt, unlike net-debt, ratio does not take into account assets that could easily be liquidated for gross debt repayment. More so, another likely measure for fiscal stability is debt-to-revenue ratio. However, this indicator is also limited by the difficulty in determining an ex ante threshold appropriately (Mink & Rodrigues-Vives, 2004).

Empirics

Relevant empirical studies on stability and/or sustainability cut across economies even though the underlying effects of macroeconomic factors vary from country to country. Thus, for example, while examining how fiscal instability affect economic growth in Nigeria, Akanni and Osinowo (2013) use time series data over the period 1970-2010. As fiscal spending and output are measured respectively with Hodrick-Prescot (HP)-filtered and correlation

technique, the study affirms a highly volatile real GDP and fiscal spending in the sub-period 1970-1985, a countercyclical spending over 1970-1986, and a relatively stationary spending, as well as unstable real GDP between 1987 and 2010. It concludes that for sustainable economic environment, fiscal discipline is required in Nigeria. Also, in the assessment of the relationship between fiscal sustainability and financial stability, Komarkova, et al (2013) illustrates the need to take into cognizance the depth at which debt sustainability depends on both the debt-GDP ratio and the macroeconomic environment as regard growth and interest rates. Essentially, the discussion mainly surrounds tools of prudential policy that are suitable for reducing balance sheets' sovereign risk. In conclusion, thus, the paper asserts that growth in the interdependence of financial and fiscal stability is in tandem with growth in the government-financial sector interaction. In review, however, it is observed that the paper is not specific on the period covered in its analysis. Specifically, given that financial and macroeconomic variables are dynamic in nature, a study on the behaviour of such variables should be carried out in consideration of time. The consideration of time would have necessarily provided the basis for comparing the dynamics of the variables among different studies conducted at different time periods.

Furthermore, Ayinde (2014) examines the sustainability of fiscal management in Nigeria during the period 1970-2011. Consequent upon employing a barrage of tests in light of disaggregated components of government expenditure, the results reveal both strong and weak unsustainability of fiscal policy in Nigeria. Also, findings show that government's fiscal operations change in tandem with regimes such that fiscal policies sustainability remains elusive in the country. Similarly, in the quest to determine whether, or not, the Nigerian government violates inter-temporal budget constraint during the period 1980-2010, Oyeleke and Ajilore (2014) investigate the sustainability of fiscal policy in the country. While adopting error correction technique, the study also uses Engle-Granger cointegration method to ascertain the long-run relationship between government revenue and expenditure. In the review of the paper, it is observed that the result of unit root test shows that the variables are integrated at orders 0 and 1 which implies that Engle and Granger technique is not suitable for the cointegrating analysis (Engle & Granger, 1987). Rather, Autoregressive Distributed Lag (ARDL) techniques would have been appropriate because of its suitability for series that are integrated fractionally, or of order 0 and 1 (Pesaran & Shin, 1999; Pesaran et al., 2001). In effect, the use of ARDL would have afforded the paper a more robust result. Also, in the attempt to examine the existence of threshold effects between public debt and growth in Nigeria, Omotosho et al. (2016) use quarterly data over the period 2005-2015. The Khan and Senhadji (2001) approach reveals an inverted U-shape relationship as threshold level of

73.7% of GDP is identified as against 49.4 and 30.9% inflexion points for external and domestic debts, respectively. The findings imply, according to the study, that accumulated debt in excess of the estimated threshold will impact growth negatively as records show an excessive debt above threshold level prior to debt forgiveness in 2005. In conclusion, however, a window of opportunities is suggested to be open for additional external debt accumulation for the country.

Moreover, as annual event, Nigeria's Debt Management Office (2017) conducts its debt sustainability analysis (DSA) exercise for Nigeria by adopting World Bank/IMF debt sustainability framework for low-income countries (DSF-LICs) using debt stress categorisation methodology and by considering the baseline, optimistic and pessimistic scenarios. Thus, on the basis of external debt sustainability analysis, the baseline scenario affirms that the country's external debt portfolio maintains a low risk debt stress as debt ratios fall below respective thresholds throughout 2017-2033, the projection period. Similarly, the fiscal sustainability analysis reveals that total public debt-to-GDP ratio is also below its threshold throughout the projection period. However, while there is a considerable rise in the ratios of total public debt-to-GDP and total debt service-to-revenue, the study calls for revenue expansion, as well as diversifying the sources of the country's revenues away from oil. However, in another study which attempts to assess the fiscal sustainability path of Nigeria given the 2018 budget and the country's debt plan, Elendu (2017) identifies conditions that should be avoided; those that hinder growth, raise tax burdens, or shift large proportion of costs to future generation. In conclusion, the paper asserts that fiscal sustainability can be maintained in Nigeria if investment is directed towards educating the workforce, if there is provision of efficient transportation system, innovative entrepreneurs, infrastructural development, and supporting small scale businesses. In review, however, it is observed that Elendu's paper does not mention the methodology adopted for the analysis that leads to its findings and conclusion. A mention of the methodology would have lent some credence to the paper as the steps and procedures leading to the findings would have been informative.

In addition, while examining the components of fiscal financing that are effective for solvency in Nigeria, Kolawole (2019) assesses the relationship between fiscal financing and sustainability in the country from 1981 to 2015. As a one-way causal effect is established from each of the components of financing to sustainability, the ARDL technique reveals a significantly positive impact of domestic financing on fiscal sustainability in both short- and long-runs. In addition, the results show that oil revenue and GDP growth impacts positively in the short-run as against negative effect from real interest rate in the long-run. The study thus concludes that foreign financing is not effective for sustaining the country's

debt obligation. Also, in the attempt to ascertain whether, or not, fiscal policy is sustainable in the long-run, Ogiji and Ajayi (2020) employs data between the period 2000:Q1 and 2018:Q4 to establish the adequacy of fiscal measure adopted by the government in Nigeria. By adopting a fiscal reaction model along with ARDL technique, the study finds that as a measure of primary balance, the ratio of public debt-to-GDP is significantly negative which signals a considerable pressure for the country to run primary surpluses in the future. Thus, an improved revenue generation capacity and expenditure switching strategies are recommended.

Meanwhile, in a panel of 11 countries in the Eurozone, Paniagua et al. (2017) examine public finance sustainability during the period from 1970 to 2014. Using an empirical approach, as against the standard univariate estimation, the paper considers primary surpluses and its components which include tax revenue, government spending and gross debt ratio for analysis. The results reveal that public resources that are meant for bail out of countries end up triggering heterogeneous effective fiscal responses from different countries. In review, since the paper uses a dynamic panel specification, it could have adopted the Blundell and Bond (1998) system Generalized Method of Moment (GMM). Being appropriate for dynamic panel analysis, the system GMM would have taken care of countries heterogeneity and revealed a robust result.

Thus, given the brief literature above, the review shows that none of the studies specifically considers the short-run analysis of the situation of debt as regards fiscal stability in relation to the macroeconomic environment. This gap, in essence, affirms the justification for the present study.

ANALYTICAL FRAMEWORK AND METHODOLOGY

Analytical Framework

The analytical framework is built on two approaches: fundamentals-based and expectation-based approaches. Basically, these approaches give insight to the reason financial creditors may stop lending to governments (Giammarioli et al., 2006). Thus, the fundamentals-based approach is concerned with the failure of the government to sustain its debt obligations thereby forcing investors to deny the government further access to financing. On the other hand, the expectation-based approach concentrates on the supplier side in the form that the government may be shut off from external financing when lenders are not able to coordinate activities among themselves. In this approach, even if all the lenders collectively agreed to advance finance to a government, any individual creditor among others can choose to act independently by refusing to provide loan to the government despite the group's acceptance of the sustainability of the fiscal

position of the government in the long-run. This behaviour thus implies the expectation that a government may default in payment. Hence, in this approach, the concern of creditors is not the sustainability of debt position, but rather the ability of government to honour debt obligations in the short-run. As such, while the interest of one approach is the sustainability of the government's debt obligations the other is rather concerned with the ability of government to service its debt in the short-run, even if the debt position is sustainable (Cohen & Portes, 2004). Therefore, as the expectation-based approach models financial markets in relation to domestic financing, the fundamentals-based rather models the market relative to foreign financing. In essence, since both domestic and foreign financing are important for debt analysis, then both variables influence fiscal stability with inevitable consideration for the role of interest rate.

Methodology

The assessment of the relationship between fiscal stability and macroeconomic environment in Nigeria adopts a single multivariate equation. Thus, gross debt-to-GDP ratio is proxy for fiscal stability and serves as dependent variable. The independent variables include real GDP growth rate, total revenue, real interest rate, exchange rate, total debt, and fiscal balance (Chalk & Hemming, 2000; Burnside, 2004; Giammarioli et al., 2006). Invariably, total debt is obtained from the addition of external debt and domestic debt while total revenue results from the summation of oil revenue and non-oil revenue. In effect, due to the fact that the country has history of debt overhang and forgiveness amid multiple revenue strategies,^{vi} the study uses annual time series data covering 39 years over the period 1981-2019. As such, pre-estimation exercise commences with Dickey-Fuller breakpoint minimum tests, followed by the stationarity tests using the Augmented Dickey-Fuller (ADF) of Dickey and Fuller (1979), the techniques of Phillips and Perron (PP) (1988) and Kwiatkowski, Phillips, Schmidt and Shin (KPSS) (1992). The causality tests follow through the approach of Granger (1988). However, for the reason to obtain a uniform scale of measurement, as well as to ease the interpretation of results, data for fiscal stability, total revenue and total debt are transformed from nominal to natural logarithms.

Meanwhile, the paper follows the fundamentals-based approach which recognises, in addition to changes in macroeconomic variables, that the determinants of fiscal sustainability also affect fiscal stability. Thus, following the theoretical works of Giammarioli et al, (2006) and Gottschalk (2014), as well as Kolawole (2019) on the empirical front, the expression capturing the relationship between fiscal stability and macroeconomic factors is stated as follows.

$$Fst_t = f(Grt_t, Rev_t, Rir_t, Xrt_t, Dbt_t, Fbal_t) \tag{1}$$

where, at time t , Fst is fiscal stability measured as gross debt-to-GDP ratio, Grt is real GDP growth rate as annual percentage of GDP whose aggregates are based on constant 2005 U.S. dollars, Rev is total revenue made up of oil and non-oil revenue including intergovernmental transfer but excluding noncash transactions, Rir is real interest rate which is the lending interest rate adjusted for inflation and measured by the GDP deflator, Xrt is official exchange rate and refers to the exchange rate calculated as an annual average based on monthly averages in local currency relative to the U.S. dollar, Dbt is total public debt which consists of all liabilities that require payment or payments of interest and/or principal and is measured as a stock, and $Fbal$ is fiscal balance between revenue and expenditure and is measured as % of GDP. Data for all the variables are collated from CBN (2019), NBS (2021) and World Bank (2021).

The linear transformation of equation (1) becomes,

$$Fst_t = \beta_0 + \beta_1 Grt_t + \beta_2 Rev_t + \beta_3 Rir_t + \beta_4 Xrt_t + \beta_5 Dbt_t + \beta_6 Fbal_t + \varepsilon_t \tag{2}$$

where, β_0 is slope while β_1, \dots, β_6 are parameters, and ε is error term. The a priori expectation is that growth rate and revenue would have positive impact on fiscal stability, as against negative impact from other variables.

Specifically, equation (2) states explicitly that fiscal stability is determined in the right-hand-side by certain macroeconomic factors. However, because of the short-run analysis of the exercise, the following vector autoregressive (VAR) model of order p is necessarily

required to capture the impacts of the right-hand-side variables on fiscal stability. Thus,

$$\Delta Fst_t = \sum_{i=0}^p \gamma_{1i} \Delta Fst_{t-1} + \sum_{i=0}^p \gamma_{2i} \Delta Grt_{t-1} + \sum_{i=0}^p \gamma_{3i} \Delta Rev_{t-1} + \sum_{i=0}^p \gamma_{4i} \Delta Rir_{t-1} + \sum_{i=0}^p \gamma_{5i} \Delta Xrt_{t-1} + \sum_{i=0}^p \gamma_{6i} \Delta Dbt_{t-1} + \sum_{i=0}^p \gamma_{7i} \Delta Fbal_{t-1} + \delta ECT_{t-1} + u_t \tag{3}$$

where, Δ is the change operator, δ is the speed of adjustment parameter, ECT is the residual from the co-integrating relationship among the variables, and u is error term.

RESULTS AND DISCUSSION

The outcome from the analysis of the relationship between fiscal stability and macroeconomic environment is sectioned into pre-estimation results and estimation results, as presented and discussed, as follows.

Pre-estimation results

The descriptive statistics in Table 2 shows the average revenue from oil reaching ₦2,430.4 billion as against ₦1,039.7 billion from the non-oil sector while external debt and domestic debt are averagely ₦1,698.2 billion and ₦2,874.9 billion, respectively. These statistics explicitly give room for the fear of debt sustainability as the country's revenue performance could not have marched its debt profile, even as the economy experiences an average 5% growth, over the period 1981-2019.

Table 2
Descriptive statistics

	FST	GRT	OREV	NREV	RIR	XRT	XDBT	DDBT	FBAL
Mean	0.09	5.07	2430.4	1039.7	9.5	94.1	1698.2	2874.9	-2.4
Median	0.06	5.02	1230.9	314.5	6.2	101.7	633.1	898.3	-2.1
Maximum	0.33	15.3	8879	4725.6	65.9	306.9	9022.4	14272.6	-6
Minimum	0.01	0.06	7.3	2.98	1	0.6	2.3	11.2	-0.03
Std. Dev.	0.08	3.69	2723.4	1351.8	11.03	92.82	2195.8	4124.1	-1.6
Skewness	0.92	0.76	0.78	1.17	3.72	0.81	1.76	1.52	-0.4
Kurtosis	3.14	3.25	2.28	3.12	18.98	2.86	5.59	4.05	-2.4
Jarque-Bera	5.56	3.92	4.76	8.99	505.08	4.3	31.1	16.9	-1.7
Probability	0.06	0.14	0.09	0.01	0.00	0.12	0.00	0.00	-0.4
Sum	3.71	197.8	94783.6	40548.6	368.9	3671.6	66230.4	112121.4	-93
Sum Sq. Dev.	0.28	518.9	2.82E+08	69437144	4621.6	327404.1	1.83E+08	6.46E+08	-91.1
Observations	39	39	39	39	39	39	39	39	39

Source: Author's computation.

Meanwhile, following Harvey et al. (2013), the results of the Dickey-Fuller breakpoint minimum tests in Table 3 serves as precursor to the unit-root tests

whose results reject the null-hypothesis of non-stationarity for total revenue, exchange rate, and total debt as presented in Table 4. In this regard, the pre-

estimation tests continue with the structural break methodology of Bai and Perron (2003) to ascertain the possibility of multiple breaks in the series.

Table 3
Results of Dickey-Fuller breakpoint minimum tests.

Series	Fst	Grt	Rev	Rir	Xrt	Dbt	Fbal
Critical value	-3.52	-5.59	-5.02	-15.2	-1.02	-3.32	-4.25
Probability	0.37	0.01	0.68	0.01	0.99	0.49	0.09
Break date	2009	1999	1986	1995	2014	2009	2000

Source: Author's computation. Note: Decisions are based on 5% level of significance.

Essentially, the not-so-frequent disparity in the outputs of ADF and PP, as obtained in the tests involving GDP growth rate in Table 4, necessitates the

inclusion and adoption of KPSS. In effect, as KPSS affirms an I(0) status for GDP growth rate, the variable is therefore adjudged as I(0).

Table 4
Results of unit-root tests

Variable	ADF			PP			KPSS		
	Level	1st Diff	Dec	Level	1st Diff	Dec	Level	1st Diff	Dec
<i>Fst</i>	-4.71	-	I(0)	-4.24	-	I(0)	0.64	-	I(0)
<i>Grt</i>	-2.45	-13.53	I(1)	-5.25	-	I(0)	0.10	-	I(0)
<i>Rev</i>	-1.28	-4.95	I(1)	-1.34	-6.25	I(1)	0.71	0.26	I(1)
<i>Rir</i>	-2.38	-	I(0)	-6.03	-	I(0)	0.21	-	I(0)
<i>Xrt</i>	-2.07	-4.50	I(1)	-1.51	-4.24	I(1)	0.72	0.06	I(1)
<i>Dbt</i>	-2.64	-4.43	I(1)	-2.41	-4.44	I(1)	0.71	0.34	I(1)
<i>Fbal</i>	-3.13	-	I(0)	-3.14	-	I(0)	0.29	-	I(0)

Source: Author's computation. Note: Decisions are based on 5% level of significance.

Moreover, the significant values of F-statistics in the Bai and Perron (2003) results in Table 5 affirm the presence of multiple breakpoints in 1994 and 2008;

1996 and 2008; and 1994 and 2007 for total revenue, exchange rate, and total public debt, respectively.

Table 5
Result extract from Bai and Perron tests

Series	Break Dates	F-stat(1)	Critical value(1)	F-stat(2)	Critical value(2)
<i>Rev</i>	1994, 2008	2144.065	9.03	57.54701	10.14
<i>Xrt</i>	1996, 2008	2291.166	9.11	58.91113	10.33
<i>Dbt</i>	1994, 2007	2418.301	9.15	62.79121	11.24

Source: Author's computation.

Nonetheless, following the approach of Perron (1989) and Weideman (2016) to understand whether, or not, the breaks in the series are the reasons for their non-stationarity at level, each of the series is partitioned into segments which are then further tested for stationarity. Consequently, the results of the tests, as presented in Table 6, suggest that the stationarity of the segments implies that non-stationarity of the series, before partitioning, is actually due to the breaks in trend.

Thus, the 1994 break in revenue series could be ascribed to the effect from the introduction of VAT in

1993 which phases out the regime of 'Sales Tax' in the country. The VAT introduction probably causes an increase in non-oil revenue to ₦41.72 billion in 1994 from ₦30.67 billion in 1993 as against reduction in oil revenue to ₦160.19 billion from ₦162.1 billion, respectively. The break in 2008 could, however, be traced to the collective effects of tax reforms in 2004 as well as the passage of the FIRS Establishment Act in 2007. Therefore, as part of the reforms, the funding autonomy propels revenue collection such that, in comparison to ₦1.2 trillion in 2004, the actual tax collection rises to ₦2.972 trillion in 2008 even as

against ₦2.682 trillion collected over the period 1996-2003 (Okauru, 2012; Trustees of Princeton University, 2012). More so, the break in foreign exchange in 1996 results probably from the cumulative effects of the reforms and liberalization of the foreign exchange market in 1994 and 1995, respectively. Essentially, the 1994 policy, in reaction to the volatility in the exchange rates, pegs the value of the local currency against foreign currencies, centralizes foreign exchange in the CBN, and restricts the Bureaux de Change to buy foreign exchange as agents of the CBN, among others. The 1995 policy, however, liberalizes the foreign exchange market following the introduction of an autonomous foreign exchange market (AFEM) by the apex bank. As such, the average AFEM rate appreciates from ₦82.33 per dollar in 1995 to ₦81.48 to a dollar in 1996. In addition, the 2008 break reflects the combined effects of policies which include the introduction of whole sale Dutch auction system (WSDAS) as well as the completion of consolidation in the banking industry in 2006, and the 2007 appointment of additional two banks to collect the Nigerian exports supervision scheme (NESS) fees. In

effect, aside the experience of stability in the liberalized foreign exchange market, Nigeria’s net international investment position climbs steadily from -\$21,945.18 million in 2005 to \$14,722.01 million in 2008 with debt securities improving, respectively from \$276.56 million to \$1,256.55 million (CBN, 2019, 2021b). As regards debt series, the 1994 break is traceable to the effect of the decline in the country’s external reserve in 1993 as a result of oil price slump coupled with persistent high debt service payment (Kalu, 1994). However, the 2007 break is ascribed to the ripple effect of the discussions surrounding the sustainability of the country’s debt which eventually resulted into debt forgiveness by the London and Paris clubs in 2005. Also, the break is linked to the servicing of promissory notes and meeting bilateral commitments in 2006 which culminated in a significant reduction in the country’s foreign debt profile from ₦2,695 billion in 2005 to ₦438.89 billion in 2007, and the total public debt from ₦4,220 billion to ₦2,608 billion in the same period (CBN, 2019; Kolawole, 2020).

