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WORKPLACE SAFETY AND MANUFACTURING PRODUCTIVITY IN THE UNITED STATES: A DESCRIPTIVE RESEARCH APPROACH

OLUWASEYI RACHAEL HINMIKAIYE[1]*, OMOTOLANI ENIOLA AKINBOLAJO[1], OLAJUMOKE DEBORAH AKANBI[2] & OWOLABI WILLIAMS ADEYEMI[3]

[1]Department of Industrial Management, Texas A&M University, Kingsville, Texas, US.
[2]Department of Economics and Decision Sciences, Western Illinois University, Chicago, US.
[3]Department of Economics, Obafemi Awolowo University, Ile-Ife, Nigeria.

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ABSTRACT

The study empirically investigated the relationship between workplace safety and manufacturing productivity in the United States. Annual time series secondary data for the period 2000-2022 were collected and analyzed in the study. Data generated include manufacturing value added, public health expenditure, domestic private expenditure, gross fixed capital formation, and labor force. Which were obtained from the World Development Indicators (WDIs, 2024). The study used descriptive statistics in form of tables, Autoregressive Distributed Lag (ARDL) and the Fully Modified Ordinary Least Squares (DOLS) for robustness checks. The study established among other things that in the short run the interactive health and labor variable has positive relationship with manufacturing output, whereas it was only significant in one lagged period. As found, a percentage increase in the interactive variable will increase manufacturing output by 11.53 percent ($t = 3.34$, $p < 0.05$). In the ARDL long run results, the interactive variable is both significant and negative, whereas as revealed by the FMOLS, a more advanced long run estimator, a positive and significant long run relationship was obtained, such that a percentage increase in the interactive variable will increase manufacturing productivity 4.52 percent ($t = 4.46$, $p < 0.01$). Considering that a healthy workforce is a productive workforce, the study recommends that regulatory authority in the United States makes it compulsory for manufacturing organization to comply by statutory guidelines and policies on workplace safety.

Keywords: Workplace Safety, Occupational Health & Safety, Manufacturing Productivity, Health Expenditure.

1.0 INTRODUCTION

Workplace safety is an essential concern for companies, employees and industrial regulators in the United States and other countries. According to Beus et al (2016), unsafe workplace portends severe consequences for individuals and organizations. The authors further encouraged an increasing examination of the factors affecting workplace safety in an organization. The coverage of workplace safety in the United States is wide based and extends to some critical concerns such as work condition, workplace environment, employees' safety, and other concerns about injuries, risks, and hazards elimination. Statistics on workplace related nonfatal injuries in the US is alarming. According to records on workplace injury statistics, about 2.6 million nonfatal workplace injuries, accidents, falls, trips, and slips occur each year in the United States' private industry. In 2020, 266,530 workplace injuries relating to sprains, strains, and tares were recorded in the United States.

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Additionally, 84 percent of all nonfatal workplace injuries was due to trips, slips, overexertion, falls and contacts with equipment and objects. In the field of health, available records showed that nursing assistants encounter injuries the most at the rate of 370 injuries for every 10,000 full-time workers. Similar trends were recorded in the field of agriculture, particularly in the area of hunting, fishing, and forestry with about 23.4 fatalities for every 100,000 employees. Whilst the cases of nonfat injuries were widely captured and recorded in their trending status, fatal injuries in the United States have also been identified to be on the increase. For instance, there were 5,190 cases of fatal occupational injuries in the United States in 2021. With about $250 billion expenditure by the government on injuries and illnesses due to workplace in the United States, there is no better way to acknowledge the concerns of the US government on workplace safety.

