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# Universal Journal of Accounting and Finance

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# Predictive Modeling of Insurance Claims using Machine Learning Approach for Different Types of Motor Vehicles

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## ABSTRACT

*The main objective of this research paper is to build an appropriate mathematical model that helps in forecasting third party claim amount for different categories of vehicles based on the chosen characteristics of the data. In actuarial research, predicting the insurance claim amount for different vehicle categories is a challenging task, and minimal empirical research studies were done to forecast the claims. In the present study, the annual time series historical data were collected for a period of 34 years. We had built the machine learning predictive models to modeling the claim amount with different categories of vehicles effectively. In this context, we exhibited the feasibility of using a statistical machine learning approach such as Linear regression Model, the Exponential Smoothing Model, autoregressive integrated moving average (ARIMA), artificial neural network (ANN), and hybrid ARIMA-ANN models to predict the various categories of vehicles claim amount. The data were analyzed, compared, and the empirical analysis showed that Artificial Neural Network is a better predictive model among the other time series models based on performance evaluation metrics RMSE and MAPE with lesser variance. Therefore, the machine learning approach for forecasting third party claim amounts will help the Insurance Companies in India to provide a better predictive model, which ensures better claims settlement and management for different categories of vehicles.*

**Keywords** Linear Model, Box-Jenkins Model, Multilayer Perceptron, TRAINLM, Hybrid Model

## 1.INTRODUCTION

Motor Insurance is one of the most exciting branches of the insurance sector. In the year 1895, the third-party liability insurance policy was introduced in the Insurance field. The accidental damage for the four-wheelers was added to the policy in 1899. In India, the Motor Vehicles Act was passed in 1939. However, the provisions of compulsory third party (TP) insurance were introduced in the act only on 1st July 1946. For Insurance purposes, the Motor business in India, the motor vehicles are broadly categorized into Motorized two-wheelers, Private cars, Commercial four-wheelers, Commercial three-wheelers, Special types of vehicles. The motor insurance is also classified into third-party liability insurance claims and comprehensive package policy claims. In current years, the insurance sector of a commercial motor vehicle has heavily suffered due to third party damage losses based on some of the issues faced by the motor insurance industry of India such as there is no cooperation of insured for declaring claim settlement, the viability of motor insurance companies and there is no flexibility of law for dealing of the claim. To effectively build a suitable mathematical model for the third-party claim amount to help insurance companies with a proper claim settlement with accuracy.

In this context of TP claim data modeling, most researchers have neither evaluated the data nor modeled the existing data. In the literature, very few researchers studied information related to marine insurance, fire insurance, health insurance, etc., by predicting the number of claims and not used any of

the other methodologies to forecast the claim amount, but there was a broad application of ANN model in different fields. A study [1] reveals that the ANN model is more potent in forecasting power distribution data than the time series models. Based on the comparative review of different models [2], the ANN models outperform the other traditional models in predicting the demand with greater accuracy. The ANN predictive efficiency is better than GARCH models in forecasting the stock exchange rate [3]. Another stock market exchange study concluded that ANN is an appropriate model for forecasting capital markets such as stock and currency [4]. Based on forecasting, electric power consumption in educational institutions suggested that the ANN model's developed structure performed good prediction [5]. Comparing different models [6] showed the hybrid model backpropagation is better than both the BPNN and ARIMA in all criteria for forecasting the sales. In the application of weather forecasting [7], the ANN approach with increased hidden layers predicts the maximum temperature with higher accuracy in a year. Another study revealed that the hybrid model with a combination of ARIMAX and NN showed better forecasts than individual forecasting models [8]. A survey of predicting stock market returns showed that non-linear models are better for forecasting the returns in emerging and frontier markets [9]. For predicting the market demand [10] and also improving the academic performance of the institution [11], the ANN model gives better accuracy as compared with other advanced models [12]. In a study on predicting the electricity demand in Thailand, the ANN model showed a more significant prediction [13]. By using the Multi-layer perceptron architecture ANN model machine learning approach, the traffic flow in Morocco country was predicted [14] with accuracy. Another study [15] predicted river runoff using ANN with accuracy. Apichottanakul et al. [16] have forecasted the market share of Thai rice. Other studies [17] related to the feed mix industry also showed that the production rate and dust level enhance the mill's capability by using ANN predicted well. Some research showed that the hybrid ARIMA-ANN model improved the accuracy of forecasting the resource usage in server virtualization as compared to ARIMA and ANN separately [18]. Another study also suggested that the hybrid ARIMA-ANN model has the best model for forecasting Indian Robusta coffee projection [19]. In recent years, machine learning techniques are developed to predict the financial time series data with greater accuracy [20]. A study on spine surgery, a machine learning predictive model, is designed to improve risk adjustment with greater efficiency [21]. In health care insurance claims, the Recurrent Neural Network (RNN) model shows better performance than other regression models [22]. In another study related to health insurance claim data, a machine learning predictive regression model LASSO was developed to formulate a population health management in Japan [23]. A study to forecast the stock exchange by applying machine learning techniques such as stacking and blending gives better prediction than bagging and boosting [24]. In another study, a machine learning approach was applied for modeling volatility in the pricing of deposit insurance [25]. For predicting accidental claims using telematics data, the logistic regression showed better prediction than the XGBoost machine learning algorithm [26]. However, the previous research on insurance claim modeling is very little, and few authors have considered the ARIMA model for prediction fire insurance, property insurance, and health care insurance. In India's motor insurance sector, there is no substantial amount of research study has been done, which remains a motivating factor for us to build appropriate forecasting models.

## **2. RESEARCH METHODOLOGY**

### **2.1. Data Used for Research**

From different Public Insurance companies of India, the secondary data are collected for distinctive 34 years from 1985 to 2018. The secondary data consists of 108 column variables and 9,62,689 row values (i.e., approximately One hundred three million nine hundred seventy thousand data points). We have



studied the third-party claim amount variable for different categories of motor vehicles from these data points. Out of this 9,62,689 third party claim data set, 1,32,685 consists of Two-wheeler claims, 2,05,420 consists of Private car claims, 4,51,978 consists of Commercial four-wheeler claims, 1,25,487 consists of Commercial three-wheeler vehicle claims, and 47,119 belongs to Special type of vehicle claims. Further, we have divided each category of vehicle claim data randomly into 70% for training and 30% for the testing for fitting the best models using the machine learning approach. We now discuss the techniques of model building, as explained below.

## 2.2. Time Series Models

For the historical TP claim data set for various vehicles, we have applied a simple linear model, ARIMA, exponential Smoothing, ANN, and the combination of linear & non-linear domain, a hybrid model. We then predicted the claim data for all the models and compared them with the statistical metrics such as Root Mean Square Error (RMSE) and Mean Absolute Percentage Error (MAPE). The five forecasting modeling techniques used are as follows:

### 2.2.1. Linear Model

A simple linear regression model is a forecasting technique for predicting the TP claim amount by a given predictor variable time. The fitting of a simple linear model with an error term for predicting the claim amount based on historic data is provided by

$$Y_i = \beta_0 + \beta_1 X_i + e_i \quad (1)$$

Where  $X_i$  is a time variable in a yearly unit;  $Y_i$  is a TP claims amount;  $e_i$  is a residual error term

### 2.2.2. Exponential Smoothing

The exponential smoothing model uses the weighted average of past data to forecast the future claim amount when time-series data don't have any seasonality or trend and only have a level. This model will be represented as an equation to forecast the future claim amount is given as follow

$\hat{y}_{(i+1)} = \alpha \{y_i + (1-\alpha)y_{i-1} + (1-\alpha)^2 y_{i-2} + \dots\}$  Where  $\alpha$  is the smoothing parameter,  $0 \leq \alpha \leq 1$ ;  $y_i$  is the third-party claim amount  $\hat{y}_{i+1}$  is the forecast value of the claim amount.

### 2.2.3. ARIMA (p, d, q)

For third-party claim data for different vehicles, we have fitted ARIMA (p, d, q) model. In order to provide an ARIMA model efficiently, the data needs to be stationary. If the original data is non-stationary, then reconstruct it to stationary by differentiating the original series, then it will be modeled by ARIMA (p, d, q). The autocorrelation function (ACF) and partial autocorrelation function (PACF) are evaluated, and it suggests the most appropriate ARIMA model for the claim data. The Box-Jenkins modeling approach illustrates four iterative steps: Identification of Model, Estimation of Parameters, Diagnostic Checks & Validation, and Model Forecasting. The mathematical equation of Box and Jenkins [27], ARIMA (p, d, q) process can be expressed as AR (p) I (d) MA (q) in terms of the backward shift operator:

$$\begin{aligned} (1 - \alpha_1 B_1 - \alpha_2 B_2 - \dots - \alpha_p B_p)(X_t - \mu) &= \\ (1 + \beta_1 B_1 + \beta_2 B_2 + \dots + \beta_q B_q) e_t & \\ (1 - \alpha_1 B_1 - \alpha_2 B_2 - \dots - \alpha_p B_p)(X_t - \mu) &= (1 + \beta_1 B_1 + \\ \beta_2 B_2 + \dots + \beta_q B_q) e_t & \quad (3) \end{aligned}$$

Where B is describing the process of differencing, which is given by

$$y'_t = y_t - y_{t-1}$$

$$y'_t = y_t - By_t$$

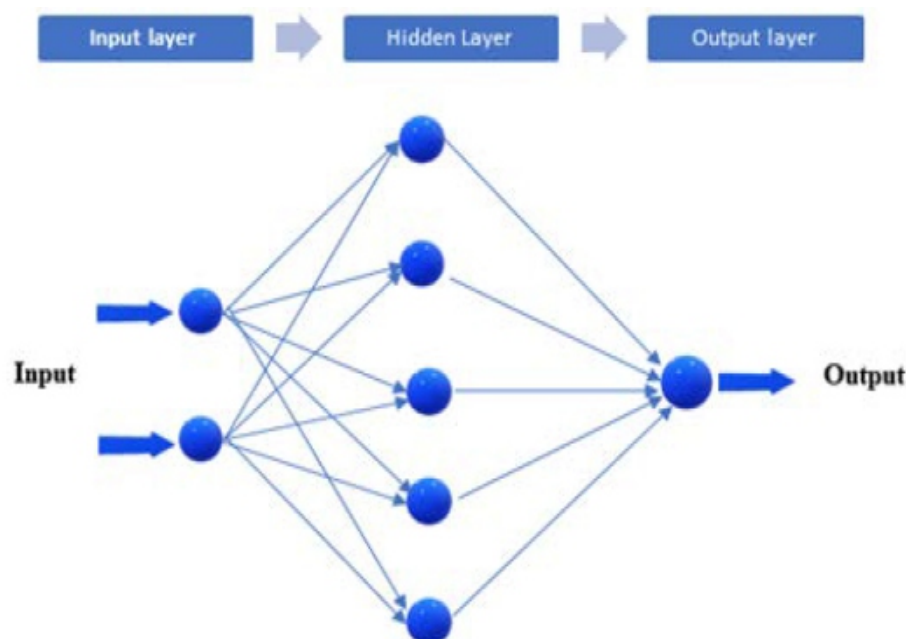
$$\Rightarrow y'_t = (1 - B)y_t$$

In this context, we have constructed different ARIMA models to know which model fits the data well. For this, various statistical characteristics such as the RMSE, MAPE, Akaike Information Criteria (AIC), and Bayesian Information Criteria (BIC) are computed and compared for all vehicles to identify the best model.

#### 2.2.4. Artificial Neural Network (ANN)

ANN is a mathematical or computational model of the machine learning technique interconnected with many neurons functioning together to resolve many complicated problems. The interconnection of artificial neurons, which emulates the function of human brains to solve scientific problems. Based on their interconnections, neural network models are developed. These networks are generally classified as a single layer and multi-layer perceptron model with feed-forward or feedback propagation. In the feed-forward network propagation model, the signals are moved from one neuron to another in a forward direction.

In many applications, the multi-layer feed-forward neural network (FFNN) model can predict the time series data. The multi-layer perceptron network consists of a multi-layer, an input layer, hidden layers, and an output layer. The model's validity is determined by neural network structure, methods of training or algorithms, and activation functions. Figure 1 shows the FFNN model structure with the input layer and the hidden layer, consisting of neurons.



**Figure 1. Neural Network Architecture**

The mathematical relationship between the input  $(y_{t-1}, y_{t-2}, \dots, y_{t-p})$  and the output  $(y_t)$  for MLFFN can be written as

$$y_t = \alpha_0 + \sum_{i=1}^m \alpha_i f(\sum_{j=1}^n \beta_{ij} y_{t-1} + \beta_{0j}) + e_i y_t = \alpha_0 + \sum_{i=1}^m \alpha_i f(\sum_{j=1}^n \beta_{ij} y_{t-1} + \beta_{0j}) + e_i \quad (4)$$

Here ' $\alpha_i$ ' is a weight from the hidden to output nodes, and ' $\beta_j$ ' weight from the input to hidden nodes;  $n$  and  $m$  refers to the number of Input nodes and number of hidden nodes; 'f' is the sigmoidal activation functions;

The sigmoidal function can be mathematically expressed as follows:

$$f(x) = \frac{1}{1+e^{-ax}} \quad (5)$$

### 2.2.5. Hybrid Model

In much real-world time series forecast modeling and as per the literature, neither ANN nor ARIMA is suitable for all situations because the time series contains both linear domain and non-linear domain problem structures. For a linear domain, the ARIMA model is ideal, whereas ANN is suitable for a non-linear domain. Both models have achieved success in their domains. Therefore, Zhang [28] proposed the mixed-use of linear and non-linear domains in a suitable methodology, a hybrid ARIMA-ANN model. In this approach, Zhang combined both ANN and ARIMA separately for modeling linear and non-linear components to evaluate accurate forecasting.

According to the Model, we have

Where  $y_i$  Stand for the third-party damage claim amount.  $L_i$  and  $N_i$  denote the linear and non-linear components of time series data.

According to Zhang, the ARIMA is fitted to the original series to model the linear part, and the corresponding residuals from the linear part contain only non-linear components that will be fitted by the ANN model. The residuals obtained from the ARIMA model are given by  $e_i = y_i - \hat{L}_i$ , where  $\hat{L}_i$  stands for forecast value from ARIMA. Then, model the residuals using ANN that will capture the non-linear pattern of the TP claim data. Using  $n$  inputs, the ANN model for residuals will be of the form

$$e_i = f\{e_{i-1}, e_{i-2}, e_{i-3}, \dots \dots e_{i-n}\} + \varepsilon_i \quad (7)$$

Where  $f$  represents the non-linear function obtained by the ANN and  $\varepsilon_i$  represents the random error. The forecasted value obtained from ANN equation (2) denoted as  $\hat{N}_i$  then the hybrid ANN-ARIMA forecast to the time series data is obtained as

$$\hat{y}_i = \hat{L}_i + \hat{N}_i \quad (8)$$

The hybrid model is now applied to third-party claim data to check for better forecasting accuracy than ARIMA and ANN by comparing RMSE and MAPE.

### 2.3. Performance Criteria

The performance criteria such as Mean Absolute Percentage (MAPE) and Root Mean Square Error (RMSE) are shown in equations (9) and (10).

$$RMSE = \sqrt{\frac{1}{n} \sum_{i=1}^n (y_i - \hat{y}_t)^2} \quad (9)$$

$$MAPE = \frac{1}{n} \sum_{i=1}^n \left| 100 \frac{y_i - \hat{y}_t}{y_t} \right| \quad (10)$$

### 3. EXPERIMENTAL EVALUATION

The secondary dataset consists of 962119 third-party overall claim samples (all categories) of vehicles from a public insurance company. Further, these are categorized into 132685 two-wheeler claims, 205420 private cars, 451978 claims are Four wheelers, 124917 claims are three-wheelers, and 47119 are claims of a special type of vehicles. For this categorized data, we modeled the claim amount for the data. We evaluated the five different time series techniques empirically: Linear Model, Exponential Smoothing model, ARIMA model, ANN model, and hybrid ARIMA-ANN model to find which of these models fits well. The data analytics are analyzed by using STATGRAPHICS Version 18.1.12 and MATLAB 2019b Version.

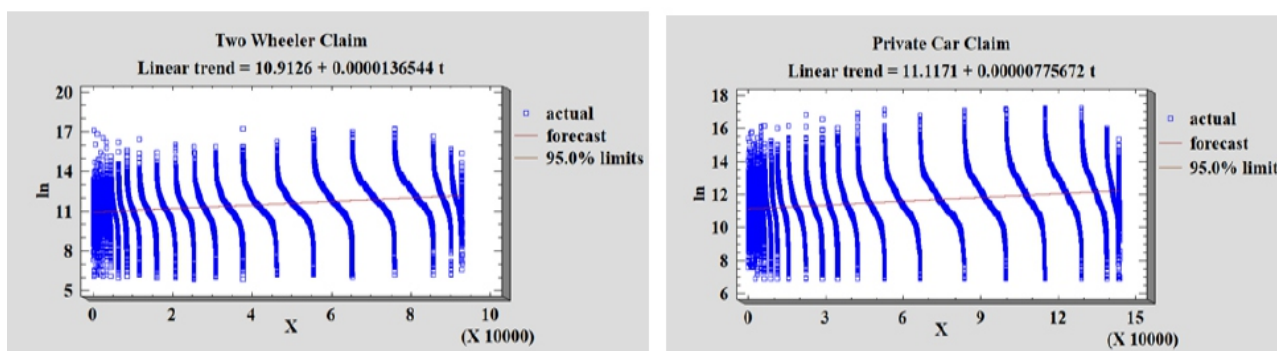
### 4. RESULTS AND DISCUSSION

#### 4.1. Results of Linear Models

This article generates third-party claim forecasting models of the various types of motor vehicles by using three traditional time series models, ANN, and the hybrid ARIMA-ANN model based on secondary data. This study modeled exponential smoothing using STATGRAPHICS, while all other models are built using MATLAB. Then, all three evaluations are compared by the model's predicted values, and with actual values, the characteristics of RMSE and MAPE are estimated. From equation (1), we have fitted the generalized linear model, and it is observed that the coefficients  $\beta_0$  and  $\beta_1$  are significant. Thus, by applying the coefficients  $\beta_0$  and  $\beta_1$  in equation (1), the linear model is fitted for different vehicle categories to predict the values. From Fig.2, it is observed that the claim data do not display any clear trends.

#### 4.2. Results of Exponential Smoothing Models

From equation (2), we have identified the appropriate optimal smoothing constant  $\alpha$  by using the trial and error method for the exponential smoothing method. For that, twelve experimental trials are performed with various smoothing parameters from 0.1 to 0.95 for each category of vehicles. We have generated the exponential smoothing model based on equation (2) with parameter  $\alpha$  ( $0 \leq \alpha \leq 1$ ). From Fig.3, it is observed that the minimum performance accuracy measures such as MAPE, MSE, RMSE are obtained at a larger value of the  $\alpha$  ( $> 0.93$ ) because the actual and forecasting TP claim amounts are fluctuating rapidly for all categories of vehicles. Also, it is clear that the smoothing constant  $\alpha$  increases the performance measures of accuracy decrease.