Table 6
Results of stationarity tests on individual segment.

Segments	R1	R2	R3	X1	X2	X3	D1	D2	D3
Year	1981-93	1994-07	2008-19	1981-95	1996-07	2008-19	1981-93	1994-06	2007-19
ADF	-3.22	-4.24	-4.62	-5.44	-4.58	-3.21	-4.49	-3.99	-4.11
PP	-3.22	-4.34	-4.64	-5.44	-4.57	-3.21	-4.49	-3.99	-4.11
KPSS	0.11	0.12	0.15	0.11	0.11	0.1	0.16	0.16	0.12
Conclusion	S	S	S	S	S	S	S	S	S

Source: Author’s computation. Note: R = Revenue; X = Exchange rate; D = Debt; and S = Stationary.

Meanwhile, there is the necessity to capture the effects of breaks in the respective dates. In this regard, and following Bai and Perron (2003), the comparable equations in Table 7 are estimated. In each of the equations, *C* is constant intercept term, *T* is time as trend variable, *D* is dummy variable which starts as 1 for the break date as well as the subsequent years, and

0 for the years before the break. Therefore, the 1994 dummy is 0 from 1981 to 1993 and 1 from 1994 to 2019; the 1996 dummy is 0 from 1981 to 1995 and 1 from 1996 to 2019; the 2007 dummy is 0 from 1981 to 2006 and 1 from 2007 to 2019; and the 2008 dummy is 0 from 1981 to 2007, and 1 from 2008 to 2019.

Table 7
Equations to be estimated based upon Bai and Perron results.

Series	Equations	Break Dates
<i>Rev</i>	$Rev_t = C + D_{1994} + D_{2008} + T + D_{1994}T + D_{2008}T + \mu_t$	1994, 2008
<i>Xrt</i>	$Xrt_t = C + D_{1996} + D_{2008} + T + D_{1996}T + D_{2008}T + \mu_t$	1996, 2008
<i>Dbt</i>	$Dbt_t = C + D_{1994} + D_{2007} + T + D_{1994}T + D_{2007}T + \mu_t$	1994, 2007

Source: Author’s specification.

Table 8
Lag order selection criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-533.5485	NA	25989.18	30.03047	30.33838	30.13794
1	-276.0405	400.5680*	0.255212	18.44670	20.90995*	19.30644
2	-227.9060	56.15690	0.370623	18.49478	23.11338	20.10679
3	-149.9509	60.63180	0.204981*	16.88616*	23.66010	19.25045*

Source: Author's computation.

Very imperative is the need to ascertain the causal relationship between a respective pair of the variables. In this regard, the lag length selection is conducted and the result is presented in Table 8 in which majority of the criteria select a lag of 3.

Thus, following the lag length selection, the pairwise causality results in Table 9 reveal feed-back effects between fiscal stability and real interest rate.

Incidentally, however, in a one-way causality, fiscal stability appears to be Granger-caused by each of growth rate, revenue, exchange rate, debt, and fiscal balance. Imperatively, the null hypothesis of the relationship is that there is Granger no-causality between a pair of variables. Thus, the null is accepted if the probability value is above 5%, otherwise it is rejected.

Table 9
Abridged results from pairwise Granger-causality tests.

Null Hypothesis:	Obs	F-Statistic	Prob.
GRT does not Granger Cause FST	36	5.7968	0.0088
FST does not Granger Cause GRT	36	0.6592	0.5241
REV does not Granger Cause FST	36	6.4797	0.0011
FST does not Granger Cause REV	36	1.7828	0.1845
RIR does not Granger Cause FST	36	4.0162	0.0214
FST does not Granger Cause RIR	36	5.5763	0.0114
XRT does not Granger Cause FST	36	5.3941	0.0131
FST does not Granger Cause XRT	36	0.3588	0.7013
DBT does not Granger Cause FST	36	6.3934	0.0012
FST does not Granger Cause DBT	36	0.5001	0.6111
FBAL does not Granger Cause FST	36	5.9806	0.0062
FST does not Granger Cause FBAL	36	0.3412	0.7134

Source: Author’s computation. Note: Decisions are based on 5% level of significance.

Estimation Results

As presented in Table 10, and contrary to expectation, real GDP growth rate bears negative effect on fiscal stability as debt obligation becomes 8 percentage point stable given 10% fall in the rate of growth. In other words, a rise in GDP growth rate inhibits government’s compliance with debt obligation in the short-run. The negative effect of GDP growth rate reflects the situation in which rising debt drags growth backward due to dwindling revenue and rising spending (Cecchetti et al., 2010; Kumar & Woo, 2010). Also, an increase in the stock of public debt causes fiscal instability as a 10% addition to the stock of outstanding public debt results in 1.8 % point reduction in the ability of the government to pay debt. This, as a matter of fact, reflects IMF’s worry over the country’s ability to repay its rising external debt, even though the government claims that the debt is sustainable (Oketola & Ameh, 2019). Imperatively, excessive debt impacts negatively on growth and development as the ability of government to implement desired policy is weakened when increasing percentage of revenue is devoted to debt-service payments (Gottschalk, 2014). The

findings notwithstanding, IMF (2010) affirms that countries with significantly lower debt-GDP ratio may likely experience debt distress if they operate in a weaker policy and institutional environment.

Regarding exchange rate, as expected, results imply that as the country’s currency appreciates, the country becomes more fiscally stable in meeting its debt obligation. Numerically, that is to say, a 10% appreciation in the rate at which the local currency is exchanged for the dollar brings about 1.1 % point increase in the ability of the government to comply with its debt obligation in the short-run. This situation gives space to the relevance of the view of Basdevant and de Wet (2000) that exchange rate dynamism correlates with debt unsustainability. That is, when exchange rate depreciates, the debt burden increases relative to the domestic currency. However, where a country’s debt is substantially foreign currency denominated, the best option for sustainability is to stabilize the exchange rate. As such, in this case, the idea of depreciating domestic currency to discourage imports and stimulate exports would not be a considerable option to policy makers.

Table 10
Impacts of macroeconomic factors on fiscal stability in the short-run

Short-run estimates: Dependent variable: ΔFst				
Variable	Coefficient	S-Error	t-statistic	Probability
<i>C</i>	2.04	0.03	0.59	0.41
$\Delta Fst(-1)$	0.21	0.15	5.71	0.00
$\Delta Grt(-1)$	-0.08	0.16	-5.23	0.00
$\Delta Rev(-1)$	0.09	0.12	4.82	0.03
$\Delta Rir(-1)$	-0.21	1.14	-0.54	0.24
$\Delta Xrt(-1)$	-0.11	0.17	-5.38	0.00
$\Delta Dbt(-1)$	-0.16	0.11	-5.51	0.00
$\Delta Fbal(-1)$	0.31	1.77	0.94	0.62
<i>ECT(-1)</i>	-0.82	0.18	-5.11	0.01
Adj R ²	0.73			
F-Stat	32.57			0.00
DW-stat	1.76			

Source: Author's computation. Note: Decisions are based on 5% level of significance.

Furthermore, and in conformity to expectation, total revenue propels fiscal stability positively given that a 10% increase in revenue translates into an approximately 1.0 % point rise in the government's compliance with debt obligation. That is, the more the revenue falls, the more it becomes difficult for the government to repay the country's debt in the short-run. Essentially, as spending outpaces revenue with debt burden becoming worrisome, the need to increase non-oil tax revenue is paramount as observed in the finance Act 2020 where amendments are made to some extant tax laws (Oxford-Analytica, 2019; Financial Derivatives Company, 2020). Thus, the drive to boost revenue collections by relevant government agencies is a pointer to sustaining the country's debt. However, with respect to real interest rate, the results suggest that interest rate affects debt obligation negatively, but not significantly in the short-run. But then, there are two sides to the explanation regarding the effect of interest rate. The one side argues that as public debt increases, interest rate is expected to increase as investors demand higher interest premium in compensation for

government defaults. The other, however, holds that in a recession where savings are surplus, and inflation is low, higher level of debt might not bring about a rise in real interest rate (Pettinger, 2018). Also, as numerous short-term variables affect fiscal stability, Komarkova, Dingova and Komarek (2013) assert the importance of interest rate when considering the sustainability of debt. Generally, the model adjusts back to long-run equilibrium with a speed of 82% as indicated by the coefficient of error correction term, *Ect*.

Moreover, in comparison to the baseline short-run results, the outcome of the estimation of equations in Table 7, as well as the effects of the breaks, are presented in Tables 11 and 12, respectively. As it stands in Table 11, the columns for Constant and Trend show the values for short-run estimates, while the columns for Constants and Trends in 1994, 1996, 2007 and 2008 indicate the values as departure from the baseline. In effect, the departure from the baseline result shows in Table 12 that, despite the breaks, revenue consistently has significant positive impact on fiscal stability in Nigeria.

Table 11
OLS results from the estimation of equations in Table 7

Series	C	C-1994	C-1996	C-2007	C-2008	T	T-1994	T-1996	T-2007	T-2008
<i>Trev</i>	2.04	0.081**	-	-	0.09*	-1.1	0.03**	-	-	0.01**
<i>Xrt</i>	2.04	-	0.07**	-	0.06*	-1.1	-	0.03**	-	0.01**
<i>Dbt</i>	2.04	0.08**	-	0.07*	-	-1.1	0.06**	-	0.02**	-

Source: Author's computation. Note: * and ** denote significance at 1 and 5%, respectively.

The results, however, show a significantly positive effect of exchange rate. That is to say, that domestic currency depreciation leads to fiscal instability over the break periods. As regards debt, the results show that, if

there were no breaks, the negative impact of debt would be less devastating on the country's solvency in the short-run.

Table 12
 OLS results of the effect of breaks

Variable	Coeff	Std Error	t-stat	Prob
<i>Trev</i>	0.13	0.12	5.68	0.01
<i>Xrt</i>	0.06	0.14	5.44	0.03
<i>Dbt</i>	-0.08	0.11	-5.91	0.00
Adj R ²	0.63			
F-stat	22.81			0.00
DW	1.73			

Source: Author's computation. Note: Decisions are based on 5% level of significance.

CONCLUSION AND POLICY IMPLICATIONS

This paper focuses on the relationship between fiscal stability and macroeconomic environment in Nigeria. Findings reveal that while the country's currency maintains stability in 2019, external reserves decline to the lowest at \$38 billion in the same year. The situation necessarily correlates with the persistent 45% yearly shortfall in actual revenue relative to the target since 2015. In 2012, as crude oil production slows by 2% and international price climbs mildly by 0.6%, a loss of about ₦853 billion revenue is recorded. Similarly, in 2016, the slump in the price of crude, among other factors, results in revenue shortfall of ₦1.1 trillion. As such, the shortfall in revenues and the fiscal commitment to finance imports, as well as socio-economic infrastructure and budgetary expenditure, constraint the government into borrowing from both foreign and domestic sources. In effect, government efforts at meeting its debt obligation results in structural breaks which provide information on the need for improved revenue collections as well as imminent intervention in the foreign exchange market while debt needs to be kept within short-term stability.

Thus, the whole analysis reveals a mixed relationship subsisting between fiscal stability and certain macroeconomic factors in Nigeria.

Nonetheless, consequent upon the findings, the following recommendations suffice with policy implications. Since revenue is paramount for fiscal stability, government should strive to either review the extant revenue policy of tax reforms or introduce new strategies that would help increase collections in both oil and non-oil sectors. Ordinarily, when revenue collection is improved upon, more money would be available to fund public projects and grow the economy while some parts would be used to repay debt. More so, an increased revenue collection would to a large extent curb the spate of borrowing by the government. Also, as rising public debt leads to fiscal instability, then the government should, as a necessity, reduce borrowing. If government reduces borrowing, it would, in one hand, save the future generation from burden of repaying the debt they do not owe or benefit from; and on the other hand enhance government's capacity to comply with debt obligation which would invariably boost the country's credit worthiness with investors and creditors. Ordinarily, a creditworthy economy will always find it easy to secure financial assistance whenever the need arises, especially in the short-run.

REFERENCES

- AFDB (2021): *Nigeria economic outlook*. African Development Bank. Retrieved May 26, 2021 from <https://www.afdb.org/en/countries-west-africa-nigeria/nigeria-economic-outlook>.
- AFRICAN ECONOMIC OUTLOOK (2014): *Nigeria 2014*. Retrieved February 03, 2021 from <http://www.africaneconomicoutlook.org>
- AKANNI, K.A., & OSINOWO, O.H. (2013): Effects of fiscal instability on economic growth in Nigeria. *Advances in Economics and Business*, 1(2), 124-133. DOI: 10.13189/aeb.2013.010207.
- AMAEFULE, E. (PUNCH January 23, 2018): Fg hires consultants to probe minerals sector's revenue leakages. *Punchnewspaper*. Retrieved May 12, 2021 from <http://punchng.com/fg-hires-consultants-to-probe-minerals-sectors-revenue-leakages/>.
- ASU, F. (PUNCH January 3, 2019): IMF warns Nigeria, others as global debt hits \$184tn. *Punchnewspaper*. Retrieved May 16, 2021 from <https://punchng.com/imf-warns-nigeria-others-as-global-debt-hits-184tn/>.
- AYINDE, T.O. (2014): Sustainable fiscal management in Nigeria: A triangulation analysis. *Journal of Economics and Development Studies*, 2(2), 2334-2390.
- BAI, J., & PERRON, P. (2003): Computation and analysis of multiple structural change models. *Journal of Applied Econometrics*, 6, 72-78.
- BASDEVANT, O., & DE WET, T. (2000): *Debt sustainability and exchange stabilization: Towards a new theory*, 3(3), 436-445.

- BLUNDELL, R., & BOND, S. (1998): Initial conditions and moment restrictions in dynamic panel data models. *Journal of Econometrics*, 87, 115-143.
- BURMSIDE, C. (2004): *Fiscal sustainability in theory and practice: Handbook*. Retrieved July 12, 2021 from [https://www.amazon.com/Fiscal-Sustainability-Theory-Practice- Handbook/dp/082135874X](https://www.amazon.com/Fiscal-Sustainability-Theory-Practice-Handbook/dp/082135874X).
- CECCHETTI, S.G., MOHANTY, M.S., & ZAMPOLI, F. (2010): *The future of public debt: Prospects and implications*. BIS Working Papers No. 300, Basel: Bank for International Settlements.
- CBN (2019): *Statistical bulletin*. Central Bank of Nigeria. Retrieved May 22, 2021 from <https://www.cbn.gov.ng/documents/statbulletin.asp>.
- CBN (2021a): *Crude oil production, price*. Central Bank of Nigeria. Retrieved May 22, 2021 from <https://www.cbn.gov.ng/documents/statbulletin.asp>.
- CBN (2021b): *Exchange rate policy*. Central Bank of Nigeria. Retrieved May 23, 2021 from <https://www.cbn.gov.ng/IntOps/ExchRatePolicy.asp>.
- CHALK, N., & HEMMING, R. (2000): Assessing fiscal sustainability in theory and practice. *IMF Working Paper* WP/00/81, International Monetary Fund.
- COHEN, D., & PORTES, R. (2004): "Dealing with destabilizing 'market discipline.'" CEPR, *Discussion Paper*, No. 4280.
- DMO (2017): *Report of the annual national debt sustainability analysis*. Debt Management Office, Nigeria. Retrieved May 26, 2021 from <https://www.dmo.gov.ng/debtsustainabilityreport>.
- DICKEY, D.A., & FULLER, W.A. (1979): "Distribution of the estimators for autoregressive time series with a unit root". *Journal of the American Statistical Association*, 74, 427-431.
- ELENDU, K. (2017): Fiscal sustainability: Between Nigeria's debt plan and the 2018 budget. Retrieved from <http://csr-in-action.org/fiscal-sustainability-between-nigerias-debt-plan-and-the-2018-budget/>.
- ENGLE, R.F., & GRANGER, C.W.J. (1987): "Co-integration and error-correction: Representation, estimation and testing". *Econometrica*, 55, 251-276.
- FINANCIAL DERIVATIVES COMPANY (2020): *FDC monthly economic update*. A Financial Derivatives Company Publication, 10(1), January 15. Retrieved April 21, 2021 from <https://trwstockbrokers.files.wordpress.com/2020/01/fdc-economic-december-monthly-update-january-15-2020.pdf>.
- GIAMMARIOLI, N., NICKEL, C., ROTHER, P., & VIDAL, J-P. (2006): Assessing fiscal soundness: Theory and practice. *SSRN Electronic Journal*, pp. 637-672. Doi: 10.2139/ssrn.2005166.
- GOTTSCHALK, J. (2014). Fiscal and debt sustainability. Fiscal Analysis and Forecasting Workshop. IMF-TAOLAM.
- GRANGER, C.W. (1988): Some recent development in a concept of causality. *Journal of Econometrics*, 39, 199-211.
- HARVEY, D.I., LEYBOURNE, S.J., & TAYLOR, A.R. (2013). Testing for unit roots in the possible presence of multiple trend breaks using minimum Dickey-Fuller statistics. *Journal of Econometrics*, 17(2), 265-284.
- IMF (2006): *Fiscal adjustment for stability and growth*. International Monetary Fund, Washington D.C.
- IMF (2010): *IMF staff guidance note on the application of the joint fund-bank debt sustainability framework for LICs*. International Monetary Fund. Retrieved July 23, 2021 from <http://www.imf.org/staff-guidance-note-on-the-application-of-the-joint-fund-bank-debt-sustainability-framework-for-lics/>.
- KALU, I.K. (1994): *Press briefing on 1994 budget and national rolling plan 1994-1998*. New breed magazine, pg. 14.
- KHAN, M.S., & SENHADJI, A. S. (2001): Threshold effects in the relationship between inflation and growth. *IMF Staff Papers*, Vol. 48.
- KOLAWOLE, B.O. (2019): *Fiscal financing and sustainability in Nigeria: An empirical assessment*. In Dauda, R.O.S., Akinleye, S.O., & Balogun, E.D. (eds.) *Leading Issues in Macroeconomic Stabilisation and Financial Development: A Festschrift in Honour of Professor Oluwatayo Fakiyesi*, pp. 231-249. Akoka, Lagos: University of Lagos Press and Bookshop Ltd.
- KOLAWOLE, B.O. (2020): Effect of budget deficit on economic growth in Nigeria. *LASU Journal of Economics*, 2(1), 17-32.
- KOMARKOVA, Z., DINGOVA, V., & KOMAREK, L. (2013): Fiscal sustainability and financial stability. *Czech National Bank/ Financial Stability Report*, pp. 103-112.
- KUMAR, M.S., & WOO, J. (2010): *Public debt and growth*. IMF Working Paper 10/174, Washington, DC: IMF.
- KWIATKOWSKI, D., PHILLIPS, P.C.B., SCHMIDT, P., & SHIN, Y. (1992): Testing the null hypothesis of stationarity against the alternative of a unit root. *Journal of Econometrics*, 54(1-3), 159-178.
- MINK, R., & RODRIGUEZ-VIVES, M. (2004): "The measurement of government debt in the economic and monetary union." In *Public Debt*, Roma: Banca d'Italia.
- NBS (2021): *Key statistics: Gdp, unemployment, cpi*. National Bureau of Statistics, Nigeria. Retrieved May 21, 2021 from <https://www.nigerianstat.gov.ng>.
- NWEZE, C. (2019, April 22): N24.39tr debt: Nigeria not in debt crisis, says fed govt. *The Nation* Retrieved April 28, 2021 from <https://thenationonlieng.net/n24-39tr-debt-nigeria-not-in-debt-crisis-says-fed-govt>.
- Organisation for Economic Co-operation and Development [OECD] (2020): *Revenue statistics in Africa 2020 – Nigeria*. Retrieved 21 June, 2021 from <https://www.oecd.org/ctp/tax-policy/revenue-statistics-africa-nigeria.pdf>.