Available data showed the critical role of manufacturing in the growth of the US economy. According to the neoclassical economists, manufacturing productivity and the growth of the overall economy can be aided by two critical factors, labor and capital (Solow, 1964; Levy, 2005, Narayanan, 2008; Vollrath, 2021). Whilst machines and equipment are major compositions of capital assets, the operations of the capital assets are by human and in some rare cases, by robots and artificial intelligence. The interface between humans and the equipment, in the manufacturing process, exposes the employees, who are engaged in machine operations, packaging, and supply chaincand logistics to various types of hazards. Although, several studies have established positive impacts of labor supply on firm's productivity, the exposure of workers to risks and the incidences of workplace injuries are capable of reducing workers' productivity. Whilst the efficiency of labor can be enhanced through training, skills acquisition, and motivation, the need to provide safety in and around workplace is equally important. When manufacturing workers are not adequately protected enough from work related accidents, they are susceptible to occupational injury, which may range from nonfatal to fatal and may as well be life-threatening. This paper investigates the relation between workplace injury and the effect it may have on manufacturing productivity in the United States.

2.0 LITERATURE REVIEW

2.1 Conceptual Definition

In perfectly understanding the relationship between workplace safety and the manufacturing productivity, there is need for conceptual understanding of the relevant terms. Workplace, its safety, productivity, and manufacturing productivity were briefly discussed below.

2.1.1 Workplace Safety

Workplace safety is an essential component in industrial or managerial operations. Wahocho (2024) defined workplace as a place or environment where employed individuals perform certain tasks and responsibilities assigned by their employers. From the definition of Wahocho, a workplace maybe regarded as a place of work or employment. This perception has been punctured by Bhardwaj and Tanwar (2022), who, in the wake of COVID-19, defined workplace as including working from home. Therefore, considering individual's homes as workplace has broadened the concept of workplace and its safety. Workplace safety has been defined in terms of safety in work environment and preventing all practices that can injure, endanger, or negatively impact the health and condition of workers. For instance, Beus et al (2016) defined workplace safety "as an attribute of work systems reflecting the (low) likelihood of physical harm—whether immediate or delayed— to persons, property, or the environment during the

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performance of work.". The importance of workplace safety to the performance of employees in the realization of organizational goals cannot be overstated. According to Boles et al (2004), a safe work environment is capable of reducing the incidence of absenteeism at work, thereby improving productivity in workplace.

2.1.2 Productivity

Productivity may be generally perceived as fruitfulness in workplace. In the parlance of economics, it relates inputs to outputs. In other words, it relates to efficiency. Bjorkman (1992), defined productivity using a variety of mathematical relationships. The author defined productivity as a ratio of total products produced to the number of employees that produced them. In another definition, he defined productivity as a ratio of total products to the total man-hours. These definitions point to the active participation of workers in their complete state of health and safety. Any perceived illness or hazard relating to worker may reduce the number of workers per time, which will reduce the overall performance of the task.

2.1.3 Manufacturing Productivity

Manufacturing productivity is a measure of manufacturing output against all the input factors, which include man-hours, raw materials, capital assets, technology and operational efficiency. Manufacturing activity is a strategic stimulant for economic growth. It is also the center of attention for occupation safety and health. Productive activities in the manufacturing complex requires interaction between different people, who perform different tasks with the aid of fully and semi- automated machines and equipment. The contingent incidences of health workplace health hazards is capable of dampening workers' productivity in the manufacturing sector.

2.2 Theoretical Reviews on Manufacturing Productivity and Workplace Safety

There are many theoretical underpinnings for understanding the relationship of workplace safety with productivity in the manufacturing sector. Some of the relevant theories are examined thus.

2.2.1 Integrated Safety Model

Integrated safety model (ISM) integrates safety measures with work performance in a workplace. Its major objective is to ensure that work or any assigned task is carried out safely and correctly. The belief behind the theory is that work is no more important than that safety of workers that are doing it. ISM has five core pillars.

Figure 1. Integrated Safety Model (ISM)

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Source: Argonne National Laboratory, 2024 the five pillars of ISM are:

- Defining scope of work
- Analyzing the associated (real and perceived) hazards
- Developing and Implementing Control measures
- Performing the task, and
- Providing feedback for improvement.

