

"Do not fear to be eccentric in opinion,
for every opinion now accepted was
once eccentric."

Bertrand Russell



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Editorial Foreword

Dear readers,

The world economy is experiencing new challenges, such as making renewable energy efficient, coping with new political developments, and economic and political migration.

Recent studies¹ show that the war in Ukraine remains the world's biggest concern, and financial and climate crises are on the rise. People's concerns about the war are especially deep in Europe: Poland (90%), Germany (73%), Spain (69%), France (69%) and the UK (55%). In particular, half of Europeans worry the war may draw in other countries (51%) or lead to nuclear conflict (48%). While 60% of people worry about the price increases created by the war, 53% also worry about the humanitarian crisis. 59% of Africans worry that the war is creating food shortages on the continent. The implications of such a conflict can be seen in all economic and social areas for European and not only. Researchers became interested in exploring the impact of economic policies, inflation and as a consequence the cost of living and quality of life. The current global challenges generated a diversity of socio-economic research topics to be in the scientific community's attention, the researcher's contributions focusing on new perspectives and solutions to support businesses and society to cope with difficult times they are going through and build strong social cohesion.

REASER's current Issue brings to your attention exciting topics such as European innovation patterns, the trade war – on steel and aluminium markets, tax reforms in different countries and the social effects, corporate governance and monetary policy, climate change and land damages impacting farmers

The authors, young or experienced, come from different regions of the world and the European Union, the Middle East, and Asia (e.g. Albania, Cuba, Egypt, Ecuador, Jordan, India, Slovakia, Tunisia, Vietnam, Uruguay), and bringing you new perspectives on regional economic and social issues.

We appreciate our authors' hard work and dedication, which make their articles so enjoyable for our readers. We are also grateful to our reviewers for their involvement in making the review process more rewarding for all parties committed to improving the journal's quality. Moreover, the constantly growing interest of our readers for more than a decade generated a stronger flow of citations for each published Issue.

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Prof. Manuela Epure, PhD, MCIM

Deputy Editor-in-chief

¹ Kantar' Global Issues Barometer, 2022

Spatial patterns of European innovation: a spatial econometric approach with technological proximity weights

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Abstract. *The paper deals with a spatial econometric analysis of 220 European regions. The analysis follows the Mixed Geographically Weighted Regression – Spatial Autoregressive approach. Patent applications were a proxy for innovation output. Instead of traditionally applied geographical proximity, technological similarity was considered. The results supported the assumption of spatial differentiation of model parameters and indicated that regional innovation activities do not have only a local character in almost half of the regions. The region's technological similarity appears to be a significant factor stimulating innovation for regions that are not among the top innovators.*

Keywords: European Innovation, Spatial Econometrics, Technological similarity

JEL Codes: O31, R12

1. Introduction

The issue of innovation has been playing an essential role in the theoretical and empirical literature for a long time in connection with many economic phenomena. We can observe an increasing number of research studies focused on innovation's spatial component and innovative actors' geographical proximity. The results point to spatial innovation spillover effects, perceived as factors explaining innovation.

Although innovation is global and national policies create a platform for innovation, the main actors in innovation activities are regions or metropolitan areas where companies, research institutions, and government can interface more directly. The innovation clusters or innovation “hot spots” create suitable conditions for the creation of innovations, knowledge sharing, and their rapid dissemination. The research focused on innovation processes in European regions points to an uneven distribution of innovation processes and a tendency to cluster innovation activities (see, e.g., Charlot et al., 2015; Autor, 2019; Khan, 2012; Kumar, 2008; Moreno et al., 2005a or Moreno et al., 2005b). Regarding proximity among innovation actors, a study by Boschma (2005) critiqued the role of geographical proximity in learning and innovation processes. In his study, Boschma assumes that other forms of proximity can replace geographical proximity and that other forms of proximity dimensions, such as cognitive, organizational, social, or institutional proximity, may be more appropriate.

The paper's main aim is to explore an alternative measure of proximity between regions concerning the European innovation problem. From the traditionally considered geographical proximity (defined as the spatial distance between actors - European regions), we have moved to technological similarity based on the two indicators. These indicators are Small and medium-sized enterprises (SMEs) introducing product or process innovations, and Small and medium-sized enterprises (SMEs) introducing marketing or organizational innovations. The primary assumption of this analysis is that European regional innovations are unevenly distributed, probably spatially correlated, given the proximity of the regions in terms of technological similarity. We intend to simultaneously account for spatial effects such as spatial

autocorrelation and spatial heterogeneity. We see such an approach as beneficial to the innovation literature because although previous research on regional innovations has emphasized spatial autocorrelation and heterogeneity, these issues have been addressed separately.

Spatial econometrics offers limited tools suitable for simultaneously handling both spatial effects. Several notable exceptions can be found in the theoretical literature, e.g., Charlott et al. (2015) or Guastella and van Oort. (2015). These studies propose a geo-additive modeling framework to capture spatial autocorrelation and spatial heterogeneity simultaneously. Another study, the study by Cho et al. (Cho et al. 2010), suggests a model that combines Geographically Weighted Regression (GWR) and Spatial Error Model (SEM), called GWR-SEM. The latest advancement in this area is evident from the work of Geniaux and Martinetti (Geniaux and Martinetti, 2018) where a new class of data-generating processes (DGPs) called Mixed Geographically Weighted Regression – Spatial Autoregressive (MGWR-SAR) models was introduced. A significant advance of these models is that the regression and spatial autocorrelation parameters may vary in space, and the mixed case is also allowed. We chose this approach as the primary tool of our analysis.

The structure of the remaining parts of the paper is as follows: part 2 contains the data description, the specifications of the spatial weight matrices, and the main theoretical backgrounds of the study. In part 3, the empirical results are presented and interpreted. The main concluding remarks can be found in section 4. The paper ends with references.

2. Methodology

The following sections will present the data, the study area, the spatial weighting matrices, and the main methodological issues.