- OGILJI, P., & AJAYI, K.J. (2020): Estimating a fiscal reaction function for Nigeria. *CBN Journal of Applied Statistics*, 11(1), 35-63.
- OKAURU, I.O. (2012): *Federal inland revenue service and taxation reforms in democratic Nigeria*. Nigeria: Safari Books.
- OKETOLA, D., & AMEH, J. (PUNCH April 11, 2019): N24.39tn debt: Imf worries over Nigeria's repayment capacity. Retrieved 18 July, 2021 from <https://punchng.com/n24-39tn-debt-imf-worries-over-nigerias-repayment-capacity/>.
- OMOTOSHO, B.S., BAWA, S., & DOGUWA, S.I. (2016): Determining the optimal public debt threshold for Nigeria. *CBN Journal of Applied Statistics*, 7(2), 1-25.
- OXFORD-ANALYTICA (2019): Nigerian government faces critical revenue challenges. *Expert Briefings*. Retrieved July 8, 2021 from <https://doi.org/10.1108/OXAN-DB243574>.
- OYELEKE, O.J., & AJILORE, O.T. (2014): Analysis of fiscal deficit sustainability in Nigerian economy: An error correction approach. *Asian Economic and Financial Review*, 4(2), 199-210.
- PANIAGUA, J., SAPENA, J., & TAMARIT, C. (2017): Fiscal sustainability in EMU countries: A continued fiscal commitment? *Journal of International Financial Markets, Institutions & Money*, pp. 1-32. doi: <http://dx.doi.org/10.1016/j.intfin.2017.08.014>.
- PERRON, P. (1989): The great crash, the oil price shock, and the unit root hypothesis. *Econometrica: Journal of the Econometric Society*, pp.1361-1401.
- PESARAN, H.M., & SHIN, Y. (1999): Autoregressive distributed lag modelling approach to cointegration analysis. In Storm, S. (ed.), *Econometric and Economic Theory in the 20th Century* (Chapter 11). The Ragner Frisch Centennial Symposium, Cambridge University Press, Cambridge.
- PESARAN, M.H., SHIN, Y., & SMITH, R.J. (2001): "Bounds testing approaches to the analysis of level relationship." *Journal of Applied Economics*, 16, 289-326.
- PETTINGER, T. (2018): Does higher debt lead to higher interest rates? Retrieved July 19, 2021 from <https://www.economicshelp.org/blog/4966/debt/link-between-debt-and-bond-yields/>
- PHILLIPS, P.C.B., & PERRON, P. (1988): "Testing for a unit root in time series regression." *Biometrika*, 75, 335-346.
- PROSHARE (2018, December 26): Nigeria prioritizes revenue generation, mulls response to global changes affecting assumptions. Retrieved May 08, 2021 from <https://www.proshareng.com/news/NIGERIA%20ECONOMY/Nigeria-Prioritizes-Revenue-Generation-Mulls-Response-To-Global-Changes-Affecting-Assumptions/43293>.
- SUNNEWSONLINE (2021, January 26): FG deficit rises to N4.45tn in 10 months. Retrieved May 15, 2021 from <https://www.sunnewsonline.com/fg-deficit-rises-to-n4-45tn-in-10-months/>.
- TRUSTEES OF PRINCETON UNIVERSITY (2012): A change agent in the tax office: Nigeria's federal inland revenue service, 2004-2009. *Innovations for Successful Societies*, Princeton University. Retrieved June 21, 2021 from https://successfulsocieties.princeton.edu/sites/successfulsocieties/files/Policy_Note_ID184.pdf.
- UDOMA, U.U. (2019): *Breakdown of 2019 fgn budget proposal*. Retrieved March 23, 2021 from <https://www.proshareng.com/admin/upload/report/11888HMBNP2019EBPPublicPresentationReviewed191218FINAL1-proshare.pdf>.
- WEIDEMAN, J.P. (2016): Structural breaks in renewable energy in South Africa: A Bai and Perron break test application. *Department of Economics Working Paper*, 2016-36, University of Pretoria.
- WORLD BANK (2021): *World development indicators*. Retrieved July 22, 2021 from <https://datacatalog.worldbank.org/dataset/world-development-indicators>.

^{i i} The International Monetary Fund [IMF] is worry about the sustainability of the country's debt profile which rises from \$3627.5 million in 2009 to \$79.44 billion in first quarter 2019 (Nweze, 2019).

^{ii ii} The total deficit widens from 4.3% in 2019 to 5.2% in 2020 as the figure reaches ₦4.45trillion from ₦3.8trillion in 2019 (Asu, 2019; African Development Bank [AfDB], 2021; Sunnews, 2021).

^{iii iii} Even while the debt level is within the specific limit of 19.39% as public debt-to-GDP rises from 13.02% in 2015 to 16.27% in 2016, yet, owing to low revenue, especially from the oil sector, the public debt service-to-revenue is relatively high at 33.94% (DMO, 2017; AfDB, 2021).

^{iv iv} The federal government introduced the fiscal sustainability plan (FSP) in 2016 and the economic sustainability plan (ESP) in 2020 to revive the economy from recessions in both years.

^{v v} According to DMO (2017), external debt analysis captures external debt of the federal government of Nigeria (FGN), the 36 states and federal capital territory (FCT); while fiscal sustainability analysis (or total public debt sustainability) covers domestic and external debt of the FGN, states and FCT, and their respective revenues, including internally generated revenues.

^{vi vi} The revenue strategies include the introduction of value added tax (VAT) in 1993, tax reforms of 2004, and FSP in 2016, among others. The country received debt forgiveness from the London and Paris Clubs in 2005.

Development of Income Taxes in Slovakia and the European Union in the Light of Recent Economic Changes in Europe

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SUMMARY

Political, economic, and social developments in the world have undergone relatively turbulent changes over the last two decades. The European Union has not avoided them either. Naturally, any such change directly or indirectly affects the national economies of individual countries. Governments adapt to the new conditions through measures in the areas of employment, production, taxes, levies, and the like. This paper aims to examine the development of income taxes in Slovakia and other countries of the EU. Personal income tax and corporate income tax are the most significant direct taxes in all Member States in terms of collection volume. Their development varies from one region of Europe to another. Therefore, the idea of greater tax harmonization in the Union regularly runs into the arguments of countries in favor of maintaining tax competition. The paper seeks the similarity of individual tax systems and suggests a possible procedure in their further convergence.

Keywords: Tax; Tax system; Direct taxes; Personal income tax; Corporate income tax; Tax base, Tax rate; Tax harmonization; Income taxes; Clusters.

JEL classification: H21; H24; H25.

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INTRODUCTION

In terms of the tax collection volume, income taxes are the most significant direct taxes in Slovakia, as in other European countries. The tax system of Slovakia has undergone several tax reforms since the establishment of an independent state. All of them significantly affected the tax burden on the population's and entrepreneur's income.

The government, entrepreneurs, experts, and other entities of the national economy discuss the fairness and efficiency of income taxation regularly. This paper offers a detailed analysis of income tax development in Slovakia in recent years. It examines the impact of reforms on the tax burden and presents the current situation of personal income and corporate income

taxation. However, as in Slovakia, constant changes in income taxation are taking place in other Member States of the European Union. Each EU country must be prepared to respond flexibly and effectively to current pandemic situations, including through tax measures. To do this, it is necessary to know how the entities react to the new tax measures. The aim of the paper is to examine the development of income taxes in Slovakia and the other Member States. Each country's economy has undergone its own historical, political, economic, and social development, which has been reflected in the needs of the public sector, the private sector, and the population. So, the different taxation of income in individual countries is thus natural.

RELATED RESEARCH

The whole 20th century was characterized by a rapid process of internationalization in several social areas, including international economic cooperation. The Member States of the EU and their tax systems could not avoid this global trend, either. National tax systems need to respond to their trading partners because of increasing international trade.

Despite significant rises since 2010, EU-28 income tax revenue as a percentage of GDP reached a plateau in 2015, with the euro area following a broadly similar trend. The structure of taxation varies quite significantly across the Member States. When it comes to the share of direct taxes in total tax revenues, Denmark has the highest share (66%), followed by Ireland, the United Kingdom, Sweden, and Malta with shares lying between 40% and 50% of revenue (Genschel & Jachtenfuchs 2018).

Significant differences in income taxes can be followed between Western or Northern Europe (such as Belgium, Denmark, France, Netherlands, Germany) and Eastern European countries (e.g. Bulgaria, Romania, Slovakia, and the Czech Republic). There are significant differences in the rates for income taxes, as well as in the tax collection volume.

Nowadays, all developed countries join different integration clusters. They cooperate and depend on each other. Reasons are mainly political and economic, such as strengthening the position on defense, creating competitive economies, expanding markets, and the like. There is a lot of effort needed to make this cooperation work effectively. To make the cooperation as easy as possible, there are efforts to standardize, coordinate, and harmonize the greatest possible number of processes, laws, directives, regulations, etc. The European Union is a typical example of such a cluster. The processes of international coordination in the EU also affect the taxes and tax systems of the Member States.

The current tax framework in the EU leaves Member States free to choose their tax system if they comply with the rules unanimously adopted by the EU Council. If a Member State's tax policies violate the principles of the single market, the EU is empowered to take decisions to ensure protection against tax fraud and evasion, as well as to suppress aggressive tax planning (Niazi 2016, Nerudová 2004).

In the area of corporate taxation or combating harmful competition and aggressive tax planning, targets are set to reduce the number of loopholes resulting from complex rules, assessment bases and rates that may apply to individual businesses (Douma & Kardachaki 2016).

To date, there are relatively significant differences between the tax burden associated with income from employment in the individual EU Member States. Concerning tax proceedings, the difference is mainly in the setting of the tax base for the calculation of tax liability (Psenkova 2016).

Legislators need to prepare a legislative concept that is not only in line with all EU intentions and regulatory requirements but also acceptable to national taxpayers when preparing country tax system adjustments. Moreover, it is important to realize that tax harmonization is followed by changes in the accounting legislation of individual European countries (Hakalova et al. 2018, Pírva 2012).

The European Commission launched a debate on the gradual transition to more effective taxation decisions in the EU. The Commission Communication builds on Juncker's 2018 speech to the EU members, calling for a move towards qualified majority voting in tax matters. At present, when voting, unanimous decisions are required in the tax policy following primary law, which imposes considerable restrictions, as new legislation is indeed difficult to adopt, and legislation once adopted is also hard to change because any change requires unanimity again. The current situation can lead to costly delays or a complete blockage of proposals that may be relevant to growth, competitiveness, and tax justice in the single market (Genschel & Jachtenfuchs 2018).

This paper aims to explore selected aspects of the most relevant direct taxes (Personal Income Tax – PIT, and Corporate Income Tax – CIT) primarily in Slovakia, then in the other Member States. The task is to assess the reality of tax unification in the EU and to suggest possible progress in this process soon.

DEVELOPMENT OF INCOME TAXES IN SLOVAKIA

Direct taxes are levied directly on the taxpayer whose income or assets are taxable. Indirect taxes are also called consumption taxes, usually collected from consumers by the taxpayer. In the recent period, the classification of taxes according to the territorial aspect of tax determination has become increasingly important. Territorial decentralization of public administration is associated with the financial decentralization of lower government funds (Jakúbek & Tej 2015). There is an increasing tax revenue transfer from the state budget to the municipalities' budgets. Cities and municipalities are strengthening their tax jurisdiction.

Table 1
Tax classification in Slovakia

Territorial aspect of tax determination	DIRECT TAXES	INDIRECT TAXES
State budget	Individual (personal) and corporate income tax	Value-added tax
	Motor vehicle tax	Excise duty on mineral oil Excise duty on tobacco products Excise duty on alcoholic beverages Excise duty on electricity, coal, and natural gas
Budget of municipalities and Higher Territorial Units	Real estate tax (on land, buildings, flats, and non-residential premises)	
	Dog tax	
	Tax on the use of public areas	
	Accommodation tax	
	Tax on vending machines	
	Tax on non-winning gaming machines	
	Tax on the entry and staying of motor vehicles in historical parts of towns	
	Nuclear facility tax	

Source: authors, data from the Ministry of Finance of the Slovak Republic (2020a)

The taxes are defined by the Income Tax Act, the Motor Vehicle Tax Act, the Value Added Tax Act, four excise tax laws, and the Local Taxes and Fees Act. At present, there are 15 taxes in Slovakia, which are determined by individual tax laws (Table 1).

Tax collection is provided by the following tax administrators:

- Financial Administration (income to the state budget - income taxes, motor vehicle tax, value added tax, excise duties),
- Municipalities (income to the local budget - local taxes).

Although the personal income tax is collected by the Financial Administration, it is then redistributed as follows (Ministry of Finance of the Slovak Republic 2020c):

- 70% of the total revenue for municipalities,
- 30% of the total revenue for Higher Territorial Units (regions). There are 8 Higher Territorial Units in Slovakia, 2890 municipalities, and 140 cities.

Taxation is one of the most relevant instruments of the state's economic policy. Tax revenues are formed mainly from income taxes, value-added tax, and excise duties (Table 2).

Table 2
Tax revenues of the Slovak State budget (Million EUR)

Time	Tax revenues overall	Income tax		VAT	Excise duties	Other tax revenues
		PIT	CIT			
2004	7 808	931	1 098	3 507	1 499	773
2005	9 017	1 302	1 472	3 880	1 804	559
2006	9 461	1 530	1 576	4 165	1 597	593
2007	10 644	1 810	1 878	4 166	2 178	612
2008	11 270	2 073	2 104	4 654	1 809	630
2009	9 954	1 708	1 614	4 231	1 763	638
2010	10 083	1 691	1 623	4 186	1 931	652
2011	10 897	1 873	1 659	4 651	2 000	714
2012	10 997	2 065	1 689	4 322	1 973	948
2013	11 565	2 072	1 808	4 664	1 985	1 036

2014	12 729	2 345	2 211	5 013	2 015	1 145
2015	14 158	2 657	2 717	5 416	2 108	1 260
2016	14 568	2 695	2 942	5 415	2 174	1 342
2017	15 344	2 605	2 635	5 913	2 252	1 939
2018	16 382	3 208	2 891	6 326	2 315	1 642
2019	18 273	3 577	2 907	6 826	3 010	1 953
Change 2004-2019	+ 10 465	+	+	+ 3 319	+ 1 511	+ 1 180
Increase (%)	+134.0%	+284.2%	+164.8%	+94.6%	+100.8%	+152.7%

Source: Ministry of Finance of the Slovak Republic (2020b)

Tax collection more than doubled in the period under review. For the monitored period on tax revenues, we chose 16 years, from 2004 (when the Slovak Republic joined the EU) to 2019 (the latest published data on tax revenues). The most significant increase in the collection of taxes in this period was made in personal income tax, in relative terms by more than 284%. The second place belongs to the corporate income tax, which grew by more than 164%. The first reason for the growth in tax collection is the performance of the economy. The second possible factor is the growth of the tax rate. Another factor is the improvement of the efficiency of tax collection through better control of financial statements and fraud detection.

The so-called flat tax (or in other words linear tax) introduced in 2004 was abolished in 2013 after the change of government. The introduction of a flat tax shifted the tax burden from direct to indirect taxes. The simple system and control were aimed at minimizing tax evasion. Besides, the inflow of foreign capital into the Slovak economy increased. However, this was caused not only by the introduction of a flat tax but also by the simultaneous implementation of economic and institutional reform.

The overall tax collection after the financial and economic crisis in 2009 fell by more than 10%. Despite the introduction of various measures to mitigate the crisis effects, it took almost three years to exceed the values of 2008. Tax collection gained momentum after 2012. In the last year of the period under review (2019), its value exceeded 2008 by almost 63%.

In 2019, an amount of EUR 18.273 billion was recorded for tax revenue. The largest part represented indirect taxes in the amount of EUR 9 836 billion,

namely, value-added tax in the amount of EUR 6.826 billion and excise duties in the amount of EUR 3.010 billion. Of the direct taxes, the highest revenues were (obviously) from personal income tax (EUR 3.577 billion) and corporate income tax (EUR 2.907 billion). The largest increase in tax collection during the period under review was recorded for value-added tax EUR 3.319 billion, personal income tax EUR 2.646 billion, and corporate income tax EUR 1.809 billion.

Income tax

Income tax was introduced in Slovakia on the first day of the independent Slovak Republic, on 1 January 1993 by Federal Act no. 286/1992 Coll. It replaced the previous categories of payroll tax, income tax from literary and artistic activities, citizen's income tax and pension tax, agricultural tax, profit tax, and profit levy (for legal entities). Income tax is a common designation for personal income tax and corporate income tax. They have been regulated from 1 January 2004 to the present in joint Act 595/2003 Coll. on Income Tax, also known as the Income Tax Act (Legislative and Information Portal of the Ministry of Justice of the Slovak Republic 2020). The law has been amended and changed several times, as it was necessary to adapt the individual provisions of the Income Tax Act to the conditions related to membership in the European Union (Korečko & Suhányiová 2019). The tax administrator in the Slovak Republic is the Financial Administration, which registers tax subjects of income taxes in the Register of Tax Subjects. The number of tax subjects in the observed period is shown in Table 3.

Table 3
Number of registered tax subjects in Slovakia (2004 to 2019)

Time	Income tax	
	PIT	CIT
2004	1 847	128 497
2005	2 003	142 169
2006	2 157	155 969
	211	

2007	2 296 434	171 601
2008	2 436 153	189 958
2009	2 559 000	204 115
2010	2 676 557	220 748
2011	2 747 220	237 794
2012	2 823 840	255 959
2013	2 879 037	278 903
2014	2 921 699	287 880
2015	3 008 570	285 388
2016	3 124 373	294 396
2017	3 241 894	306 622
2018	3 355 264	322 235
2019	3 465 164	340 389
Change 2004- 2018	+ 87.5 %	+ 164.9 %

Source: Financial Administration of the Slovak Republic (2020)

The highest number of tax subjects represent payers of personal income tax. The highest increase in the number of tax subjects occurred among corporate income taxpayers (an increase of 164.9%).

Personal income tax (PIT)

The subject of Personal income tax in the sense of the Income Tax Act is a taxpayer who achieves taxable income and:

- is a tax resident – a person who has a permanent residence in the territory of the Slovak Republic or usually stays there for at least 183 days in the relevant calendar year. Tax residents are subject to personal income tax calculated on their worldwide income, taking into account reliefs under Slovak law and double taxation treaties;
- person who is not a Slovak resident, but the tax liability shall apply to income derived from sources in the Slovak Republic. Non-residents are liable to personal income tax calculated on their income from sources in the Slovak Republic;
- a taxpayer with a permanent residence abroad, who was sent to Slovakia by a legal entity as an expert for the purpose of providing professional assistance to legal entities domiciled in Slovakia and stays here only for the purpose of professional assistance. The subjects of PIT are divided into groups by source of income:

- income from dependent activity (employees) - Section 5 of the Income Tax Act,
- income from business, from other self-employed activity, from rent and income from the use of work and artistic performance - Section 6 of the Income Tax Act,
- income from capital assets - Section 7 of the Income Tax Act,
- other income - Section 8 of the Income Tax Act.