In the implementation of the ISM, Argonne National Laboratory identified seven requirement that must be duly considered, which include: providing line managers safety tasks, setting clear roles and tasks, providing commensurate competence with schedules tasks, balancing priorities, identifying relevant standards and requirements, providing commensurate hazard control to scheduled work, and authorizing the operations. The ISM is applicable in all workplace, regardless of whether it is services, construction, manufacturing, or office administration.

2.2.2 Frederick Herzberg Theory

Frederick Herzberg theory posits that employee satisfaction is two dimensional, namely: hygiene and motivation. He further posits that issues relating to hygiene, such supervision, working policies and salary are negatively affects workers' satisfaction in the workplace, whereas motivators, such as individual recognition and achievement, not only make workers more committed but also more productive. Herzberg believes that, the purpose of the hygiene factors is to motivate workers to perform efficiently. In line with this thought, salaries, wages, administrative policies, physical working conditions, interpersonal relationship and job security, which if absent, they could lead to worker's dissatisfaction. Conversely, there are other factors, otherwise called satisfiers, which have the capability to promote job satisfaction. These factors include: responsibilities, recognition, achievements, personal growth, opportunities, etc. This theory, however, has some limitations, which hinder its general applicability. Some of the criticisms of the theory are: biasness, uncertain reliability, deflated assumptions on satisfaction and productivity, ambiguous measurement of satisfaction.

Figure 2. Frederick Herzberg Two-Factor Theory

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Source: Google.com, 2024

In relation to workplace safety and productivity, Herzberg two-factor theory may be augmented to accommodate workplace safety as part of the driving factors for motivation, which the theory hypothesized as capable of improving productivity.

2.2.3 McGregor Theory X and Y

Theory X and Y by McGregor hypothesizes two distinctive models of workers motivation in a workplace. Theory X is the first flip of two theories propounded by Douglas McGregor, a highly reputed management theorist and writer. McGregor propounded theories X and Y, which are basic management theories that conceptualized workers' perception of work, their attitudinal relation to work and how such perceptions shape organization's work environment. The two theories conceptualized the views of people in a work place, which views are based mostly on the manager's perceptions. Although, both theories tend to be opposite in nature, their respective expectation to an organization remains the same, which is to maximize workers' productivity. Theory X assumes that human beings have a general dislike for work, and where possible, they will boycott it. The theory further assumes that since workers are not freely disposed to working, they have to be coerced, forced, controlled, directed and even be threatened by punitive measures. Conversely, theory Y describes workers that are highly motivated towards work and are also internally motivated to work.

Figure 3. McGregor Theory X and Y

Source: Google.com, 2024

In relation to workplace safety, McGregor's theory X and Y are relevant in describing workers' attitude to work when safety variables are infused into the workplace policy. Many workers will be freely disposed to working in line with theory Y, when they have assurance that workplace safety is assured. Conversely, in line with theory X assumptions, when coerced to work, workers may be encouraged further the assurance of workplace safety and that forcefully submitting to working will not bring any injury to them.

2.2.4 Neoclassical Theory of Economic Growth

Neoclassical growth theory was developed as an extension of the classical theory of economics, which was developed on the principles of free market system and minimal government

$$Y_t = fA(K_t + L_t)$$

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intervention in the economic system. The theory asserts that economic output can be explained by the relationship between technology (productivity or efficiency), labor and capital stock in various proportions. This is mathematically represented by the Cobb Douglas production function as: $Yt = fA(Kt + Lt)$. Labor can be augmented for effective performance either through education, training and capacity building and/or by health maintenance through workplace safety, reduction of accidents within domestic and public places, and ensuring compliance with all regulatory standards.

Cobb-Douglas Production Function

Where Y represents output, A is the level of technology, which defines the efficiency of the function, K is the stock of capital stock, while L is labor force, t is the time variation.