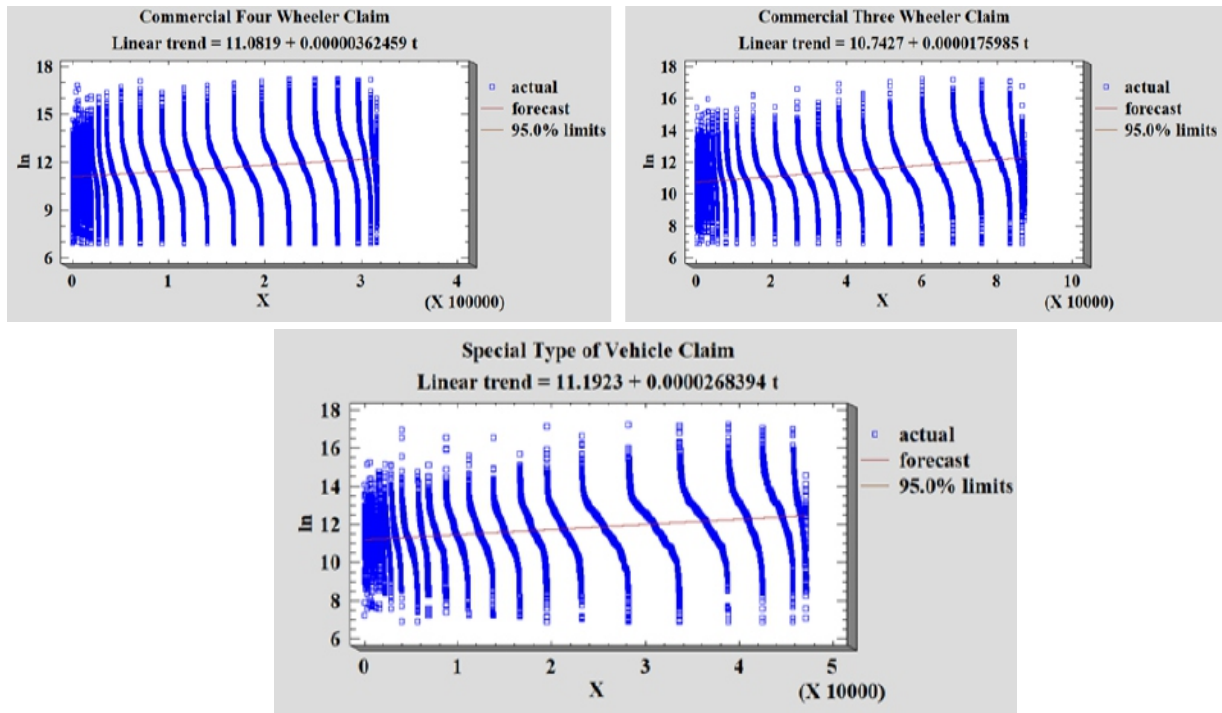


Figure 2. Linear Model plot for different types of Vehicle Claims

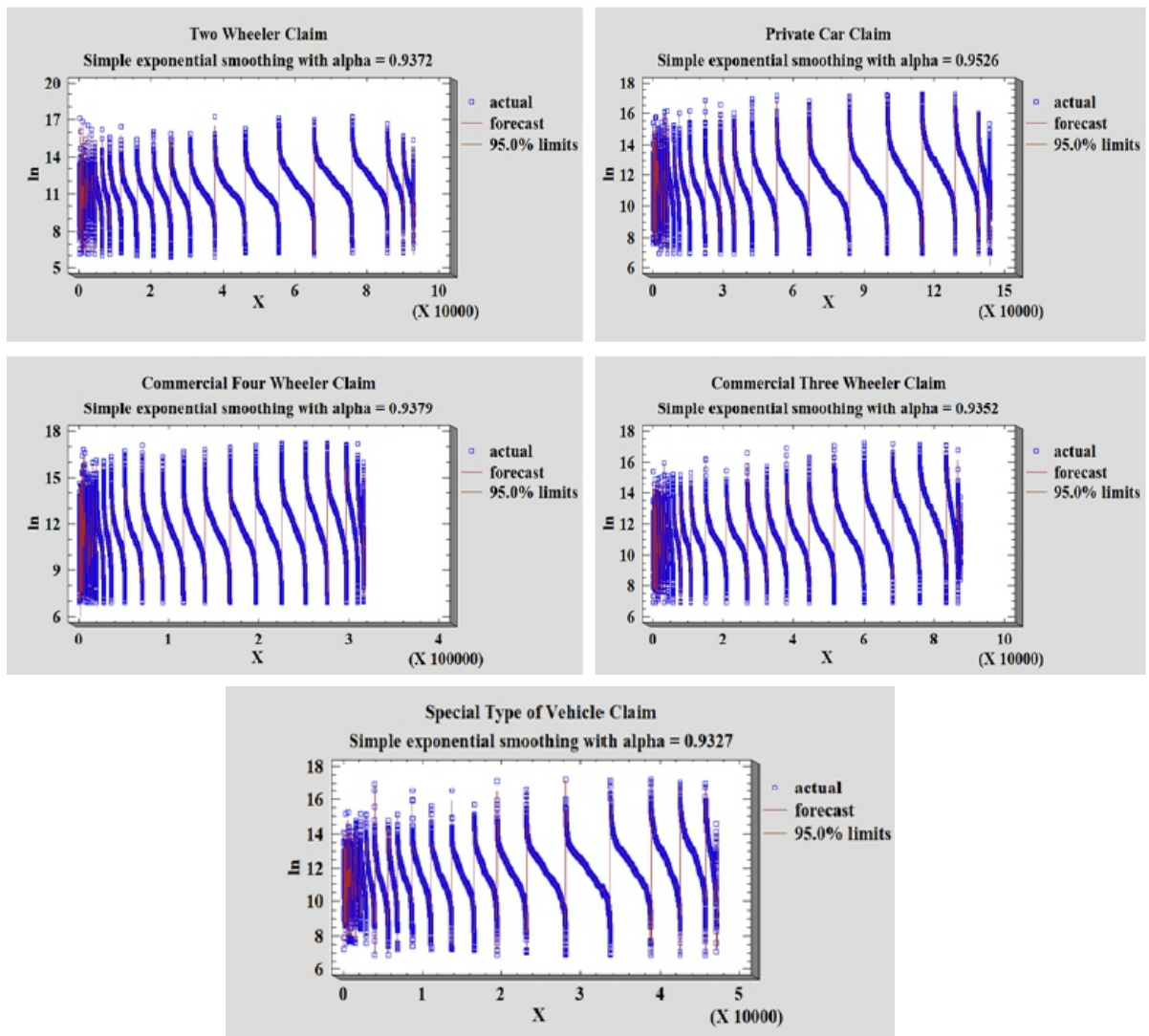


Figure 3. Exponential Smoothing Model plot for different types of Vehicle Claims

### 4.3. Results of ARIMA (p, d, q) Models

Based on equation (3) Box Jenkins methodology, the ARIMA models were built through the iterative building process, such as identifying the model, estimation, validation, and diagnostic checking. We first checked whether the time series data set for different categories of vehicles are stationary or not. We applied the Augmented Dickey-Fuller test for the original data set; the results concluded that the TP claim data of all categories of vehicles were stationary (i.e.,  $p < \alpha$ ). Now, the TP claim data for all types of vehicles will be modeled by ARIMA (p, d, q).

From TABLE 1, we have computed the best possible feasible ARIMA models and their performance criteria AIC, RMSE, MAPE, and BIC values. By comparing all the fitted ARIMA models based on their performance criteria, ARIMA (1, 0, 2) model fits well with relatively smaller performance criteria values mentioned above to forecast the TP Claim Amount for Two-wheelers, Private Cars, Commercial four-wheelers, Commercial Three Wheelers and Special type of Vehicles.

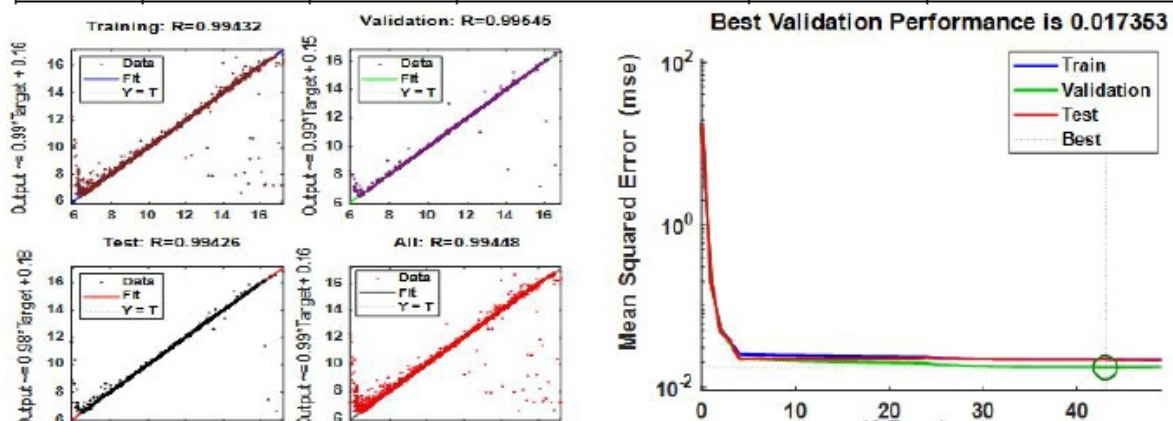
### 4.4. Results of Artificial Neural Network Models

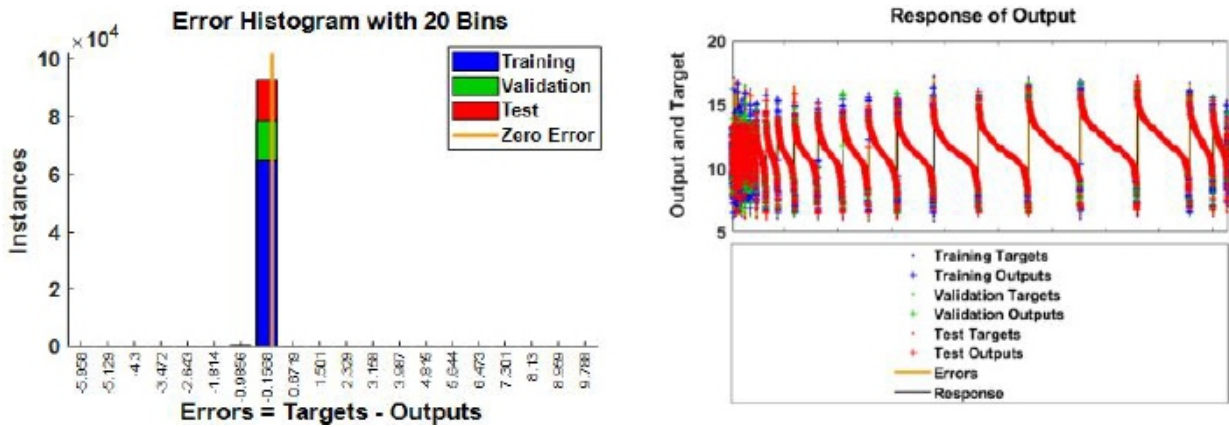
By using Machine learning methodology, the analytical process was performed by considering the ANN procedures using MATLAB 2019b version workspace and computed the neural network technique evaluated. Out of the total samples, 70% of samples are selected randomly for training, 15% of them are chosen randomly for validating the network model, and the remaining 15% of them are the utterly independent test of network generalization.

We have selected the number of neurons in the hidden layer based on the desired performance using the TRAINLM method. By using the trial and error method, the performance of the network can be checked, and it has to be retrained if the performance is not satisfied. Finally, the TRAINLM method predicts the values based on Mean Square Error (MSE) for different vehicle categories.

**Table 1. Performance Criteria values for the ARIMA (1, 0, 2) Models for different Categories of Vehicles**

Statistics	Two Wheeler	Private Car	Commercial Four Wheeler	Three Wheeler	Special Type of Vehicle
RMSE	0.16705	0.12432	0.09060	0.15552	0.32744
MAE	0.00625	0.00381	0.00187	0.00598	0.02909
MAPE	0.05103	0.02993	0.01476	0.04778	0.23585
AIC	-3.5788	-4.1697	-4.80254	-3.7218	-2.2325
BIC	-3.57850	-4.1695	-4.80244	-3.7215	-2.23089





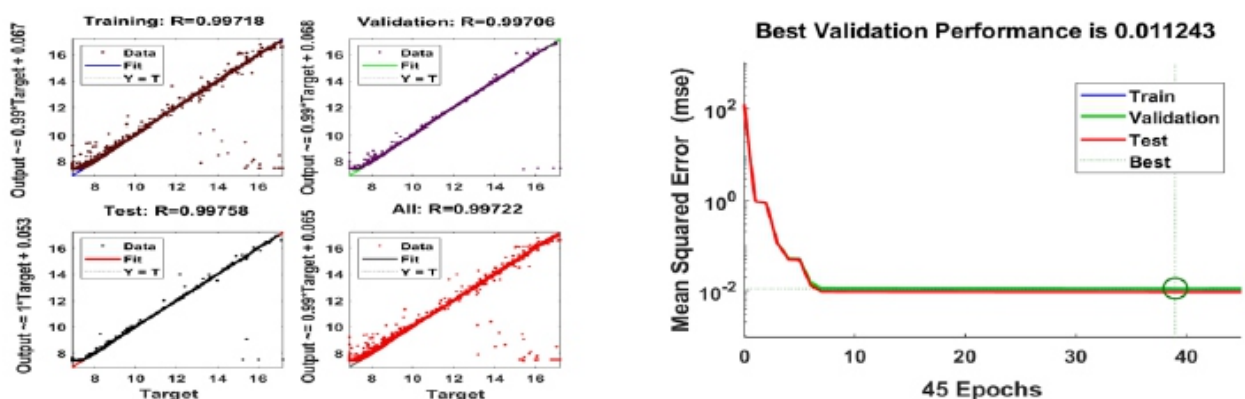
**Figure 4. Regression plot, performance plot, Error histogram and Response plot for Two-wheeler Claims Using the ANN model**

From Fig.4, the Regression plot for training, validation, and test claims data sets with respect to two-wheeler claims fall along a 45-degree line, and also  $R > 0.9941$  for each case indicates the predicted regression plot showed a good fit. It also suggests that the network outputs are equal to the targets. The performance plot predicts the best performance validation RMSE as 0.017353. Also, the error histogram for training, validation, and testing data are represented by blue, green, and red bars gives an idea about the indication of outliers. It is observed that the error is zero; the prediction was successful.

From Fig. 5, the regression plots for private cars show a perfect fit with  $R > 0.997$  for training, validation, and testing data set. It is also showing the best validation performance RMSE as 0.011243 with error histograms; the error is zero, which indicates that the predicted model is perfect.

From Fig. 6, the regression plots for the Commercial four-wheeler show a perfect fit in each case  $R$  values are above 0.998, with the resulting best validation performance RMSE as 0.005305, and the error is zero, which indicates that the predicted model is perfect.

From Fig. 7, the regression plots of ANN show a perfect fit with  $R$ -value is higher than 0.995 in each case, with the resulting best performance RMSE as 0.021751 for Commercial Three-wheeler, and the error is zero. It indicates that the predicted model is perfect.



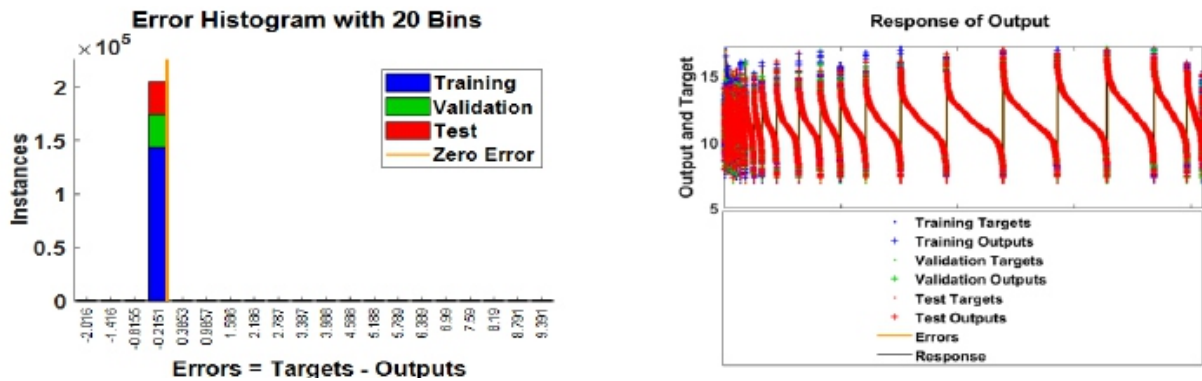


Figure 5. ANN model - Regression plot, performance plot, Error histogram and Response plot for Private Car Claims

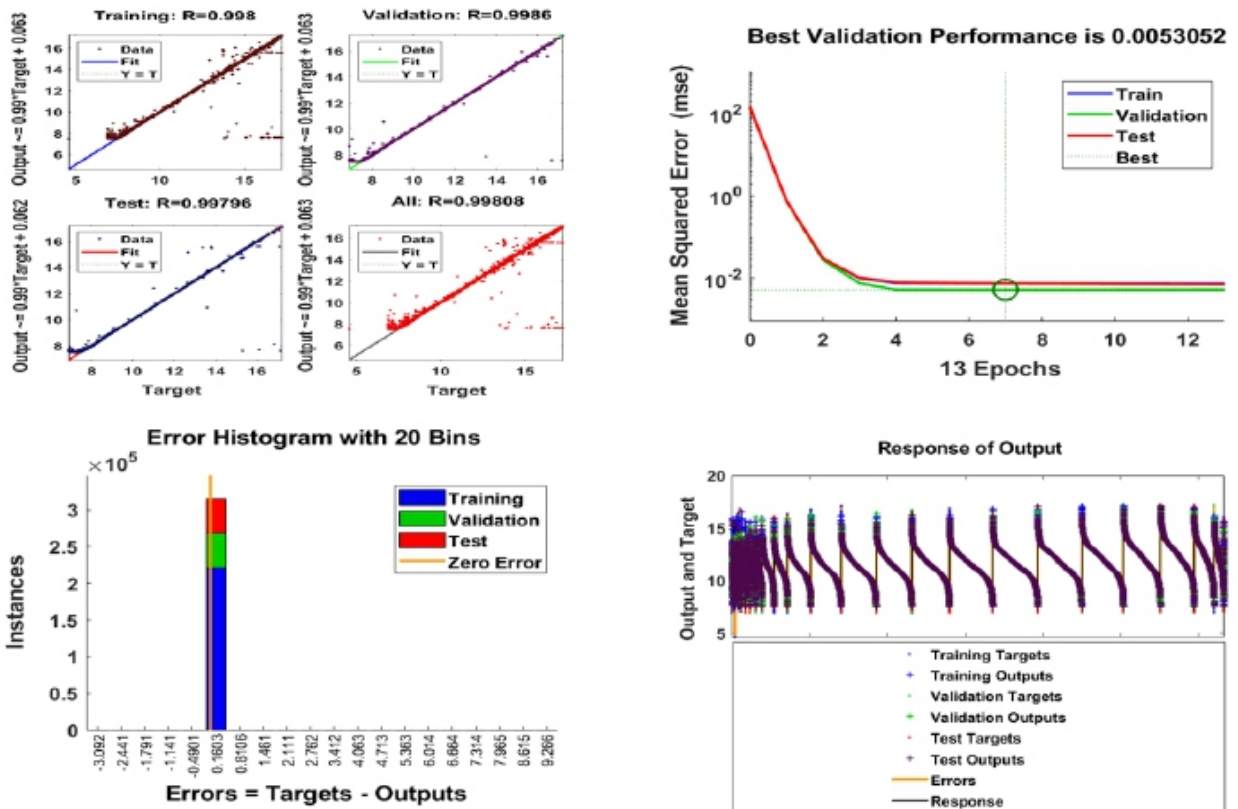
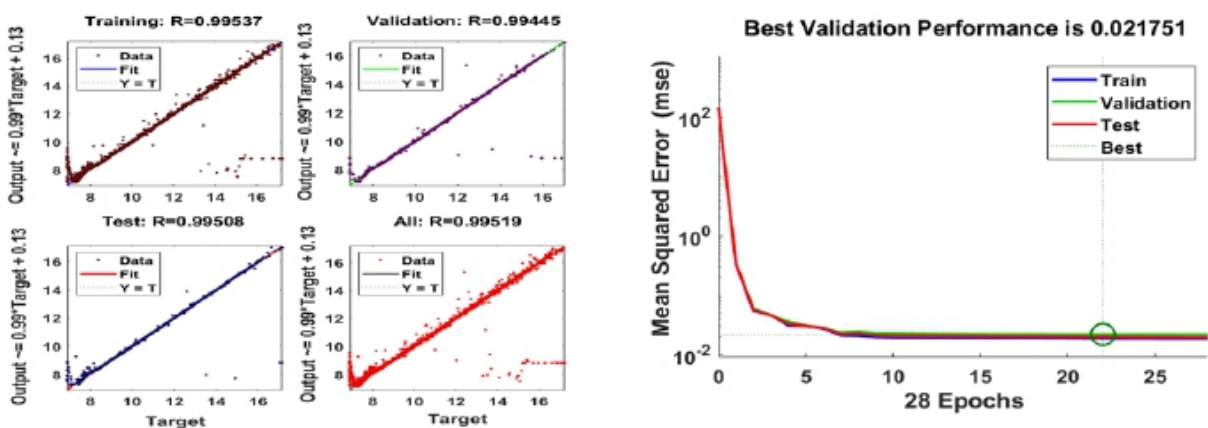


Figure 6. ANN model - Regression plot, performance plot, Error histogram, and Response plot for Commercial Four-wheeler Claims





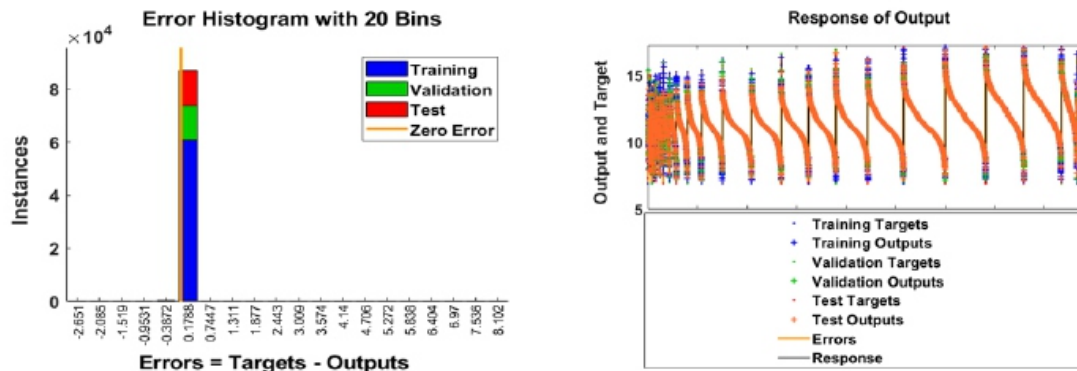


Figure 7. ANN model - Regression plot, performance plot, Error histogram and Response plot for Commercial Three-wheeler Claims

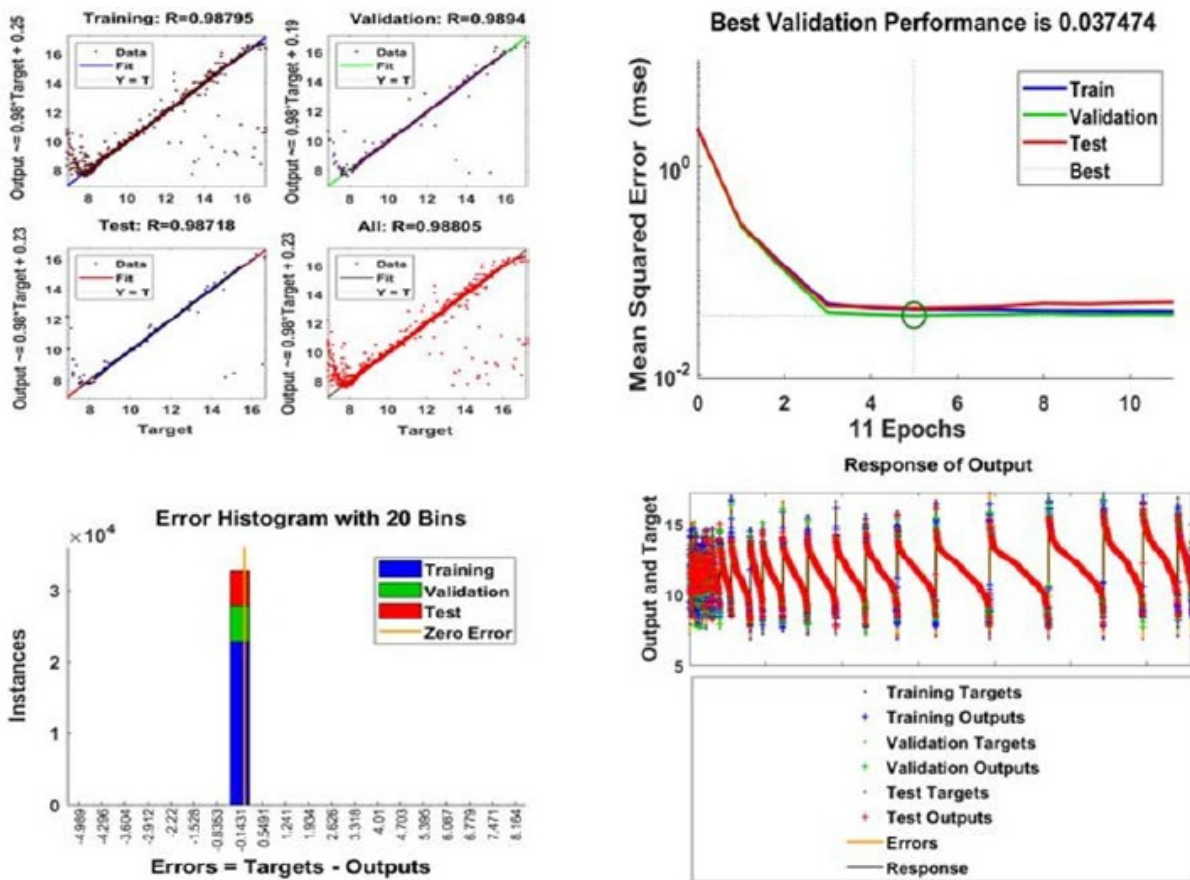


Figure 8. ANN model - Regression plot, performance plot, Error histogram and Response plot for Special type of vehicle Claims

From Fig. 8, it is observed for a special type of vehicle, the regression plots of ANN show a perfect fit with R values are above 0.998 for training, testing, and validation, with the resulting best performance RMSE as 0.037474, and the error histogram showed the error is zero.