The tax base is a relevant variable in calculating the tax liability. It consists of partial tax bases according to individual groups of income. The non-taxable parts of the tax base are derived from the partial income tax bases from dependent activity, business, and other self-employed activity or their total. Then the other partial tax bases are added. Items deductible from the tax base are non-taxable parts of the tax base for the taxpayer and his/her spouse, non-taxable parts of the tax base for spa care, tax bonus for a child, or unpaid interest on a mortgage for young people and contributions to supplementary pension savings (Fiľarská et al. 2018). For each of these items, the conditions for entitlement and the method of calculation sets the law. The correct classification of income received is necessary for the correct quantification of the taxpayer's tax liability.

Since 2004, the non-taxable part on taxpayers has been set as a multiplicand of the subsistence minimum sum applicable on 1 January of the tax year. The subsistence minimum is a socially recognized

minimum income limit of a natural person, below which a state of material need occurs (Ministry of Labour, Social Affairs and Family of the Slovak Republic 2020).

The amount of the non-taxable part has not changed significantly between 1993 and 2003. A more significant change occurred in 2004, when the amount increased by 108.54%. After 2004, it increased slightly depending on the increase in the subsistence minimum, which was the basis for determining the non-taxable part of the tax base, namely 19.2 times the amount of the subsistence minimum. For 2009 and 2010 the method of calculating the non-taxable part of the tax base changed. The provision was a part of the 2-year anti-crisis package. According to this transitional provision, the non-taxable part of the taxpayer's tax base was an amount corresponding to 22.5 times the amount of the subsistence minimum applicable per year.

From 1 January 2020, the subsistence level increased to the amount of EUR 210.20, compared to 2019, when the subsistence level was EUR 205.07. Since 2020 the non-taxable part of the tax base represents 21 times the amount of the subsistence minimum (EUR 4 414.20 per year).

If a taxpayer reaches the tax base higher than 100 times the applicable subsistence level, the non-taxable

part of the tax base represents the difference of 44.2 times the applicable subsistence level and one-quarter of the tax base. If this difference is zero or negative, the right to a non-taxable part of the tax base does not arise.

The non-taxable part of the tax base can be applied by the taxpayer to his/her spouse only if he/she lives with the taxpayer in the household and meets one of the following conditions: he/she took care of a dependent minor living with the taxpayer, receives a care allowance in the relevant tax period, has been included in the register of job seekers, is considered a citizen with a disability, or is considered a citizen with a severe disability.

Since 2004, a tax bonus on every dependent child (from birth up to 25 years of age) living in a household with a taxpayer has been applied. The taxpayer can reduce the calculated tax liability by the amount of the tax bonus. From 2019, the amount of the tax bonus also depends on the age of the child. In 2019, the annual tax bonus was EUR 465.57 per child under 6 years of age and EUR 266.04 from 6 years old. In 2020 the tax bonus increases by 17% per child under 6 years, and by 2.5% per child from 6 years of age. Table 4 shows the development of changes in the annual amount of the non-taxable part of the tax base for a spouse and the changes in the tax bonus from 2004 to 2019.

Table 4

Non-taxable part of the tax base for spouse and tax bonus for a dependent minor child for one calendar year (EUR)

Time	Non-taxable part of the tax base for spouse	Tax bonus
2004	2 683.13	159.33
2005	2 918.94	165.97
2006	3 014.54	215.10
2007	3 173.87	218.08
2008	3 269.47	226.45
2009	4 025.70	235.92
2010	4 025.70	240.12
2011	3 559.30	243.18
2012	3 644.74	249.24
2013	3 735.94	254.64
2014	3 803.33	256.92
2015	3 803.33	256.92
2016	3 803.33	256.92
2017	3 803.33	256.92
2018	3 830.02	258.72
2019	3 937.35	266.04 or 465.57
Change 2004-2019 (EUR)	+1 254.22	+106.71 or +306.24
Change 2004-2019 (%)	+ 46.74 %	+66.94 or +192.20

Source: authors, based on Income Tax Act no. 595/2003 (Legislative and Information Portal of the Ministry of Justice of the Slovak Republic 2020)

In addition to the tax bonus for a child, the taxpayer can also apply a tax bonus on mortgage interest paid (since 2019).

Other non-taxable amounts by which the taxpayer can reduce the tax base are:

- contributions for supplementary pension savings up to a maximum of EUR 180,
- expenses for spas.

From 1993 to 2003, in the Slovak Republic, a progressive personal income tax was used. Its percentage rate increased with the amount of income. The tax rate was used in the calculation of the income tax of employees, self-employed persons, and other self-employed persons. As of 1 January 2004, a flat tax was introduced, and its percentage rate was the same – 19%. However, from 1 January 2013, taxation again became progressive. The tax rate remained 19% for that part of the tax base that did not exceed 176.8 times the amount of the applicable subsistence minimum. For the part of the tax base exceeding 176.8 times the subsistence minimum, the tax rate became 25%.

Since 2013, there is also a so-called special rate of income tax on dependent activities of selected

constitutional officials (president, members of the government, deputies of the National Council of the Slovak Republic, chairman, and vice-chairman of the Supreme Audit Office) in the amount of 5%. The revenues of these constitutional officials are extra taxed at a special tax rate of 5%, in addition to the tax rate of 19% or 25%.

From 2017, dividends received by a natural person from sources abroad are taxed at a rate of 7% (from a contracting state) or at a 35% tax rate (from a non-contracting state).

From 2020, a 15% income tax rate is applied to the personal income tax base from business and other self-employed activities if the income does not exceed the amount of EUR 100,000. If the partial tax base exceeds EUR 100,000, the rate of 19% or 25% shall apply (Table 5).

Table 5
Personal income tax rates in Slovakia

Time	Tax base (EUR)	Tax rate (%)
2004 to 2012	without limit	19
2013	did not exceed 34 401.74	19
	exceeded 34 401.74	25
2014 to 2017	did not exceed 35 022.31	19
	exceeded 35 022.31	25
2018	did not exceed 35 268.06	19
	exceeded 35 268.06	25
2019	did not exceed 36 256.38	19
	exceeded 36 256.38	25
2020	from business and other self-employed activity not exceeding 100 000	15
	does not exceed 37 136.36	19
	exceeded 37 136.36	25

Source: authors, based on Income Tax Act no. 595/2003 and its amendments (Legislative and Information Portal of the Ministry of Justice of the Slovak Republic 2020)

The highest income from personal income tax achieved in Slovakia was in 2019 in the amount of EUR 3.577 million. The lowest income was recorded in 2004 in the amount of 931 million. The income from personal income tax in the period 2004-2019 increased by EUR 2,646 million (by 284%). The highest share of personal income tax in total tax revenues was 201.1% in 2018, and the lowest in 2004 was 11.92%. The highest amount of income per person in 2019 was EUR 1,032 (in 2004 it was EUR 504).

Corporate income tax (CIT)

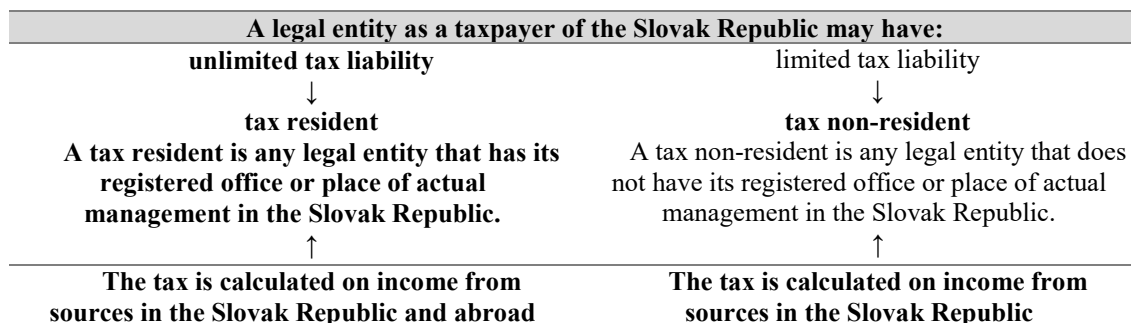
The subject of the tax is a legal entity established for business and a legal entity not established for business but developing business activities to make a profit. The following legal entities are taxpayers of corporate income tax:

- associations of natural and legal persons,
- special-purpose property associations,
- local government units,
- other entities provided for by law.

The largest share of corporate income tax is paid to the state budget by the associations of natural and legal persons, cooperatives, and commercial companies (joint-stock company, limited liability company,

limited partnership, public trading company, a legal entity established under EU law) (Korečko et al. 2019). The classification of taxpayers into tax residents and tax non-residents is listed in Table 6.

Table 6
Classification of taxpayers according to the scope of tax liability in the Slovak Republic



Source: authors, based on Income Tax Act no. 595/2003 (Legislative and Information Portal of the Ministry of Justice of the Slovak Republic 2020)

The corporate income tax is calculated on income from the activities of the taxpayer and the disposal of the taxpayer's property. The law also defines those types of income that are not subject to tax, for example:

- income earned by donation or inheritance,
- profit share (dividend), to the extent that it is not a tax expense for the taxpayer paying this profit share,
- acquisition of new shares and increase of the share in the registered capital from the retained earnings of a joint-stock company, a limited liability company, or a cooperative.

Since 2017, taxation of profit shares (dividends) has been re-taxed in some cases. If the profit share is used to acquire a legal entity (resident or non-resident) from a source in Slovakia, it is not subject to tax. If the profit shares are received from abroad from a non-Contracting State, the legal entity shall be taxed at a tax rate of 35%.

The tax base is the difference by which taxable income exceeds tax expenses while respecting the material and temporal connection of income and expenditure in the relevant tax period. The determination of the corporate income tax base in the double-entry bookkeeping system is based on the pre-tax profit (revenues minus costs). The profit is adjusted by addable and deductible items, so-called non-tax items that increase or decrease the tax base.

Items that increase profit or loss (non-tax-deductible expenses) include, for example:

- representation expenses (except for expenditure on promotional items not exceeding EUR 17 per item),
- deficiencies and damages more than the compensation received, except for damage caused by a natural disaster (e.g. floods, hail, avalanches, earthquakes) or caused by an unknown perpetrator,
- a positive difference between accounting and tax depreciation of tangible fixed assets,
- donations provided,

- costs incurred for consumed fuels exceeding the limit specified in the technical certificate,
- travel allowances granted exceeding the limit set by the Travel Allowances Act,
- fines, penalties, and interest on arrears charged to expenses may reduce the tax base only after payment,
- the cost of consultancy and legal services can reduce the tax base only after payment,
- costs incurred in marketing, market research, obtaining standards and certificates can reduce the tax base only after payment, etc.

Items that reduce profit or loss (non-taxable income) include, for example:

- a negative difference between accounting and tax depreciation of tangible fixed assets,
- fines, penalties, and interest on arrears charged to income may increase the tax base only after collection,
- income from which the tax is levied by deduction (withholding tax).

From 1 January 2019, the corporate tax expense is limited to a contribution provided for the recreation of an employee whose employment with the employer has lasted continuously for at least 24 months and if the employer has more than 49 employees. The contribution is a tax-deductible expense of 55% of the employee's recreation expenses, up to a maximum of EUR 275 per calendar year.

The tax base can be reduced by a tax loss during a maximum of four consecutive tax periods, up to a maximum of 25% of the accumulated tax loss.

The tax base can also be adjusted for tax relief in the following cases:

- tax relief for recipients of investment aid,
- a tax credit for the recipient of incentives for science and research,
- automatic deduction of expenditure on science and research.

In the Slovak Republic, a compromise approach is applied in principle when determining the tax base. The starting point is the economic result found in the accounting records but adjusted outside the accounting for those costs and revenues (Table 7).

Table 7
Simplified procedure for calculating income tax payable

ACTIVITIES	
INSIDE accounting (revenues - costs)	OUTSIDE accounting
	earnings before income tax
	+
	items increasing the profit/loss
	-
	items reducing the profit/loss
	+/-
	items adjusting the tax base or tax loss
	=
	tax base (+) or tax loss (-)
	-
	deduction of tax loss
	-
	deduction of research and development costs
	=
	the tax base less the deduction of tax loss and research and development costs
	x
	income tax rate
	=
	tax before applying tax relief
	-
	income tax relief
	=
income tax = earnings after tax	income tax payable
	-
	income tax advances paid
	=
	tax for payment / tax overpayment

Source: authors

The tax rate is only one of the factors influencing the amount of taxation. Its level is often overrated. On the contrary, the psychological aspect of the tax rate is underrated. A good example, according to Mareca (2018), is the recent tax reform in the United States (reduction of corporate tax from 35% to 21%) and a significant reduction in corporate income tax in Hungary from 16% to 9% in 2017.

Tax rates have gradually changed during the 27 years of independent Slovakia's existence. It is almost unbelievable today that the system could operate in 1993 at a 45% corporate income tax rate (the subsequent taxation of profit shares was at 15%). Between 1993 and 2002, the tax rate fell to 25%. The period after 2004 can objectively be considered the best set tax system. The business environment has also significantly improved. Structural reforms were

implemented, including the introduction of a flat tax of 19% (in the case of corporate income tax, personal income tax, and value-added tax). From 2013, the rate increased from 19% to 23%, a year later it decreased to 22%. In the years 2017 to 2019, the corporate income tax rate was 21%.

Since January 2020, the corporate income tax rate has been modified in the same way as for personal income taxation. The rate of corporate income tax from the tax base reduced by tax loss is from the year 2020:

- 15% in the case of a legal person whose income for the tax period does not exceed EUR 100,000,
- 21% in the case of a legal person whose income for the tax period exceeds EUR 100,000.

To ensure the even distribution of revenues flowing into the state budget, taxpayers defined

by law are obliged to pay advances on income tax during the tax period. A tax advance is a mandatory tax payment paid during a tax period if the actual amount of tax for that period is not yet known.

The obligation to pay advances on corporate income tax depends on the amount of tax for the previous year:

- if the amount of tax for the previous year is more than EUR 2,500 and less than or equal to EUR 16,600, the taxpayer pays an advance quarterly of 1/4 of the tax for the previous year,
- if the amount of tax for the previous year is higher than EUR 16,600, the taxpayer pays monthly advances in the amount of 1/12 of the tax for the previous year.

The highest share of corporate income tax in total tax revenues in 2016 was 20.19%, the lowest in 2004 was 14.06%. The highest-paid corporate income tax calculated per legal entity amounted to EUR 11,076 million in 2008, and the lowest was in 2013 (EUR 6,483 million).

COMPARISON OF SELECTED DIRECT TAXES IN THE EUROPEAN UNION

Following a significant increase since 2010, income tax revenues in the EU-28 reached their maximum in 2018. The euro area has followed a broadly similar trend. The structure of income or direct taxation varies considerably from one Member State to another. As regards the share of direct taxes in total tax revenues, Denmark has the highest share recently (up to 66%), followed by Ireland, the United Kingdom, Sweden, and

Malta, with proportions ranging between 40% and 50% of total tax revenues (European Commission 2020).

It has been documented that corporate and personal income taxes, as well as employer's social contributions, have an impact on growth and investment in national economies. Corporate taxes affect the location of businesses and direct domestic and foreign investment. Income taxes and social contributions have a dominant position among direct taxes in all Member States in terms of collection volumes. For this reason, we have decided to analyze just selected indicators related to these taxes.

Table 8 shows the evolution of personal income tax (PIT) in the EU countries for the period 2010-2019. The trend graph in the table shows that United Kingdom, Estonia, Spain, and Romania, in particular, recorded stable developments in tax revenue over the reporting period (the graphical representation of trend graphs is a more accurate representation of the differences between reporting years due to values without rounding; values shown in the table have been rounded to one decimal place). Highlighted bars in the trend graph represent the highest values of observed indicators in the monitored period. In case of the PIT, the development in individual countries in the last decade has differed significantly. France, Luxembourg, Poland, and Slovakia recorded growth in tax revenue. The last column of the table shows the average annual growth coefficient (AAGR) of the analyzed indicator over the period. The EU average, in this case, shows a slight increase in the indicator (1.0106). Seven countries recorded a decline in the revenue from personal income tax (AAGR <1). Traditionally the highest level of PIT revenues tends to be recorded in the countries of northern Europe (Denmark, Sweden, Finland).