2.3 Empirical Review

The relationship between workplace safety and productivity in different sectors of the economy has been considered both in the US and the world over. The literature is awashed with many scholarly articles and papers on the nexus of occupational health and safety in workplace with productivity. These articles have established a positive impact of workplace safety on the productivity of labor. For instance, Oxenburgh et al (2004) established a close link between employees' health and safety, and productivity in workplaces. The findings of Oxenburgh et al (2004) aligns with the outcome of a previous study by Webb (1989), which asserted that promoting workplace safety and health leads to higher productivity, when workers are able to work without the fear of imminent of injury or accident.

However, studies have also established that many factors may improve productivity in workplace other than improvement in occupational health and safety standards. For instance, Katsuro et al (2015) asserted that it is a misleading notion to conclude that every improvement in productivity is attributable to changes in OHS standards. Although, the authors believed that occupational health and safety in workplace are important considerations for labor productivity, they were in doubt about the extent to which the productivity of a business organization benefits from the health and safety policy. Although, it may be difficulty to directly measure the extent of health safety on productivity, McCunney (2001) was of the opinion that observing quality health standards in work environment will reduce absenteeism, thereby improving the productivity of labor.

Issues relating to workplace safety remains a paramount concern for the government of the United States and other governments across the world. This is because the contribution of healthy and productive labor to economic growth is empirically and theoretically undeniable. Studies continue to verify the role of workplace safety on labor productivity. In an innovative twist, Obrenovic et al (2020) examined the effect of Covid-19 pandemic emergency management on employee productivity's sustainability. A positive relationship between the variables was affirmed, therefore, the study recommended the provision of safety emergency management as an avenue for enhancing labor productivity. Whilst the importance of safety emergency management to productivity has been established, a study by Wilson (2010) affirmed that 30% of the higher institutions in the United States did not have equipment for safety emergency management. However, the study was criticized by Mutegi et al (2023) as failing to empirically establish a link between safety emergency management and labor productivity.

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The concept of safety management in workplace goes beyond the provision of physical and intangible systems put in place. It could simply be described as a workplace lifestyle that must be imbibed and woven into the fabrics of all workplaces. Beyond providing rules and regulations for maintaining workplace safety, the role of multi-level training on workplace safety in sustaining workplace safety cannot be overstated. Bieder et al (2018) investigated the nexus between safety training and workers' skill in transportation sector in France, having reviewed 16 related studies, the study by Bieder et al (2018) concluded that organizations provide safety training only to satisfy external requirements and not necessarily to improve workers' safety. Huang et al (2022) conducted a similar study on the US by examining how the behavior of long truck drivers is impacted by supervisors' safety training. The study by Huang et al (2022) was criticized for failing to test the inferential relationship that exists between the variables.

There are indications that the relationship between workplace safety and labor productivity is yet to be perfectly dissected and established; hence, this study.

3.0 METHODOLOGY

This study adopted descriptive research design and time series data on manufacturing output, Gross Fixed Capital Formation (GFCF), Labor Force (LFT), Total Health Expenditure (THE), and the interactive data on Health and Labor for the United States, spanning 2000 – 2022 were collected from the World Development Indicators (WDI, 2022). This is intended to gauge the effect of health expenditure and its interactive relation with labor force on the both manufacturing output and the national output. The assumption underlying this approach is that total health expenditure and the interactive relation of health expenditure with labor force will positively impact manufacturing output and the national output. Therefore, total health expenditure is adopted as proxy for workplace safety.

3.1 Model Specification

The underlying theory that explains the relationship between inputs and output in an economy is the neoclassical theory of economics, which was stated in Cobb-Douglas production function as:

$$Yt = fA(Kt, Lt) \quad (1)$$

Where: Yt represents total output (or manufacturing output) at time t

K_t represents the stock of capital assets in the production process
L_t represents Labor force.
A represents the state of technology.