2.1. Study Area, Data and Spatial Weighting Schemes

The Regional Innovation Scoreboard (RIS) 2019 (Hollanders et al., 2019) and data from the Eurostat regional statistical database (Eurostat, 2021) were used to perform a spatial econometric analysis of the European innovation problem. The analysis includes the regions of EU Member States, Norway, Serbia, and Switzerland. Since the policy at the European Union (EU) level focuses mainly on the regional level, our database of 220 European regions is defined at the NUTS 1 or NUTS 2 level (NUTS - Nomenclature of Territorial Units for Statistical Purposes). The vast majority of regions are included at the NUTS 2 level. However, countries for which NUTS 1 and NUTS 2 levels coincide with the country's territory are included at the NUTS 1 level (country levels). In this paper, Patent Cooperation Agreement (PCT) applications represent the proxy output of regional European innovation, i.e., a modeled variable. Fig.1 presents Jenks's natural break map and a box plot for PCT applications to provide an overview of the actual spatial distribution of the modeled variable. A natural breaks map uses a nonlinear algorithm to group observations such that the within-group homogeneity is maximized (see Fisher, 1958 and Jenks, 1977). Using natural breaks maps seems more appropriate than, for instance, a quartile map because the natural breaks criterion is better at grouping the extreme observations. In contrast to the quantile maps, the number of observations in each category can be highly unequal. It is clear from Fig.1 that the regions of Greece, Spain, Portugal, southern Italy, and most regions in Eastern Europe have low levels of patents. On the contrary, patent production is concentrated mainly in the regions of Germany, Finland, Sweden, Norway, Switzerland, the Netherlands, and Denmark.

All calculations and graphical visualization of the results (maps and box plots) were carried out in GeoDa, GeoDaSpace, and RStudio.

The geographical differences in the distribution of innovation resulting from Fig.1 and many empirical studies point to an uneven distribution of innovation processes across European regions. Although the role of geographical proximity in innovation processes is often emphasized, this paper aims to examine another form of proximity among European regions. In contrast to geographical proximity (geographical distance between innovation actors - European regions), we consider technological similarities based on two

indicators. The first indicator is Small and medium-sized enterprises (SMEs) introducing product or process innovations, and the second indicator Small and medium-sized enterprises (SMEs) introducing marketing or organizational innovation is considered. Both indicators are defined as a percentage of SMEs. The neighborhood of the regions will be defined based on the difference in the number of SMEs. Fig.2 shows Jenks's natural break maps for the two indicators. As in the case of patent applications, we see that the highest concentration of innovators is evident in the regions of countries such as Germany, Finland, Norway, Switzerland, the Netherlands, and Denmark, and the number of innovators is lower for the regions of Spain and most regions of Eastern Europe. On the other hand, Greek or Portuguese regions have low patent performance and are characterized by many SMEs.

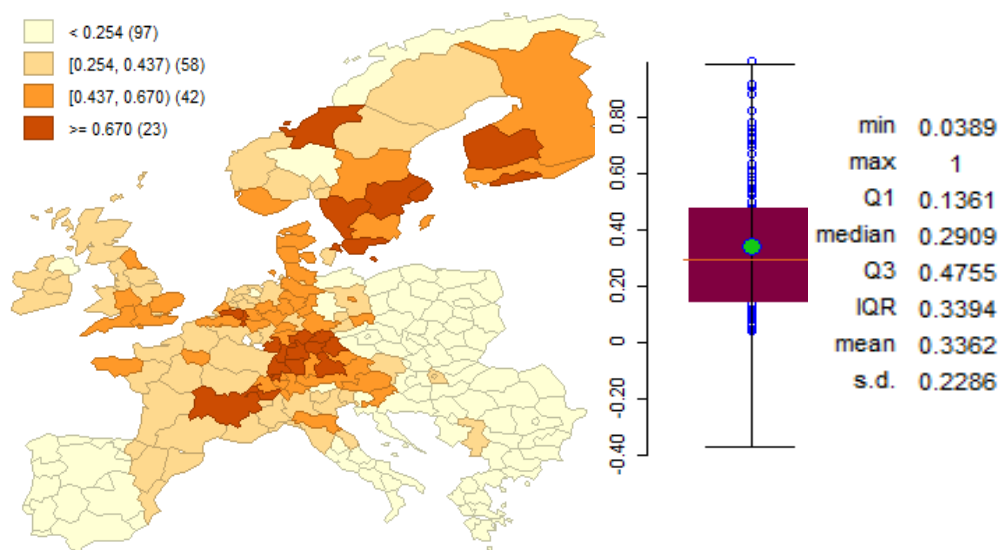
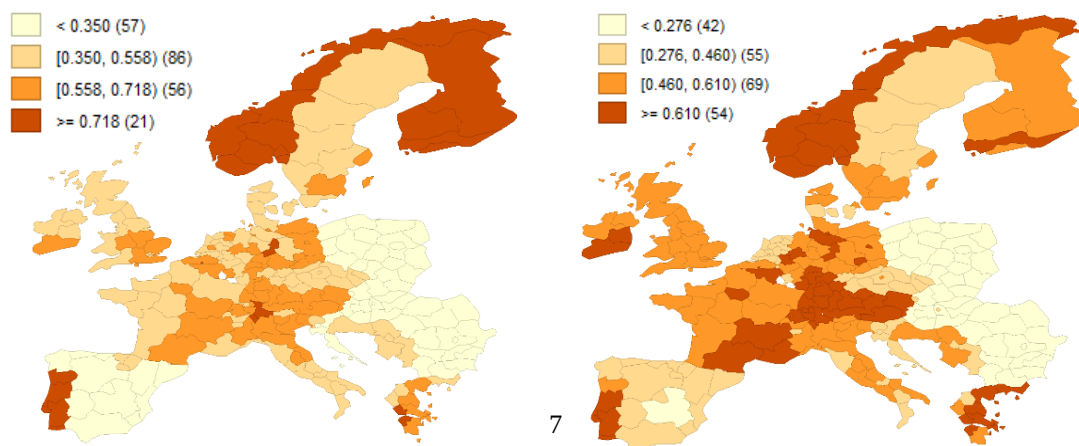


Fig. 1: Jenks's natural break map and box plot for Patent applications
 Source: RIS 2019 data (Hollanders et al., 2019); author's calculations
 Notes: Q1 – First quartile; Q3 – Third quartile; s.d. – Standard deviation



(a) (b)
 Fig. 2: Jenks's natural break maps for (a) SMEs - product or process innovations (b) SMEs - marketing or organizational innovations

Source: RIS 2019 data (Hollanders et al., 2019); author's calculations

The central premise of this analysis is that European regional innovations are unevenly distributed, probably spatially correlated, considering the proximity of regions in terms of technological similarity. The Moran's I test was performed as a starting point for spatial autocorrelation detection. The Moran's I value for PCT applications (technological similarity is considered) was 0.311 and statistically significant (pseudo p -value 0.001). The resulting potential spatial spillovers and uneven distribution of innovation have led us to consider spatial autocorrelation and spatial heterogeneity. The new MGWR-SAR models (presented in the next section) allow simultaneous consideration of both spatial effects (spatial autocorrelation and heterogeneity).