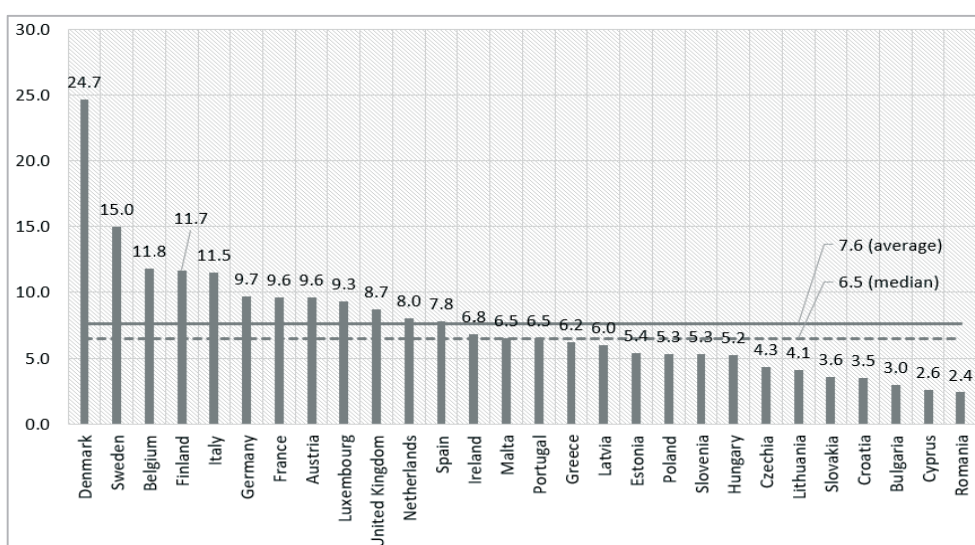
Table 8
Tax revenue (personal income tax) EU-28 (% of GDP)

Country	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Trend graph	AAGR
EU-28 (average)	7.30	7.31	7.56	7.68	7.80	7.65	7.59	7.64	7.65	8.06		1.0106
Belgium	12.2	12.4	12.6	13	12.9	12.4	12	11.9	11.8	11.4		0.9925
Bulgaria	2.7	2.6	2.7	2.8	3.0	2.9	2.9	3.0	3.0	3.1		1.0155
Czechia	3.3	3.5	3.6	3.7	3.7	3.6	3.8	4.0	4.3	4.9		1.0449
Denmark	24.9	24.9	25.2	26.0	29.0	26.4	25.6	25.4	24.7	26.5		1.0069
Germany	8.1	8.2	8.6	8.9	8.9	9.0	9.1	9.4	9.7	9.6		1.0215
Estonia	5.3	5.1	5.2	5.4	5.7	5.7	5.8	5.7	5.4	n.a.		1.0023
Ireland	8.5	8.9	9.4	9.3	9.2	7.2	7.3	6.9	6.8	6.7		0.9739
Greece	4.0	4.7	6.9	5.9	5.9	5.7	5.8	6.2	6.2	5.9		1.0441
Spain	7.1	7.4	7.6	7.7	7.7	7.3	7.3	7.5	7.8	n.a.		1.0118
France	7.7	7.9	8.5	8.8	8.8	8.8	8.7	8.7	9.6	9.5		1.0236
Croatia	3.5	3.4	3.7	3.9	3.9	3.5	3.6	3.3	3.5	3.6		1.0031
Italy	11.2	11.0	11.7	11.7	11.6	11.9	11.6	11.6	11.5	11.6		1.0039
Cyprus	3.0	3.1	3.3	2.7	2.5	2.5	2.4	2.5	2.6	2.8		0.9924
Latvia	6.2	5.6	5.7	5.8	5.9	5.9	6.3	6.6	6.0	6.5		1.0053
Lithuania	3.6	3.5	3.5	3.6	3.6	3.9	4.0	3.8	4.1	7.1		1.0784
Luxembourg	7.9	8.2	8.4	8.7	8.7	9.1	9.1	8.9	9.3	9.3		1.0183
Hungary	6.4	4.8	5.3	5.0	4.9	4.9	4.9	5.1	5.2	n.a.		0.9744
Malta	5.2	5.7	5.8	6.0	5.7	5.4	5.7	6.0	6.5	6.6		1.0268
Netherlands	7.6	7.3	6.8	6.7	6.9	7.4	7.1	8.3	8.0	8.5		1.0125
Austria	9.6	9.6	9.9	10.1	10.4	10.8	9.3	9.3	9.6	9.8		1.0023
Poland	4.3	4.3	4.5	4.5	4.6	4.7	4.8	5.0	5.3	5.3		1.0235
Portugal	5.4	6.0	5.8	7.7	7.7	7.3	6.8	6.4	6.5	6.4		1.0191
Romania	3.2	3.3	3.4	3.4	3.5	3.7	3.6	3.6	2.4	2.3		0.9640
Slovenia	5.5	5.5	5.6	5.1	5.0	5.1	5.2	5.1	5.3	5.3		0.9959
Slovakia	2.6	2.8	2.9	2.9	3.0	3.1	3.3	3.4	3.6	3.8		1.0431
Finland	11.6	11.8	12.2	12.3	12.8	12.6	12.5	12.0	11.7	11.7		1.0010
Sweden	14.3	13.9	14.3	14.6	14.5	14.8	15.5	15.5	15.0	14.6		1.0023
United Kingdom	9.4	9.3	8.7	8.7	8.5	8.7	8.6	8.7	8.7	8.8		0.9927

Source: authors, based on data from Eurostat (2021)

Figure 1 shows the ranking of countries by volume of personal income tax revenue in 2018 (the year 2018 was chosen due to the availability of all data). The lowest revenue from the tax was reported in Romania

(2.4% of GDP) and Cyprus (2.5% of GDP), followed by Bulgaria, Croatia, and Slovakia, which did not exceed 4% of GDP. The median was 6.5% of GDP.

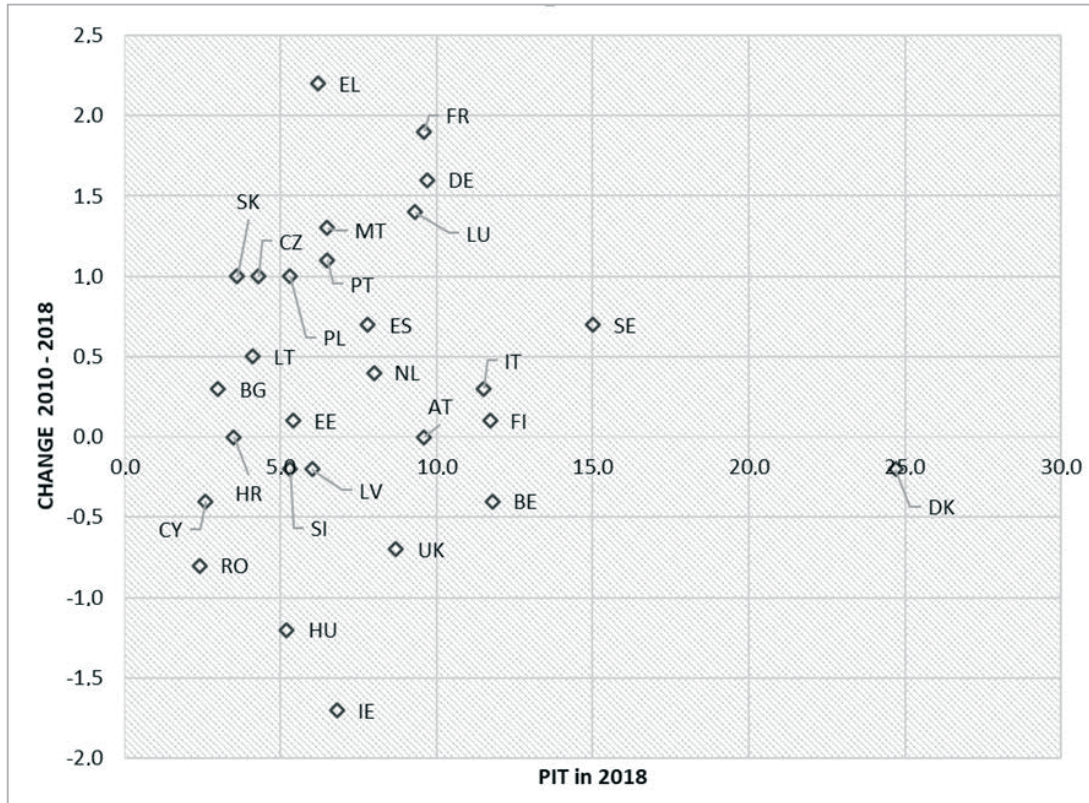


Source: authors, based on data from Eurostat (2021)

Figure 1. Ranking of EU countries according to PIT revenue in 2018 (% of GDP)

The EU-28 average of personal income tax revenue was 7.6% of GDP in 2018. Among the Member States, Denmark (24.7% of GDP) and Sweden (15.0% of GDP) collected the most on PIT in 2018. Compared to the reference year 2010, most of the countries have recorded an increase in the revenue generated by the

tax. Nine of the countries are below the zero axes, so their income from the tax has decreased. The greatest increase in the last 8 years was recorded by Greece and France (an increase of 2.2% and 1.8%, respectively), followed by Germany (+ 1.6%) (Figure 2).



Source: authors according to Eurostat (2021)

Figure 2. Personal income tax in 2010 and 2018 (% of GDP)

The highest rate of personal income tax at the beginning of 2019 for the EU-28 (simple average) was 39.4%, slightly higher than in 2017, when it was 39%. Historically, this rate had been fallen most sharply from 47.2% in 1995 to 38% in 2009. Since that year, the average highest rate has risen to around 39% and has not changed significantly since 2013.

Table 9 shows the evolution of the corporate income tax in the Member States over the same reference period. In this case, as well, the development in individual countries looked different over the last decade. Most countries present a stable tax collection

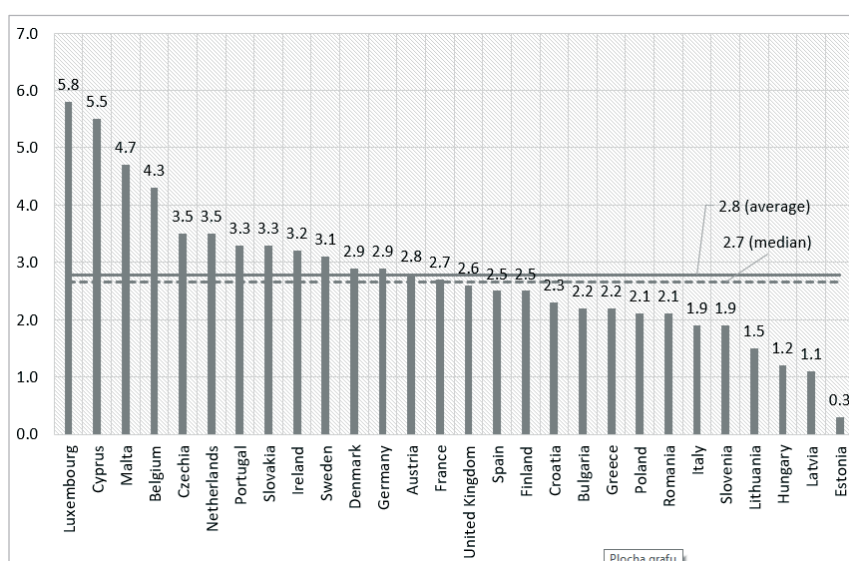
rate. The average tax collection increased in the EU from 2.4% of GDP in 2010 to around 2.8% of GDP in 2019. The collection volume measured as a percentage of GDP is significantly lower in most Member States compared to the personal income tax. The only exceptions are Cyprus and Malta. The average growth coefficient (AAGR) shows relatively stable values for all EU countries in the last decade. The AAGR is lower than 1 in only five countries, which indicates an average decrease in the CIT over the reference period of 10 years.

Table 9
Tax revenue (corporate income tax) EU-28 (% of GDP)

Country	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Trend graph	AAGR
EU-28 (average)	2.4	2.5	2.4	2.5	2.5	2.6	2.7	2.8	2.8	2.8		1.0102
Belgium	2.5	2.8	3.0	3.1	3.1	3.3	3.4	4.1	4.3	3.7		1.0445
Bulgaria	1.7	1.6	1.6	2.0	2.0	2.0	2.1	2.1	2.2	1.9		1.0124
Czechia	3.2	3.2	3.1	3.2	3.3	3.4	3.5	3.5	3.5	3.3		1.0034
Denmark	2.3	2.2	2.6	2.8	2.8	2.8	2.9	3.3	2.9	3.1		1.0337
Germany	2.1	2.4	2.5	2.4	2.4	2.3	2.6	2.7	2.9	2.6		1.0271
Estonia	0.2	0.2	0.3	0.3	0.3	0.2	0.2	0.2	0.3	0.3		1.0461
Ireland	2.4	2.2	2.3	2.4	2.4	2.6	2.7	2.8	3.2	3.1		1.0288
Greece	2.5	2.1	1.1	1.1	1.9	2.1	2.5	1.9	2.2	2.2		0.9859
Spain	2.0	1.9	2.3	2.2	2.1	2.4	2.3	2.3	2.5	n.a.		1.0283
France	2.3	2.6	2.7	2.8	2.7	2.6	2.6	2.9	2.7	2.8		1.0221
Croatia	1.9	2.3	2.0	2.0	1.8	1.9	2.2	2.3	2.3	2.4		1.0263
Italy	2.3	2.2	2.3	2.5	2.2	2.0	2.1	2.1	1.9	1.9		0.9790
Cyprus	5.5	6.2	5.7	6.5	6.4	5.9	5.5	5.5	5.5	5.9		1.0078
Latvia	1.0	1.4	1.6	1.6	1.5	1.6	1.7	1.6	1.1	0.2		0.8363
Lithuania	1.0	0.8	1.3	1.4	1.4	1.5	1.6	1.5	1.5	1.6		1.0536
Luxembourg	5.8	5.0	5.1	4.8	4.3	4.4	4.5	5.1	5.8	5.9		1.0019
Hungary	1.1	1.1	1.3	1.2	1.5	1.7	2.2	1.9	1.2	n.a.		1.0109
Malta	4.9	4.5	5.1	5.5	5.3	5.3	5.6	5.8	4.7	4.9		1.0000
Netherlands	2.3	2.2	2.1	2.1	2.5	2.7	3.3	3.3	3.5	3.7		1.0542
Austria	2.0	2.1	2.1	2.2	2.2	2.3	2.4	2.5	2.8	2.8		1.0381
Poland	1.9	2.0	2.1	1.8	1.7	1.8	1.8	1.9	2.1	n.a.		1.0126
Portugal	2.7	3.1	2.8	3.3	2.8	3.1	3.0	3.2	3.3	3.1		1.0155
Romania	2.1	2.3	1.9	2.0	2.1	2.3	2.2	2.0	2.1	2.1		1.0000
Slovenia	1.8	1.6	1.2	1.2	1.4	1.5	1.6	1.8	1.9	2.0		1.0118
Slovakia	2.4	2.4	2.3	2.8	3.3	3.7	3.5	3.5	3.3	3.0		1.0251
Finland	2.4	2.6	2.1	2.3	1.9	2.1	2.2	2.7	2.5	2.5		1.0045
Sweden	3.1	2.9	2.5	2.6	2.6	2.9	2.9	2.9	3.1	3.0		0.9964
United Kingdom	2.9	2.8	2.6	2.4	2.4	2.3	2.6	2.6	2.6	2.4		0.9792

Source: authors based on data from Eurostat (2021)

Figure 3 shows the ranking of countries according to the collection of the analyzed tax in 2018.



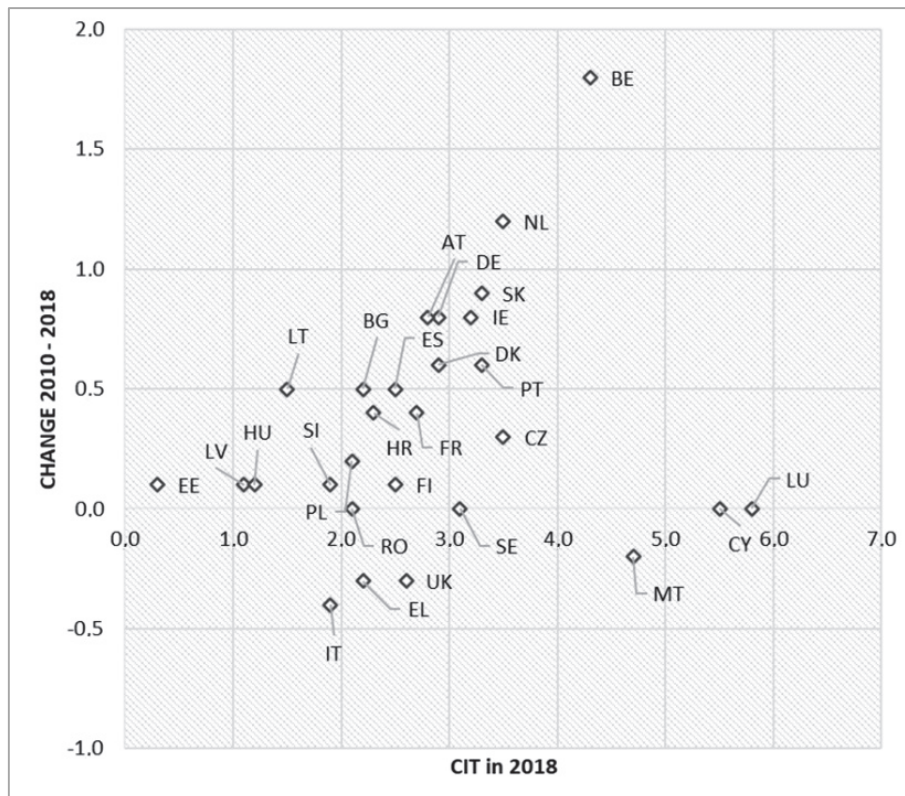
Source: authors, based on data from Eurostat (2021)

Figure 3. Ranking of EU countries according to CIT revenue in 2018 (% of GDP)

In terms of comparison with other member countries, Estonia recorded the lowest volume by far of corporate income tax collection in 2018, with the level of tax collection at 0.3% of GDP. Malta and Cyprus were above 5% of GDP. The EU average in 2018 was 2.8% of GDP. The median was one-tenth of a percent lower than the average.

In 2010, the average corporate income tax revenue in the EU-28 was 2.4% of GDP. In 2018, this average indicator increased to 2.8%. Compared to the reference year 2010, corporate tax collection increased in fifteen Member States, most notably in Belgium (+1.8%) and the Netherlands (+1.2%). On the other hand, Italy recorded the most significant decrease compared to the

reference year (a decrease of 0.4%). Malta (4.7% of GDP), Cyprus (5.5% of GDP), and Luxembourg (5.8% of GDP) recorded the highest corporate income tax revenues in 2018. The lowest amount was collected in 2018 by Estonia (0.3% of GDP). Figure 4 shows that in the case of CIT fewer of the Member States are below the zero axis than in the case of PIT. The others recorded an increase in tax revenues compared to the reference year 2010. Graphic representation largely confirmed the results of the average tax growth coefficient for the last decade in Table 9. However, the dispersion of the basic set of countries is smaller in terms of collection volume than in the case of personal income tax.



Source: authors based on data from Eurostat (2021)

Figure 4. Corporate income tax in 2010 and 2018 (% of GDP)

Table 10 shows the development of net social contributions (NSC) in the Member States over the last decade. In this case, most countries present themselves with a stable development of values over time. The

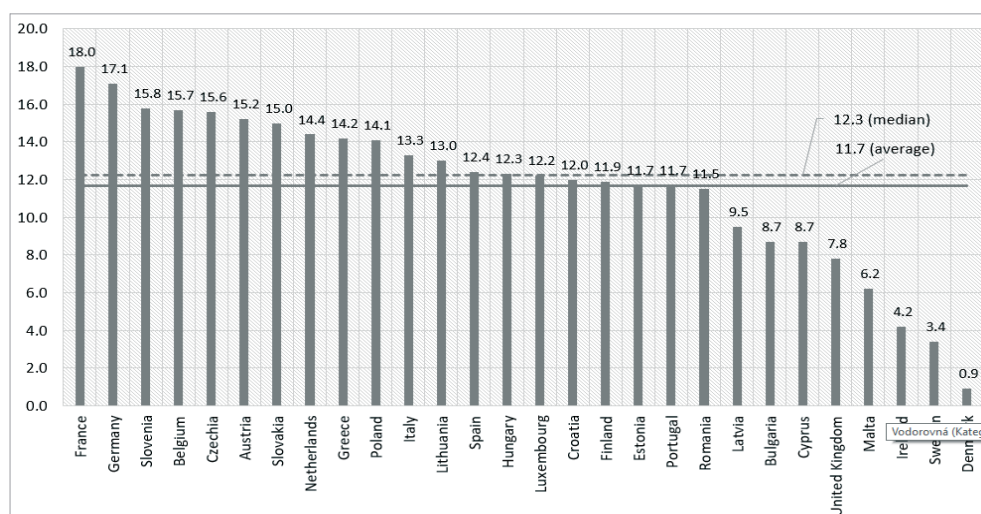
lowest income levies are imposed by Denmark, while the highest are found in France. Trend charts and the average growth coefficient show that the development of the social burden varies considerably across the EU.