In essence, the theory expresses output as the interaction between capital stock, labor force and the state of technology at any point in time. However, since workers are the subject of workplace safety, their level of productivity will be determined by many factors of which workplace safety is a significant part? Therefore, equation (1) will be augmented by health expenditures variables, first for checking the direct effect of health expenditure on output, and then the interactive effect of labor and health expenditure on output.

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Equation (1) then, becomes:

$Y_t = fA(K_t, L_t, HE_t, HEXL_t)$ (2)

All the variables were log-linearized for uniformity and ease of interpretation. The linear relationship assumed to exist between national output (or manufacturing output) and the explanatory variables (capital stock, labor, health expenditure and interactive labor and health expenditure variable) is specified in structural form as:

$lnY_t = \alpha o + \alpha_1 lnK_t + \beta lnL_t + \lambda lnHE_t + \gamma lnHEXL_t + \mu_t$ (3)

Where: lnY_t is the log of national (or manufacturing) output,

lnK_t = log of capital stock,

lnL_t = log of labor force,

$lnHE_t$ = log of Health Expenditure,

$lnHEXL_t$ = log of interaction between Health Expenditure and Labor Force,

μ_t is the idiosyncratic error term that is IID $\mu_t \sim N(0, 1)$,

αo is the intercept term, α_1, β, λ and $\boldsymbol{\gamma}$ are the unknown coefficients terms of the exogenous variables.

However, the ARDL short run and long run model is specified as:

$$\Delta lnMANt = \phi o + \sum_{i=0}^{q} \phi 1 \Delta lnKt{-}i + \sum_{i=0}^{q} \phi 2\, \Delta lnLt{-}i + \sum_{i=0}^{q} \phi 3 \Delta lnHEt{-}i + \sum_{i=0}^{q} \phi 4 \Delta lnHEXLt{-}i$$

$$+ \mathrm{P}1 \Delta lnKt{-}i + \mathrm{P}2 \Delta lnLt{-}i + \mathrm{P}3 \Delta lnHEt{-}i + \mathrm{P}4 \Delta lnHEXLt{-}i + ECTt{-}1 + \mu t \quad (4)$$

For robustness checks, the long run effect was also crosse-checked with Fully Modified Ordinary Least Squares (FMOLS) due to its ability of removing unnecessary restrictions that can affect the predictive ability of estimation results.

$$lnMANt = \varphi o + \varphi 1 lnKt + \varphi 2 lnLt + \varphi 3 lnHEt + \varphi 4 lnHEXLt + \sum_{i=0}^{q} \psi i \Delta lnKt{-}i$$

$$+ \sum_{i=0}^{q} \psi i\, \Delta lnLt{-}i + \sum_{i=0}^{q} \psi i \Delta lnHEt{-}i + \sum_{i=0}^{q} \psi i \Delta lnHEXLt{-}i + \emptyset' \boldsymbol{Di} + vlt \quad (5)$$

$i=0$ $i=0$ $i=0$

3.2 Data Sources and Measurement

Table 3.1 Measurement of Variables and Data Sources

Variable	Measurement	Sources
Manufacturing Productivity	Manufacturing, value added (Constant 2015US$)	World Development Indicators, 2022
Economic Productivity	Gross Capital Formation (Constant 2010 US$)	World Development Indicators, 2022.
Factor Enabling Productivity 1: Labor Force	Total labor force (comprising age 15 and above)	World Development Indicators, 2022.
Factor Enabling Productivity 2: Capital Stock	Gross Fixed Capital Formation (Constant 2015US$)	World Development Indicators, 2022
Factor Enabling Productivity 3: Workplace Safety and OHS	Total private and public health expenditure	World Development Indicators, 2022.

4.0 PRESENTATION OF RESULTS AND DISCUSSION OF FINDINGS

4.1 Pre-Regression Analyses

The study followed the standard by first conducting all necessary pre-regression analyses with a view to observing the statistical properties and qualities of the data generated and their usefulness for regression and forecast purposes. As such, the stationarity, the cointegration, and lag selection criteria tests, were conducted before the regression analyses were done. All the results turned out well.