In all subsequent spatial econometric models, PCT applications at the European Patent Office (PCT applications in the EPO per billion regional Gross Domestic Product (GDP)) are used as a modeled variable - innovation output. The following variables are considered as innovation inputs: top 10% most-cited publications (as a percentage of total scientific publications), Research & Development (R&D) expenditure in the business sector (as a percentage of regional GDP), human resources in science and technology (as a percentage of the active population) and population density (persons per square kilometer).

All data are normalized using the min-max procedure, while RIS 2019 data are already reported as normalized. We also assume that lagging European regions (with a GDP per capita below 75% of the EU-27 average GDP) are weaker in patenting activities. The dummy variable is considered to control additional regional characteristics. Dummy variable for lagging regions ($DUMMY_{LAGG}$) is defined as: $DUMMY_{LAGG} = 1$, if region belongs to the category of lagging regions, others=0.

The estimation of spatial econometric models is based on the specification of the spatial weighting matrix $\mathbf{W} = (w_{ij} : i, j = 1, \dots, N)$ which summarizes the spatial relationships between N regions and is a key to the specification of the spatially lagged dependent variable. We consider technological similarity/proximity weights ($\mathbf{W}^{\text{TECH.PROX}}$) – the weights are a negative power distance function of distance (Euclidean distance metric was considered) of the following form:

$$w_{ij} = d_{ij}^{(-\alpha)} \quad (1)$$

where

$$\alpha = 1;$$

d_{ij} is the distance between observations i and j (based on the SMEs - product or process innovations).

In local regressions, i.e., MGWR-SAR estimation, a bandwidth parameter and a kernel function type must be provided. Spatial kernel weights ($\mathbf{W}_i^{\text{KERNEL-TECH.PROX}}$) - the adaptive Gaussian-shaped kernel function based on 50 nearest neighbours is used. The adaptive Gaussian-shaped kernel function is given as:

$$w_{ij} = \exp\left(-1/2\left(d_{ij}/h_{i(k)}\right)^2\right) \quad (2)$$

where

w_{ij} is the j -th element of the diagonal of the matrix $\mathbf{W}_i^{\text{KERNEL-TECH.PROX}}$;

d_{ij} is the distance (Euclidean distance metric was considered) between observations i and j (based on the SMEs - product or process innovations and SMEs - marketing or organisational innovations);

h is the bandwidth parameter.

The bandwidth parameter h is a function of the k nearest neighbours (50 nearest neighbours) and the same number of observations - locations are included in each local estimate.

To illustrate the spatial weights of the neighbourhood, we present Fig.3, which depicts the Swedish region Sydsverige (dark marked region) and its neighbouring regions. This region is one of the leaders in innovation activities (represented by patents); it is characterized by a diversified business environment, with several established clusters and several strong universities, which are also very beneficial in innovation. Fig.3(b) shows its neighbouring regions based on technological similarity/proximity weights, and for comparison, Fig.3(a) shows a neighbourhood based on the very well-known queen contiguity spatial weights. This figure clearly illustrates the differences in neighbouring regions. Higher variability in the number of neighbours occurs when we consider the matrix $\mathbf{W}^{\text{TECH.PROX}}$.

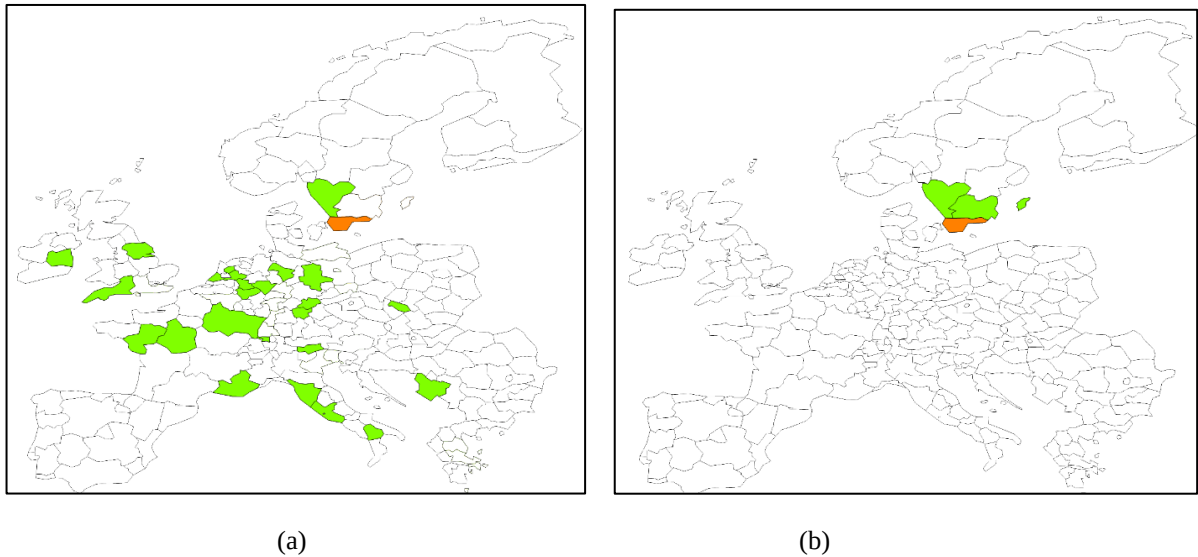


Fig.3: Swedish region Sydsverige (dark marked region) and its neighbouring regions - queen contiguity weights (a) and inverse distance technological proximity weights (b)
 Source: author's calculations

2.2. Econometric models

In the empirical part of this paper, we will focus on the estimation of the following three econometric models:

1. Non-spatial Ordinary Least Squares (OLS) regression:

$$y_i = \beta_0 + \sum_{k=1}^K \beta_k x_{ki} + \varepsilon_i, \quad i = 1, 2, \dots, N \quad (3)$$

where

y_i is the dependent variable at location i (N is the number of regions);

x_{ki} is the value of k -th explanatory variable at location i (K is the number of explanatory variables);

β_k is the regression coefficient of k -th explanatory variable;

β_{0i} is the intercept parameter;

ε_i is the random error at location i (independent and identically distributed).

The OLS estimation method will be used to estimate model (3).