From the above results based on all vehicle categories, the MLFF neural network with a sigmoid transfer function in the hidden layer and a linear function in the output layer prediction was accurate with less RMSE.

#### 4.5. Results of Hybrid ARIMA-ANN Model

In this model, first, we have fitted the ARIMA Model for original data for all categories of vehicles, which is obtained from equation (3). The residuals obtained from the ARIMA model shows non-linearity (equation 7). Then, we have applied the ANN technique, MLFF neural network, to the ARIMA residuals by using the Levenberg-Marquardt algorithm.

Finally, according to G. Peter Zhang [28] equation (8), the hybrid model's predicted values are estimated by adding the predicted values of ARIMA and ANN. Also, we have evaluated the various performance measures of the hybrid model for different categories of vehicles.

#### 4.6. Evaluation of Forecast Accuracy

From the literature review of a few authors suggested that ARIMA is an accurate model to predict the data with trend and seasonality [29,30]. Many of them suggested mixed use of the linear and non-linear hybrid model is a reliable model for forecasting the financial data.

In this study, we compared all five forecasting models, such as the Linear Model, Exponential Smoothing, ARIMA, ANN, and hybrid models for various categories of motor vehicles for TP claim accuracy.

**Table 2. Comparison of forecast accuracy between Models for different Vehicle Categories**

Vehicle Category	Model	Training Data Set		Testing Data Set		Training Data	Testing Data
		RMSE	MAPE	RMSE	MAPE		
Two-Wheeler Claim	Linear Model	1.33406	9.22843	1.32864	9.18160	92880	39805
	Exponential Smoothing	0.16722	0.04949	0.23507	0.10833		
	ARIMA	0.16705	0.05103	0.23469	0.10994		
	ANN	0.14527	0.04204	0.18714	0.10547		
	Hybrid	0.16660	0.12312	0.23040	0.28109		
Private Car Claim	Linear Model	1.352	9.3685	1.36274	9.4498	143794	61626
	Exponential Smoothing	0.1244	0.02897	0.18706	0.0672		
	ARIMA	0.1243	0.02993	0.18692	0.0675		
	ANN	0.11755	0.02697	0.16268	0.05029		
	Hybrid	0.12391	0.02975	0.18476	0.21816		
Commercial Four-Wheeler	Linear Model	1.32918	9.37124	1.32867	9.37040	316385	135593
	Exponential Smoothing	0.09062	0.01469	0.13145	0.03129		
	ARIMA	0.09060	0.01476	0.13132	0.03146		
	ANN	0.08489	0.01202	0.11985	0.06080		
	Hybrid	0.08793	0.06663	0.13048	0.09672		
Commercial Three-Wheeler	Linear Model	1.34259	9.33241	1.35022	9.36136	87742	37745
	Exponential Smoothing	0.15565	0.04702	0.22814	0.10470		
	ARIMA	0.15552	0.04778	0.22791	0.10457		
	ANN	0.13832	0.08848	0.17348	0.17451		
	Hybrid	0.15212	0.11847	0.21883	0.20914		
Special type of vehicle	Linear Model	1.28410	8.90154	1.29360	9.01618	32984	14135
	Exponential Smoothing	0.23366	0.21165	0.32799	0.24036		
	ARIMA	0.32744	0.23585	0.32744	0.23585		
	ANN	0.20455	0.17511	0.26450	0.22598		
	Hybrid	0.23058	0.28233	0.30908	0.38381		

From Table 2, the exploratory results showed the performance criteria index of RMSE and MAPE for different categories of vehicles with other models such as Linear Model, Exponential smoothing, ARIMA, and hybrid model for both trained and tested data set. Also, both trained and tested data indicated that the ANN model was better compared to other models. Out of five vehicle categories of insurance claims, the ANN model produced an optimal forecast for all vehicle categories. Another exciting conclusion is that the hybrid model and traditional time series models ARIMA, exponential smoothing has not become abortive; they are still handy for forecasting because the performance criteria values are less, as shown in Table 1. These comparative results showed that the ANN model yields a more accurate forecast than any other model for different categories of vehicles with lesser RMSE and MAPE.

## 5. CONCLUSIONS

In recent years, the growing demand for a motor insurance segment, due to the inherent risk factor, the unpredictable occurrence of the motor insurance claim, and the complex nature of claim data, accurately predicting third party claim amount for various categories of vehicles can help the Motor Insurance companies of India to provide a better customer-centric forecasting model which ensures better claims settlement and management. In this context, we have applied a time series modeling technique such as Linear model, Exponential Smoothing, ARIMA, ANN, and hybrid ARIMA-ANN model to see which of these models are better for forecasting the claim amount and calculated the performance measure: RMSE and MAPE for all models.

From the data analytics performed by time series analysis, ARIMA (1, 0, 2) model fits well for all categories of vehicles by using the Box-Jenkins approach based on the respective performance criteria that are AIC, BIC, MAPE, and RMSE. Comparing the performance criteria of different models based on trained and tested datasets for each category of vehicles, the ANN model yields a more accurate forecast compared to all other models because of its non-linear claim data set.

Finally, this exploratory analysis concluded that the ANN models outperform the other predicting models in forecasting the insurance claim amount with greater accuracy. As per the literature studies, the predictions are performed by a hybrid model, which fits well with the data. This study reveals an interesting fact that the hybrid model was not found to be appropriate for any category of vehicle type because the time series contains non-linear data set. Thus, the ANN model is suggested as the best model for forecasts of any vehicle category compared to the linear model, exponential smoothing, ARIMA, and hybrid modeling. This exploratory machine learning analytics approach would help motor insurance companies deal with the uncertain occurrence of claims and ensure the Claims' easy disbursement. Also, this Artificial Neural Network customer-centric forecasting modeling approach helps the insurance companies to provide better claim settlement and management.

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# Effect of Capital Structure on Firms Performance in Nigeria

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## ABSTRACT

*Abstract The lack of precise methodology to determine the capital structure mix on firm performance has generated a lot of mixed results. Empirical studies from emerging nations revealed a scarcity of empirical findings on the measures with a significant impact on firm performance. This paper examines capital structure measures on manufacturing firm's performance in Nigeria. Using annualized panel data for a sample of 15 quoted firms from diverse sectoral classifications from 1999-2018. Excluding the financial firms due to the uniqueness of their capital structure and the strict legal requirements for their financing choices. This study focus on non-financial firms. Capital structure measures book value and market value of the firm. Results indicate that performance proxy by ROE, and Tobin's Q, significantly influence SDTA, SIZE, LDTA, and TDTA while ROA negatively influences LDTA, D\_E, and TDTA. Findings revealed a robust relationship between Tobin's Q and financial performance compared to other book value. Tobin's Q is a better measure of performance within the period under review. The study reveals that Nigerian firms are keenly financed by short-term debt supporting the Pecking Order Theory. It's vital to note that no single theory can sufficiently explain the capital structure effect on firm performance.*

**Keywords** Capital Structure, Performance, Manufacturing Companies, Debt, Equity

**JEL Classification numbers:** G32, L25, L6, N67, G 23, M41

## 1.INTRODUCTION

The financial decision of a firm is vital in determining the optimal capital structure mix. Measuring the firm managerial and financial prowess to adjust and direct its numerous leverages to maximize its value, growth, and generate optimum returns. Firms have a diverse level of leverage, the determination of the best mix to enhance performance by managers remains a puzzle to be solved in corporate finance theory and finance literature. The capital structure comprises long-term debt, specific short-term debt, common equity, preferred equity, and retained earnings. Firm performance is calculated by its capacity to generate optimum returns from its assets, maximize the value and wealth of the shareholders. The financing decisions of firms vary according to the rate of risk related to each financing option as well as the relationship between risk and return (Abu-Rub, [1]). Capital structure effect on firm performance varies proportionately in two ways; according to Desai, ([2]) highly leverage firms with similar risk level might have a higher cost of capital and leverage.

Similarly, high financial leverage stirs volatility and lower firm values than others as a result of valuation in the capital structure. Modigliani, and Miller, ([3]) assert the irrelevance of the debt-to-equity ratio effect on firm value. The MM model considered the Arrow-Debreu environment of the perfect market condition of no taxes, rational investors, perfect competition, free economy, no bankruptcy costs among others (Hartono, and Utami [4]). According to Modigliani and Miller ([3]), firm's performance is independent of their capital structure; and their financing strategies "equity and debt" are "irrelevant" to the firm's value.

They further upheld that firms at all capital structure levels should maintain the same market value and Weighted Average Cost of Capital (WACC). Empirical findings, on the contrary, argued that the idealistic assumptions are unrealistic and impossible in reality where government taxes are inevitable. Ahmad, Salman, and Shamsi ([5]) observed that imperfect market condition factors group under firm-specific, industry-specific, and country-specific such as firm size, profitability, corporate tax, bankruptcy costs, industry type, and internal policies influences the capital structure decision of a firm (Akeem, Edwin, Kiyanjui and Kayode [6] Dada, and Ghazali [7]). In conceding the tax shield advantage on debt, under imperfect market conditions, Modigliani and Miller ([8]) upheld that a unit increase in firm value increases debt in the capital structure mix where interest payments are tax-deductible to maximize performance and minimizes borrowing cost. Firms enjoy tax shields using more debt under an imperfect market condition. The interest tax shields proposed by Modigliani and Miller, ([8]) are considered irrelevant to the firms with other tax shields, such as depreciation (DeAngelo, Harry, Ronald and Masulis. [9]).

The empirical literature suggests an optimal capital structure that maximizes firm value and simultaneously minimizes the cost of capital, to balance risk and return without a specific methodology to achieve the best mix (Dada, and Ghazali, [7]). Financial theorists, over the decade, tried to provide possible explanations on the financing decisions of firms with diverse and unrealistic assumptions such as the Net Operating Income Approach and the traditional theory. The agency cost theory and pecking order theory among other theories provided a rich understanding of the effect. According to the agency theoretical model popularized by Jensen, and Meckling, ([10]), the capital structure level of a firm minimizes the agency cost and maximizes firm values by trading off agency cost of debt against debt benefit (Riahi-Belkaoui [11] cited in Pirzada, and Bin Mustapha, and Wickramasinghe [12]).

The lack of a precise methodology to determine a firm's optimal capital structure, boost productivity, profitability, growth, stakeholder satisfaction, firm value, minimizes cost, and strike a balance between risk and return is the major problem of this study. Earlier studies are in advanced countries with functional stock markets. In Nigeria and other emerging countries, contemporary studies reveal diverse results on firm Performance as presented in table (1) below. In Palestine [13], India Kannadhasan, ([14]), Pakistan Umar, Tanveer, Aslam, and Sajid, [15], Nigeria Aransiola, and Aransiola ([16]), Nigeria Nwachukwu and Akpeghughu [17] Oil and Gas Companies in Pakistan Raheel, and Shah, F.M [18] Bangladesh Hossain, Imran, and Hossain [19] also observed diverse results as a result of methodology, variable measurement, scope of study, method of data collection among others.

This study differs from previous studies to employ Tobin's Q a measure of market value and accounting value, along with other book value, to examine capital structure on non-financial firm performance which most studies ignored in Nigeria to focus on quoted Banks Nwachukwu and Akpeghughu [17]; Adesina, Nwidobie, and Adesina [20]; Olaniyan, Soetan, and Simon- Oke [21] among others. The contemporary econometric technique (panel data analysis) was also adopted to extend and improve on the other empirical, analysis conducted so far in Nigeria.

The panel data methodology allows for an unbiased and efficient estimation which most studies in Nigeria use the linear regression model predominantly.

## 2. LITERATURE REVIEW

The firm's performance is sizably affected by various factors and capital structure is key among them. Numerous theoretical, and empirical studies conducted to explore possible "positive, negative, or no

relationship" between capital structure and firm performance reported mixed results and findings. Similarly, financial theorists tried to propose possible explanations on capital structure effect on firm performance, presenting idealistic assumptions. The Net Income Approach Theory Modigliani and Miller, [8] proposed a positive effect of debt on the firm value. This theory assumes that the cost of debt is less than the cost of equity and that corporate income tax exists. The theory supports 100% debt finance. The Net Operating Income Approach assumes that the common stock price is not affected by modest or excessive use of debt financing in the operational and business activities of the firm. The firm's value is independent of the weighted average cost of capital and total firm value (Pandey [22]). The assumptions of the Net Income and Net Operating, Income Approach were criticized on the ground of impracticability, artificial, and inadequate (Rezaei, and Ortt, [23]).

The traditional theory hypothesizes that at a minimum level the weighted average cost of capital; a firm optimal capital structure and shareholders' wealth are maximized and achieved. Kraus, and Litzenberger, [24] proposed the trade-off theory of optimal capital structure to maximizes firms' value through debt financing to the extent where tax shield is higher than the bankruptcy cost. The trade-off theory allows firms to adopt both debt and equity financing sources notwithstanding their operational cost implication on their operational and business activities. The pecking order theory proposed by Myers, and Majluf, [25], envisages, no optimal leverage due to asymmetric information and transactions costs.

Firms adopt a hierarchical order of available and accessible financing preferences from the least sensitive (least risky) to the most sensitive (most-risky). Thus, firms preferred internal funding over external funding except where internal funds are inadequate or unavailable.

Debt funding is required where external financing is desirable and equity finance becomes the last resort where the desirable is unavailable and inaccessible. The hierarchical order was initiated by Myers, and Majluf, [25] regarding the adverse selection problem of information asymmetric between the managers and outsiders (investors). Pecking order theory proposes that management would at all times prefer equity financing over debt financing in the presence of information asymmetry to reduce transaction costs. By implication, highly profitable firms would prefer internal funding, whereas firms with low profitability tend to employ external financing. The theory hypothesizes a negative relationship between profitability and debt usage. It can be inferred that external financing signifies firm unproductivity and a hostile effect on the stock price as a result of information asymmetry between managers and outsiders (investors). Information asymmetry also occurs when external financing signals a problem that may affect the share price (Frank and Goyal, 26; Kumar, Colombage, and Rao, 27)). The pecking order theory does not envisage the debt ratio (a mix of debt and equity) because of internal and external capital.

Table (1) presents empirical review of studies conducted locally and internationally on capital structure effect on firm performance.

**Table 1. Empirical Review**

Author(s)	Objective	Methodology	Findings/Results
<b>Positive</b>			
Le, and Phan [33]	Capital structure and firm performance	Regression	Positive effect on firm performance.
Yinusa, Ismail, Yulia, and Olawale [34]	Capital structure on firm performance	GMM model	Positive effect on performance where debt financing is moderately employed in Nigeria
Adesina, Nwidiobie, and Adesina, [20]	Post consolidation capital structure on the financial performance of Nigeria quoted banks.	Regression	Positive effect on firm performance.
Kannadhasan [14]	Financial leverage on of Pharmaceuticals companies in India 2000-2012	Panel Data	Positive effect on performance.
Vätavu [35]	Capital structure on performance	Regression	Positive effect on performance.
<b>Negative Results</b>			
Ahmed and Amina [36]	Capital structure on the performance of non-financial firms in Egypt.	OLS Regression	Negative effect on performance
Olaniyan, Soetan, and Simon- Oke [21]	Capital Structure on Performance of firms in Nigeria.	GMM	Negative effect on performance
Umar, Tanveer, Aslam, and Sajid, [15]	Debt and equity financing on the performance of listed firms in Bursa Malaysia from 2001-2010	Regression	Negative effect on performance
Aransiola, and Aransiola [16]	Capital structure on the performance of manufacturing firms in Nigeria	Panel Regression	Negative effect on performance
Raluca, [37]	Capital structure on Corporate performance of listed Romanian firms	Regression	Negative effect on performance
<b>Mixed Results</b>			
Nwachukwu and Akpeghughu [17]	Capital structure and firms performance in the Nigerian banking sector	Regression	A positive relationship with equity capital and a negative relationship with debt capital and return on investment
Tianyu, [38]	Capital structure on performance in both developed and developing markets	Regression	Negative effect on Chinese firms and a positive on Germany and Sweden, firms before the 2008 financial crisis.
Saeedi and Mahmoodi [39]	Capital structure on performance of listed firms in the Tehran Stock Exchange	Panel Regression	Capital structure shows a weak-to-no impact on performance
<b>Inconclusive Results</b>			
Raheel, and Shah [18]	Financial leverage on firms' profitability in Oil and Gas Companies of Pakistan Listed in KSE	Regression Analysis	The non-significant effect between financial leverage and earnings per share.

**Source: Authors Computation (2020).**

The debt ratio represents the accumulated external financial needs of the firm. The theory concentrates on the cost of capital reduction and ongoing performance ignoring the firm's long-term reputation of reliability (regular debt payments), profitability (stable or increasing dividends), and performance. The underpinning theory of this study is the pecking order theory given its relevance in literature. Capital structure effect on firm performance under the perfect market conditions in the United States Petroleum, oil, and electricity industries was examined using the two-stage instrumental variable approach. Findings revealed a non-significant influence on the firm's value. Singh, and Hamid [28] and Singh [29] examined the Western models of capital structure theories in developing nations results revealed a mismatch of funding where long term investments are financed by short term debt. Most firms in developing countries finance their business and operational activities inversely, from the pecking order theorem relying heavily on external financing, the bulk of which is short-term finance (Singh [29]). On the other hand, firms in developing countries rely more heavily on equity issues than those in the developed business climate. Empirical literature acknowledged the long and short-term debt ratio as the best-fit measure of leverage ratios in developing countries like Nigeria. Salawu, [30] observed that 60% of Nigerian firm's capital structure is short-term debt. Myers [31] observed that only a small proportion of capital formation of US quoted firms are finance externally, equity issues



represent a minor percentage while the bulk of external finance is debt. The findings and results vary with publicly quoted firms in Nigeria. The theory of capital structure is closely related to the firm's cost of capital (Nwude, Itiri, Agbadua, and Udeh [32]).

### 2.1. Knowledge Gap

The lack of precise methodology on the determination of the capital structure mix on firm performance has generated a lot of mixed results. Most contemporary empirical studies in Nigeria employed diverse leverage measures excluding others; Salawu [30], adopted the short term debt, and excluding total debt to total assets, reporting a negative result. Dada, and Ghazali [7] employed total debt to equity excluding, short term debt to total assets, and long term debt to total assets, short-term debt, long-term debt, and total debt observing a mixed result of a positive and negative relationship while DeAngelo, Harry, Ronald and Masulis [9] employed total debt to equity and long term debt to total assets, excluding short-term debt, and total debt. This study employed Tobin's Q to proxy market value and growth, a leverage ratio of Long Term Debt to total asset, Total Debt to total asset, Short Term Debt to total asset, and Debt equity ratio to cover and expand the frontiers of other empirical analysis in Nigeria. Tobin's Q is a combination of market value and accounting value measuring the firm's value. This study adopts a contemporary econometric technique of (panel data analysis), by using fixed-effect estimation, random-effect estimation, and a pooled regression model with an array of pre-test and diagnostic tests.

### 3. METHODOLOGY

The population of this study consists of 102 listed manufacturing firms in the Nigerian Stock Exchange (NSE) as in December 2018. To achieve the study objective, panel data gathered from the annual report of studied firms covering 19 years (1999-2018) of 15 listed firms in all the 7 sectors of Agriculture (FTN Cocoa Processors Plc), Oil and Gas (MRS Oil Nigeria), Basic Material (Meyer and Berger paint), Consumer Goods (Vita foam, Presco and Honey Well), Health Care (Juli Nigeria, Nigeria-German Chemicals), Information, Communication & Telecoms (Airtel Nigeria, MTN Nigeria) and Industrial Goods (Dangote Cement, Lafarge Africa and UAC of Nigeria) were selected.

For this study, lots of factors were put into consideration in the selection of the sample firms. Such factors highlighted include: firms that were listed in NSE before the year of inception of the study, firms that ceased operation at any point during the period of the study and those that had problems with NSE and Securities and Exchange Commission (SEC) within the period under review were also excluded.

The study adopted the Panel Least Squares models of either the Random Effects Model (Error Component Model) or the Fixed Effect Model (Least Squares Dummy Variable Approach (LSDV) to analyse the effect of capital structure on firm performance in Nigeria. This study excluded the financial companies and the banking sector due to the uniqueness of their capital structure and the strict legal requirements for their financing choices. This study adopted the return on assets (ROA), return on equity (ROE), and Tobin's Q to measure a firm's performance and Long Term Debt to the total asset (LD/TA), Total Debt to total asset (TD/TA), Short Term Debt to total asset (SD/TA) and Debt equity ratio (D\_E) as measures of leverages. Firm size is the controlled variable and is considered to be an important determinant of a firm's profitability.

The functional relationship between firms' performance and capital structure is shown below:

$$Y_{IT} = \beta_0 + \beta_1 X_{it} + \beta_2 Z_{it} + \mu_i \quad (1)$$

$$Y_{it} = \beta_0 + \beta_1(LDTA_{it}) + \beta_2(TDTA_{it}) + \beta_3(SDTA_{it}) + \beta_4(DE_{it}) + \beta_5(SIZE_{it}) + \mu_{it} \quad (2)$$

### Model 1

$$ROA_{it} = \beta_0 + \beta_1(LDTA_{it}) + \beta_2(TDTA_{it}) + \beta_3(SDTA_{it}) + \beta_4(DE_{it}) + \beta_5(SIZE_{it}) + \mu_{it} \quad (3)$$

### Model 2

$$ROE_{it} = \beta_0 + \beta_1(LDTA_{it}) + \beta_2(TDTA_{it}) + \beta_3(SDTA_{it}) + \beta_4(DE_{it}) + \beta_5(SIZE_{it}) + \mu_{it} \quad (4)$$

### Model 3

$$Tobin's Q_{it} = \beta_0 + \beta_1(LDTA_{it}) + \beta_2(TDTA_{it}) + \beta_3(SDTA_{it}) + \beta_4(DE_{it}) + \beta_5(SIZE_{it}) + \mu_{it} \quad (5)$$

Where:  $Y_{it}$  = Dependent Variables.

$\beta_0$  = Intercept of the Equation,

$\beta_1$  = Coefficient of  $X_{it}$  Variable.