4.2 Regression Results on the Impact of Workplace Safety on Manufacturing Productivity in the US

The role of health cannot be overstated in relation to productivity. Wellness provides for active workplace participation, therefore, in the US manufacturing sector. Table 4.1 presents the short run and the long run results.

Table 4.1 ARDL Results of the Impact of Workplace Safety on Manufacturing Productivity

Variable	Coefficient	Std Error	t-Stat	Prob.	R-Sqd	Adj. R-Sqd
C	-371.9128	37.69471	-9.866445	0.0001	0.9823	0.9694
D(LNGFCF)	1.023990	0.057316	17.86563	0.0000		
D(LNLFT)	-3.057175	2.027637	-1.507752	0.1823		
D(LNLFT(-1))	-16.39096	4.249224	-3.857402	0.0084		
D(LNHEXLAB)	1.222344	1.935610	0.631503	0.5510		
D(LNHEXLAB(-1))	11.53401	3.453314	3.339983	0.0156		
D(LNTHEX)	-1.438164	1.808728	-0.795125	0.4568		
D(LNTHEX(-1))	-11.28932	3.374542	-3.345437	0.0155		
CointEq(-1)*	-1.300436	0.131837	-9.863998	0.0001		
LNGFCF	0.961522	0.117703	8.169023	0.0002		

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LNLFT	14.66533	3.090947	4.744608	0.0032
LNHEXLAB	-10.62651	2.620433	-4.055249	0.0067
LNTHEX	10.76883	2.556281	4.212694	0.0056

*, **, and *** represent 10%, 5%, and 1% level of significance; Note: R-Sqd is R-Squared

Source: Authors' Computation, 2024.

Table 4.1 presents the results of the long run and short run analyses of the relationship between manufacturing productivity and growth enabling factors such as capital stock, labor force, while the effect of health expenditure and the interactive effect of health and labor on manufacturing productivity, both in the short and the long run, was also examined. The results revealed that capital stock has positive impact on manufacturing productivity, such that a percentage increase in capital stock will increase manufacturing productivity by 1.02 percent ($t = 17.87$, $p < 0.01$). Unexpectedly, however, labor force has negative effect on manufacturing productivity in the US within the period under investigation, though it was only significant in the first lagged period. The spate of increasing automation of the manufacturing process and the need to enhance the effectiveness of the US labor force are plausible causes of labor's negative effect on manufacturing. Similarly, health expenditure was found to have negative effect on manufacturing productivity, though it was also, only significant in the one lagged period. However, the interactive effect of health and labor on manufacturing productivity was found to be positive, though, it was only significant in the first lagged period. The disequilibrium between the short run and long run period was found to be correctable at the speed of 1.3 percent per annum.

The long run results revealed that capital stock, labor force and health expenditure have positive and significant impacts on manufacturing productivity in the US within the period. Specifically, a percentage increase in capital stock, labor force and health expenditure will increase manufacturing productivity by 0.96 percent ($t = 8.17$, $p < 0.01$), 14.67 ($t = 4.75$, $p < 0.01$), and 10.77 ($t = 4.21$, $p < 0.01$), respectively. Conversely, the interactive effect of health and labor on manufacturing productivity is negative in the long run. The results showed that a percentage increase in health and labor interaction will reduce manufacturing productivity by 10.63 percent ($t= -4.05$, $p < 0.01$).

For robustness check, the long run relationship between manufacturing productivity and the regressors were also examined using Fully Modified OLS. The results are as presented in Table 4.2

Table 4.2 FMOLS Results of the Impact of Workplace Safety on Manufacturing Productivity

Variable	Coefficient	Std Error	t-Stat	Prob.	R-Sqd	Adj. R-Sqd
LNGFCF	0.154971	0.064596	2.399072	0.0290	0.9044	0.8805
LNLFT	-1.923212	1.141757	-1.684431	0.1115		
LNHEXLAB	4.518165	1.012101	4.464145	0.0004		
LNTHEX	-3.916400	0.871164	-4.495595	0.0004		

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*, **, and *** represent 10%, 5%, and 1% level of significance; Note: R-Sqd is R-Squared

Source: Authors' Computation, 2024.