Table 10
Net social contributions revenue in EU-28 (% of GDP)

Country	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Trend graph	AAGR
EU-28 (average)	11.3	11.3	11.4	11.5	11.4	11.4	11.5	11.5	11.7	11.7		1.0018
Belgium	16.5	16.7	16.9	17.1	16.8	16.6	16.0	15.9	15.7	15.7		0.9945
Bulgaria	6.7	6.7	6.8	7.5	7.8	7.8	7.7	8.3	8.7	8.9		1.0321
Czechia	14.6	14.7	14.8	14.8	14.6	14.4	14.7	15.0	15.6	15.6		1.0074
Denmark	1.3	1.3	1.2	1.1	1.0	1.0	0.9	0.9	0.9	0.8		0.9475
Germany	16.6	16.4	16.6	16.6	16.5	16.5	16.7	16.9	17.1	17.3		1.0046
Estonia	12.9	11.7	11.3	11.1	11.0	11.3	11.5	11.4	11.7	11.8		0.9901
Ireland	5.7	6.1	5.6	5.8	5.6	4.3	4.4	4.3	4.2	4.5		0.9741
Greece	13.1	13.2	13.9	13.5	13.5	13.8	14.1	14.4	14.2	14.6		1.0121
Spain	12.8	12.7	12.6	12.4	12.5	12.2	12.2	12.3	12.4	12.9		1.0009
France	18.1	18.3	18.5	18.8	19.0	18.8	18.7	18.8	18.0	16.8		0.9918
Croatia	11.8	11.6	11.5	11.2	11.8	12.0	11.9	11.9	12.0	11.8		1.0000
Italy	13.3	13.1	13.3	13.4	13.2	13.2	13.0	13.0	13.3	13.5		1.0017
Cyprus	8.0	7.9	7.8	7.6	8.3	8.3	8.2	8.5	8.7	10.7		1.0328
Latvia	8.8	8.8	8.9	8.7	8.7	8.6	8.6	8.8	9.5	10.0		1.0143
Lithuania	12.2	11.5	11.2	11.1	11.4	11.9	12.5	12.5	13.0	10.0		0.9781
Luxembourg	12.2	12.1	12.5	12.4	12.0	12.0	11.8	12.2	12.2	12.1		0.9991
Hungary	11.9	13.0	13.7	13.4	13.3	13.3	13.9	12.9	12.3	11.8		0.9991
Malta	6.9	7.1	7.0	6.9	6.6	6.2	6.2	6.2	6.2	6.0		0.9846
Netherlands	13.5	14.2	15.1	15.3	15.2	14.5	15.2	14.3	14.4	14.0		1.0040
Austria	14.8	14.8	14.8	15.2	15.2	15.1	15.1	15.1	15.2	15.4		1.0044
Poland	11.9	12.2	13.0	13.4	13.2	13.5	13.8	13.9	14.1	14.2		1.0198
Portugal	11.9	12.0	11.4	12.0	11.8	11.6	11.6	11.6	11.7	11.9		1.0000
Romania	9.4	9.1	8.8	8.6	8.5	8.1	8.8	9.4	11.5	11.3		1.0207
Slovenia	16.1	15.9	16.2	15.8	15.6	15.7	15.7	15.7	15.8	16.0		0.9993
Slovakia	12.2	12.2	12.4	13.5	13.6	13.9	14.4	14.9	15.0	15.3		1.0255
Finland	12.2	12.1	12.7	12.7	12.7	12.7	12.8	12.1	11.9	11.9		0.9972
Sweden	3.1	3.3	3.3	3.4	3.3	3.3	3.3	3.3	3.4	3.4		1.0103
United Kingdom	7.7	7.6	7.6	7.4	7.3	7.5	7.6	7.8	7.8	8.1		1.0056

Source: authors according to Eurostat (2021)

Figure 5 shows the ranking of countries according to the collection of net social contributions in 2018.

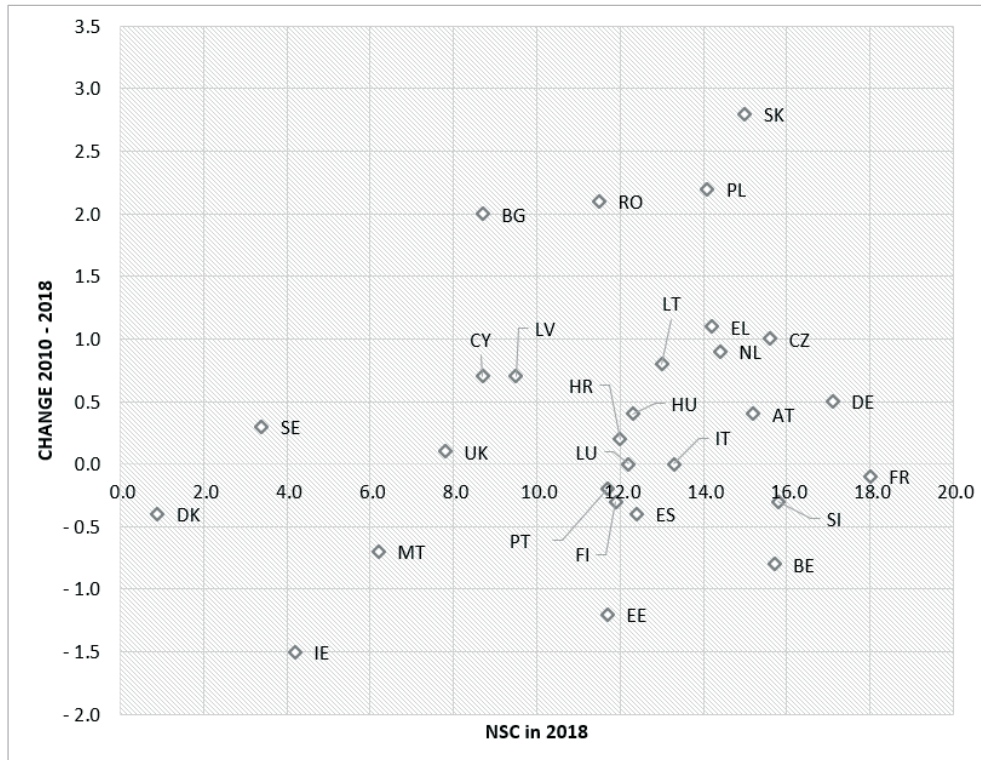


Source: authors according to Eurostat (2021)

Figure 5. Ranking of EU countries according to NSC revenue in 2018 (% of GDP)

Compared with other member countries, Denmark recorded the lowest by far volume of NSC collection in 2018 (0.9% of GDP). On the other hand, the highest amount of NSC was collected by France (18% of GDP), followed by Germany (17.1% of GDP). The median was six-tenths of a percent higher than the average.

The highest increase in net social contributions collection between 2010 and 2018 was recorded in Slovakia (+2.8%), followed by Poland (+2.2%), Romania (+2.1%) and Bulgaria (+2.0%). On the contrary, the most significant decline of the indicators was in Ireland (-1.5%) and Estonia (-1.2%) (Figure 6).



Source: authors according to Eurostat (2021)

Figure 6. Net social contributions in 2010 and 2018 (% of GDP)

CLUSTER ANALYSIS OF EXAMINED VARIABLES

Since high-dimensional data are clustered, the resulting clusters are high-dimensional geometrical objects, which are difficult to analyze and interpret. A low-dimensional graphical representation of the clusters could be much more informative than such a single value of the cluster validity, as one can cluster by eye and qualitatively validate conclusions drawn from clustering algorithms (Abonyi & Balázs, 2007).

The aim of cluster analysis in further research is to reveal mutual similarities or differences between the Member States based on further analysis of previous research data. Preceding quantitative and graphical analyses indicate differences in the development of selected tax indicators. Therefore, we decided to use another tool to analyze multidimensional data. Inputted data were data obtained from statistical reports, which are published annually on the website of the European

Commission (Taxation trends in the European Union, Eurostat Database).

The three variables (direct taxes indicators) input for 2018 (the year 2018 was chosen due to the availability of all data) were personal income tax (PIT), corporate income tax (CIT), and net social contributions (NSC). Two clustering methods were used, the hierarchical Ward's method and the non-hierarchical K-means method. A significant part of these degrees of similarity is based on the calculation of the distance of objects. We have used the Euclidean distance defined by the formula:

$$d_{ij} = \sqrt{\sum_{k=1}^K (x_{ik} - x_{jk})^2} \quad (1)$$

where x_{ik} is the value of k variable for i -th object and x_{jk} is the value of k variable for j -th object. Once calculated the distance, then the rule of linking statistical units into clusters is determined.

Ward's method is a "procedure for forming hierarchical groups of mutually exclusive subsets on

the basis of their similarity with respect to specified characteristics” (Ward 1963, p. 10).

The following clustering process using the K-means method consists of dividing n objects with m characters into k clusters so that the inter-cluster sum of squares is minimized.

The premise of cluster analysis is that the examined features do not correlate with each other. Spearman's correlation coefficient confirmed a low correlation between variables (Table 11).

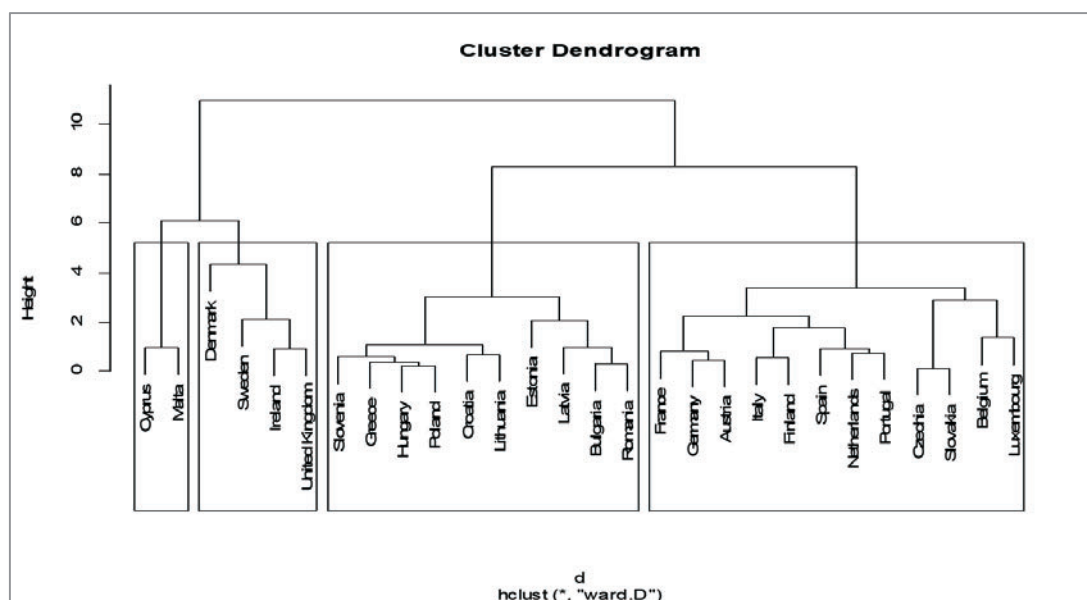
Table 11
Spearman's correlation coefficient

	PIT	CIT	NSC
PIT	1.00000000	0.23643106	0.03586094
CIT	0.23643106	1.00000000	-0.06385317
NSC	0.03586094	-0.06385317	1.00000000

Source: authors

The result of clustering is a tree diagram (dendrogram). Each node represents one phase of the clustering process, the vertical axis represents the coefficients of proximity. With increasing distance

(differences in the values of clustering variables), objects that were completely different at the beginning of grouping also join into clusters (Fraley et al. 2012).



Source: authors

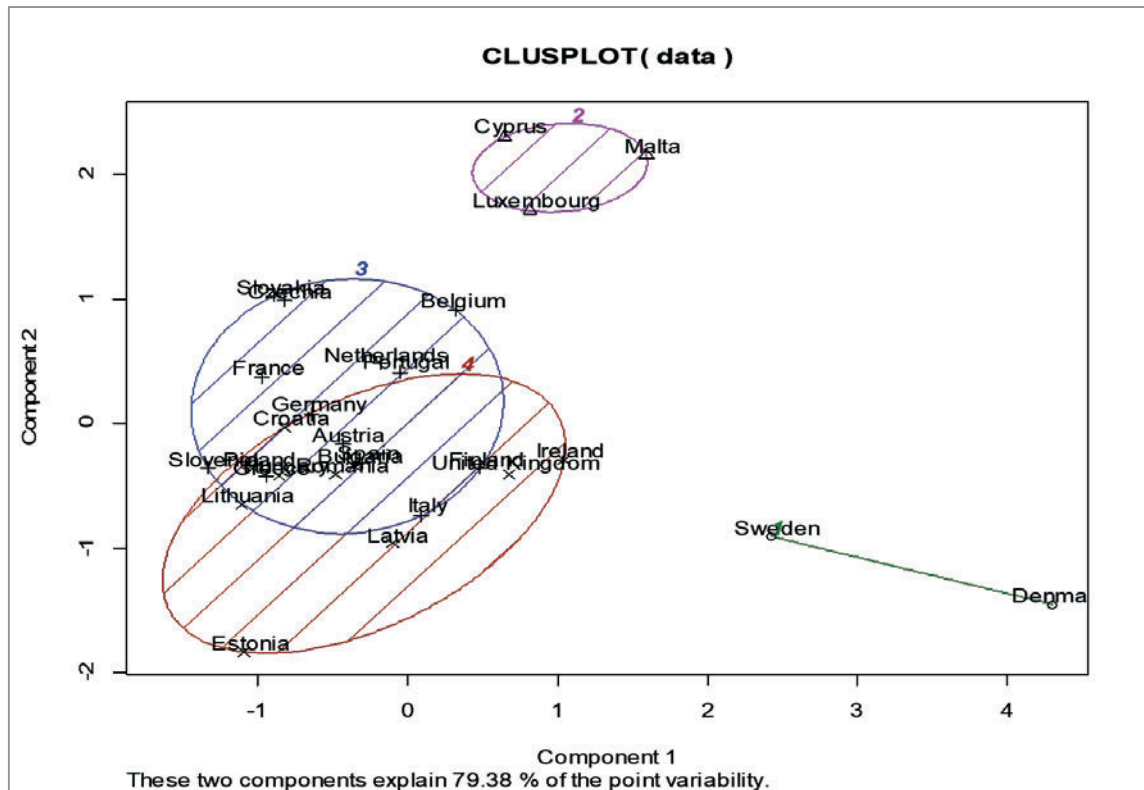
Figure 7. Cluster dendrogram according to Ward's method

Figure 7 shows a cluster diagram created after entering three variables from direct taxes. There are four clusters of countries with similar characteristics:

1. France, Germany, Austria, Italy, Finland, Spain, the Netherlands, Portugal, Czechia, Slovakia, Belgium, Luxembourg;
2. Slovenia, Greece, Hungary, Poland, Croatia, Lithuania, Estonia, Latvia, Bulgaria, Romania;

3. Denmark, Sweden, Ireland, United Kingdom;
4. Cyprus, Malta.

The four clusters as the output of the hierarchical Ward clustering method determined four clusters for further clustering using the K-means method. (Figure 8)



Source: authors

Figure 8. Scatterplot according to K-means method

For testing we have chosen 4 clusters as an imputed command for K-means clustering. We consider the data set, which contains $n=28$ objects, and partition it into $k=4$ clusters. The ellipses are based on the average and the covariance matrix of each cluster, and their size is such that they contain all the points of their cluster. The ellipsis sizes of clusters 3 and 4 are very similar. Cluster 4 displays less variability of Component 2. The larger shading intensity indicates the largest density of divided objects in ellipse.

The cluster analysis outlines potentially existing clusters competing for investment within the EU. It aimed to identify similarities between the Member States. If we consider two variables, we can visualize clusters using the non-hierarchical method of K-means. It requires the analyst to indicate in advance the number of clusters extracted. In this case, the two variables explain 79.38% of the point variability of the set.

CONCLUSIONS

Income tax reduces the disposable income of the entity burdened by it. The source of the tax payment is the income of economic entities operating in the national economy. In the Slovak Republic, natural and legal persons are taxed on income tax. In terms of the collection volume, income taxes are the most relevant direct taxes in Slovakia. Since the establishment of an independent state, with the changes of governments

and their value orientation, there have been changes in the taxation of income of the population as well as of entrepreneurs. The analysis of the development of income taxes in recent years in Slovakia has shown that entrepreneurs and individual citizens must constantly adapt to new regulations and measures.

The analyses performed revealed relatively high variability of the examined EU members in the case of income tax collection. Direct taxes are currently a more significant obstacle to the European internal market than indirect taxes. On the other hand, direct taxes have more diffuse effects. Income taxes as well as social contributions impact investment decisions, company formation, or employment in individual countries. Differences in the volume of direct tax collection and the ongoing competition between the Member States in this area have a significant impact on economic developments in the various regions of Europe. It is questionable whether disparities between regions are widening or narrowing because of tax competition. Of course, investment decisions are affected by many other important factors. They do not depend solely on a country's tax policy. National tax systems are (to some extent) an obstacle to the optimal distribution of production factors in the EU, which disadvantages and hampers European businesses, for example, compared with the United States. The differences in taxation confirm the comparison of selected taxes in the EU. However, the cluster analysis suggests possible steps for future cooperation between the Member States. Economic and political developments in the various

regions of Europe have had an impact on the issue of accepting the fiscal burden in countries, but this does not mean rejecting progressive ideas from a global perspective. The cluster analysis also revealed similar

developments in tax systems in terms of their geographical location in Europe. Therefore, it would be better to work together in clusters first than to try to apply uniform rules in all Member States at once.

References

- ABONYI, J. & BALÁZS, F. (2007). *Cluster Analysis for Data Mining and System Identification*. Basel: Birkhäuser. <https://doi.org/10.1007/978-3-7643-7988-2>
- DOUMA, S. & KARDACHAKI, A. (2016). The Impact of European Union Law on the Possibilities of European Union Member States to Adapt International Tax Rules to the Business Models of Multinational Enterprises. *INTERTAX*, 44(10), 746-754. Retrieved: December 2020: <https://kluwerlawonline.com/journalarticle/Intertax/44.10/TAXI2016064>
- EUROPEAN COMMISSION (2020). Taxation Trends in the European Union, 2020 edition. Directorate-General for Taxation and Customs Union, European Commission, Publications Office of the European Union. Retrieved: December 2020: https://op.europa.eu/en/publication-detail/-/publication/c0b00da7-c4b1-11ea-b3a4-01aa75ed71a1/language-en?WT.mc_id=Selectedpublications&WT.ria_c=51677&WT.ria_f=6180&WT.ria_ev=search
- EUROSTAT (2021). Current taxes on income, wealth, etc. Retrieved: January 2021: <https://ec.europa.eu/eurostat/databrowser/view/tec00018/default/table?lang=en>
- FILARSKÁ, J., KOTULIČ R., KRAVČÁKOVÁ VOZÁROVÁ, I., IVANKOVÁ, V. & VAVREK, R. (2018). Pension reform in Slovakia and its influence on the future income of the population in the post productive age. *Journal of Applied Economic Sciences*, 13(3), 685-692.
- FINANCIAL ADMINISTRATION OF THE SLOVAK REPUBLIC (2020). Výročné správy FS (Financial reports of the Financial Administration). Retrieved: December 2020: <https://www.financnasprava.sk/sk/financnasprava/vyroczne-spravy>
- FRALEY, CH., RAFTERY, A. E., MURPHY, B. T. & SCRUCCA, L. (2012). mclust Version 4 for R: Normal Mixture Modeling for Model-Based Clustering, Classification, and Density Estimation Technical Report No. 597. Department of Statistics, University of Washington. Retrieved: January 2021: https://www.researchgate.net/publication/257428214_MCLUST_Version_4_for_R_Normal_Mixture_Modeling_for_Model-Based_Clustering_Classification_and_Density_Estimation
- GENSCHEL, P. & JACHTENFUCHS, M. (2018). How the European Union constrains the state: Multilevel governance of taxation. *European Journal of Political Research*, 50(3), 293-314. <https://doi.org/10.1111/j.1475-6765.2010.01939.x>
- HAKALOVA, J., PALOCHOVA, M., PSENKOVA, Y. & BIELIKOVA, A., (2018). Regulation of Czech Accounting and Taxes in the Context of European Accounting, Taxes and Ongoing International Harmonization. Proceedings of the 4th International Conference on European Integration 2018, 388-395.
- JAKÚBEK, P. & TEJ, J. (2015). Reform of financial administration in the Slovak republic: reviews of participants. *Economic Annals – XXI*. No. 5-6 (2015), s. 33-36.
- KOREČKO, J., BAČÍK, R. & VOZŇÁKOVÁ, I. (2019). Public administration in EU: harmonization of income taxes. *Marketing and Management of Innovations*, 2019(4), 280-291.
- KOREČKO, J. & SUHANYIOVÁ, A. (2019). *História, vývoj a regulácia daňového systému v Slovenskej republike (History, development and regulation of the tax system in the Slovak Republic)*. Prešov: Bookman.
- LEGISLATIVE AND INFORMATION PORTAL OF THE MINISTRY OF JUSTICE OF THE SLOVAK REPUBLIC (2020). Income Tax Act no. 595/2003. Retrieved: December 2020: <https://www.slov-lex.sk/pravne-predpisy/SK/ZZ/2003/595/>
- MARECA, R. (2018). 25 rokov daňového systému SR – podnikatelia kedysi platili 60 % dane (25 years of the Slovak tax system – entrepreneurs formerly paid taxes at the level of 60 %), Retrieved: December 2020: <https://www.danovecentrum.sk/aktuality/25-rokov-danoveho-systemu-sr--podnikatelia-kedysi-platili-60--percent-dane-aktualita-dc-3-2018.htm>.
- MINISTRY OF FINANCE OF THE SLOVAK REPUBLIC (2020a). Taxes, Customs and Accounting. Retrieved: November 2020: <https://www.mfsr.sk/en/taxes-customs-accounting/>
- MINISTRY OF FINANCE OF THE SLOVAK REPUBLIC (2020b). Verejná správa – konsolidované výsledky (Public Administration – Consolidated Results). Retrieved: November 2020: <https://www.mfsr.sk/sk/financie/statne-vykaznictvo/specialny-standard/verejna-sprava-konsolidovane/>
- MINISTRY OF FINANCE OF THE SLOVAK REPUBLIC (2020c). Výsledky rozpočtového hospodárenia – príjmy a granty (Budgetary management results – income and grants). Retrieved: November 2020: <https://www.mfsr.sk/sk/financie/statne-vykaznictvo/specialny-standard/verejna-sprava-konsolidovane/>