$X_{it}$  = Independent Variable.

$I$  = (Cross-Sectional Variables) Number of Manufacturing Firms

$t$  = Time Period

$\mu$  = Error terms

**Estimation Procedure:** The estimation processes follow an array of pre-estimation tests, Panel estimation, and diagnostic tests. The unit root test was conducted using the summary method to determine the dataset stationarity.

**Estimation Technique:** The choice of either pooled Ordinary Least Square (OLS), Fixed Effects, and Random Effects regression models is dependent on the Hausman Test conducted on the panel regression results.

$$Hstat = (\beta_{FE} - \beta_{RE})'[Var(\beta_{FE}) - Var(\beta_{RE})] - 1(\beta_{FE} - \beta_{RE}) \sim X^2(k)$$

Large statistic implies that the estimated p-value between the  $H_0$  Random Effects (ECM) Error Component Model and the  $H_1$  the Fixed Effects (LSDV) Least Square Dummy Variable Approach is significant. The  $H_0$  is rejected and  $H_1$  is accepted otherwise  $H_0$  is accepted and  $H_1$  is rejected.

## 4. DATA ANALYSIS AND RESULTS: DESCRIPTIVE STATISTIC

### Pre-Test

Figure 1 shows the mean, and median of the series. The standard deviation measures dispersion. Skewness shows the degree of or departure from symmetry and kurtosis the degree of peakedness and Jarque-Bera measure the normality. The results are largely Mesokurtic, the Kurtosis equal (3). By implication, the datasets are normally distributed.

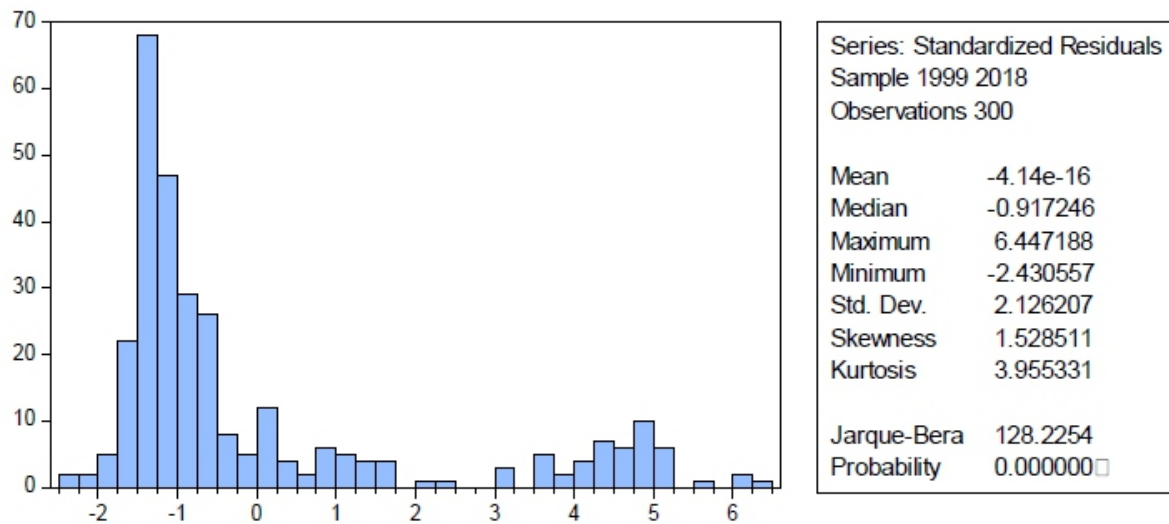


Figure 1. Descriptive Statistics

Table 2. Summary of Panel Unit Root Test Results

Variables	Levin, Lin & Chut	Breitung t-stat	Im, Pesaran & Shin W-stat	ADF-Fisher Chi-Sq	PP-Fisher Chi-Sq	Status
D_E	34.0423*** (0.0000)	-7.91893*** (0.0000)	-7.66577*** (0.0000)	110.137*** (0.0000)	250.402*** (0.0000)	1(0)
LDTA	-4.00291*** (0.0000)	-6.80445*** (0.0000)	-5.3681*** (0.0000)	80.5630*** (0.0027)	229.044*** (0.0002)	1(0)
LOGSIZE	-4.78906*** (0.0000)	-0.70201*** (0.2413)	-6.51502*** (0.0000)	97.6679*** (0.0000)	209.216*** (0.0000)	1(0)
ROA	-5.50497*** (0.0000)	0.77728 (0.7815)	-7.42021** (0.0000)	112.351* (0.0000)	234.444*** (0.0000)	1(0)
ROE	-14.8383*** (0.0000)	-6.76110*** (0.0000)	-10.9254** (0.0000)	138.305** (0.0000)	260.685*** (0.0000)	1(0)
SDTA	-5.35865*** (0.0000)	-5.68768* (0.0000)	-7.23945*** (0.0000)	105.291*** (0.0000)	244.655*** (0.0000)	1(0)
SIZE	-2.29973 (0.0107)	2.21615* (0.9867)	-3.37353*** (0.0004)	68.2886** (0.0001)	175.752*** (0.0000)	1(0)
TDTA	-6.01908*** (0.0000)	-1.76351* (0.0389)	-4.46514*** (0.0000)	72.6531*** (0.0000)	215.854*** (0.0000)	1(0)
TOB Q	-6.41906*** (0.0000)	-1.71783*** (0.0429)	-6.41906*** (0.0000)	96.7111* (0.0000)	186.441*** (0.0000)	1(0)

Source: Authors' Computation (2020)

The p-values are smaller than 1%; the null hypothesis is rejected; we conclude that the variables series are stationary.

\*\*\*, \*\*, \* mean significant at 1%, 5% and 10% respectively. P-Values are in parenthesis. The results depict that all the variables both explanatory and control variables are stationary at level.

#### 4.1. Unit Root Test

The summary methods of Levin, Lin, Chu [40] (assuming common unit root process), Im, Pesaran and Shin W-stat, Augmented Dickey-Fuller test (ADF), and PP-Fisher Chi-square panel unit root tests were employed to examine the stationarity properties of the variables for a meaningful analysis.

## 4.2. Panel Regression Analysis

### Model 1: Capital structure correlates with return on assets of manufacturing firms in Nigeria

The Hausman test was adopted to select the best fit model to test the hypothesis; the Cross-Section chi-square statistic with 5 degrees of freedom is 2.80 and the p-value of 0.7305 is presented in Table 3 below. The P-value of the Hausmann Chi-square Statistic is greater than 5%. The null hypothesis is accepted (random effect).

**Table 3. Capital Structure Versus Return on Assets of Manufacturing Firms in Nigeria**

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	284.340	114.730	2.478	0.0138
LDTA	-17.463	10.501	1.662	0.0000
D_E	-29.678	7.485	-3.964	0.0001
LOGSIZE	21.032	7.603	-2.766	0.0060
SDTA	96.198	8.036	11.969	0.0000
TDTA	-10.116	2.912	-0.040	0.0001
Effects Specification				
R <sup>2</sup>	0.66	Hausman Test	2.80	
Adjusted R-squared	0.63	P-value	0.7305	
F.Stat.	28.87	D.W stat	1.902	
P-value	0.0000			

**Source: Authors' Computation (2020)**

Table (3): The R<sup>2</sup> of 66% shows, the goodness of the panel regression. The exogenous variables are jointly responsible for a 66% variation in the endogenous variable with an unexplained variation of 34%. Firm performance proxy by return on asset indicate a negative and significant relationship between long term debt, debt-equity, and total debt. The overall panel regression results are significant. F-stat of (28.87) is associated with a P-value of (0.000). The result is reliable for a meaningful analysis. The Durbin Watson Statistics of 1.90 is approximately 2 ruling out all possible suspicion of first-order positive autocorrelation.

### Model 2: Capital structure correlates with return on equity of manufacturing firms in Nigeria

The Hausman test was adopted to select the best fit model to test hypothesis two; the Cross-Section chi-square statistic with 5 degrees of freedom is 1.761 and the p-value of 0.881 is presented in Table 4 below. The P-value of the Hausmann Chi-square Statistic is greater than 5%. The null hypothesis is accepted (random effect) following the standard null hypothesis.

**Table 4. Capital Structure Versus Return on Equity of Manufacturing Firms in Nigeria**

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	2.649	1.802	1.469	0.1427
D_E	-0.185	0.148	-1.2467	0.0001
LOGSIZE	0.008	0.1185	0.069	0.0002
LDTA	0.399	0.181	2.202	0.0285
SDTA	0.535	0.162	-3.294	0.0001
TDTA	0.136	0.062	-2.170	0.0001
Effects Specification				
R <sup>2</sup>	0.87	Hausman Test	1.761	
F.Stat.	3.407	P-value	0.881	
P-value	0.0000	D.W stat	2.161	

**Source: Authors' Computation (2020)**

Table (4): The R<sup>2</sup> of 87% shows, the goodness of the panel regression model. The exogenous variables are jointly responsible for an 87% variation in the endogenous variable with an unexplained variation of 13%. Firm performance proxy by return on equity showed a positive and significant relationship with firm size, LDTA, SDTA, and TDTA and a negative relationship with ROE under the measure of D\_E. The overall panel regression results are significant. F-stat of (3.407) associated with the P-value of (0.000). The result is reliable for a meaningful analysis. The Durbin Watson Statistics of 2.161 rules out all possible suspicion of first-order positive auto correlation.

### **Model 3: Capital structure correlates with a market value of manufacturing firms in Nigeria**

The Hausman test was adopted to select the best fit model to test hypothesis three; the Cross-Section chi-square statistic with 5 degrees of freedom is 6.773 and the p-value of 0.238 is presented in Table 5 below. The P-value of the Hausmann Chi-square Statistic is greater than 5%. The null hypothesis accepted (random effect) is preferable over the fixed effect following the standard null hypothesis.

**Table 5. Capital Structure Versus Market Value of Manufacturing Firms in Nigeria**

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.263	0.876	0.300	0.7639
TDTA	-0.027	0.022	-1.246	0.0011
SDTA	0.091	0.061	1.487	0.1380
LOGSIZE	0.087	0.058	1.505	0.1333
LDTA	-0.212	0.080	-2.647	0.0086
D_E	0.0056	0.057	0.098	0.9220
Effects Specification				
R <sup>2</sup>	0.68	Hausman Test	6.773	
F.Stat.	12.925	P-value	0.238	
P-value	0.0000	D.W stat	2.108	

**Source: Authors' Computation (2020)**

Table (5): The R<sup>2</sup> of 68% shows, the goodness of the panel regression model. The exogenous variables are jointly responsible for a 68% variation in the endogenous variable with an unexplained variation of 32%. The overall panel regression model result is significant. F-stat of (12.925) is associated with the P-value of (0.000). The result is reliable for a meaningful analysis. The Durbin Watson Statistics of 2.108 rules out all possible suspicion of first-order positive auto correlation.

## 5. DISCUSSION

The results in model (1) of table (3) reveal a negative and significant relationship between LD<sub>TA</sub>, D<sub>E</sub>, and TD<sub>TA</sub> on the performance level of studied firms by 17.46%, 29.67%, and 10.11% respectively. Supporting the pecking order theory hypothesizes a negative relationship between profitability and debt usage. [41;42] argued that long-term debt increases a firm's value, due to a lower long-term debt ratio in the capital structure of companies. Highly profitable Nigerian firms require less debt finance. On the other hand, a positive and significant relationship was observed between short-term debt leverage ratio, ROA, and ROE supporting the agency cost model of debt ratios as a disciplinary device to reduce cash flow waste mitigating the opportunistic behaviours of shareholders-managers to generate sufficient cash flow to prevent liquidation. The result correlates with the true nature of the Nigerian business climate where the majority of firms depend on short-term financing from deposit money banks as a result of the high cost of raising equity from the stock market and debt market underdevelopment. The findings are consistent with the finding of (Nwachukwu and Akpeghughu 17; Hossain, Imran, & Hossain 19)).

A positive and significant correlation was reported between TD<sub>TA</sub>, LT<sub>DTA</sub>, ST<sub>DTA</sub>, and ROE. A unit increase influences manufacturing firm performance in model (2) of table (4). In model 3 of table (5) the results show a positive and significant relationship between market value measured by (Tobin Q) and SD<sub>TA</sub>, LD<sub>TA</sub>, D<sub>E</sub>. A negative relationship with TD<sub>TA</sub> was also reported. The control variable of firm size reveals a strong significant effect on firm performance and market value measured by Tobin Q. The significance of a firm's size on performance indicates that large firms earn higher returns compared to smaller firms, presumably as a result of diversification of investment and economies of scale. Total debt shows a negative and significant relationship with the firm market value. It can be inferred that a unit increase in total debt decreases the firm market value. The findings substantiate the findings and results of (Umar, Tanveer, Z., Aslam, S., and Sajid 15; Akguc, , Choi,., Kim, and McKenzie, 43; Aransiola, and Aransiola 16; Ardalan,44)) and others.

## 6. CONCLUSIONS

The results and findings of this study revealed a disparity between the capital structure of firms in an emerging business climate like Nigeria and those in the developed nations. Manufacturing firms in Nigeria prefer and rely heavily on short-term debt rather than long-term financing. Firm-specific factors that are relevant in the developed business climate are also relevant in Nigeria in explaining the capital structure and corporate performance. Overall, empirical results support the pecking order and agency cost theories of capital structure.

The findings limit the explanatory power of the capital structure theories in Nigeria showing that the theoretical underpinnings are still largely unresolved.

It's vital to note that no single theory can sufficiently explain the relationship between capital structure and firm performance. Theories are based on critical assumptions ignoring the extremely diversified and complex realities in the economic and business climate.

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# Corporate Cash Holdings and Agency Conflicts: Evidence from Moroccan Developing Market

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## ABSTRACT

*The topic of corporate cash holdings has received relatively little attention from academic researchers. However, this decision has always been at the center of interest of any company seeking to improve its performance. This article aims to examine the relationship between agency costs related to managerial discretion and cash holdings by Moroccan companies. In order to do this, we will mobilize both agency theory and free cash flow theory. To date, and to our knowledge, no research has been conducted on the cash flow of Moroccan companies in the light of agency theory. This study contributes to cash holdings research in Morocco by exploring the reasons for holding cash through a sample of Moroccan non-financial companies that are listed on the Casablanca Stock Exchange for a period of 12 years (from 2007 to 2018). This research uses econometric models based on a positivist approach with a hypothetical-deductive method. Our results show that there is a strong positive relationship between cash holdings and cash flow. It also turns out that the liquidity of these companies is significantly negatively affected by the debt leverage and the growth opportunities of the company.*

**Keywords :** *Cash Holdings, Morocco, Agency Theory, Free Cash Flow Theory, Firm-specific Variables*

## 1. INTRODUCTION

The interest in the problem of corporate cash holdings is continuously growing as figures illustrate the sustainable trend of increasing corporate cash reserves around the world over time. For example, the liquidity ratio of listed European companies increased on average from 8% to 17% of total assets between 1980 and 2015<sup>1</sup>. However, classical financial theory teaches us that companies should aim for zero cash. As cash management tools become increasingly sophisticated, one might have expected an evolution towards this theoretical optimum, meaning a decrease in the average levels of cash held. In reality, the opposite has happened: cash levels are high and have been growing constantly over the past 35 years. Numerous international studies confirm this observation, for instance, the average cash ratio was 23.2% for US companies in 2016, compared with 10.5% in 1980 (Bates, Kahle & Stulz, 2009), 12.33% on average in Australia over the period 1990-2015 (La Cava & Windsor, 2016), and 12% in India over the period 2005-2015 (Arora, 2019). So, what are the reasons why companies hold cash? According to neoclassical financial theory, the question of holding cash is not relevant. In fact, in the friction-free world of Modigliani and Miller (1958), the investment decision is separated from the financing decision. The company can evaluate its investment opportunities without worrying about how they will be financed because of its ability to raise funds on the financial market or to sell assets on the market at no cost. However, in the real world, companies have an incentive to hold a certain level of liquidity. By questioning the restrictive assumptions of neoclassical finance, recent developments in contemporary finance have revealed the motivations and consequences of holding cash. These sketches

<sup>1</sup> *Moody's: Cash holdings US corporates recede in H1 2018 on back of tax reform" Moody's Investors Service, November 27, 2018, [https://www.moody's.com/research/Moodys-Cash-holdings-US-corporates-recede-in-H1-2018-on--PR\\_392219](https://www.moody's.com/research/Moodys-Cash-holdings-US-corporates-recede-in-H1-2018-on--PR_392219)*

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of insight are understood in terms of trade-off theory (Opler et al., 1999), hierarchical order theory (Myers and Majluf, 1984), and agency theory (Jensen, 1986).

According to trade-off theory, the optimal level of liquidity is the result of a compromise between the benefits and costs of holding cash. The creation of a safety cushion, which avoids the costs of external financing or liquidation of the firm's assets, would be the main benefit that the firm can derive from holding cash and would also allow the firm to exercise its future investment options. However, holding cash has a cost to the firm. There are two types of cash costs. First, the rate of return on liquid assets is limited and is often lower than the cost of the firm's resources. The very presence of cash therefore reduces the profitability of the firm. Second, the assessment of the costs and benefits of liquidity may differ between shareholders and management. In particular, managers may wish to hold a high level of cash in order to serve their own interests and increase their autonomy (Opler et al., 1999). This cost resulting from agency problems between shareholders and management and the low return on cash relative to other assets of the firm are the main costs of holding cash. This theory has been confirmed by several recent empirical works (Elyasiani & Zhang, 2015; Yogesh Maheshwari & Vigneswara, 2017; Asimakopoulos, Asimakopoulos & Fernandes 2019).

A different view of treasury is based on the explanation of the pecking order theory, which states that there is no optimal level of debt and that, consequently, the firm does not have an optimal financial structure (Myers & Majluf, 1984). The firm would first use the company's liquid funds to finance an acquisition or a new project, then issue risk-free debt, and later, risk debt or convertible bonds before opting to issue shares. The company's objective is to avoid situations where it is forced to abandon profitable investment projects or to issue undervalued shares. This is largely due to the existence of information asymmetry in the financial market between investors and company managers. In fact, managers have information that investors do not have and act in the interest of former shareholders. Potential investors are faced with the risk of overvaluation of the company's shares. Faced with this risk, potential investors may demand that the shares be issued at a lower value than the stock market price. This fear makes recourse to the capital market costly because of the risk of adverse selection on the company's assets. In contrast to trade-off theory, few empirical studies have been able to consolidate the pecking order theory (Sher 2014; Graham & Leavy 2018).

The explanation based on the agency theory puts forward the impact of the managerial discretionary behavior on the level of cash holdings by the firm. This theory explains that this discretionary behavior occurs when part or all of the capital is transferred to an independent shareholder, thus resulting in a manager-shareholder relationship with the risk of a conflict of interest. This divergence of interests is due to the reduction of the manager's share in the capital, which reduces their share of dividends, reduces their motivation to maintain net income at a high level, and pushes them to appropriate other firm resources in the form of indirect benefits (Jensen & Meckling 1976). Numerous international studies confirm this theory with their empirical results (J. Harford et al. 2008; Al-Najjar & Belghitar, 2011; Uyar & Kuzey, 2014)

The characteristics of the economic environment where Moroccan firms operate, namely weak creditor and shareholder protection, ineffective law enforcement, and high shareholder concentration, make Morocco an ideal setting to study this issue and offer the best territory for the establishment of several types of agency problems. This is why we are working on this article in the framework of agency and free cash flow theories. In order to provide an input to the cash holding behavior of Moroccan firms, we will analyze the liquidity of 38 Moroccan companies listed on the Casablanca Stock Exchange over a period of 12 years (from 2007 to 2018).

This article will be organized as follows. In the first point, we briefly review the literature focusing on agency theory and free cash flow theories. This review highlights the determinants of cash holdings and identifies the important variables that influence the firm's decision to hold cash. Next, we examine methodology and sampling. We then present the results and their analysis, and finally summarize the main results in our conclusion.

## **2. LITERATURE REVIEW**

The agency theory was pioneered by Berle and Means in 1932, who showed how separation of ownership and control impacts organizations. They did this by analyzing the development of several corporations in the United States of America in the 1930s, and then publishing their findings in a famous book entitled *The Modern Corporation and Private Property* in 1932. They were not the first to have stressed the impact of the separation of ownership and control in business corporations. Long before that, Adam Smith (1776) raised this issue and announced that management in corporations is entrusted to the directors, while shareholders admitted that they do not interfere in the management of their company by simply receiving dividends. Faced with this situation, Adam Smith (1776) raised the risk of indifference, excessive spending, and lack of vigilance on the part of non-owner managers in the administration of shareholders' interests and wealth. In their book, Berle and Means (1932) found that organizations no longer met the requirements of the classic model of the organization where owners-controlled management. They state that management control in modern companies is exercised with limited intervention by the owners.

This led them to acknowledge the emergence of a separation between the functions of ownership and control. The authors announced the appearance of a new corporate system dominated by a diversified and dispersed shareholder base that sided with individual ownership rights. They expressed their fear of the economy being dominated by a minority of large firms where several shareholders holding a small percentage of the capital would be deprived of their management rights, and then risk being misappropriated by non-owner managers. In this regard, Berle and Means have distinguished five main types of control: control through almost complete ownership of the capital, majority control, control through a legal mechanism for issuing non-voting shares, minority control, and control by management. Management control is exercised when the shareholder base is diversified to the extent that no group of shareholders can have sufficient voting rights to control the company. In companies, where the ownership structure is widely dispersed, the election of board members is entrusted to power funds that hold the voting mandates. The proxy holders can appoint themselves as members of the board of directors. Whoever has the power to make up the board has control, because the members of the board will certainly act according to the board's interests. Otherwise, the members will be replaced. Berle and Means (1932) point out that in modern companies with diversified shareholdings, owners do not assume any role in the management of their capital contributions because they have abandoned their tasks of controlling the company by delegating them to management. In this way, they share the profits distributed by the company without being able to exercise control over investments and the continuity of their business. The separation of ownership from control in widely held companies and their sharing between shareholders and non-owner managers serves as a basis for promoting the agency theory. These assumptions are regarded by Jensen and Meckling (1976) as the basic elements of agency theory, which in turn defines the agency relationship between the owners of the firm who present themselves as shareholders on one hand, and the persons who have been entrusted with the management of the firm and who present themselves as managers on the other. An agency relationship is established when the actions of one person affect both his or her utility and that of another person as a result of an explicit or implicit contractual relationship. The person undertaking the actions is the "agent" hired to perform one

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or more tasks on behalf of the "principal" whose utility is affected by the actions of their agent. The relationship between firm owners and non-owner managers is a perfect illustration of this, given the divergent interests between them (Jensen & Meckling, 1976).