2. Spatial Autoregressive model (SAR) - $\mathbf{W}^{\text{TECH.PROX}}$ spatial weights:

$$y_i = \rho \sum_{j=1}^N w_{ij} y_j + \beta_0 + \sum_{k=1}^K \beta_k x_{ki} + \varepsilon_i, \quad i = 1, 2, \dots, N \quad (4)$$

where

ρ is a spatial autoregressive parameter;

w_{ij} is an element of spatial weighting matrix $\mathbf{W}^{\text{TECH.PROX}}$.

The remaining model (4) terms were defined with the previous model (3). The issue of endogeneity problem appears in spatial autoregressive models such as model (4). In such models, the spatially lagged dependent variable $\mathbf{W}y$ is present. Therefore, the OLS method is not a suitable estimation method. The parameters of the model (4) can be estimated through Instrumental Variable approach, Maximum Likelihood, or generalized moment method. However, the modification of spatial aspects must be done. Estimating the SAR model in this paper is performed using the spatial two-stage least square (S2SLS) technique with $\mathbf{X}$ (matrix of regressors) and $\mathbf{W}\mathbf{X}$ (matrix of spatially lagged of regressors) as a set of instruments. Estimation details can be found, e.g., Anselin and Rey (2014) or Geniaux and Martinetti (2018).

3. Mixed Geographically Weighted Regression - Spatial Autoregressive (MGWR-SAR) - spatial kernel weights $\mathbf{W}_i^{\text{KERNEL-TECH.PROX}}$ and $\mathbf{W}^{\text{TECH.PROX}}$ spatial weights:

$$y_i = \rho_i \sum_{j=1}^N w_{ij} y_j + \beta_{0i} + \sum_{k=1}^K \beta_{ki} x_{ki} + \varepsilon_i, \quad i = 1, 2, \dots, N$$

(5)

where y_i is the dependent variable at location i ;

x_{ki} is the value of k -th explanatory variable at location i ;

β_{ki} is the local regression coefficient of k -th explanatory variable at location N ;

β_{0i} is the intercept parameter at location i ;

ρ_i is a spatial autoregressive parameter at location i ;

w_{ij} is an element of spatial weighting matrix $\mathbf{W}^{\text{TECH.PROX}}$;

ε_i is the random error at location i (independent and identically distributed).

Several MGWR-SAR model specifications can be derived from equation (5). This group of models is estimated by S2SLS method (see Geniaux and Martinetti, 2018).

The estimation of all econometric models in this paper follows the concept of an extended Regional Knowledge Production Function, which accounts for the role of territorial characteristics and spatial processes (for more details, see, e.g., Moreno et al., 2025a).

3. Results and Discussions

Tabl.1 contains the main estimation results. If we consider the results of the spatial dependence tests (see Tab.1), which were carried out based on OLS estimation (based on the formula (3)) and technological similarity/proximity weights matrix, we find that the problem of spatial autocorrelation is present. Therefore, discussing the OLS estimation in more detail is not necessary. We consider the OLS estimation and the SAR spatial model estimation (based on the formula (4)) to be the starting step of the econometric analysis. The estimation results of the SAR spatial model indicate the adequacy of the inclusion of all considered innovation inputs and point to the importance of spatial innovation spillovers. The models also contain dummy variables to capture the diversity of the innovation process in lagging regions. The statistical significance of both dummy variables (in absolute and interaction forms) indicated the expected differences. The estimates and statistical significance of the spatial autoregressive parameter (see the spatial lag parameter in Tab.1) indicate that the effect on innovation output using technological similarity as a measure of regional proximity is not negligible. Also, all indirect (results not shown due to lack of space, available on

request from the author) effects resulting from SAR estimation indicate significant spatial spillovers among regions.

In addition to the problem of spatial autocorrelation, in an area as large as the European space, it can also be expected that the strength of influence of individual innovation determinants may differ in individual regions. Therefore, the problem of spatial heterogeneity should also be considered. For this purpose, the simultaneous consideration of these two spatial effects within one model, we used a new approach to MGWR-SAR models outlined in Geniaux and Martinetti (2018) and presented by formula (5). We assume a model with all spatially variable parameters, including the spatial autoregressive parameter. In the MGWR-SAR model estimation process, an adaptive Gaussian kernel based on the 50 nearest neighbours defined by formula (2) was used.

Now we will focus on the main estimation results of the MGWR-SAR model (see Tab.1). The estimates are also presented in box plots (see Fig.4). Even the basic descriptive statistics (see Fig.4) draw a non-negligible variability of the estimated parameters.

Table 1: Estimation results generated by OLS, SAR, and MGWR-SAR model

Variable/innovation input	OLS	SAR	MGWR-SAR Percentage of significant cases at 95 %
Intercept	-0.1691***	-0.1831***	53.18%
Most-cited publications	0.2440***	0.1948***	47.73%
R&D expenditure in the business sector	0.5899***	0.5806***	100.00%
Human resources in science and technology	0.2898***	0.2777***	80.00%
Density	-0.3498***	-0.3386***	89.09%
DUM(Lagging regions)	0.1265***	0.1196***	71.82%
DUM(Lagging regions)* Human resources in science and technology	-0.5002***	0.4690***	93.18%
Spatial Lag	—	0.1352**	47.73%
R^2	0.7472	0.7582	—
Spatial pseudo R^2	—	0.7525	—
AIC	-314.465	—	-363.5662
Moran's I (Patent applications)	0.3107***	—	—
Moran's I (OLS residuals)	3.3453***	—	—
Lagrange Multiplier (SAR)	8.9227***	—	—
Robust Lagrange Multiplier (SAR)	4.4134**	—	—
Lagrange Multiplier (SEM)	4.8214**	—	—

Robust Lagrange Multiplier (SEM)	0.3121	–	–
Anselin–Kelejian test	–	0.321	–
Number of data points	220	220	Kernels type: Gauss Adapt, bandwidth=50

Notes: Parameters are statistically significant at **p-value<0.05; ***p-value< 0.01, LM – Lagrange Multiplier
 Source: author's calculations

The boxes in Fig.4 represent the interquartile range, and they do not overlap with one another. So, there are significant discrepancies in the estimated parameters in magnitude. All boxplots (box width) are presented concerning the percentage of significant cases. According to our results, R&D expenditure in the business sector seems to be the most significant innovation input; this factor was statistically significant in every region (see Tab.1). Moreover, its impact on innovation output reached the highest values (for instance, mean value was 0.5706). Another highly significant factor seems to be input Human resources in science and technology, which achieve high efficiency (mean value 0.3161) and a high proportion of statistically significant regions (80%).