The results of the Fully Modified Ordinary Least Squares (FMOLS) as contained in Table 4.2 showed a little deviation from the ARDL long run results. The results revealed that the long run impact of capital stock, and interactive effect of health and labor on manufacturing productivity are positive and significant in the long run. Specifically, a percentage increase in capital stock and the interactive health/labor variable will bring about 0.15 percent ($t = 2.39$, $p < 0.05$) and 4.52 ($t = 4.64$, $p < 0.01$) increase in manufacturing productivity, respectively. Conversely, labor force is found have negative, insignificant long run effect on manufacturing productivity; whereas health expenditure was found to have negative but significant effect on manufacturing productivity such that a percentage increase in total health expenditure will reduce manufacturing productivity by 3.91 percent ($t = -4.49$, $p < 0.01$).

4.3 Post-Estimation Diagnosis

Post-estimation diagnoses were conducted on the results in order to ascertain the validity and usefulness of the results for predictions and forecasts purposes. The Breusch-Pagan-Godfrey test for Heteroskedasticity, Breusch-Godfrey Serial Correlation LM test and the model's stability test through CUSUM and CUSUM of squares were also conducted. They all aligned with their A priori expectations.

4.4 Discussion of findings

The importance of labor (healthy labor) in the manufacturing sector cannot be overemphasized. Workplace safety is as important to labor productivity, while labor productivity is important to the manufacturing sector. Currently, the interactive effect of health and labor variable on manufacturing is positive, its not being significant in the current term should be a source of concern to policy makers. It points to a case of non-commitment of firms to safety matters in workplace. Furthermore, the health expenditure may be such that is concentrated more on other sectors than the manufacturing sector; hence, its impact on manufacturing workplace safety may be little and inconsequential. Nevertheless, the long run positive relationship between health expenditure and labor force, as perfectly captured by the FMOLS results, raises a ting of hope on the possible future improvement in the manufacturing sector as a result of health expenditure-labor interaction on the manufacturing sector. As further shown by the ARDL long run results, though health expenditure- labor interactive variable had long run negative effect on manufacturing productivity, the solace is found in the long run positive relationship between health expenditure and manufacturing productivity. This is because labor force is the transmission channel through which health expenditure can impact manufacturing productivity.

5.0 CONCLUSION

This study concludes that workplace safety is a panacea for labor productivity, and that in the labor-intensive manufacturing sector, improving the health conditions and safety of employees will inspire them to be more productive. The Manufacturing sector in the United States is one of the largest contributors to the economic growth. Therefore, taking the issue of manufacturing

workplace safety seriously will improve the efficiency of labor and by extension, the overall economy of the United States.

5.1 Recommendation

The manufacturing sector is highly placed in the United States in relation to its creation of employment, training of workforce, and more importantly, its contribution to the United States' GDP. A healthy workforce is a productive workforce. Based on this notion and the empirical findings in this paper, it is highly recommended that the regulatory authority in the United States makes it compulsory for manufacturing organization to comply by statutory guidelines and policies on workplace safety. Their compliance with occupational health and safety standards in workplace will make room for a healthy workforce.

Author's Contributions

Oluwaseyi Hinmikaiye conceived the idea, downloaded relevant papers, conducted literature review, and prepared the manuscript. Omotolani Akinbolajo collated relevant data, and prepared the pre-regression analyses. Olajumoke Akanbi conducted the econometric analyses, while Williams Adeyemi reviewed the manuscript and made useful recommendations.

Conflict of Interest

There is no conflict of interest relating to the study.

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Data Availability

The study was conducted using free and open-sourced data as indicated in the article.

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