The firm's holding of the remaining cash left after the financing of all the projects with a positive net present value called "Free Cash-Flow" represents a significant part of the divergence of interest between manager and owner and, therefore, of agency costs (Jensen, 1986). In fact, the latter creates conflicts of interest between the managers of a company and its shareholders. Since they are not the sole owners of the companies they manage, the managers could act against the interests of the shareholders in return for their own. In such situations, managers seek to increase the amount of liquid assets themselves for several reasons: Kruger (2015) shows, for example, that a high level of liquidity increases losses through expenditures on projects with negative NPVs. In fact, cash holding allows managers to finance projects with a negative NPV or low rate of return that the capital markets would not accept to finance, or simply use the liquidity for their interests by increasing the benefits in nature and thus derive more private benefits. The presence of cash encourages managers to diversify into projects that are not necessarily successful and that belong to sectors of activity in which they are familiar with in order to extend their discretionary power (Charreaux, 1997). Thus, one of the easiest ways for executives to achieve their goal is to accumulate cash rather than distributing it to shareholders in the form of dividends or share buybacks. In this way, executives avoid the use of capital markets and their controls (Dittmar & Marth-Smith, 2007; Coulier, 2008). This divergence of interest between the principal and the agent leads to reflections and maneuvers to encourage the agent to behave in a way that maximizes not only his utility, but also that of the principal (Jensen & Meckling, 1976).

To investigate the relationship between agency costs related to opportunistic management behavior and cash holdings by firms, previous research has used explanatory variables to test managerial discipline.

## **DETERMINANTS OF CASH HOLDINGS**

The literature review suggests several explanatory variables for firms' behaviour when holding cash. The determinants selected from the theoretical and empirical literature are justified in their expected impact on the level of cash holdings. The main determinants of cash holdings can be summarized below.

### **Size**

Larger companies usually have dispersed structures, and where ownership is widely dispersed, shareholders have little power over management, which prevents them from forcing managers to distribute the cash they have accumulated in the form of dividends or share buybacks. Consequently, due to managerial discretion, the level of cash will be high (Drobetz & Grüninger, 2007). Likewise, being seen as an anti-takeover device, size reduces the disciplinary role of takeover bids by limiting their number and contributing to the entrenchment of managers. From what has been advanced, we can make the following assumption: H.1 "Firm size has a positive impact on the level of liquid asset holdings".

### **Debt**

Managers of low-indebtedness firms have little control over capital markets and can, therefore, hold high levels of cash without being disciplined by them (Opler et al., 1999). Jensen (1986) suggests using debt to align the deviant behavior of managers. In fact, debt is seen as a disciplinary mechanism that forces managers to dispose of cash that they would not have distributed to shareholders in the form of

dividends. Otherwise, the company would face the risk of receivership or liquidation. The relationship between cash and debt is, therefore, negative. The research of Yogesh and Vigneswara (2017) confirms this negative relationship by demonstrating that firms whose main source of financing is debt are less confronted with agency costs. From what has been advanced, we can make the following assumption: H.2 "Corporate indebtedness has a negative impact on the level of liquid asset holdings".

### **Dividends**

The payment of dividends indirectly avoids the problems of opportunistic behavior of managers (Easterbrook, 1984; Jensen, 1986). This is because the distribution of profits will force company managers to turn to bank loans to finance new investments, and thus submit to the pressure and constraint of the financial market. So we can make the following assumption: H.3 "Dividend distribution has a negative impact on the level of holdings of liquid assets".

### **Cash flow**

According to agency theory (Jensen, 1986), the higher the firm's cash flow, the greater the agency costs between management and shareholders will be. The manager seeking his interest will see this as an opportunity to maximize the liquid assets at their disposal rather than using them optimally. The relationship between the cash and cash flow would then be positive. Therefore, we can advance the following hypothesis: H.4 "Cash flow has a positive impact on the level of liquid asset holdings".

### **Growth opportunities**

According to agency theory, firms with limited growth opportunities are more exposed to discretionary management risk, since in the absence of sufficient growth and investment opportunities, managers are more likely to accumulate the most liquidity to benefit from their discretionary power (Opler et al., 1999), and to then reinvest them in unprofitable projects related to their career and experience, fostering their entrenchment (Ferreira & Vilela, 2004; Afza & Adnan, 2007). Several empirical studies document a significantly negative relationship between growth opportunities and cash holdings (Afza & Adnan, 2007; Baklouti & Bouri, 2015; Yogesh & Vigneswara, 2017). Growth opportunities are measured by Tobin's Q ratio calculated by dividing the market value of equity (Market Capitalization) plus the value of net financial debt over the net book value of the firm's assets (Book Value). Since netbook assets do not consider the presence of growth opportunities, Tobin's Q will be high for companies with growth opportunities. Therefore, we can assert the following hypothesis: H.5 "Growth opportunities are negatively correlated with cash holdings".

### **Financial distress**

As several authors explain, firms in financial distress suffer from lower agency costs because of the disciplinary role of financial pressure on managers who find themselves forced to make optimal use of the available funds at their disposal, fearing the risk of bankruptcy of the firm (Kim et al., 1998; Drobetz & Grüninger, 2007). The relationship between financial distress and liquidity would then be negative. Thus, hypothesis H.6 can be established as follows: "Financial distress has a negative impact on the level of ownership of liquid assets".

### **Larger shareholder**

The control of managers is essential in reducing agency conflicts between shareholders and managers. However, for a minority shareholder, the cost of supervision is greater than the benefit it can derive from it, so it is not in their interest to effectively control the managers. On the other hand, the benefits that a major shareholder derives from the supervision of managers exceed the costs it incurs, and therefore it

is in their interest to effectively supervise them. Concentration of ownership is therefore associated with more effective control of managers (Shleifer and Vishny, 1986). From these findings, we can make the following hypothesis H.7: "The percentage of capital held by the majority shareholder has a negative impact on cash holding".

### The board size

The literature suggests that the number of directors on the board is supposed to shape the quality of the board's supervisory activities. The ability of a board to better control managerial behavior depends primarily on the ease of communication and cooperation in the meeting room, which in turn depends on the number of directors. Lipton and Lorsch (1992) argue that large boards of directors are less effective and easier for a CEO to dominate, as many directors tend to be "polite and courteous" rather than critical of management decisions. While large boards probably offer greater potential for knowledge and skills, their organizational deficiencies, increased potential for conflict, and the risk of the existence of stowaways appear to be much greater (Yermack 1996). This allows us to make the following hypothesis H.8: The size of the board of directors has a negative impact on cash holdings.

The following Table 1 summarizes all the determinant:

**Table 1. Variable definition summary.**

Variables	Measure
Cash Holding (Cash)	Cash and Cash equivalent/Net total assets
Company size (Size)	Natural Logarithm of total assets
Debt Ratio (Debt)	Total of long and short-term debt/Total assets
Dividend (Divid)	Total distributed dividends/Total assets
Cash flow (Cf)	Earning before interest + depreciation /Total assets
Growth opportunities (Tobin's Q)	Equity Market Value + Liabilities Market Value/ Equity Book Value Liabilities Book Value
Financial distress	The risk of financial distress is measured by the inverse of the Z- score bankruptcy prediction model developed by Altman (1968)
Largest shareholder (1st Share)	% of the capital held by the largest shareholder
Board size (BD-Size)	Number of directors

### 3. METHODOLOGY

We conducted an empirical econometric study using a positivist approach based on a hypothetico-deductive method according to the methodology advocated by Gill and Johnson, (2010). We used data extracted from the financial statements of 38 companies listed on the Casablanca Stock Exchange during the period 2007-2018. These companies were selected for two main reasons. Firstly, listed companies have access to both financing markets, namely the banking and capital markets, which gives them the capacity to have a comprehensive financing policy and strategy. The second reason lies in the characteristics of accounting and financial data of listed Moroccan firms, which can be considered

accessible, exhaustive, and reliable, unlike unlisted companies. We use panel regression analysis in our study for the advantages it offers compared to time series data, notably a larger sample size, less collinearity, consideration of section heterogeneity, and better efficiency.

As for the choice of sampling, the target population includes companies listed on the Moroccan market between 2007 and 2018, the data of which are available on the Casablanca Stock Exchange website. However, for the purpose of the study, companies in the financial sector<sup>2</sup> are excluded given the specificity of their liquidity needs. Firms for which data are missing or are not listed continuously over the entire period of the study are also eliminated<sup>3</sup>.

Analysis of the data for all the firms in the sample reveals the presence of outliers. The existence of these outliers may alter the regression results by masking existing relationships or by artificially revealing them. These points are removed.

**Table 2. Study sample**

	Companies	Observations
Starting sample	75	900
• Financial companies	11	132
• Insurance	5	60
• Stock market information missing	21	252
Companies studied	38	456

The purpose of econometrics in this study is to estimate the coefficient  $\beta$  by using panel data regression analysis.

$$\text{Cash } i,t = \alpha + \beta_1 \text{ Size } i,t + \beta_2 \text{ Cash flow } i,t + \beta_3 \text{ Debt } i,t + \beta_4 \text{ Dividend } i,t + \beta_5 \text{ Tobin's } q \text{ } i,t + \beta_6 \text{ Financial distress } + \beta_7 \text{ 1}^{\text{st}} \text{ Share } i,t + \beta_8 \text{ CEO-Dual } i,t + \varepsilon \text{ } i,t$$

#### 4. RESULTS AND DISCUSSION

The data for our variables were collected from the reports and financial statements published by 38 listed companies on the Casablanca stock exchange. In what follows, We will first present descriptive statistics of the explanatory variables, as well as the univariate analyses of the data, and on the other hand the presentation and interpretation of the results of the regression tests.

##### Descriptive statistics

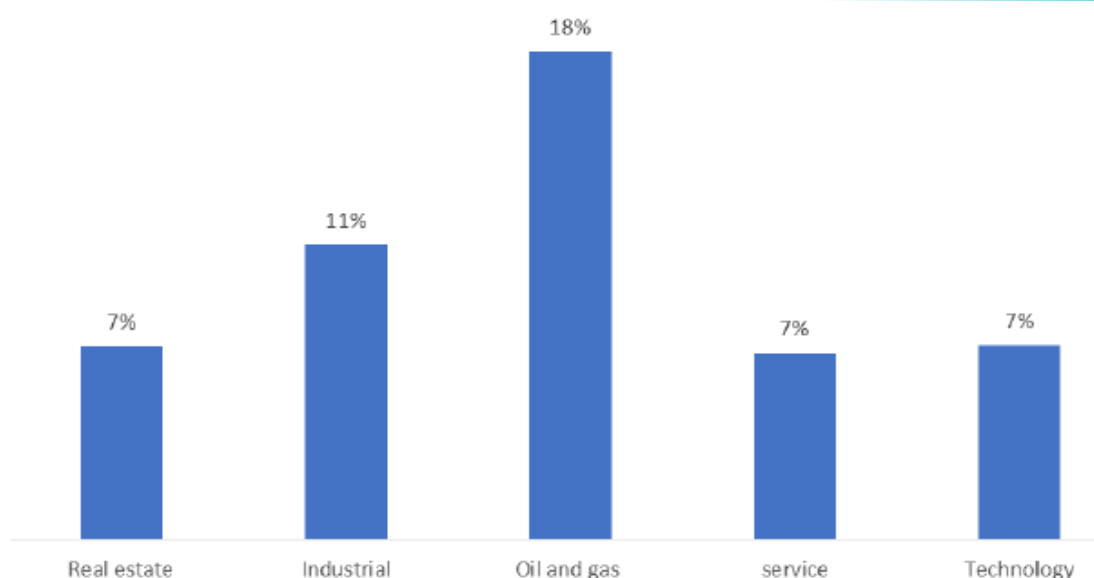
Table 3 below presents descriptive statistics for the dependent variable "Cash holding" (Cash) that characterizes our sample of Moroccan firms. We find that the average level of liquidity is 10.35% with a minimum of 0.0% and a maximum of 73.6%, although the median level of cash holdings is 4.11%, indicating that some firms hold relatively large amounts of cash relative to the median value.

**Table 3. Descriptive statistics for the dependent variable**

Variable	Mean	Median	SD	Minimum	Maximum
Cash	10.35%	4.11%	13.90%	0.00%	73.60%

<sup>2</sup> Financial companies are excluded from our sample because their liquidity holdings are linked to requirements other than those examined in our article.

<sup>3</sup> The company must be listed on a market and data must be available for a minimum of ten consecutive years.



**Figure 1. Average level of cash holdings by sector**

Figure 1 shows the cash ratio by business segment. It can be noted that it is in the oil and gas mining sector that the average cash level is highest, representing 18% of net assets, followed by the industrial sector with an average of 11%. Finally, the technology, real estate and service sector have a similar average liquidity holding of around 7% of net assets for the total sample.

**Table 4. Descriptive statistics for the independent variables**

Variable	Mean	Median	SD	Minimum	Maximum
Size	8.76	8.93	0.6	7.5	10.63
Debt	35%	36%	17%	0%	98%
CF	16%	13%	16%	-5%	144%
DIVID	6%	4%	7%	0%	76%
Tobin's Q	3.13	2.39	2.43	-3.48	19.66
Financial Distress	0.24	0.17	1.12	-10.05	9.03
1st Share	48%	51%	22%	7.5%	97%
BD-Size	8	8	3	3	17.00

Regarding the characteristics of the companies in our total sample over the period 2007-2018, they are summarized in Table 4. As can be seen, the average size in our total sample is 8.76 with the standard deviation of 0.6. The mean value for debt is 35% and its standard deviation is 17%. The average value of cash flow is 16% and its standard deviation is 16%. On average, companies in our sample pay out about 6% of their assets in the form of dividends with a standard deviation of 7%. The average value for tobin'q is 3.13 with a standard deviation of 2.43. The mean value of financial distress is 0.24 with a standard deviation of 1.12. The first shareholder has been identified and the variables "1st Share" measure the percentage held by each of them. The first shareholder holds on average 48% of the capital. The average board size is eight members.



Table 5 below presents the correlation coefficients between the variables in our study. This matrix shows that all the explanatory variables are correlated with the explained variable with a risk of error below 1% with the exception of the financial distress and the 1st Share variables which have an insignificant correlation coefficient. The strongest positive correlation coefficient shows a correlation between cash and cash flow of 0.55, while the largest negative correlation coefficient concerns debt and the holding of liquidity to the value of -0.23. As for the other significant coefficients, it varies between -0.18 and 0.36. The correlation coefficients between the explained variable cash position and the explanatory variables, cash flow, dividend and board size are significant and positive; whereas the variables size, debt, and Tobin's Q are all negative and significant. Furthermore, no correlation coefficient reaches the threshold of 0.6. We can then conclude that our study is not affected by the risk of multicollinearity.

**Table 5. Correlation matrix**

Variable	Cash	Debt	Cf	Size	Divid	Tobin's q	Financial Distress	1st Share	BD-size
Cash	1.00	-0.23	0.55	-0.18	0.21	-0.13	-0.38	0.04	0.12
		**	**	**	**	**			**
Debt	-0.23	1.00	-0.20	0.31	-0.27	0.24	0.30	0.06	-0.02
	**		**	**	**	**	**		
Cf	0.53	-0.20	1.00	-0.02	0.46	0.12	-0.28	0.01	0.03
	**	**			**	**	*		
Size	-0.18	0.29	-0.02	1.00	0.15	0.30	0.09	0.15	0.36
	**	**			**	**	*	**	**
Divid	0.22	-0.27	0.48	0.17	1.00	0.19	0.23	0.12	0.10
	**	**	**	**		**	**	**	**
Tobin's Q	-0.13	0.23	0.12	0.29	0.19	1.00	0.11	0.20	0.16
	**	**	**	**	**		*	**	**
Financial distress	-0.05	0.10	-0.04	0.14	0.05	0.20	1.00	0.07	-0.06
		*		**		**			
1st Share	0.04	0.06	0.01	0.15	0.11	0.20	0.06	1.00	-0.05
				**	**	**			
BD-size	0.12	-0.02	0.03	0.37	0.10	0.16	-0.07	-0.05	1.00
	**			**	**	**			

Table 5 shows the Pearson correlation coefficients between all the explanatory and explanatory variables. We note that there are no correlation problems between the variables that could bias our results.

\*\* The correlation is significant at the 0.01 level (two-tailed)

\* The correlation is significant at the 0.05 level

## REGRESSION RESULTS AND INTERPRETATION

Table 6. Regression results

Variable	OLS	Fixed Effects	Random Effects
Size	-0.061	-0.132	-0.028
	***		
Debt	-0.102	-0.116	-0.083
	**	**	
CF	0.12	0.049	0.091
	*	*	**
Divid	-0.324	-0.379	-0.28
Tobin's q	-0.006	-0.007	-0.002
	**	**	*
Financial distress	-0.013	-0.036	-0.074
1st Share	-0.024	-0.101	-0.021
BD-size	0,011	0,005	0,002
	**	*	
Constant	0.445	0.249	0.354
	***		**
Observation	456	456	456
R2	0.192	0.112	0.17
F-Test		8.54 (0.18)	
		**	
Hausman Test			2.95 (0.00)
			***

Table 6 presents the results of the following three regression models that we estimated to examine the impact of our variables on liquidity levels for our total sample

Table 6 presents the estimation results using 3 regression methods: random effects, fixed effects and OLS. The explanatory variables in all regression models are: Size, Debt, Cash flow, Working capital requirement, Dividend, Family shareholding, Shareholder concentration.

\*\*\*The correlation is significant at the 0.01 level.

\*\*The correlation is significant at the 0.05 level.

\* The correlation is significant at the 0.1 level.

According to our estimation models, there is a significant relationship between cash holdings and all the explanatory variables with a risk of error between 1% and 10%, with the exception of the financial distress variable. This implies that this firm-specific characteristic is not relevant in explaining the cash-holding decisions of the firms in our sample. The majority of our significant results are consistent with our hypotheses based on agency theory, and are in line with most of the available empirical results. For example, we show that Moroccan firms hold less cash when their debt levels are high, supporting H2, which explains that debt is a disciplinary mechanism that reduces managers' discretionary latitude and forces them to spend excess cash (Jensen, 1986). Moreover, the positive and significant coefficient of cash flow at the 1% threshold according to our result validates our H.4 hypothesis. In fact, the cash

flow generated by the firm will be accumulated in order to build up cash reserves by managers to increase their discretionary power and become rooted in the firm. Finally, in line with Yogesh and Vigneswara (2017), we find that Moroccan companies with significant growth opportunities tend to accumulate less cash, thereby confirming H.5, which explains that the risk of over-investment is greater when companies have available liquidity funds and few investment opportunities, given that managers are more likely to accumulate the most cash to strengthen their discretionary power and increase their rooting within the company. The size of the board is positively related to the company's cash position at the 1 % threshold, which means that the larger the size of the director's board is, the higher the cash position is. In fact, a large board tends to increase agency costs (Yemack 1996). In addition, the lack of harmony between the ideas of board members gives managers room to maneuver and increase their discretionary power. This finding supports hypothesis H.8, that large boards of directors do not provide effective control over management, thereby increasing cash resources.

However, we found some results that clearly contradict our predictions. Our estimation model shows that larger Moroccan firms hold more cash on their balance sheets. This contradicts H1. It is important, however, to note that these two contrasting results to our hypotheses are in line with numerous empirical works based on financial structure theories (Ferreira & Vilela 2004; Bates et al. 2009; Graham & Leavy 2018).

## **5. CONCLUSIONS**

This paper studies the liquidity holding decision by Moroccan firms based on a sample of non-financial firms listed on the Casablanca Stock Exchange during the period 2007-2018 in light of agency theory and free cash flow theory. Our empirical results show that our two explanatory theories play an important role in explaining the behavior of Moroccan firms in terms of cash holdings. In fact, in line with the predictions of the agency and free cash flow theories, our results indicate that the level of indebtedness is negatively related to liquidity. We were also able to show that companies with a high level of cash flow and larger board accumulate significantly higher cash reserves. Finally, we have shown that companies with significant growth opportunities have a lower level of cash holdings than other companies. These results are consistent with the findings of Iskandar and Jia (2014) and Chen et al (2015).

## **LIMITATION AND IMPLICATIONS**

As with any research work, this paper has a number of limitations. The first one is a generic limitation, which all empirical studies suffer from. Indeed, the results obtained in our various studies have been obtained on samples and for specific periods of time. They are thus not universal and can be questioned by other samples.

Concerning the limitations specific to our study, we can conclude that our study could have gained relevance if the variable "cash holdings" used from company balance sheets was available on a monthly or quarterly basis. In fact, cash holdings change constantly during the year and a dynamic analysis would be more appropriate.

The main purpose of this work is to contribute to the preliminary results in this field and to shed additional light on a current topic still very little discussed in Morocco. This research has thus made it possible to broaden the field of knowledge in terms of cash holding decisions in Moroccan companies to the extent that we have made a minor contribution to the contextualization of existing knowledge in this research theme, as well as to the understanding of the behavior of companies and their main trends in terms of cash holdings, including the objectives and motivations of managers.

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# Minimum Wages, Relative Wages, and Productivity: An Empirical Analysis on Indonesia Food and Beverage Industry

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## ABSTRACT

*Abstract Background of the research: Previous study on minimum wages policy in Indonesia mostly focused on employment and welfare effect, while its relationship with productivity is lack. Purpose: This study tends to study the wages and productivity relationship using minimum wages increase information in Indonesia. This paper aims to calculate the time varying productivity using one step production function then implements difference-in-difference technique to measure the productivity changes due to the implementation of minimum wages policy. Methodologies: We choose the case of food and beverage industry in Indonesia and find a strong support for efficiency wages theory. This research takes information from medium to large firms within food and beverages industry in several region in Indonesia as a sample. The reason why this research used this sample is the importance of food and beverages industry in Indonesian economy. Principal results: Using standard panel regression, this paper also find evidence on positive relationship between relative wages and productivity. Major conclusions: The findings showed that firms adopting minimum wages policy show higher changes in productivity compared to firm that is already above the minimum wages. Contributions to the field: the study made a good attempt to examine a critical issue of relationship between minimum wage policy and total factor productivity changes for food industry in the context of Indonesia. Important aspects of the study: The important aspects of the study lie in the analysis of food demand as the indicator of agricultural markets.*

**Keywords** Efficiency Wages, Minimum Wages, Productivity, Employment

**JEL Classification Code:** E24, D24, J24, J38

## 1. INTRODUCTION

Classical economist believes that the relationship between wages and productivity is created by perfect market mechanism that equalizes marginal productivity of labor and its wages. Thus, by this mechanism there will be no unemployment in the economy as level of wages automatically decrease in respond to higher supply of labor. This mechanism might work in traditional sector as there is no labor differentiation and no rigidity in labor market But this mechanism may not work in current labor market condition as there are rules that make labor market more rigid.