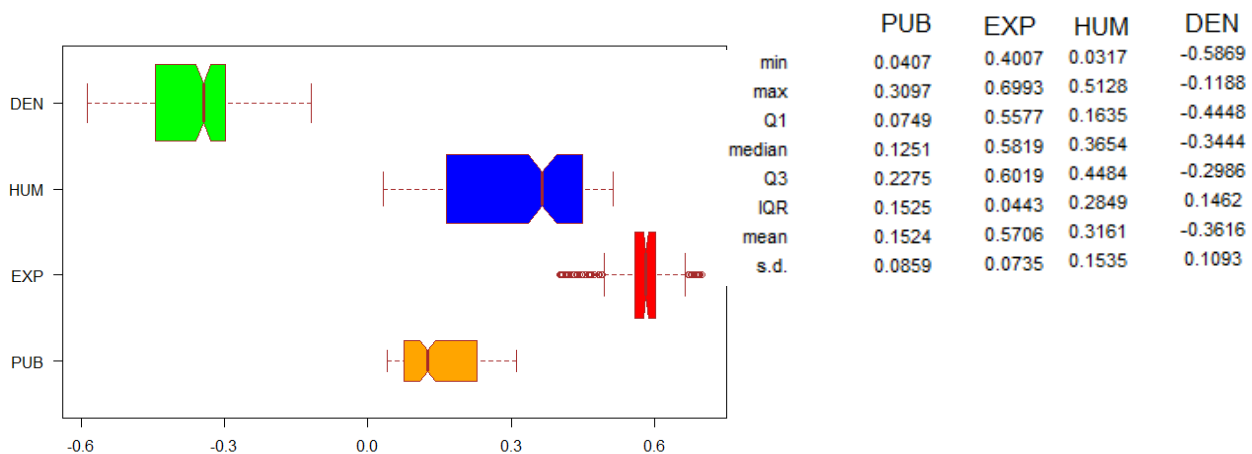


Fig. 4: Multiple boxplots for comparison – estimated parameters

Notes: PUB – Most-cited publications; EXP – R&D expenditure in the business sector; HUM – Human resources in science and technology; DEN – Density; Q1 – First quartile; Q3 – Third quartile; IQR – Interquartile range; s.d. – Standard deviation

Source: author's calculations

Both dummy variables were also included in the MGWR-SAR estimation as local variables, which is possible because the MGWR-SAR function allows dropping variables with low local variance in the local regression, which allows dummies to be considered without problems. MGWR-SAR also allows local outliers to be dropped in the local regression.

Finally, we constructed cluster maps based on the Machine Learning clustering algorithm to assess the parameters' spatial heterogeneity. Our clustering method was the density-based spatial clustering of applications with noise (DBSCAN). We decided on this because the DBSCAN does not require specifying the number of clusters to use. Only a function to calculate the distance between values need to be specified. Euclidean distance metric was applied. Another advantage compared to other algorithms (e.g., K-means clustering) is the different way the clusters are formed. In, e.g., K-means, clusters depend on the mean value of cluster elements, so each data point influences the forming of clusters. Even a slight change in data points can affect the clustering result (for details, see, e.g., Anselin, 2020).

The resulting cluster maps are shown in Fig.5 and Fig.6. Regarding local parameter estimates of Most cited publications and R&D expenditures in the business sector, we can see some similarities (see Fig.5). Both DBSCAN cluster maps contain one large cluster (with 157 and 142 observations, respectively) and some small ones. In addition, one region and seven regions are classified as outliers (noise). We see a different spatial pattern in the cluster maps for the Human resources in science and technology and Density. As we can see in the cluster maps in Fig.6, the clusters are now much smaller. In both cases, one large cluster in the previous case, covering mainly the Central and Western European regions, is being decomposed into several smaller sub-clusters. In the case of the innovation input Human resources in science and technology, up to 21 regions were identified as outliers. These results support the assumption of spatial heterogeneity, the spatial differentiation of parameters is very evident for human resources and population density, as we found many small clusters. On the other hand, the magnitudes of scientific publications and R&D expenditures seem more homogeneous across European regions.

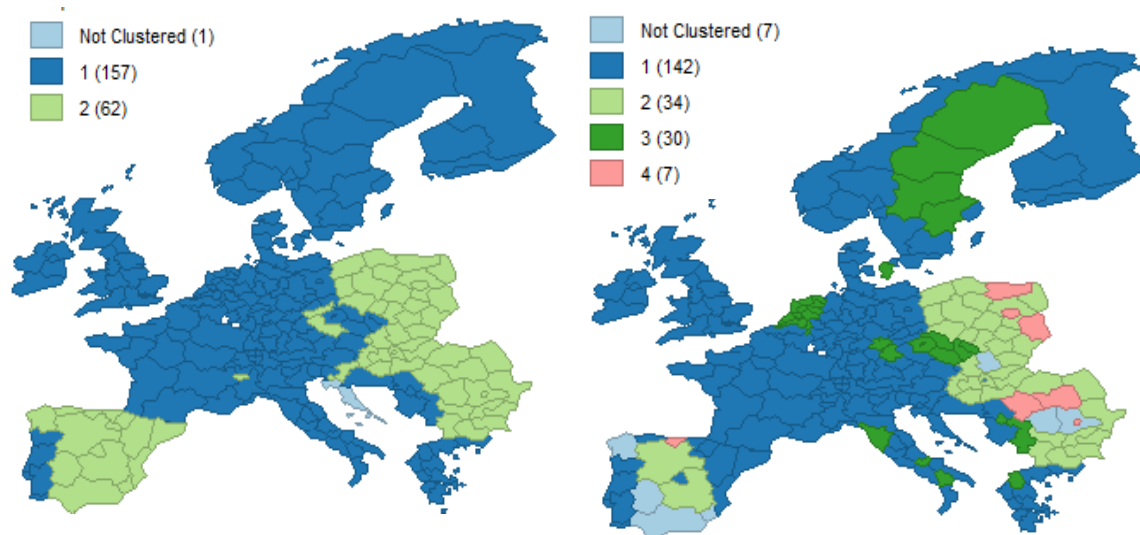


Fig. 5: DBSCAN cluster maps for Most-cited publications for R&D expenditure in the business sector
 Source: author's calculations