- MINISTRY OF LABOUR, SOCIAL AFFAIRS AND FAMILY OF THE SLOVAK REPUBLIC (2020). Životné minimum (Subsistence minimum). Retrieved: December 2020: <https://www.employment.gov.sk/sk/rodina-socialna-pomoc/hmotna-nudza/zivotne-minimum>
- NERUDOVIÁ, D. (2004). Tax competition and tax harmonization in the European Union. *Acta Universitatis Agriculturae et Silviculturae Mendelianae Brunensis*, 52(6), 135-144. <https://doi.org/10.11118/actaun200452060135>
- NIAZI, S.U.K. (2016). Tax Harmonization in the EU: Insights on Political and Legal Fusion under Neofunctional Rationale. *Journal of Politics and Law*, 9(4), 15-29. <http://dx.doi.org/10.2139/ssrn.2716904>
- PÍRVU, D. (2012). The Tax Harmonization in the European Union. In: *Corporate Income Tax Harmonization in the European Union*. Palgrave Macmillan Studies in Banking and Financial Institutions. Palgrave Macmillan, London. pp. 8-24. https://doi.org/10.1057/9781137000910_2
- PSENKOVA, Y. (2016). Comparison of tax burden of incomes from the dependent activity of employees in the Czech Republic and Slovak Republic in the context of globalization trends. 16th International Scientific Conference on Globalization and its Socio-Economic Consequences, 1832-1839.
- WARD, J.H., Jr. (1963). Hierarchical Grouping to Optimize an Objective Function. *Journal of the American Statistical Association*, 58, 236-244. <https://doi.org/10.1080/01621459.1963.10500845>

Identification of Risks to the Achievement of Climate Neutrality Targets – in Order to Audit the Riskiest Branches of the Hungarian Economy

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SUMMARY

Reducing greenhouse gas (GHG) emissions, considered to be the main cause of global warming, is one of the greatest challenges of our time. The implementation of new practices is assisted by the supreme audit institutions, among them the State Audit Office of Hungary, with advice based on their audits. Auditing is effective when it is carried out in the areas most at risk of failing the objective. The SAO's experts have developed a method for identifying the branches of the national economy the most at risk in terms of reducing GHG emissions. The essence of this method, the developed logical probability model and the results of the calculations are presented in this article.

Keywords: Climate change, mitigation of GHG emission, risk identification, auditing, logical probability model

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INTRODUCTION

In line with the aim of the European Union, the Hungarian Parliament set the achievement of carbon neutrality by 2050 in Act 44 of 2020 on Climate Protection. To this end, greenhouse gas (GHG) emissions should be reduced to 50 percent of 1990 emissions by 2030. The State Audit Office of Hungary (SAO), as the main financial and economic audit body of the Parliament, tries to help achieve the goal set by the Parliament through its audits. The first step is to identify those sectors of the economy where GHG emissions need to be significantly reduced, as the failure to do so poses a serious risk to meeting the national target. As a second step, it is expedient to focus the SAO's audits on the GHG emission reduction programs of the sectors of the national economy that are considered to be at risk. This article presents the risk identification method developed for this purpose and its results found. The method can be widely used, as reducing GHG emissions is a vital task for every country, so it is important to identify the risks that threaten the achievement of this goal.

SUMMARY OF THE LITERATURE USED

One of the most widely used methods of climate protection research and official analysis is risk assessment. The risks associated with global warming can be divided into two major groups: The first is the 'mitigation risk', i.e. the inadequate reduction of greenhouse gas emissions. The second is the "adaptation risk," which means that humanity, individual communities, the economy among others cannot adapt to warming temperatures which cause severe ecological damage. The literature on climate risks deals with the latter to a greater extent. However, the topic of this article is related to the mitigation risk. Mitigation in the climate change context refers to actions aimed at the reduction of greenhouse gas emissions relative to baseline case. The importance of climate change risk assessments is recognized by the United Nations Framework Convention on Climate Change (UNFCCC) which underlines the importance of evidence-based risk assessment to guide public policy (Adger et al, 2018.)

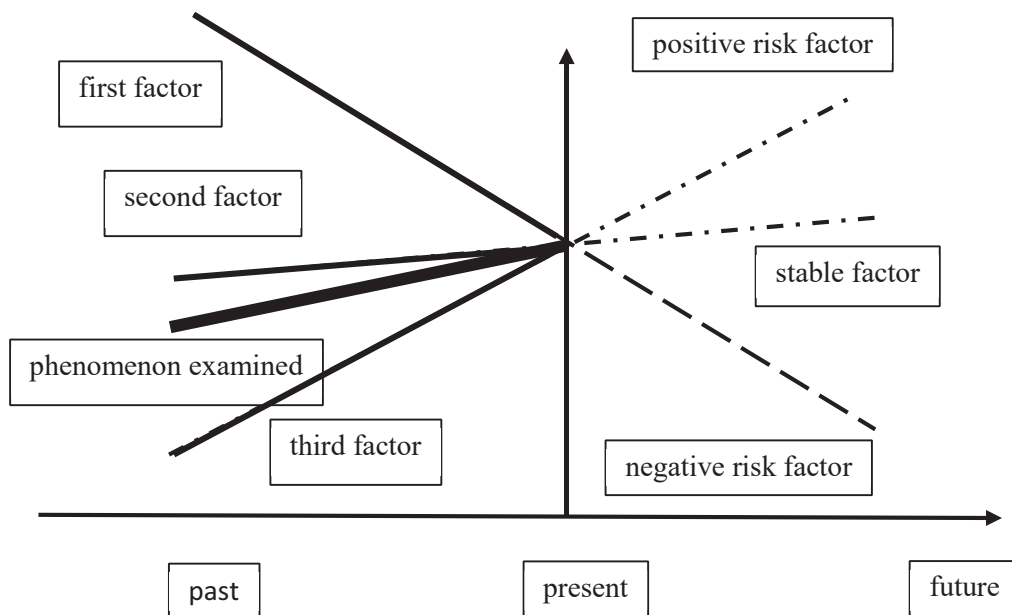
Given that the fight against global warming requires international cooperation, it is appropriate that the risks associated with this issue be analysed in accordance with an internationally agreed methodology. In order to standardize risk assessment at a national level, the European Commission has published Guidelines (European Commission, 2010). In this article, we use the terminology of these Guidelines. This is also justified as EU regulations on climate protection set mandatory requirements for Member States.

Our research, on which this article is based, aims to identify mitigation risks in climate protection in order to focus the SAO's audits on the most significant risks. According to the Guidelines, risk identification is "the process of finding, recognizing and describing risks. It is a screening exercise and serves as a preliminary step for the subsequent risk analysis stage." (European Commission, 2010. p. 20.)

There is a century-old tradition of risk assessment in auditing. "The idea of the inevitability of audit risk in the context of achieving a balance between the benefits associated with its presence and the costs, expressed in Dicksee (1904). This, in turn, initiated systematic scientific research aimed at understanding the essence, structure and key characteristics of the risks associated with the implementation of the professional function of the auditor." (Arzhenovskij et al 2019. p. 74.)

"The fundamental question during the identification of risks, i.e. "Which are the possible events the effects of which can threaten goals?" remains unchanged. In this case, however, "goal" is not construed to mean an organisation's goals, rather, in broader terms, the basic social expectation of the compliant and efficient utilisation of public funds ... Where analysis involves a population (e.g. central subsystem institutions, partnerships, private individuals) with a great number of elements, the key goal of risk analysis is to sort the elements according to the specified risk criteria, i.e. to establish a kind of risk "ranking" in the interest of selecting the riskiest elements." (Domokos et al 2015. p. 11.)

To explore risk factors in more detail, audit experts began to apply the decomposition or breakdown method. The essence of this is to break down the studied phenomenon (process) into factors (sub-processes) and to examine how (positively or negatively) and with what weight these factors influenced the process itself in the past. We then extrapolate the future development of the sub-processes and, on this basis, determine how the main process itself would develop, if the past sub-processes were to continue. (See Figure 1.) Instead of the technical projection, we can develop different scenarios for the expected evolution of the sub-processes and assign different probabilities to their occurrence.

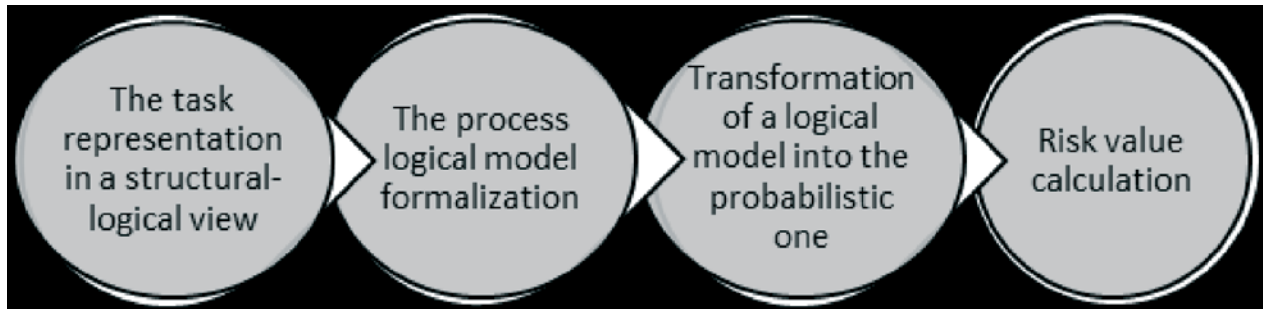


Source: Based on Pulay - Simon (2020) p. 35., own edited

Figure 1. Risk identification of processes by breaking down the process into factors (sub-processes)

Of course, it does matter how the breakdown into factors (sub-processes) takes place. A practical way to

do this is to use a logical probability model. Each step of this model is outlined in Figure 2.

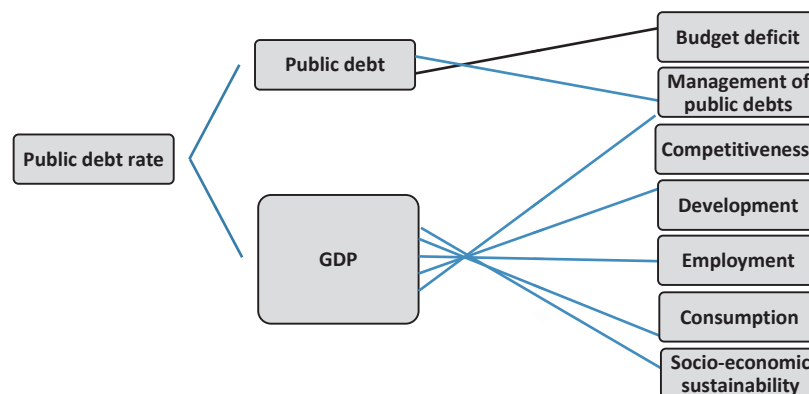


Source: Arzhenovskij et al (2019) p 82.

Figure 2. Steps of the logical probability model

- The starting step is to outline the logical structure of the studied phenomenon (task). The essence of this step is to explore the nature of the relationship between the factors that have a significant impact on the given process: for example, their impacts add up or multiply.
- During the formalization of the logical model of the process, it is expedient to graphically represent the process, indicating the relationship among the factors, the nature of the relationship, and their impacts on the process.
- In the third step, we assign probabilities to the revealed impacts, i.e., estimate the probability that these impacts will occur. We can primarily use the data of the previous period for the estimation, but we can also use expert estimates.
- In the fourth step, we use the logical model to determine the mathematical function by which the impacts and their probabilities can be summed and to calculate the degree of risk. The probabilities estimated in the third step can be modified somewhat, and by substituting these into the logic model, sensitivity tests can be performed.

The logical probability model was applied by the SAO to assess the risks threatening the fulfilment of the public debt rule. The essence of this rule is that the Hungarian public debt rate, which is the ratio of public debt to GDP, must decrease from year to year until it reaches the level of 50 percent. It is clear that both public debt and GDP are affected by a number of factors, which is why the SAO analysts divided the risk of non-compliance with the government debt rule into factors. Through this decomposition, they were able to assess one by one the expected evolution of the factors influencing the numerator or the denominator, as well as the likely impact of each factor on the public debt rate. As a logical probability model, the SAO analysts adapted the value-tree model developed by the international consultancy company McKinsey's researchers for evaluating corporate property (Copeland et al, 1994) to the public debt risk assessment. The first part of the model is presented by Figure 3. The value tree developed by the SAO has an additional branch, so a total of 21 factors were examined for impact during the risk assessment.



Source: Domokos – Pulay (2020) p. 40

Figure 3. The logic probability (value-tree) model for the risk assessment of the public debt rule

From the SAO's audit aspect the breakdown to factors is important because it is likely to reach risk factors the audit of which belongs to SAO's competence. For instance, from factors indicated in Figure 3, SAOI is mandated to audit – and actually

does so regularly – the management of public debts or the implementation of employment programmes. By using the presented risk assessment method, the SAO was able to identify a number of negative and positive

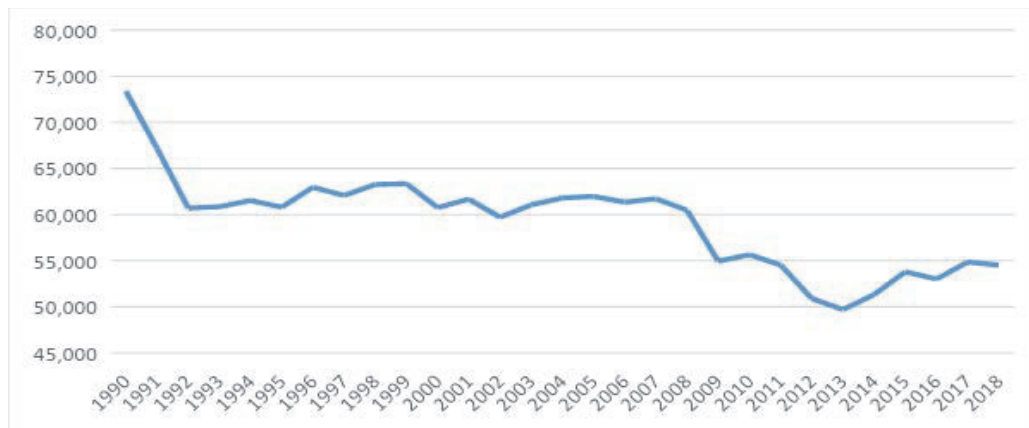
risks. (See: Pulay – Simon 2020 and Domokos – Pulay 2020).

THE APPLICATION OF THE LOGIC PROBABILITY MODEL FOR THE IDENTIFICATION OF RISKS TO THE ACHIEVEMENT OF CLIMATE NEUTRALITY TARGETS

The aim of the research was to identify those branches of the national economy whose expected GHG emissions jeopardize the achievement of the 2030 greenhouse gas emission reduction national target. This risk identification not only provides information for decision-makers, but also provides guidance to the SAO in which sectors of the national economy to audit GHG emission reduction programs. Obviously, it is advisable to audit where the risk is high.

The National Energy and Climate Plan (NECP) of Hungary worked out and published by the Ministry of Innovation and Technology determines the target of reducing GHG emissions until 2030, demanding a 40 per cent reduction in GHG emissions until 2030 compared to the 1990 level. In order to reach the target set by the NECP, domestic GHG emissions should be reduced by an additional 15.7 per cent of the GHG emissions of 1990 until 2030, compared to 2018, since in 2018, Hungarian GHG emissions accounted for 84.3 per cent of the 1990 level. Considering the involuntary reduction in GHG emissions in 2020 (exact data are not known yet), it is realistic to expect that a one per cent reduction in GHG emission per year should be achieved from 2021 to 2030 on average.

Is there a risk that Hungarian GHG emissions will not reach this level? Based on the evolution of greenhouse gas emissions between 1990 and 2018, as shown in Figure 4, we must say a resounding yes as a reply to this question. .



Source: edited by author based on data HCSO STADAT 5. 3. 2

Figure 4. GHG emissions from manufacturing activities in 1990-2018 (thousand tons of carbon dioxide equivalents)

After 1990, we can observe two decreasing sections in the diagram. First in the period 1990-1992, factories of the heavy industry, that had earlier been the largest emitters, were closed causing the economy to decline, and as a result, GHG emissions dropped dramatically. From 1993 to 2008, GHG emissions stagnated with some fluctuations, then the financial crisis of 2008 broke out and triggered a decreasing period of several years. However, that was followed by a period of rise, when GHG emissions increased with the economic expansion.

The figures indicate that, in spite of the improving numbers, it is a realistic risk that in the case of dynamic economic growth, the improving trend of GHG emissions might be broken, or at least will not reach the desired value. The occurrence of this risk depends on a number of factors. One such factor is economic growth itself which is accompanied by an increase in GHG emissions, unless GHG emissions per unit of

production decrease at a similar rate. The latter is therefore another significant factor.

It may be reasonable to break down the total GHG emissions of the economy into GHG emissions within individual branches of the economy. This is justified by the fact that the GHG emissions of the individual branches of the national economy are fairly different in both volumes and tendencies. That is there is a risk that in spite of a general declining trend, individual branches of the national economy might see a growth in their GHG emissions, making the commitment of national level impossible to fulfil.

THE LOGICAL PROBABILITY MODEL USED FOR CLIMATE RISK IDENTIFICATION

The main process in our risk identification is the GHG emission at the national level, and we identify risk factors by breaking them down to sub-processes. The sub-processes are the GHG emissions of individual branches of the national economy, which are further divided into two factors: One of the factors is production in the given branch of the national economy, and the other is the GHG emission per one unit of production (specific GHG emission). Reduction in GHG emissions is hindered by two factors: first, technological development and the transformation of the product mix do not result in the desired reduction in specific emission. Secondly, the volume of production grows dynamically, therefore the actual GHG emission may increase (or decrease less than required), even if the specific GHG emission is significantly reduced. These are two completely different risks in their nature, therefore we should manage them separately.