**Figure 1. Indonesia Unemployment Rate 1986 – 2019**

The implementation of minimum wages policy is one factor that shows rigidity in labor market. This policy has been implemented in many countries both in developed and developing nations. Higher wages created by this policy are expected to create more unemployment by perfect labor market mechanism, but there are many finding no negative employment effect from minimum wages policy [1]. In Indonesia case, it is also found that minimum wages policy implementation has no negative effect on employment [2, 3]. Indonesia unemployment rate is also keep decreasing after 1998 financial crisis until August 2019, while there are minimum wages increase every year.

This wages and productivity relationship are viewed differently by Akerlof [4]. Based on his view and findings, there are not just level of wages that define productivity but its relative is also able to unleash more productivity. This view can explain why it is rational for firm to stay above market clearing wage, thus wages stay above market clearing and create unemployment. On the other side, this view can explain why minimum wages implementation has no negative impact on employment and has positive impact on productivity because firms may increase their labor productivity instead of cutting employment.

Another feature of minimum wages policy implementation is that it can create compression of wage inequality. Based on efficiency wages theory, the compression of relative wages variation may create positive productivity effect because worker feel more equal and its spur resource reallocation towards more productive activities. Theoretical discussion and previous study show that relative wages variation plays an important role in defining labor productivity [5, 6].

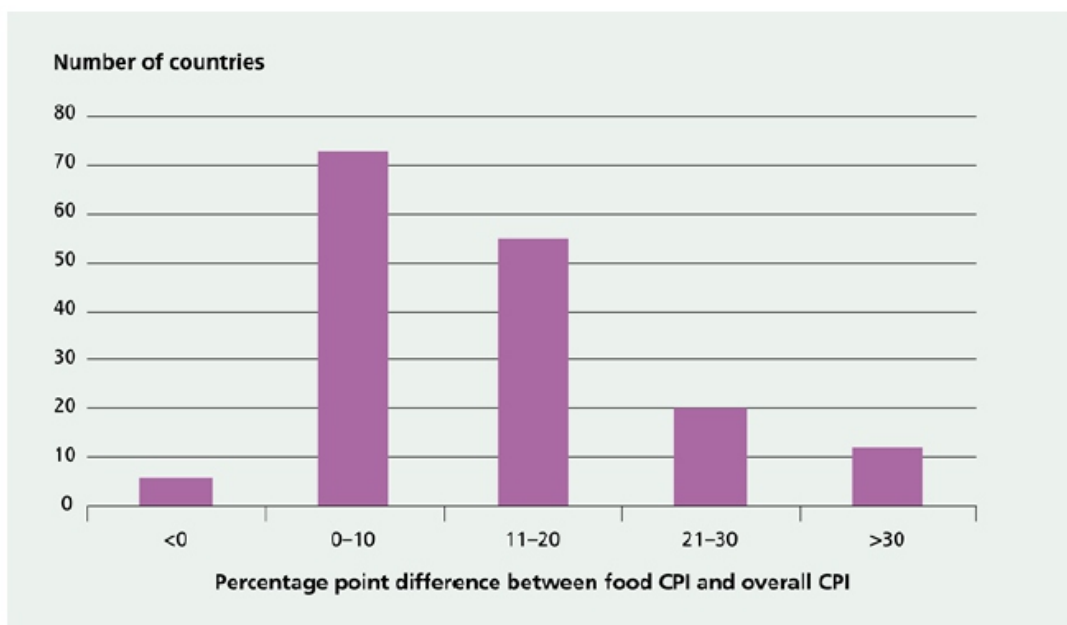
Previous study on minimum wages policy in Indonesia mostly focused on employment and welfare effect, while its relationship with productivity is lack. This study tends to study the wages and productivity relationship using minimum wages increase information in Indonesia. This research takes



information from medium to large firms within food and beverages industry in several region in Indonesia as a sample. The reason why this research used this sample is the importance of food and beverages industry in Indonesian economy.

The issue of wages and productivity relationship in food and beverages industry is relevant and very important for the following reasons; first, food demand is expected to increase in the range of 59% to 98% by 2050 [7]. This trend will shape agricultural markets [8]. We take this as important background for the processed food and beverage industry to face similar challenge by the next thirty years from now as this industry uses input mostly from agricultural sector.

The second reason why the issue is important and highly relevant is the fact that investment in agriculture in most developing countries has declined over the last 30 years and much less is spent on R&D compared to developed countries—resulting in low productivity and stagnant production [9, 10]. We are of the high interest to see this trend, and this paper assesses the labor productivity in food and beverage industry in developing country.



**CPI is consumer price index. The vertical axis shows the number of countries for each group.**

**Source: FAO, 2012 [10]**

**Figure 2. Average Difference between Food Prices and Overall Consumer Prices**

The third reason to examine this issue is the fact that food is the major contributor of inflation in most economies. About 127 countries in the world experience higher food price up to 20 points relative to the CPI; this accounts about half countries in the world. More than 30 countries experience event higher difference up to 30 points. Only less than 10 countries in the world experience the opposite, where the food prices on their country are lower than the overall consumer prices. High functioning food and beverages industry may increase the efficiency of agricultural market by its ability to increase the age of food and beverages, thus reducing waste (Figure 1).

The fourth reason to underline is the fact that the food and beverage industries pose significant potency on distributing welfare and reducing poverty. Worldwide, the food and beverage industry are highly concentrated with a just a few companies controlling thousands of brands around the world. To mention the few is Nestle, the world's largest food and beverage company with 6000 brands, Kraft Foods that

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sells snacks in 170 countries, PepsiCo with their Frito-Lay and Quaker Oats [11]<sup>1</sup>. We lay this fourth reason even though we do not specifically analyze the welfare distribution and poverty. Instead, we use this motive to start analyzing the link between wages and the productivity in this sector.

Hypotheses to test on this paper are: (i), There is a efficiency wages effect in Indonesia food and beverages industry; (ii) There is positive effect of minimum wages policy on firm productivity; (iii) There is a positive relative wage effect on productivity. To answer this hypothesis, we estimate production function following Wooldridge [12]. To measure the impact of minimum wage policy, we use difference in difference estimation; while the link is between wage and labor productivity we utilize standard panel data estimation. The results from difference-in-difference and panel data estimation used to support efficiency wages effect hypothesis.

Estimation result shows that firms adopting minimum wages policy show higher changes in productivity compared to firm that is already above the minimum wages. Furthermore, we also show that firms relative wages have significant effect on their productivity. These conclusions are robust across several years of new minimum wages introduction for the impact of minimum wages policy and several estimation techniques for relative wages effect on productivity.

The next section of this paper analyze the literature studies. Section three discusses the data and estimation method, while section four discusses the result and its analysis. Section five provides conclusion and will close the presentation of this paper.

## **2. LITERATURE REVIEW AND HYPOTHESIS**

### **2.1. Wages and Productivity Relationship**

The relationship between wages and productivity is first viewed differently by Akerlof [4]. His findings show worker with higher wages tend to give extra effort in doing their job as a gratitude for their employer. From this finding, it is said that the worker voluntarily increases their productivity because they got higher wages compared to other employee in another firms. The theory behind this relationship is equity theory, relative deprivation theory, and social exchange theory. Thus, this view gained much attention among economic literature.

There is also development in theoretical literature based on Akerlof [4] findings as it creates new feature in economic theory. First, it is rational for firm to stay above market clearing wage as they want to motivate their employee to stay above their competitor [6]. Second, it is rational for firm to give higher wage to increase employee opportunity cost in losing their job [13]. Third, it causes unemployment rate will not be able to arrive at zero point because wages stay at above market clearing wages [13].

As we follow Summers [6], there will be a productivity addition if one firm gives their worker higher wages compared to another firms in one location. This effect is based on efficiency wages hypothesis as it said that worker voluntarily increases their productivity as a gratitude for their employer that gives them more wages. Thus, not only wages define marginal productivity of labor, but their relative wages also play role in productivity determination. The relation between relative wage and productivity is also found by the study conducted in Sweden as the economy experiencing huge relative wage compression and decompression [5]. As firm managers are aware about this effect, then it will create macroeconomy impact that causes wages stays above market clearing rate, thus it creates unemployment [14].

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**Table 1. Previous Wages and Productivity Studies**

Year	Researcher	Main Objective	Method	Findings
2013	Mărginean & Chenic	Updates on current empirical proof about minimum wages theory and idea.	Literature review	Most empirical findings show no impact of minimum wages policy on unemployment, so they conclude that this type of study is no longer relevant.
2013	Magruder	Proof that minimum wages policy causes a big push in Indonesian economy	Spatial regression discontinuity	Found positive impact of minimum wages policy on formal sector but opposite on informal sector. Based on these findings, he concludes that minimum wages support big push
2000	Hibbs Jr. & Locking	Show the effect of wage dispersion and productivity in Sweden	Multiple Regression	Reduction of interindustry wage differentials evidently did, however, contribute positively to aggregate output and productivity growth
2008	Alatas & Cameron	Found the impact of minimum wages on unemployment	Quasi experimental	Found no negative impact of minimum wages policy on big firms in Indonesia.
2012	Del Carpio, Nguyen, & Wang	Found the impact of minimum wages on unemployment	Quasi experimental	The impact is varied among manufacturing firms in Indonesia, smaller firms tend to have negative impact while bigger firms are less affected.
2001	Rama	Found the impact of double minimum wages increase on unemployment	Multiple regression dummy variable	The impact is different between small and big firms, where smaller firms have negative impact while bigger firms.
2008	Draca, Machin, dan Reenen	Found the impact of double minimum wages increase on firms profit	Quasi experimental	For the case of firms in England, minimum wages policy has negative impact on firms profit.
2016	Long & Yang	Found the impact of double minimum wages increase on firms profit	Multiple Regression	For the case of firms in China, minimum wages policy has negative impact on firms profit.
2013	Georgiadis	Proofing minimum wages prevail as efficiency wages effect	Quasi experimental	Minimum wages cause firms supervision cost to decrease
2010	Owens & Kagel	Found the impact of double minimum wages increase on labor productivity	Quasi experimental	For the case of firms in England, minimum wages policy has positive impact on labor productivity.
2004	Galindo-Rueda & Pereira	Found the impact of double minimum wages increase on firm productivity	Quasi experimental	For the case of firms in England, minimum wages policy has positive impact on firm productivity.
2016	Rizov, Croucher, & Lange	Found the impact of double minimum wages increase on firm productivity	Quasi experimental	Minimum wages policy has positive impact on firm productivity, the impact is higher in England.
2015	Riley & Bondibene	Found the impact of double minimum wages increase on labor productivity	Quasi experimental	Minimum wages policy has positive impact on labor productivity and firm productivity.

There is another reason that makes it rational for firms to keep their wages higher than market clearing wages as documented by [13]. By setting their wages higher, firm is making their worker opportunity cost of losing the job become higher. This creates worker self-awareness to avoid shirking behavior as shirking may cause them losing the job and firms may lower supervision cost [15].

Another cause wage always stays at above market clearing is government policy in setting minimum wages. This policy enables firms to adjust their wage below certain line in response to higher labor supply. This policy is also forcing firms with low productivity to increase their productivity or exit from the market. While this policy may cause higher unemployment rate because higher supply of labor, several studies have shown that there is no increase in unemployment because minimum wages increases [2, 3, 1]. Therefore, firms must increase their cost and decrease their profit as employee structure does not change in rising minimum wages or firms may adjust their productivity to close the gap and keep profit rate unchanged [16, 17]. We have documented several studies that relate wages and productivity in Table 1.

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We have shown that many previous studies found relationship between wages and productivity, especially related to minimum wages implementation. Several studies found that minimum wages policy increases labor and firm productivity while the other shows that it decreases firm profit. These findings are also the reason why many previous studies were unable to found unemployment effect of minimum wages policy.

## **2.2. Minimum Wages Policy Research in Indonesia**

There are several studies about minimum wages policy implementation in Indonesia but most of them are focused heavily on its employment effect or welfare, while the effect on employment may be limited as previous study found in several countries [1]. Limited effect of minimum wages policy implementation on employment in Indonesia is expected because of lower obedience rate and high portion of Indonesia worker in informal sector [18]. This low obedience rate might also create ineffective minimum wages policy in increasing welfare. In contrast, study conducted by Magruder [3] shows minimum wages policy in Indonesia might create a big push by increasing formal employment rate and decreasing informal employment rate.

Minimum wages in Indonesia increase sharply between 1990 and 1996, from this sharp increase Alatas & Cameron. [2] shows no negative employment impact for large establishment but worker in smaller establishment may have suffered from job losses as a result of minimum wages increase. This finding suggests that larger firms can adjust its cost structure or revenue other than adjusting their employment structure. Larger firms may also have good management quality that is able to increase its productivity as cost of labor increase by minimum wages policy.

The effect of minimum wages policy in Indonesia is also found to reduce wage inequality [19]. This effect is significant because minimum wages enforce firms below minimum wages line to increase its wage, so the difference among firms decreases. This effect is important because there may be productivity related effect from more equal wages as proposed by efficiency wages hypothesis and may effect resource allocation towards more productive activities as found in Sweden wages variation compression and decompression study by Hibbs Jr. & Locking [5]. Moreover, the relationship of relative wages and productivity is also found to be matched with the theory and previous study that we found [5, 20, 21].

## **2.3. Research Objectives and Hypotheses**

This research aims to understand the wages and productivity relationship to fill the gap in the literature of minimum wages policy impact in Indonesia. We have formulated several hypotheses to answer our research objective based on theoretical framework and previous studies on wages and productivity relationship. We formulate one hypothesis that exploits minimum wages policy implementation in Indonesia and one hypothesis that relates relative wages difference between firms to understand wages-productivity relationship as formulated by Akerlof [4]. We used sample from medium to large firms in food and beverages industry to answer the hypothesis as this industry play major role in Indonesian manufacture.

1. Firms that adjust their wages after the introduction of new minimum wages policy have higher productivity change compared to another firms. This hypothesis is based on argument that firms tend to increase their productivity instead of cutting employment in respond to minimum wages increase as there is no negative effect on employment after minimum wages increase in Indonesia especially for large establishment [2]. Higher productivity is also expected from efficiency wages effect that sourced from the compression of relative wages variation as minimum wages policy in Indonesia found to decrease wage inequality [19]. Another source that may increase firm productivity after minimum wages increase is resource reallocation towards more productive activities [5].

2. Relative wages have positive effect on firm productivity. This hypothesis is based on efficiency wages theory and previous empirical findings on wages and productivity relationship. This hypothesis is used to support the explanation of hypothesis 1.

### 3. METHODS

This research employs methodology that was mostly used in previous studies that we found to proof our hypotheses. We separate the methodology in three parts, (1) productivity estimation, (2) standard panel data regression to proof wages and relative wages relationship with firm productivity, and (3) natural experiment using minimum wages policy implementation to understand wages and productivity relationship.

#### 3.1. Data and Variables

This research uses firm level data from Medium-Large Manufacturing Firm Survey Indonesian Statistical Agency for the period of 2010 – 2015. Other data are taken from Indonesia's Central Bureau of Statistics (regional consumer price index) and local government decree (minimum wages). Table 2 is the description of variable used in this research.

**Table 2. Description of Variable used in this research**

Variable	Code	Description
Value of Output	Y	Firm total production value using constant price.
Production Worker	L	Daily average of total production worker in one year.
Capital	K	Estimated of firm total fixed asset in year of survey using constant price.
Raw Material	R	Firm total raw material value using constant price.
Deflator	CPI	Regional Consumer Price Index
Production Worker Income per capita	WAGEP	Total of production worker income in one year using constant price per Number of Production Worker
Minimum Wages	MWAGE	Regional minimum wages based on each region decree
Relative Wages	rw	Ratio of production worker income per capita and its average in each location.
Treatment	T	$T_i = \begin{cases} 1 & \text{if } WAGE_{it-1} < MWAGE_{it} \times L_{it} \times 12 < WAGE_{it} \\ 0 & \text{otherwise} \end{cases}$ where $WAGE_{it}$ is total of production worker income in one year and $MWAGE_{it}$ is regional minimum wages.
Period Dummy	D	$D_t = \begin{cases} 1 & \text{Period for } t \\ 0 & \text{Period for } t - 1 \end{cases}$
Dummy Interaction $T_i$ and $D_t$	TD	Dummy interaction ( $T_i * D_t$ ) to calculate the effect of minimum wages policy.
Total Factor Productivity (TFP)	P	Calculated using equation (3.2.2a) based on estimated production function parameter
Labor Productivity	LP	Calculated using equation (3.2.2a) based on estimated production function parameter
Capital Productivity	KP	Calculated using equation (3.2.2a) based on estimated production function parameter

#### 3.2. Production Function Estimation and Productivity Calculation

This research employs Cobb-Douglas production function to calculate productivity. Production function parameters are estimated using one step production function estimation as proposed by Wooldridge [11]. Using linearized CD production function,

$$y_{it} = \alpha + w_{it}\beta + x_{it}\gamma + v_{it} + e_{it}, \quad (3.2.1)$$

where all variables denoted in lowercase are in natural logarithmic form,  $w_{it}$  is 1 x J vector of input variable,  $w_{it}$  is 1 x K vector of fixed variable,  $v_{it}$  is unobserved productivity, and  $e_{it}$  is white noise.

Wooldridge (2009) accommodated previous model proposed by Olley Pakes (OP) dan Levinsohn Petrin (LP) to offer one step production function estimation using Generalized Method of Moment.

Moments condition is derived from production function characteristics as in OP and LP. This method is using raw material as a proxy for productivity as in LP.

In executing Wooldridge [11] production function estimation, we employ prodest module in Stata. Prodest is developed by Mollisi and Rovigatti [22] to provide several productivity estimation techniques including one proposed by Wooldridge [11]. Input variable ( $w_{it}$ ) used in the calculation is number of production worker in natural logarithmic form, and fixed variable ( $x_{it}$ ) is total estimated fixed asset using constant price in natural logarithmic form and uses raw material for productivity proxy ( $m_{it}$ )

Estimated parameter is used to calculate total factor productivity ( $P_{it}$ ), labor productivity ( $Lp_{it}$ ), and capital productivity ( $KP_{it}$ ) using this equation.

$$p_{it} = y_{it} - (\beta * l_{it} + \gamma * k_{it}) \quad (3.2.2a)$$

$$lp_{it} = \ln(\beta * \frac{Y_{it}}{L_{it}}) \quad (3.2.2b)$$

$$kp_{it} = \ln(\gamma * \frac{Y_{it}}{K_{it}}) \quad (3.2.2c)$$

### 3.3. Detecting Efficiency Wages Effect

This research exploits minimum wages policy as a natural experiment to understand wages and productivity relationship using difference-in-difference technique. This method is used because it is able to support research objectives as it used by previous study similar to this research [16, 23]. Using standard difference-in-difference equation,

$$P_{it} = \alpha + \gamma T_i + \beta D_{p=1} + \delta(T_i * D_{p=1}) + \varepsilon_{it} \quad (3.3.1)$$

where  $P_{it}$  is total factor productivity,  $T_i$  is firm that affected by minimum wages policy,  $D_t$  is dummy for denoting time before and after minimum wages policy, and  $\varepsilon_{it}$  is error term.

This research also used standard panel regression technique to understand efficiency wages hypothesis using relative wages information.

$$p_{it} = \alpha + \beta_1 rw_{it} + \beta_2 wagep_{it} + \beta_3 size_{it} + \beta_4 AGE_{it} + \beta_5 DLOC_i + \beta_6 DURB_i + \varepsilon_{1it} \quad (3.3.2a)$$

$$lp_{it} = b + \beta_7 rw_{it} + \beta_8 wagep_{it} + \beta_9 AGE_{it} + \beta_{10} DLOC_i + \beta_{11} DURB_i + \varepsilon_{2it} \quad (3.3.2b)$$

$$kp_{it} = c + \beta_{12} size_{it} + \beta_{13} AGE_{it} + \beta_{14} DLOC_i + \beta_{15} DURB_i + \varepsilon_{2it} \quad (3.3.2c)$$

Parameters in equation (3.3.2) are estimated using several panel data regression techniques (fixed effect, random effect, and maximum likelihood) to make sure the consistency of relationship.

Estimation results from equation (3.3.1) and (3.3.2) are used to support efficiency wages hypothesis. The presence of this effect in the economy is supported if the result from (3.3.1) found positive relationship between minimum wages policy and productivity and the results from (3.3.2) found positive relationship between relative wages and productivity.

## 4. RESULTS AND DISCUSSION

### 4.1. Selection and Description of Areas

This research selects several regions that have relatively huge concentration of food and beverages firm. Selected region has at least 30 firm samples within 2010 – 2015 period. Table 3 reports all the region used in this research.

**Table 3. Number of Firms in Selected Region**

No	Region	Number of Firms	% of Total Firms in Food and Beverages Industry
1	Sidoarjo, East Java	82	3.99
2	Kebumen, Central Java	77	3.75
3	Banyuwangi, East Java	71	3.45
4	Garut, West Java	65	3.16
5	Cirebon, West Java	63	3.06
6	Pati, Central Java	58	2.82
7	Indramayu, West Java	47	2.29
8	Jember, East Java	42	2.04
9	Asahan, North Sumatra	39	1.90
10	Kediri, East Java	39	1.90
11	Surabaya, East Java	34	1.65
12	Tulungagung, East Java	31	1.51
13	Makassar, South Sulawesi	31	1.51
14	Pasuruan, East Java	30	1.46
	Total	709	34.48

### 4.2. Production Function Estimation Results

Estimated production function parameters are used to calculate firm's productivity in each period. Variables used to estimate production function is firm output, capital, production worker, and raw material. All variables are estimated in its natural logarithmic form. Table 4 reports its descriptive statistics.

**Table 4. Production Function Variables Descriptive Statistics**

Statistics	Variables			
	<i>y</i>	<i>k</i>	<i>l</i>	<i>r</i>
Mean	14.82	13.04	3.54	14.21
Maximum	23.55	26.25	8.34	23.32
Minimum	9.85	6.03	0.69	6.33
Standard Deviation	1.83	1.95	0.95	1.92

**Source: Author calculation**

Table 5 reports the estimation results. All estimated coefficient shows positive sign as predicted by theory and has strong significance level. The result of Wald constant return to scale test shows that this estimated production function is not following constant return to scale.