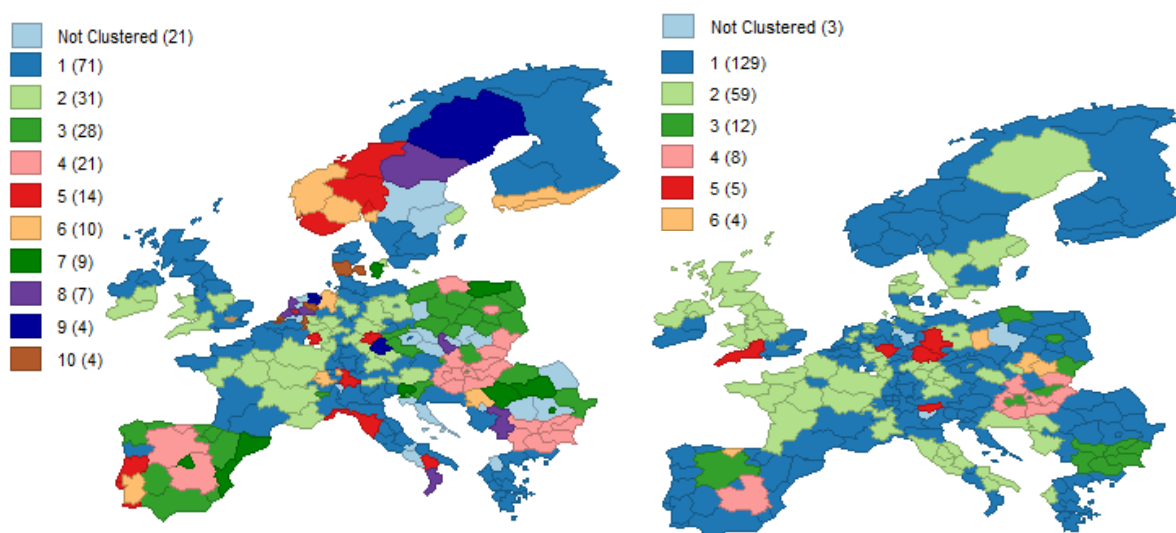


Fig. 6: DBSCAN cluster map for Human resources in science and technology and for Density
Source: author's calculations

At the end of the empirical part, we will separately deal with the estimates of the spatial autoregressive parameter. The estimated values of this parameter varied relatively high among regions, as indicated by both the natural breaks maps and the larger number of DBSCAN clusters (see Fig.7(a) and Fig.7(c)). Furthermore, it can be noted that the spatial autoregressive parameter was statistically significant in almost half of all regions (47.73%). Higher intensities of interregional innovation links were found in areas where the values of the parameter estimates were statistically significant (see Fig.7(a) and Fig.7(b)). An interesting finding is that spatial interactions are not a significant factor affecting innovation in the regions with the highest patenting activities (see Fig.1). However, we must remind that the proximity was defined through the similarity of the regions regarding SMEs. The geographical proximity of the most innovative regions and the resulting benefits for driving innovation seems more important than the similarity of these regions in terms of SMEs. These conclusions regarding the geographical proximity of the top innovation actors are evident from many empirical analyses. Clusters of innovative companies and the geographical proximity of research centres or universities allow their cooperation, sharing, and faster dissemination of new knowledge and technologies. On the other hand, the similarity of the regions in terms of SMEs seems to be a significant factor stimulating innovation processes for regions that are not among the top innovators.

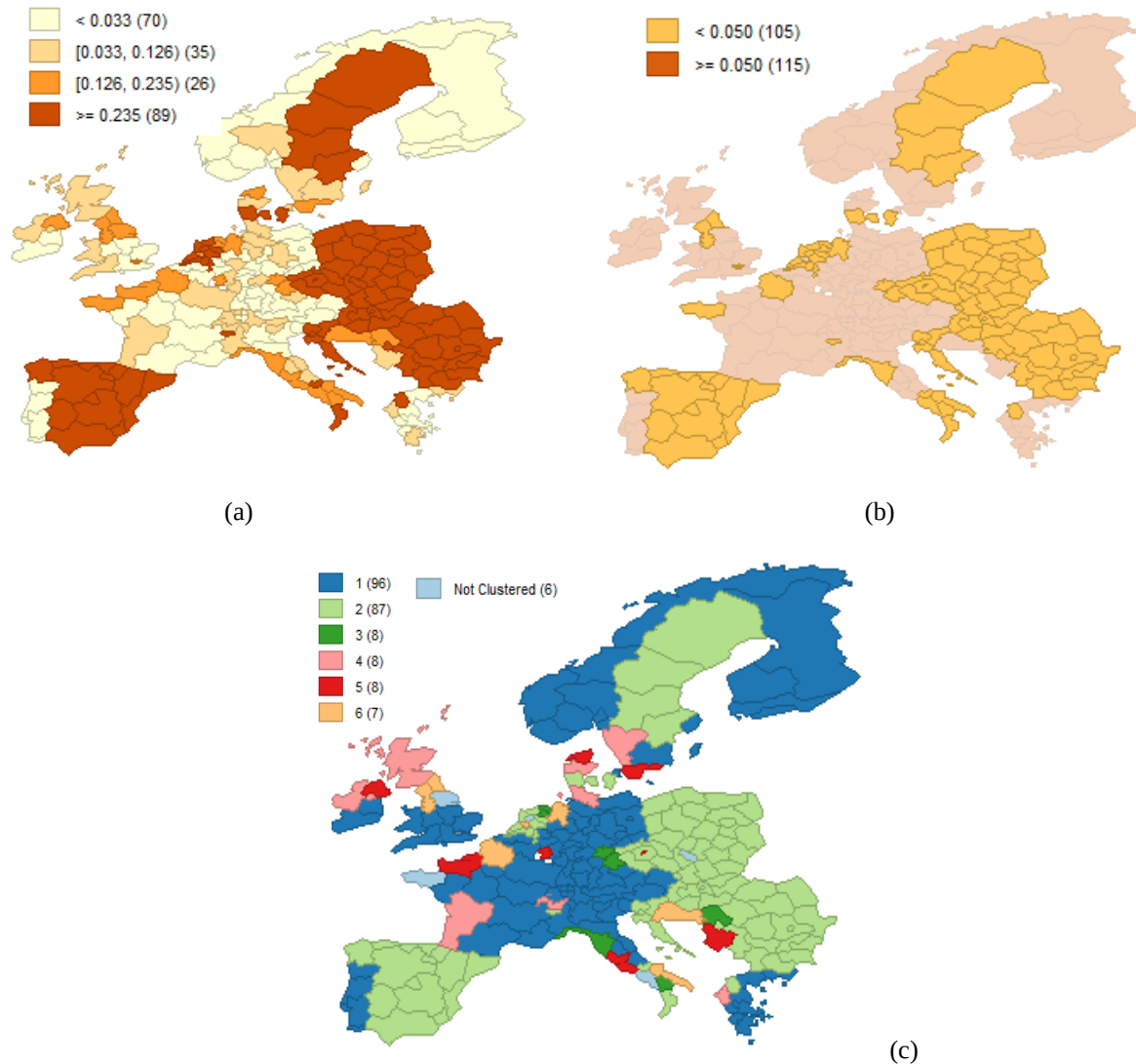


Fig. 7: Jenks's natural break map (a), statistical significance map (b), and DBSCAN cluster map (c) for spatial autoregressive parameter estimates