In the calculations, the main process is measured in the quantity of GHG emission expressed in CO₂ equivalents (hereinafter: K). The process is considered risky when GHG emission does not drop to the required level between two examined dates. The required level is α . (In the case of a 10 per cent required reduction $\alpha=0.9$). Specifying the risk in a formula, we can say that the risk occurs when the following inequality is not satisfied:

$$(1) \quad K_t \leq \alpha \times K_0$$

Placing the branches of the national economy into formula (1), we receive the following formula:

$$(2) \quad \sum K_{ti} \leq \alpha \times \sum K_{0i}$$

where K_{ti} is the volume of the GHG emission of the i -th branch of the national economy at time t ,

K_{0i} is the volume of the GHG emission of the i -th branch of the national economy at time 0.

GHG emissions of national economy level can be broken down to the production in individual branches of the national economy (the added value created there) and the specific GHG emission of manufacturing (GHG emission of one unit of production). Following the breakdown to factors, the inequality in formula (2) is as follows:

$$(3) \quad \sum C_{ti} \times V_{ti} \leq \alpha \times \sum C_{0i} \times V_{0i}$$

where

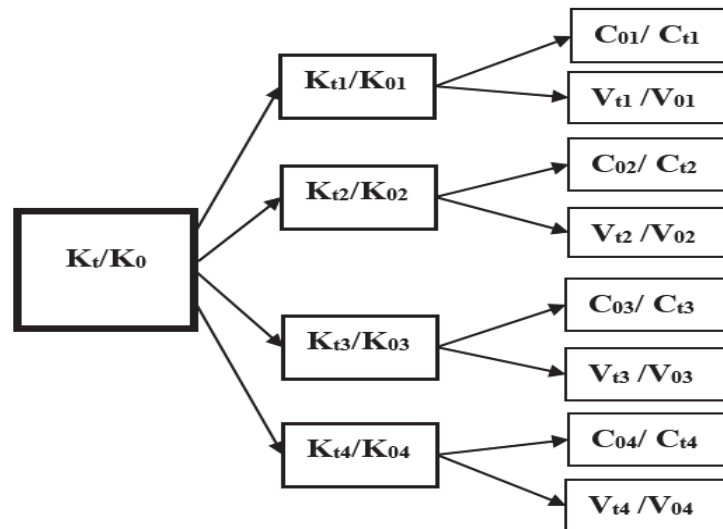
V_{0i} is the added value of the i -th branch of the national economy at time 0,

V_{ti} is the added value of the i -th branch of the national economy at time t ,

C_{0i} is the volume of the specific GHG emission of the i -th branch of the national economy at time 0,

C_{ti} is the volume of the specific GHG emission of the i -th branch of the national economy at time t .

The model of breaking down to factors (for four branches of the national economy) is shown in Figure 5.



Source: own edited

Figure 5: Logical probability model of breaking down national GHG emissions to factors

IDENTIFICATION OF THE RISK

The above model allows us to identify those branches of the national economy that involve risks as regards GHG emissions, and, as a result, audit may focus on these branches. Considering the changes in the GHG emissions of individual branches of the national

economy over time as sub-processes, processes where the extent of reduction does not reach the required rate can be identified as processes carrying negative risks. Expressed in a formula:

$$(4) \quad C_{0i} \times V_{0i} / C_{ti} \times V_{ti} > \alpha$$

After rearranging:

(5) $C_{0i} \times V_{0i} / C_{ti} \times V_{ti} / \alpha > 1$

Now we shall use this method to analyse the following: in the case of a dynamic economic growth, the expected emissions of which branches of the national economy would present a risk factor for the achievement of the national objective.

Considering the above points, we identified the key question of our risk analysis as follows: In which branches of the national economy will the expected GHG emissions present a risk to Hungary's ability to reach the target set by the NECP for 2030 in the reduction of GHG emissions during a dynamic growth in the economy? The annual average reduction of one percent was considered a risk criterion. With this in mind, in order to identify the risks, we formulated the following question: in which branch of the national economy is there a risk that the reduction of GHG emissions will not reach 1 per cent on an annual average by 2030.

The previously mentioned risk assessment guidelines issued by the European Commission states that "risk identification should be based as much as possible on quantitative (historical, statistical) data." (European Commission, 2010. p. 20.) Following this instruction, we examined whether the GHG emissions of individual branches of the national economy reached the 1 per cent reduction on average in the five-year

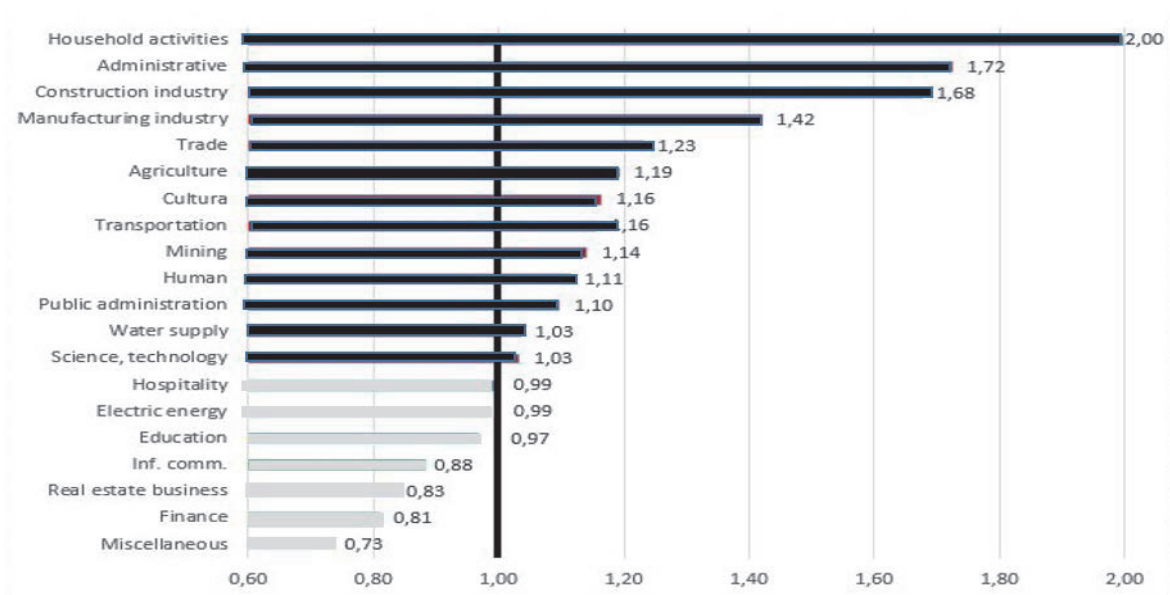
period between 2013 and 2018. The GHG emissions of branches not reaching the five percent decline over the five-year period analysed, are considered as risky from the aspect of reaching the target set for 2030. Consequently, in formula (5), α should be replaced by 5.

Calculations according to formula (5) were performed with the data of each branch. In terms of inequality (5), branches where the calculation yielded a value greater than 1 were considered risky.

Data used for the research: The Hungarian Central Statistical Office (HCSO) publishes GHG emission data in a breakdown according to the branches of the national economy, too, and this allows us to examine this phenomenon in the depth of individual branches, based on official data.

THE RESULTS

Figure 6 shows how the indicator metering the reaching of the GHG emission target developed in the individual branches of the national economy in 2013-2018. Branches that achieved values below 1 satisfied the one per cent annual GHG emission reduction rate. However, the GHG emissions of national economy branches characterised by values over 1 present risks to the objectives of reducing GHG emissions.



Source: own edited based on own calculations

Figure 6. Results of the calculations by branches of the national economy

The figure shows that until 2018, seven branches of the national economy managed to reduce emissions by 5 per cent compared to the base value of 2013. These branches of the national economy accounted for 38.1% of the emissions at the national level in 2018. Among the branches that did not reach the targets, four branches of the national economy achieved extremely

high values (over 1.40), while six branches had values between 1.10 and 1.40. Three branches of the national economy were close to reaching the target, as their indicators were 1.10 or lower.

The risk analysis confirmed that changes in the GHG emissions of individual branches of the national economy in a dynamic growth period project both

negative and positive risks regarding the question whether Hungary is able to achieve the GHG emission reduction target set in the NECP by 2030, assuming a dynamic economic growth. However, from the aspect of reaching the target, it is alarming that among national economy branches that were well below the annual average one per cent reduction in GHG emissions in 2013-2018 (their indicator was over 1.10), we found four branches that had their specific GHG emissions among the six highest values. At the same time, it is a positive risk that in the branch of “Electric energy”, which has the highest specific emission, the requirement of reducing the GHG emission by one per cent in a year was met between 2013 and 2018. It is also favourable, that the “Water supply” branch, which has the second highest specific emission, was only slightly below the required value.

THE USE OF OUR RESEARCH RESULTS FOR AUDIT PURPOSES

From the audit point of view, it does matter whether a branch of the national economy has proven to be risky because its specific GHG emissions have fallen less than desired or because its production growth rate has been above average. Since the SAO can formulate proposals for reducing GHG emissions, but it is not expedient to make recommendations for curbing production.

Consequently, it is useful to arrange risky branches of the national economy into groups, based on the question whether their risks are the consequences of their over-the-average economic growth or the slower reduction in their specific GHG emissions, or both. When defining the principles of this grouping, we use the national objective of reducing GHG emissions as the basis. Placing the specific GHG emission and the volume of production into formula (1), we get the following formula:

$$(6) C_t \times V_t < \alpha \times V_0 \times C_0$$

where V_0 = GDP of the base year
 V_t = GDP of year t
 C_0 = specific GHG emission in the base year
 C_t = specific GHG emission of year t

After rearranging the formula, we get the following inequality:

$$(7) C_t / C_0 < \alpha \times V_0 / V_t$$

If we specify the rate of economic growth in the period between years 0 and t, we can calculate the value of C_t / C_0 too, i.e. we can define the minimum reduction in specific GHG emissions that would make sure that GHG emissions do not exceed the required level. Along this logic, it can be identified as a risk originating from the insufficient rate of reduction in GHG emissions that the reduction in the specific GHG emission of the given branch of the national economy did not reach the rate of C_t / C_0 , i.e.

$$(8) C_t / C_0 < C_{ti} / C_{0i}$$

It is a risk originating from the dynamic economic growth of a given branch of the national economy when the growth rate of production in a branch of the national economy exceeds the national average growth rate, i.e.:

$$(9) V_{ti} / V_{0i} > V_t / V_0$$

It may also happen that these two risks occur at the same time, and there will be risk-free branches in the national economy, too.

We performed these calculations based on the facts that in 2013-2018 the growth rate was 14.5%. With this growth, specific GHG emission had to fall to 83.05 per cent of the 2013 value to achieve a five per cent reduction in the GHG emission in five years.

We identified the risk of dynamic economic growth in those branches of the national economy where growth exceeded the average rate, and we found the risk of slow specific improvement in branches where the improvement did not reach the above value. In certain branches, both risks occurred. The results of the calculations are summarised in Table 1.

Table 1
Classification of the branches of the national economy into risk groups

	<i>Specific emission reduction below the expected level</i>	<i>Specific emission reduction above the expected level</i>
<i>Economic growth below average</i>	<u>Risk of slow specific improvement:</u> Manufacturing industry Water supply Transportation Public administration Education Human	No risk Inf. comm. Real estate business Miscellaneous
<i>Economic growth above average</i>	<u>Risk (double):</u> Agriculture Construction industry Trade Administrative Culture Household activities	<u>Risk of dynamic economic growth:</u> Mining Electric energy Hospitality Finance Science, technology

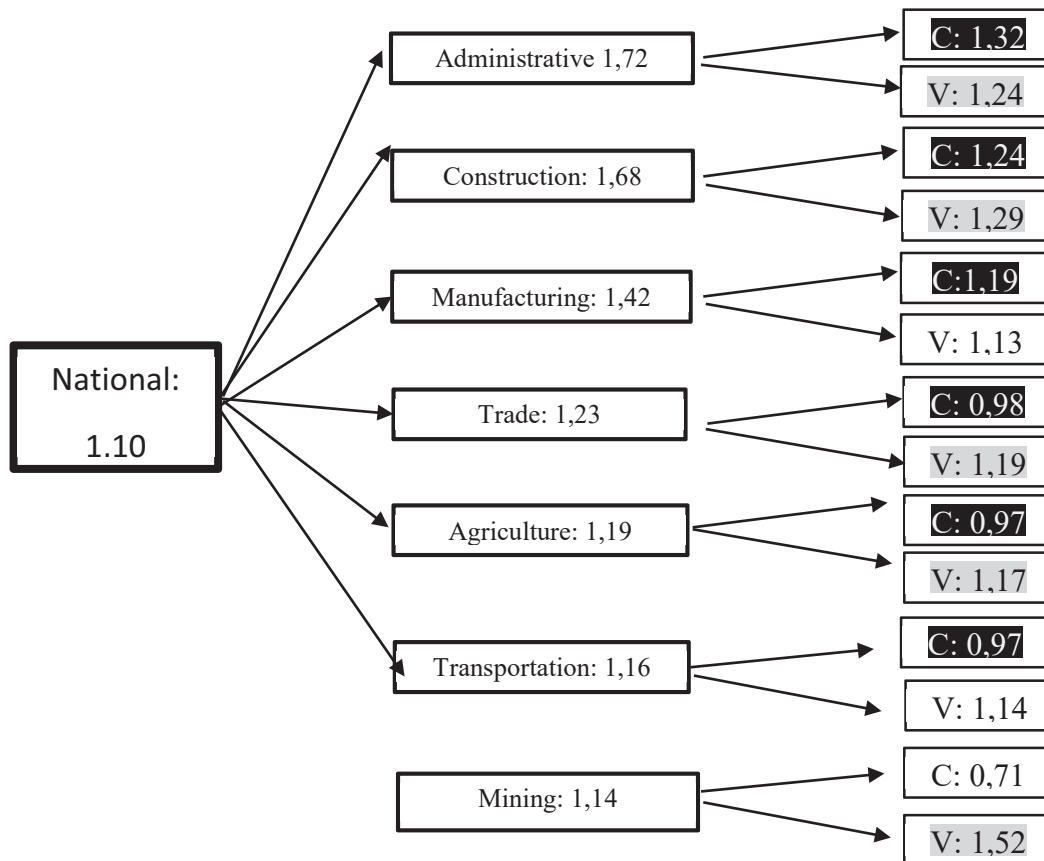
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The table contains - in italics - those branches of the national economy, too, that were not qualified as risky in the calculations, as this does not exclude the possibility that they carry some risks in one of the two risk factors. In the case of the “Education” branch of the national economy, the rate of specific emission did not reach the expected level, so GHG emission remained under the required level because of the relatively low rate of economic growth. This fact includes the risk that in the case of a faster economic growth, the GHG emission of the “Education” branch of the national economy will also exceed the required level.

Among the branches qualified as risky in the calculations, altogether two branches of the national economy were identified in which it was not possible to reduce emissions to the required level only because of their growth exceeding the average growth dynamics

of the economy. This draws attention to the fact that in the dynamic growth period of the Hungarian economy, the major risk factor was not dynamic growth, either, but the fact that it was not coupled with the expected decrease in specific GHG emission. This is clearly indicated by the fact that from the 13 branches qualified as risky, the risk of “specific emission reduction being below the expected level” was identified in the case of 11 branches. This proves that there is still room for improvement, and an audit carried out by the SAO may discover the conditions that hindered the necessary reduction in specific GHG emissions in several branches of the national economy.

The risk-based selection of audit areas is important for audit offices, as in principle they are able to achieve the highest added value by analysing the riskiest areas. The risk-based selection is supported by the risk tree, which is shown in Figure 7.



Source: own edited

Figure 7. Risk tree for the selection of the focus areas of the auditing of reductions in GHG emissions

Figure 7 follows the logical model of breaking down GHG emissions into factors. The figure shows the seven branches we found the riskiest in our calculations, in a sequence of their risk indicators. The list differs from the sequence presented in Figure 6 as we omitted those branches of the economy where GHG emissions in 2018 were lower than one per cent of the GHG emissions of the whole national economy. The risk of dynamic economic growth is marked in grey and the risk of slow improvement of specific emission is marked in black. (The relevant information can be found in Table 1) The use of the colour grey is justified by the fact that dynamic growth in itself cannot be considered as a risk from an audit point of view, as it would be hardly reasonable to submit a proposal to slow down growth. Audit should focus on those branches of the national economy where the risk is

generated by the slow improvement in specific GHG emissions. In these cases, the audit may inquire whether the given branches of the national economy have taken the measures and worked out the programmes required for a significant improvement in specific GHG emissions, and whether they have established the framework of the successful and efficient implementation of these programmes, and whether they monitor implementation.

As a summary, we can say that the risk tree is like a fruit tree, where harvest should start with the fruits on the highest branch. In the case of the risk tree, the black box of the highest branch means the area of the highest risk, and as we go down, we may select additional areas marked with black blocks that should be in the focus of audits.

REFERENCES

ADGER, W.N. – BROWN, I. – SURMINSKI, S. (2018): Advances in risk assessment for climate change adaptation policy [rsta.royalsocietypublishing.org](https://royalsocietypublishing.org) Downloaded from <https://royalsocietypublishing.org/> on 20 September Philosophical Transactions

- ARZHENOVSKIY, S.V. – BAKHTEEV, A.V. – SINYAVSKAYA, T.G. – HAHONOVA, N.N. (2019): Audit Risk Assessment Model International Journal of Economics and Business Administration Volume VII, Special Issue 1, 2019. pp. 74-85
- COPELAND, T. – KOLLER, T – MURRIN, J. (1994): *Valuation: Measuring and Managing the Value of Companies*, Second Edition, by, published by John Wiley & Sons, New York.
- DICKSEE, L.R. (1904): Auditing: Practical Manual for Auditors. 6th edn. Gee & Company.
- DOMOKOS, L. – NYÉKI, M. – JAKOVÁC, K. – NÉMETH, ERZSÉBET –HATVANI, CSABA (2015): Risk Analysis and Risk Management in the Public Sector and in Public Auditing
- DOMOKOS, L. – PULAY, GY (2020): Sustainable Budget and the Sustainability Appearing in the Budget Public Finance Quarterly 2020/2. special edition (p. 25-56.) https://doi.org/10.35551/PFQ_2020_s_2_2
- EUROPEAN COMMISSION (2010): Risk Assessment and Mapping Guidelines for Disaster Management, Commission Staff Working Paper Brussels
- HUNGARIAN CENTRAL STATISTICAL OFFICE (2020): 5.3.2. Nemzetgazdasági ágak és háztartások üvegházhatású gáz-kibocsátása. (Greenhouse gas emissions of industries and households) http://www.ksh.hu/docs/hun/xstadat/xstadat_eves/i_ua025d.html
- MINISTRY OF INNOVATION AND TECHNOLOGY of HUNGARY (2020): Nemzeti Energia- és Klímaterv (National Energy and Climate Plan) https://ec.europa.eu/energy/sites/ener/files/documents/hu_final_necp_main_hu.pdf
- PULAY, GY. – SIMON, J. (2020): Measuring the Macroeconomic Performance of Public Finance Management Public Finance Quarterly 2020/special edition (p. 23-43.) https://doi.org/10.35551/PFQ_2020_s_1_2

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