**Table 5. Production Function Estimation Results**

<b>Wooldridge (2009) Productivity Estimator</b>						
<b>Observation: 3610</b>						
<b>Group: 722</b>						
<b>Wald test on constant return to scale: Chi2 = 8,61, p-value = 0,00</b>						
<i>y</i>	Coef.	Std. Err.	<i>z</i>	P> <i>z</i>	[95% Conf. Interval]	
<i>l</i>	0.21	0.01	16.30	0.00	0.18	0.24
<i>k</i>	0.05	0.01	4.97	0.00	0.03	0.08
<i>r</i>	0.80	0.02	32.93	0.00	0.75	0.85

Source: Author calculation

Table 6 and Table 7 respectively show descriptive statistics used in the model we estimate and correlation matrix between independent variables. From the tables, we make sure that we did not faced by multicollinearity problem. The highest correlation coefficient is between wage per capita and relative wage, but it is still relatively low <0.8 to cause multicollinearity problem.

**Table 6. Descriptive Statistics of Relative Wages Related Variables**

Statistics	Variables						
	<i>wagep</i>	<i>rw</i>	<i>size</i>	<i>age</i>	<i>p</i>	<i>lp</i>	<i>kp</i>
Mean	8.8	-0.1	3.54	16.02	13.3	9.74	-1.06
Maximum	15.28	49.64	8.34	107	21.11	16.62	6.57
Minimum	4.79	-0.99	0.69	0	8.52	5.22	-9.97
Standard Deviation	1.69	1.13	0.95	16.2	1.63	1.44	1.51

Source: Author calculation

**Table 7. Correlation Matrix of Relative Wages Related Variables**

	<i>wagep</i>	<i>rw</i>	<i>size</i>	<i>age</i>
<i>wagep</i>	1.00			
<i>rw</i>	0.51	1.00		
<i>size</i>	0.10	0.02	1.00	
<i>age</i>	0.16	0.05	0.23	1.00

Source: Author calculation



First to discuss is natural experiment of wages and productivity relationship based on minimum wages increase every year during 2011 – 2015 in Indonesia. The results of minimum wages increase are found to have positive effect on firm productivity in food and beverages industry. Table 8 show positive significant sign in interaction variable in most year of minimum wages increase, only for year 2013 that shows different sign. These results imply that firms which previously operate under minimum wages and adjust its wages to match minimum wages have higher productivity change compared to another firms.

We believe that these results are robust because there is consistent strong positive effect in most observation period. The effect in year 2012 – 2013 is excluded because there may have another effect from economic crisis that causes productivity to decrease. In year 2012 both labor and capital productivity increase but not significant so the sign of total factor productivity is still positive and we can still high confidence for positive effect, while in 2013 we have weak negative effect on labor productivity and positive effect on capital productivity so in total we have insignificant positive effect on total factor productivity.

**Table 8. Estimation Results for Minimum Wages Effect on Productivity**

Year	Variables	Variables, <i>p</i> -value in ()							
		$T_t$	$D_{p=1}$	$T_t * D_{p=1}$	Constant				
2011	<i>p</i>	0.619**	(0.00)	-0.035	(0.30)	0.723**	(0.00)	13.06**	(0.00)
	<i>lp</i>	0.334*	(0.01)	-0.153**	(0.00)	0.695**	(0.00)	9.651**	(0.00)
	<i>kp</i>	-0.323*	(0.02)	0.044	(0.27)	0.622**	(0.00)	-1.172**	(0.00)
2012	<i>p</i>	-1.307**	(0.00)	-0.006	(0.88)	0.121 <sup>†</sup>	(0.08)	13.83**	(0.00)
	<i>lp</i>	-1.121**	(0.00)	0.009	(0.84)	0.073	(0.27)	10.17**	(0.00)
	<i>kp</i>	0.018	(0.87)	-0.058	(0.34)	0.092	(0.30)	-1.089**	(0.00)
2013	<i>p</i>	0.684**	(0.00)	-0.009	(0.76)	0.052	(0.46)	13.15**	(0.00)
	<i>lp</i>	0.674**	(0.00)	0.025	(0.43)	-0.074	(0.30)	9.569**	(0.00)
	<i>kp</i>	-0.228	(0.11)	-0.003	(0.94)	0.244*	(0.02)	-1.050**	(0.00)
2014	<i>p</i>	0.572**	(0.00)	0.069 <sup>†</sup>	(0.08)	0.368**	(0.00)	13.19**	(0.00)
	<i>lp</i>	0.545**	(0.00)	0.078**	(0.04)	0.273**	(0.00)	9.623**	(0.00)
	<i>kp</i>	-0.004	(0.97)	0.030	(0.56)	0.398**	(0.00)	-1.050**	(0.00)
2015	<i>p</i>	0.451*	(0.01)	-0.048	(0.15)	0.408**	(0.00)	13.36**	(0.00)
	<i>lp</i>	0.626**	(0.00)	-0.004	(0.90)	0.289**	(0.00)	9.766**	(0.00)
	<i>kp</i>	-0.307 <sup>†</sup>	(0.10)	-0.070	(0.13)	0.362**	(0.00)	-0.916**	(0.00)

\*\*/\*/<sup>†</sup> are significance sign sign for 0,01/0,05/0.1

**Source: Author calculation**

To support the explanation of Table 9, it reports the estimation results of relative wages and productivity relationship.

The second estimation results are reported in Table 9 supporting argument for efficiency wages effect. The results show positive significant effect of relative wages on total productivity and labor

productivity. This relationship is consistent among 3 models reported in the table. This result is a strong indication that efficiency wages effect exists in Indonesia food and beverages industry and there may be the cause for firm productivity increase after the increase of minimum wages that compress the relative wages variation.

Strong indication of minimum wages effect positive impact on productivity is supported by these findings. Evidence from Table 6 showed how minimum wages have a positive impact on firm productivity, while Table 9 shows positive relationship between relative wages and productivity. This may explain why there is no negative employment effect from minimum wages increase, as firms are able to increase their productivity after adjusting to minimum wages. The source of productivity increases may be explained by evidence from Table 4.6, as relative wages have significant effect on firm productivity, the compression of relative wages experienced by firms that adjust their wages to minimum wages increases their labor and total factor productivity.

**Table 9. Estimation Results for Relative Wages and Productivity Relationship**

Independent Variables	Dependent Variables								
	p			lp			kp		
	[1]	[2]	[3]	[1]	[2]	[3]	[1]	[2]	[3]
<i>constant</i>	11.27** (0.00)	10.23** (0.00)	10.51** (0.00)	9.161** (0.00)	8.691** (0.00)	8.763** (0.00)	-3.034** (0.00)	-2.366** (0.00)	-2.369** (0.00)
<i>size<sub>it</sub></i>	0.419** (0.00)	0.576** (0.00)	0.518** (0.00)	-	-	-	0.556** (0.00)	0.447** (0.00)	0.447** (0.00)
<i>age<sub>it</sub></i>	-	0.012** (0.00)	0.014** (0.00)	-	0.011** (0.00)	0.013** (0.00)	-	-0.013** (0.00)	-0.013** (0.00)
<i>wagep<sub>it</sub></i>	0.062** (0.00)	0.084** (0.00)	0.072** (0.00)	0.067** (0.00)	0.088** (0.00)	0.077** (0.00)	-	-	-
<i>rw<sub>it</sub></i>	0.074 <sup>†</sup> (0.07)	0.097* (0.04)	0.09** (0.00)	0.09* (0.05)	0.107* (0.04)	0.102** (0.00)	-	-	-
<i>DURB<sub>t</sub></i>	-	0.898** (0.00)	0.919** (0.00)	-	0.893** (0.00)	0.888** (0.00)	-	-0.34 <sup>†</sup> (0.08)	-0.34* (0.03)
<i>DLOC<sub>t</sub></i>	-	0.00702 (0.83)	0.0034 (0.91)	-	0.0417 (0.23)	0.0446 (0.16)	-	-0.165** (0.00)	-0.165** (0.00)
Observation	4332	4332	4332	4332	4332	4332	4332	4332	4332

*()*: p-value  
 \*\*/\*/† are significance sign sign for 0.01/0.05/0.1  
 [1]: fixed effect robust standard error  
 [2]: random effect robust standard error  
 [3]: maximum likelihood

**Source: Author calculation**

## 5. CONCLUSIONS

This research found supporting evidence on efficiency wages theory, where minimum wages may increase firm productivity thus it is not creating unemployment. The relationship of relative wages and productivity is also found to be matched with the theory and previous study. This relationship may explain the source of firm productivity increase after adjusting their wage to accommodate minimum wages policy. This research findings suggest that minimum wages policy is important tool to create more equitable distribution of wages, while it may also be used to spur productivity and thus development process.

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# Improved Methodology of Accounting and Audit of Payments to Employees in Ukraine

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## **ABSTRACT**

*The issue of organization of payments to employees at the enterprise is the basis of social and labour relations of employees, employers and the state, affecting the effectiveness of labour management in general, they are one of the most critical and complex areas of work, occupying a central place in the accounting system. The authors analyzed the theoretical and methodological basis of payments to employees, compared to international and domestic standards for employee benefits. Authors also analyzed the dynamics of average and minimum wages over the past 10 years, and revealed the features of the organization of wages and the general scheme of accounting for wages. The authors demonstrated the essence of the concept of "payments to employees" and its components, analyzed in detail the features of the existing practice of accounting and audit of settlements with employees. A thorough theoretical and methodological analysis of the study allowed the authors to propose improvements in accounting for settlements with employees on practical examples, namely the detailed structure of account 66 "Payments to employees". The authors also proposed an improved audit methodology that will allow the auditor to cover all aspects of payroll accounting, investigate the correctness, timeliness, legality of reflection in payroll, cover all aspects of payroll accounting, identify violations promptly, conduct a quality audit.*

**Keywords** Accounting, Audit, Employee, Payment, Salary

## **1. INTRODUCTION**

Theoretical and practical aspects of settlements with employees are relevant; it is one of the most challenging economic categories. Accounting for payments to employees is one of the most critical and complex work areas, occupying one of the central places in the entire accounting system [1-3]. For employees to receive wages and other benefits, it is crucial to promptly make the necessary calculations and draw up documents correctly [4-6]. Besides, wages are one of the factors of efficiency of the enterprise, as the amount of accrued wages, timeliness and completeness of payments to employees affect the quality of work of employees and the number of costs of the enterprise. Besides, wages are the basis for calculating a single social contribution and withholding personal income tax [7-8]. Accounting for labour and benefits is one of the most important and complicated in the enterprise's entire accounting system. In any company, this section of accounting is mandatory; it is complicated and time-consuming. That is why the problematic issues of accounting for settlements with employees need in-depth research, as their solution, in turn, will have a positive impact on the formation of reliable

information on the calculations of wages of employees, both tax and statistical accounting in general. Besides, the constant changes in the legal and organizational framework of accounting require the modern accountant to make timely adjustments both in accounting and when displaying information about wages in the enterprise's reporting [9-11]. Due to constant changes in legislation, when conducting inspections of wages, there are often deviations of accounting data from these inspections; there is also no audit methodology for checking settlements with employees at the enterprise.

## **2. THEORETICAL AND METHODOLOGICAL ISSUES OF ACCOUNTING AND AUDIT OF PAYMENTS TO EMPLOYEES**

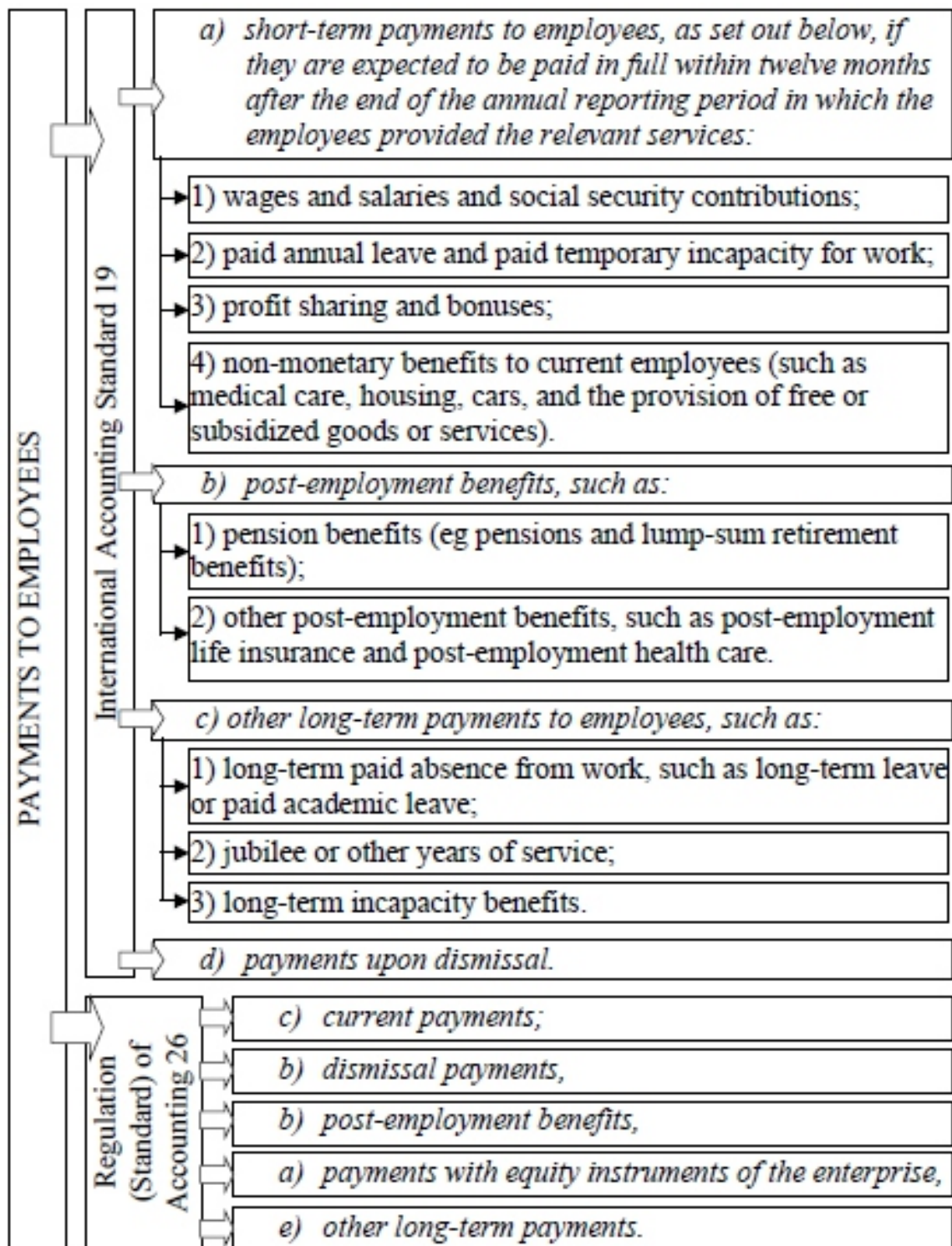
### **2.1. Theoretical Issues of Accounting Payments to Employees**

Payments to employees represent a significant share of the company's costs, so the correctness and reliability of the reflection in the accounting of information on wages significantly impact the financial result of economic activity. In today's society, the issue of settlements with employees of the enterprise is increasingly attracting practitioners' attention. It is vital in the reproduction of the social product, one of the main factors in ensuring the efficiency of the economy, and the main component of employee benefits.

By International Accounting Standard (IAS) 19, employee benefits, employee benefits are all forms of compensation provided by an entity in exchange for employees' services [12]. As for the employee's services, he may provide them full-time or part-time, based on permanent, periodic or temporary employment.

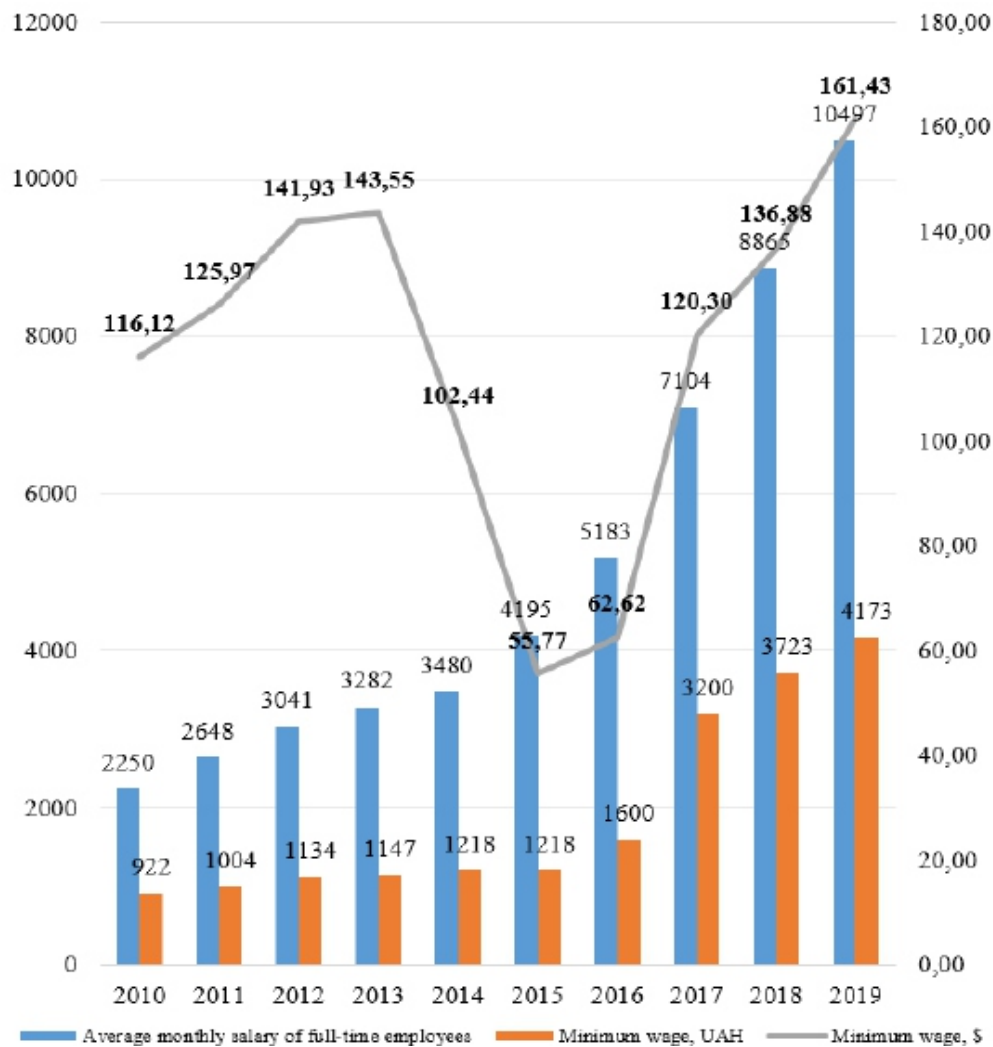
Methodological principles of formation in the accounting of information on payments (in monetary and non-monetary forms) for work performed by employees, and its disclosure in the financial statements is determined by Regulation (Standard) of Accounting 26 "Payments to employees", which came into force on January 1, 2004 [13]. Employee benefits include benefits provided to either employees or their dependents and may take the form of cash benefits (or goods and services) directly to employees, their wives, husbands, children or other dependents or others, such as insurance companies.

We compare IAS 19 and ARS 26 on the classification of employee benefits (Fig. 1).



**Figure 1. Classification to employees with workers according to IAS 19 and ARS 26**

As a rule, wages account for more than 60% of all payments to employees [14], so let's analyze this category's dynamics (Fig. 2).



**Figure 2. Dynamics of average and minimum wages**

According to Fig. 2, the largest declines in minimum wages in dollar terms occurred in 2014 (-28.6%) and 2015 (-45.6%). Since 2016, there has been a gradual, and since 2017 a record (by 92.1%) increase in the minimum wage and it amounted to UAH 3,200. The average salary is also growing, from 2016 to 2019 it grew by about 25% annually.

The main document that determines the order of organization of wages at the enterprise, the size of the basic and additional wages, the order of bonuses for employees, is the Regulations on wages at the enterprise.

**This document should contain information about:**

- general principles of organization of remuneration at the enterprise, systems and forms of remuneration applicable to different categories of employees;
- staffing of employees of the enterprise;
- construction of the basic (tariff) payment with instructions on positions and professions of tariff rates and salaries or the order of calculation, depending on indicators of work of the worker and the enterprise as a whole;
- stipulated surcharges, allowances and compensations with the indication of their sizes;
- other bonus systems used at the enterprise and the bonus scale.



Current regulations carry out the organization of remuneration in Ukraine; general agreement at the state level; sectoral and regional agreements; collective agreements; employment contracts; other enterprises' internal regulations (Fig. 3).

Wages consist of basic, additional wages and other incentive and compensation payments. According to the Law of Ukraine "On Remuneration of Labour", the basic salary is the remuneration for the work performed following the established labour standards (time norms, production, maintenance, job responsibilities). It is set in the form of tariff rates (salaries) and piece rates for workers and salaries for employees.

Additional salary is a reward for work above the established norms, labour successes and ingenuity, and special working conditions. The additional salary fund includes surcharges, allowances, guarantees and compensatory payments provided by the current legislation, the bonuses connected with the performance of production tasks and functions.