Source: author's calculations

4. Conclusions and some policy implications

This paper focuses on a spatial econometric analysis of 220 European regions based on a new class of data-generating processes, the MGWR-SAR approach. A significant advantage of this class of models is the simultaneous consideration of spatial autocorrelation of the endogenous variable and spatial heterogeneity of the parameters. As for European innovation, several studies have investigated both spatial effects, and their conclusions consider both spatial aspects. However, the simultaneous consideration of these effects within a single model is scarce, and therefore we intended to contribute to the innovation literature by estimating just such a model. Another aspect that distinguishes the analysis of this paper from the majority of analyses in a similar area can be considered the use of an alternative measure of proximity between regions concerning the European innovation problem. We have moved from geographical proximity to technological similarity based on the two indicators (Small and medium-sized enterprises (SMEs) introducing product or process

innovations and Small and medium-sized (SMEs) introducing marketing or organizational innovations. Patent applications were considered a proxy of innovation output.

The results supported the assumption of spatial heterogeneity; spatial differentiation of parameters was evident for innovation inputs, human resources, and population density, as we found many small clusters. It also appears that magnitudes of innovation input scientific publications and R&D expenditures are more homogeneous within the European regions. Considering the spatial spillovers, we found that regional innovation activities do not have only a local character in almost half of the regions. Their effects can be spread and might have impacts beyond the boundaries of the regions. An interesting finding was that spatial interactions were not a significant factor affecting innovation in the regions with the highest patenting activities. It should be remembered that proximity was defined through regional similarity in terms of SMEs. The geographical proximity of the most innovative regions and the resulting benefits for driving innovation seems more important than the similarity of these regions in terms of SMEs. These conclusions regarding the geographical proximity of the top innovation actors are evident from many empirical analyses (see, e.g., Autor, 2019). On the other hand, the similarity of the regions in terms of SMEs seems to be a significant factor stimulating innovation processes for regions that are not among the top innovators.

As our results provided individual regional estimates of parameters, innovation, and cluster policy instruments might be implemented more effectively, and a more place-based policy strategy can be pursued. For example, it is possible to predict whether the potential invested funds will only have a local benefit, or whether their benefit will spread to other regions as well. The results of such analyses help determine the targets of innovation and cluster policies. The interest does not have to be focused exclusively on the leading regions - the top innovators. However, policymakers can emphasize less developed regions or a specific group of actors, such as SMEs.

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Indirect Tax Reform and Market Efficiency : An empirical Study on Indian Stock Market

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Abstract. *The biggest indirect tax reform by the Indian Government is the implementation of the Goods and Services Tax (GST), which has replaced eleven types of indirect taxes. Ten years of data from the Bombay Stock Exchange Sensex and the National Stock Exchange Nifty50 index is studied. The data is divided into two sub-periods before GST was passed from Parliament Period - I and after GST was passed from the Parliament of India Period - II. The study intends to test the market efficiency in its semi-strong form. To establish the objective with the help of the time series data for normality, stationarity, random walk, and autocorrelation function, Kolmogorov-Smirnov (KS) test, Augmented Dickey-Fuller (ADF) test, Phillips Perron (PP) test is used for the analysis of the time-series data. The study found that returns are not normally distributed and the market is inefficient in a weak form for both the periods under study.*

Keywords: GST, Market Efficiency, Reform, Stock Exchange, Weak Form.

JEL Codes: C1, E0, H2

1. Introduction

Studies of developing economies have revealed that the proper functioning of the stock market has a considerable effect on the growth of an economy. Many studies have been conducted across the globe regarding the efficiency of financial market by various researchers. The results of those studies are conflicting, as from those studies we cannot conclude that the particular market is efficient or inefficient as market efficiency keeps on changing over time. The developing nations' share market needs frequent studies to determine if the event in the economy changes the efficiency of the market. By stock market efficiency study, we try to explain the association between the share price and market information. It was first defined by Eugene Fama in 1970. Where he describes market efficiency when the market automatically incorporates new information. Thus for an efficient market, we can say the current price reflects all the information related to the market. Fama (1970) the Efficient Market Hypothesis can be divided into weak form, semi-strong form, and strong form. In the weak form efficiency hypothesis, the market reflects the information contained in the historical price. In the semi-strong form, the current price of the share price not only reflects the historical price but also all the publicly available information. In strong form, the share price reflects both public and private information.

On 8th September 2016, the one hundredth and first constitutional amendment bill was approved by the former president Late. Mr. Pranab Mukherjee. India was Lagging behind many countries in ease of doing business and one of the core reasons is the complex tax structure. With the aim of One Nation One Tax, GST Goods and Services Tax was introduced. It is an indirect tax that has replaced many indirect taxes in India such as the VAT, excise duty, services tax, etc. The Goods and Services Tax Act was passed in the

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Parliament of India on 29th March 2017 and came into effect on 1st July 2017. In other words, Goods and Services Tax (GST) is levied on the supply of goods and services. Goods and Services Tax Law in India is a comprehensive, multi-stage, destination-based tax that is levied on every value addition. GST is a single domestic indirect tax law for the entire country. In this study, an attempt is being made to check if the implementation of GST has any impact on the Indian market efficiency. (Kushalappa. S., 2018) studied the impact of GST on the Indian stock market. The researcher studied the IT Industry, Automobile Industry, Cement Industry, FMCG Industry, and NBFC Industry sector and selected the companies on a random basis. The researcher has concluded that there is no statistically significance difference in the return in pre and post-GST implementation during the event window of 30 pre and post-event days. (Mani et al., 2017) in their study on the impact of GST on sectors, indices studied seven sectors. Automobile, Banking, FMCG, Health Care, IT, Manufacturing, and real estate. They used least square and DLOG as tools for the study of pre-15 days and post-15 days of the event. The researchers concluded that the automobile and banking sector have shown a significant impact whereas other studied sectors have some impact but not significant. Only the real estate sector has a positive return throughout the study whereas all other sector has an opposite return in the post and pre-studied period. Except for the real estate sectoral index all other indices.