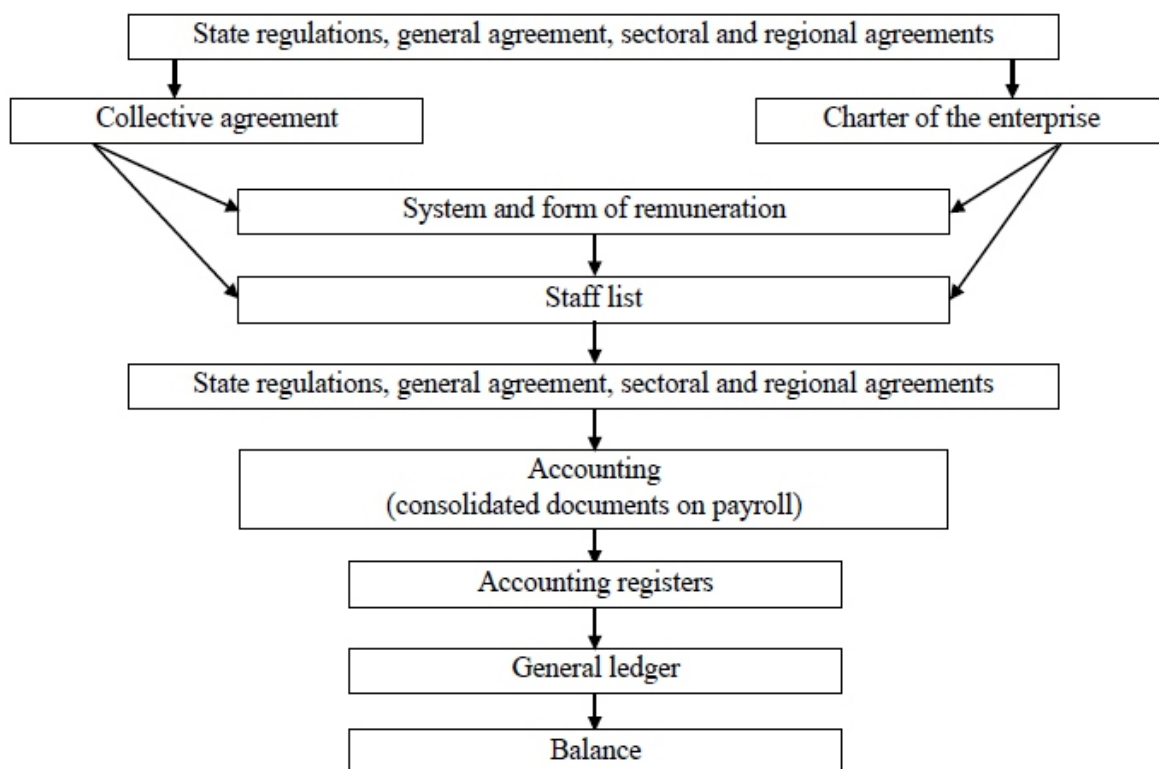


Figure 3. General scheme of the organization of accounting for payroll (compiled by the authors based on [15]) The main payments include guarantee payments. Guarantee payments are the amounts that retain the employee's salary (in whole or part) for the time when he is released from work for valid reasons provided by law and retains his job. The primary guarantee payments include payments to employees for the performance of state or public duties; payments when moving to work in another area; payments for business trips; payments for in-service training; payments for the time spent in a medical institution for examination; payments to donors; payments to employees-authors of inventions, utility models, industrial designs and innovation proposals; payments for participation in collective bargaining and preparation of a draft collective agreement or arrangement; payments to independent mediators, members of conciliation commissions and labour arbitrations while working in conciliation bodies, i.e. for participation in resolving a collective labour dispute. Guarantee surcharges are paid to the employee in case of reduced earnings. The main types of guarantee surcharges include:

- surcharges for minors;
- surcharges when transferring an employee to another job and when moving and in other cases.

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Compensation benefits are amounts paid to employees in excess of their remuneration to compensate them for the costs associated with the performance of their duties and the costs associated with moving to another place of employment. They are not included in the salary.

Other incentives and compensatory payments are payments in the form of remuneration based on the results of work for the year, bonuses under special systems and regulations, compensation and other payments that are not provided by current legislation or which are made in excess of these norms.

Following ARS 26, payments for unworked time that are not subject to accumulation are non-accrued benefits that are not eligible for future periods [13]. These include the payment of annual leave and study leave, additional leave for employees who have children, payment of the first five days of temporary disability benefits, and actually unworked time by Art. 51 of the Labour Code (payments to employees engaged in part-time work). Dismissal benefits are payments to an employee that is payable by the company's decision to dismiss the employee until he reaches retirement age or by the decision of the employee to dismiss at his request until he reaches retirement age.

When dismissing employees on the initiative of the owner or his authorized body within three months, due to changes in the organization of production and labour, in addition to severance pay, such employees are paid the average salary for the period of employment, but not more than three months from the date release. The average salary is paid in this case, taking into account the amount of severance pay (Article 49-3 of the Labour Code). If such a dismissed employee got a job earlier, before the expiration of three months, these amounts' payment is suspended.

Post-employment benefits are payments to an employee (other than redundancies and equity payments of an enterprise) that are payable at the end of an employee's employment.

We are talking about pensions (pensions) and other benefits at the end of employment (life insurance, medical care). All employee benefit plans are divided into defined contribution and defined benefit plans upon the termination of employment. A defined contribution plan is when an enterprise that employs an employee determines, following a statutory or otherwise established formula, the number of payments to the fund and the end of its obligations to both the fund and the employee. A defined benefit plan is any other program other than a defined contribution plan (for example, when you determine in advance the amount that an employee should receive upon retirement and, based on that, determine the number of contributions to the fund).

Payments of equity instruments of the enterprise – payments to the employee for which he is entitled to receive financial instruments of equity issued by the enterprise (or its parent company), or the amount of liabilities of the enterprise to the employee depends on the future price of financial instruments of equity issued by the enterprise, stock options and other equity instruments issued to employees at a cost below the fair value at which those instruments would be issued to a third party; cash payments that will depend on the future market price of the entity's shares). Agreements under which an enterprise makes payments to employees of an enterprise using equity instruments are called payment programs. Such payments are made at enterprises owned by employees and holding shares in the assets of the enterprise.

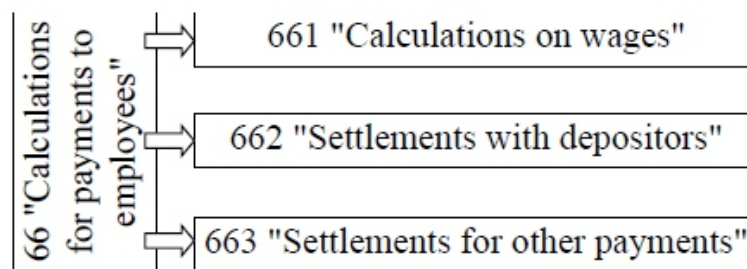
Other long-term employee benefits are employee benefits (other than post-employment benefits, redundancy payments and equity payments) that are not payable in full within twelve months after the end of the month in which the employee performed the work.

Thus, payments to employees are all forms of compensation provided by an entity in exchange for employees' services. ARS 26 sets out five types of benefits: current employee benefits, redundancy benefits, post-employment benefits, equity payments, and other long-term benefits. The share of current payments at enterprises of any form of ownership is the largest.

An important issue is the study of accounting and audit of settlements with workers.

## 2.2. Accounting of Payments to Employees

To summarize the information on settlements with the payroll staff, the Chart of Accounts provides for a passive balance sheet account 66 "Settlements for payments to employees", which according to Instruction № 291 has the following sub-accounts (Fig. 4).



**Figure 4. Detailing account 66**

The first sub-account reflects the amount of accrued wages to employees who belong to the accounting and non-accounting staff.

The second – reflects the arrears of wages, which is transferred from the first sub-account, if the employee for some reason within a specified period did not receive a salary.

Credit 661 shows the amounts of accrued wages and benefits that are not included in the wage fund. Debit 661 reflects the amounts paid, including the cost of payments in kind, all types of deductions from wages, deposited amounts of unpaid wages.

The company's labour costs are one of the main elements of the enterprise's operating costs. They are associated with almost all enterprise activities, so their reflection should be guided by the provisions of the Regulations (standards) of accounting reflection should be guided by the norms of the Regulations (standards) of accounting. Consider the regular correspondence of accounts for the accrual of wages, other incentive and compensation payments (Table 1).

**Table 1. Typical correspondence of accounts for the calculation of wages, other incentive and compensation payments**

Contents of business transactions	Corresponding accounts	
	Debit	Credit
1. Accrued wages for work performed on the construction and improvement of fixed assets	15	66.1
2. Accrued wages:		
• employees of the main production	231	
• employees of service industries and farms	233	
• employees engaged in the maintenance and repair of machines and mechanisms	911	66.1
• line personnel and other general production workers	912	
• administrative and managerial staff	92	
• employees engaged in the sale of finished products	93	
3. Accrued surcharges, bonuses and salaries to employees for work not related to production activities	949	66.1
4. Accrued wages to employees for work related to the liquidation and write-off of non-current assets	976	66.1
5. Accrued wages to employees engaged in labour to correct the marriage	24	66.1
6. Accrued wages to employees engaged in cargo operations and the purchase of materials and other inventory	201-209	66.1
7. Accrued wages to employees for work, the costs of which are included in the expenses of future periods	39	66.1
8. Accrued bonuses, financial assistance, other rewards due to the created reserve for material incentives	477	66.1
9. Accrued salaries, remuneration for years of service, bonuses at the expense of targeted funding	48	66.1

**Table 2. Typical correspondence of accounting accounts for salary deductions**

Contents of business transactions	Corresponding accounts	
	Debit	Credit
1. Withheld from the income of employees the amount of personal income tax	661, 663	641
2. Withheld from the income of employees the amount of the single social contribution	661, 663	65
3. Withheld from the income of employees the amount of military duty	661, 663	642
3. Remained from the salaries of employees the balance of unused advance from the reported amounts	661	372
4. Carried out deductions from wages of the number of shortages and theft of property	661	375
5. Withheld from the salary of the loan amount provided by the company to the employee	661	377
6. Amounts of interest on a bank loan withheld from salary	661	685
7. Amounts of alimony and other payments on writs of execution withheld from employees' salaries	661	685
8. Trade union dues were deducted from the number of wages	661	685
9. Salaries, benefits, bonuses, social benefits, etc. accrued to employees paid from the pay desk	661, 663	301
10. Listed salaries, other payments to be credited to the card accounts of employees	661, 663	311
11. Reflected sales to employees of the enterprise at the expense of wages of finished products, goods, works and services	661	701, 702, 703

The debit of account 66 "Calculations for payments to employees" reflects basic and additional salaries, bonuses, temporary disability benefits, etc. As well as the cost of materials, products and goods received at the expense of wages (repayment of debts to employees for other payments); withholding of personal income tax, single social contribution, payments on organizational documents and other deductions from payments to employees (Table 2).

In the Balance Sheet (Statement of financial position) (form №1) to display information about the simple calculations of the enterprise for wages and the single social contribution are line 1155 "Other current receivables", line 1625 "Current accounts payable for insurance" and line 1630 "Current accounts payable for payroll".

In the Statement of Financial Performance (Statement of comprehensive income) (form №2), the above information is contained in Section III "Elements of operating expenses" (line 2505 "Labour costs". Line 2510 "Deductions for social activities", line 2520 "other operating costs" (in terms of labour costs and charges for social activities, which include additional operating expenses).

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In the Statement of Cash Flows (by the direct method) (form №3) the expenditure of funds for wages of employees is reflected on line 3105, the payment of a single social contribution is indicated from line C 10 "Deductions for social activities".

Accounting for the single social contribution is carried out on account 65 "Calculations for insurance". The account's credit reflects the accrual of the single social contribution, the debit - its transfer to the Pension Fund and the accrual of benefits from social insurance funds.

Per the instructions № 291 to account 65 "Insurance payments" open the following sub-accounts:

- 65.1 "According to the calculations of the compulsory state social insurance";
- 65.2 "On social insurance";
- 65.4 "On individual insurance";
- 65.5 "On property insurance".

In the Balance Sheet (Statement of financial position) (form №1) to display information on the state of the company's payroll and single social contribution are line 1155 "Other current receivables", line 1625 "Current accounts payable for insurance" and line 1630 "Current accounts payable for payroll".

In the Statement of financial results (Statement of comprehensive income) (form №2) the above information is contained in section III "Elements of operating expenses" (line 2505 "Labour costs", line 2510 "Deductions for social activities", line 2520 other operating expenses "(in terms of labour costs and charges for social activities, which include other operating expenses).

In the Statement of Cash Flows (by the direct method) (form №3) the expenditure of funds for the remuneration of employees is reflected on line 3105, the payment of the single social contribution is indicated from line 3105.

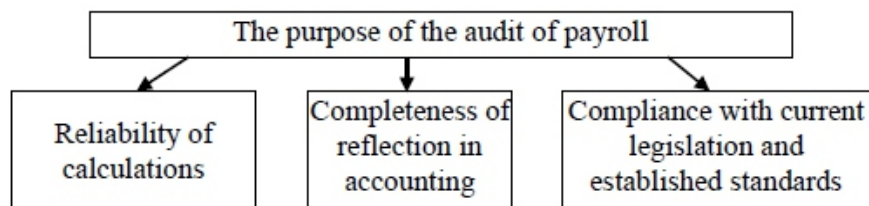
### **2.3. Audit of Payments to Employees**

In a market economy, there have been significant changes in pay, which depends not only on the performance of workers but also on production units' efficiency. Every company, every industry in Ukraine, must have real and reliable information on the payroll. The audit should provide such information. Audit of employee benefits is one of the most critical and complex work areas, which requires accurate and operational data, which reflects changes in the number of employees, labour costs, categories of workers and controls the use of labour resources [3; 5].

Audit of payroll calculations is a very time-consuming and responsible task of assuring because it combines elements of financial audit and compliance audit, which is laws in the formation of financial information on payroll and other payments to employees.

The current state of development of socio-economic relations on wages makes unique demands on the formation of goals, objectives, objects of audit and evaluation of information on payments to employees, which should consider the interests of all parties to this relationship - employer, employee and state. Given these circumstances and the proven importance of the accounting and analytical category of "remuneration", it is advisable to introduce, together with the general audit of financial statements, a mandatory special task - the audit of employee benefits with the issuance of the appropriate audit opinion.

The primary purpose of auditor's pay review is to identify the strengths of the control to ensure that there are no material errors. A more detailed description of the audit of payroll calculations' main objectives is shown in Fig. 5.



**Figure 5. The purpose of the audit of payroll**

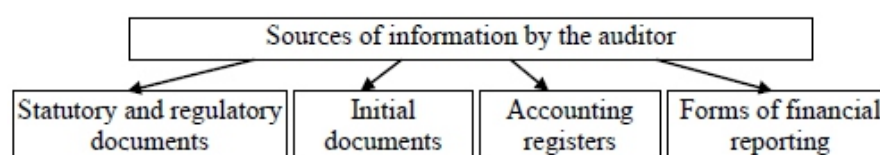
The main task of the audit of wages – checking compliance with regulations when calculating wages, deductions from it and the correctness of accounting for wages.

The most important tasks of the audit of payments to employees include:

- checking the accounting of personnel of employees of the enterprise;
- checking the correctness of the calculation of basic, additional wages and other incentive and compensation payments;
- checking the correctness of the documentation of payroll calculations;
- checking the correctness of the analysis of the average wage;
- verification of the validity of the allocation of labour costs to the cost of production or operating costs that are not included in the cost of goods sold;
- study of the correctness of the distribution of labour costs between the types of finished products (work performed, services rendered) and by reporting periods;
- checking the timeliness of payments to employees for payments;
- checking the correctness of accruals to the payroll and deductions from wages, the timeliness of their payment to the relevant authorities;
- checking the status of accounting for employee benefits;
- checking the timeliness of payment of wages [2; 3; 6].

In the course of carrying out the audit, it is possible to use various methods and methodical receptions: recalculation, an estimation of actual presence, comparison. Thus, to verify the calculation of wages used methods of comparing accounting data with primary documents (salaries approved in the staffing, and actual accruals, timesheets and payroll), recalculations (the auditor lists the amounts that were withheld, and compares with norms of current legislation), etc. There are also specific ways to verify documents. For example, primary documents that are the basis for accrual and payment of wages (spreadsheets, settlement and payment information) are studied in combination, ie in a continuous and selective manner (if the auditor checked a number of similar primary documents and found errors, then he can assume that the document from this pack is error-free).

The visual display of information sources of audit of operations on payments to employees is shown in Fig. 6.



**Figure 6. Sources of information on the audit of employee benefits**

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The purpose of the audit of payroll Reliability of calculations Completeness of reflection in accounting  
Compliance with current legislation and established standards

Sources of information by the auditor Statutory and regulatory documents Initial documents  
Accounting registers Forms of financial

Employees of this enterprise or representatives of other organizations can be involved to conduct the inspection. Each of these approaches has its advantages and disadvantages. Their employees know more about the organization. It is easier for them to determine which aspects need to be evaluated. It is easier for them to conduct surveys and questionnaires because auditors less see them as a threat, i.e. something hostile. However, it is more difficult for them to look at the problems "from the outside", they are largely accustomed to the existing order. Therefore, it is difficult for them to be completely objective in their assessments. Such qualities as objectivity and independence, which are more characteristic of external auditors, who do not need to care about the "honour of the firm", they do not depend on the leaders of the enterprise and who, finally, as specialists in labour and its payment, are aware of the latest ideas and achievements. This is appropriate because the organization of work is closely related to labour law. The assessment of the legitimacy of the firm is one of the audit's objectives.

### **3. RESULTS**

As shown by the theoretical and methodological analysis of literature sources, accounting and audit of settlements with employees can be improved.

#### **3.1. Improving Accounting for Payments to Employees**

Accounting Regulation (Standard) 26 "Settlements with Employees" provides for the distribution of payments for current payments, dismissal payments, post-employment payments, payments in equity instruments, and other long-term payments. Current payments to employees include wages for salaries and tariffs, other accruals for wages; payments for overtime (annual leave and other paid overtime); bonuses and other incentive payments payable within twelve months after the end of the period in which the employees perform the relevant work, etc. Thus, in our opinion, it is necessary to make changes to the Chart of Accounts. Based on the fact that through account 66 "Calculations of employee benefits" payments are made amounts that can not be clearly identified with wages, so it is necessary to open sub-accounts with a more detailed structure, which are presented in Fig. 7.

This proposal will lead to a quick search for the necessary information on the calculations with each employee of the company, which will reduce the time spent by the accountant.

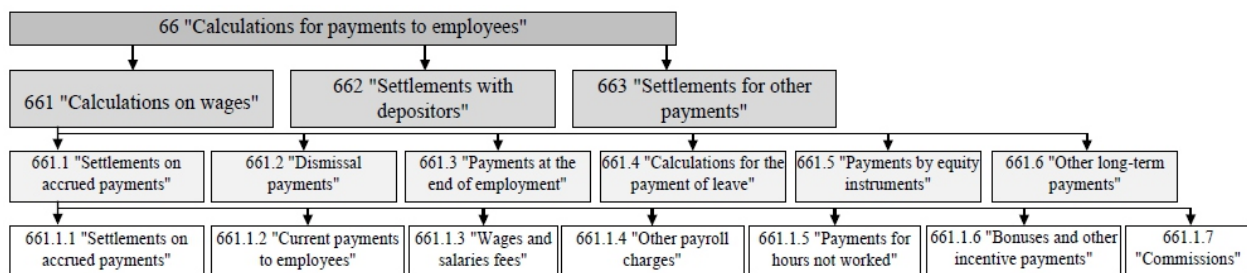
#### **3.2. Improving the Audit of Settlements with Employees**

To prevent errors in the account is necessary to conduct an audit promptly. To do this is essential to develop a methodology for auditing payments to employees.

The purpose of the audit of settlements with employees is to establish compliance with the methodology used in the organization of accounting for payroll transactions to identify errors or violations, the degree of their impact on the reliability of financial statements to verify the accuracy and correctness of accounting settlements with employees.

**Tasks of settlements with employees:** verification of compliance with the provisions of labour legislation related to the calculation of wages, the availability and compliance with the legislation of the primary documents on the accounting of working time; verification of accounting and accrual of wages, other types of payments related to the payroll; checking the correctness of the calculation of annual leave.

When conducting an audit of the accrual of benefits to employees, it is necessary to identify compliance with the procedure for accounting for settlements with employees with the requirements of legislation and applicable regulations. The plan of the audit of settlements with employees is a document of organizational and methodological nature and consists of a list of works at the main stages of the audit and deadlines for their implementation, indicating the sources of information. To do this, a general plan for the audit of settlements with employees, which is shown in Fig. 8.



**Figure 7. The detailed structure of account 66 "Calculations for employee benefits"**

Stage	List of audit procedures	Verification period	Responsible person
1. Previous	acquaintance with management, testing	« _ » _____ 2020	Full name
2. Basic	a) to establish and check the real amounts of accrued wages for 1 semester; b) analysis and verification of salary payments through the cash desk and current account in the bank for the 1st half of 2020; c) checking the correspondence of accounts.	« _ » _____ 2020	Full name
3. Final	preparation of the audit conclusion and preparation of the audit report	« _ » _____ 2020	Full name

**Figure 8. The general plan for audit of payments to employees**

The employee audit program is a detailed list of audit procedures indicating the purpose of the audit, audit evidence, audit methods, the index of the auditor's working papers, and the performers required for the audit (Table 3).

To solve the tasks of the audit of settlements with employees, we offer working documents of the auditor (Table 4-6), which in the opinion of the authors will be substantiated evidence of quality audit of wage calculations.

The proposed recommendations can help the organization to streamline and improve the accounting and audit of payments to employees, save the company financial resources and time of employees and help avoid penalties during the inspection.



**Table 3. The program of carrying out the audit of payments to employees**

Audit procedures	The purpose of the audit	Audit evidence	Verification method	Responsible person	Notes
1. Existence of a collective agreement, provisions on remuneration, provisions on bonuses, as well as: availability of orders on admission and dismissal; availability of timesheets; availability of staff list	Check documents	Contracts, regulations, primary documentation	Documentary inspection, reconciliation		
2. Checking the compliance of surnames and amounts in the settlement and payment statements	Check the availability and correctness of the primary documents	Settlement and payment information, staff list	Documentary inspection, reconciliation		
3. Checking the correctness of the calculation of wages for salaries when working for less than a month	Verification of the amount and availability of documents for the payment of wages, the reality of wage transactions, the correctness of the calculation of wages and other payments, the validity of the completeness of the reflection	Primary documentation, timesheets	Selective		
4. Checking the correctness of the calculation of wages for vacation		Timesheets	Documentary verification, selective		
5. Make sure that the accrued and paid amounts of wages are correct		Description, goals, objectives of the standard.	Documentary check, calculation		
6. Checking wage payments to bank accounts		Payment details, payment orders	Documentary inspection, continuous		

**Table 4. Auditor's working document to verify the compliance of names and amounts in the settlement and payment statements**

Date	Full Name	According to management	According to the inspection			Deviation (+/-)
			Accrued together	Withheld	Total for issuance, UAH	
1	2	3	4	5	6	7

**Table 5. Working document to verify the correctness of the calculation of wages for vacation**

Full Name	According to management	According to the inspection					Deviation (+/-)
		Months to calculate	Days	Adjustment factor	Average earnings per 1 cal. day	Amount, UAH	
1	2	3	4	5	6	7	8
Total							

**Table 6. Working document in the correctness of accrued and paid amounts of wages**

Full Name	According to management	According to the inspection								Deviation (+/-)
		salary	rank	service	intensity allowance	premium	financial aid	hospital	Total accrued, UAH	
1	2	3	4	5	6	7	8	9	10	11

#### 4. CONCLUSIONS

Wages, the level of payments to employees, their nature and structure are of great social importance and affect the standard of living and the current and future performance of the enterprise. In addition, the organisation's effectiveness depends on the work of employees themselves, and their motivation, in turn, depends on the level of wages and working conditions. Therefore, the chosen topic is quite relevant, and the proposed recommendations can help organizations streamline and improve accounting and audit of payments to employees, save the company financial resources and time of

employees and help avoid penalties for inspections; besides, the work of employees will be much easier and faster. This creates all the conditions for more efficient accounting, which helps to increase the company's profits in the future.

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