1.1. Objective of the Study

This study aims to recognise the nature of the Indian stock market by testing the randomness in the returns of the daily market and to study the impact of GST implementation. Randomness in returns of the stock is possible only if the market is not efficient in weak form. Hence, the objective of this study is to check whether the Indian stock market follows a random walk which can be established by testing the weak form of market efficiency.

1.2. Rationale and Scope of Study

As there are three forms of market efficiency, all three forms are not studied in this paper. As for the strong form of market efficiency, there is the unavailability of data as it considers private or insider information which is not available in public platforms. While the semi-strong form does not measure the randomness of the market returns. As per the objectives which are studying the randomness in market return only a weak form of market efficiency is studied. Our objective is to test the effect of recent tax reforms on the randomness in market returns which is possible only in weak form. However, the valuation of shares is an essential function of the financial market which makes a path to form trading strategies. To understand the behavior of the market, the valuation of securities is required which is only possible by studying the market efficiency. Arbitrage is possible if the market is inefficient. If the market is efficient in the weak form, purchasing the undervalued share and selling into other markets where securities are overvalued or fairly valued is not possible. So for investors, it becomes difficult to earn abnormal profits from trading in such markets.

2. Research Elaboration

In the study, both the Bombay Stock Exchange BSE and the National Stock Exchange NSE market index is studied. The periodicity of the study is from 07-09-2012 to 28-08-2022 which consists of almost ten years of data. The data is divided into two periods; Period I consists of market data from 07-09-2012 to 06-09-2016 while period II consists of data from 08-09-2016 to 28-08-2022. The data is divided based on GST approved by the president and the gazette was published. The pre-data is given the name of period I while post-data is to be called period II. SPSS, e-views, and MS Excel are used to analyze the data of the market. The methods that are used to test the time series data for a random walk are normality, stationarity, and autocorrelation function.

Jarque-Bera (JB) Test is used to measure the normality of the distribution. The results of skewness and kurtosis, which are also used to test the normality, are verified by the JB test. So, the JB test is the test of the joint hypothesis that skewness and kurtosis are zero and three respectively. The value of the JB statistic is calculated using the following equation:

$$JB = n [S^2/6 + (K-3)/24]$$

The conclusion can also be drawn based on the probability value. If the value of probability is more than 0.05 at a 5% level of significance, we accept the null hypothesis for normality and can conclude that the observed series follows a normal distribution.

Kolmogorov-Smirnov (KS) Test is a well-accepted goodness of fit test. It compares the observed cumulative distribution function for a variable with a specified theoretical distribution which may be normal, uniform, Poisson, or exponential. It determines how well a random sample of data fits a particular distribution. It checks whether the observations have come from the specified distribution.

Run Test is used to test the randomness of the time series. The null hypothesis of the test is that the observed series is a random variable. When the Z value is more than + 1.96 at a 5 percent level of significance, the test rejects the null hypothesis. The test is non-parametric and is independent of the normality and constant variance of data.

Unit Root Test is used to test the stationarity of time series data and to find out whether a time series variable is non-stationary. The most popular unit root tests used to test the stationarity are the Augmented Dickey-Fuller (ADF) test and Phillips Perron (PP) test. Both tests use the existence of a unit root as the null hypothesis. If the series is nonstationary and the first difference of the series is stationary, the series contains a unit root.

The Autocorrelation Function (ACF) is used to determine the correlation of the series with itself. It measures the amount of linear dependence between observations in a time series that are separated by lag.

3. Results and Discussions

3.1 Descriptive Statistics

The descriptive statistics describe the characteristics of the data as the summary of descriptive statistics, which is provided in exhibit - 1 for both Period-I and Period II. The sample means median, maximum, minimum, Standard deviation, skewness, kurtosis, Jarque-Bera statistics, probability, and observation value are given hereunder.

Exhibit - 1: Descriptive Statistics

	Period-I		Period-II	
	BSE	NSE	BSE	NSE
Mean	23846.89	7198.411	34446.81	10409.32
Median	25033.69	7565.800	34920.34	10583.65
Maximum	29681.77	8996.250	41952.63	12362.30
Minimum	17683.73	5285.000	25765.14	7610.250
Std. Deviation	3580.804	1107.187	4085.216	1107.581
Skewness	-0.188235	-0.164325	-0.246242	-0.406428
Kurtosis	1.473364	1.450104	2.176056	2.327365
Jarque-Bera	101.3663	102.9178	37.54798	45.36181
Probability	0.000000	0.000000	0.000000	0.000000
Observation	984	984	978	978

Source: Authors Calculation

From the exhibit of the period - I, it can be seen that the mean value, median value, minimum price maximum price and standard deviation of BSE are higher than the NSE. The high standard deviation in BSE for period I as compared to NSE signifies that BSE is more volatile. The skewness and kurtosis reveal that

the market doesn't follow a normal distribution as is also reflected in the value of Jarque-Bera and the probability value.

For period – II, it gives the same result the Std Deviation is higher in BSE Sensex. The volatility in BSE has increased in period – II as compared to period – I. The volatility doesn't change much in NSE in both periods, it remains almost the same at Std. Deviation of 1107.187 and 1107.581 in two periods. Both the market doesn't follow a normal distribution as it is reflected in the value of skewness, kurtosis, Jarque-Bera and probability value.

3.2 One-Sample Kolmogorov-Smirnov Test

The Kolmogorov-Smirnov one-sample test compares the cumulative distribution function for variables with a uniform or normal distribution and tests whether the observation has come from the specified distribution. Exhibit 2 shows the results of the KS test for Period-I and period-II respectively.

Exhibit -2: One-Sample Kolmogorov-Smirnov Test

Parameters		Period - I		Period - II	
		BSE	NSE	BSE	NSE
N		984	978	984	978
Most Extreme Differences	Absolute	.139	.053	.156	.069
	Positive	.136	.043	.156	.050
	Negative	-.139	-.053	-.137	-.069
Test Statistic		.139	.053	.156	.069
Asymp. Sig. (2-tailed)		.000 ^c	.000 ^c	.000 ^c	.000 ^c

Source: Authors Calculation

Ho : Test distribution is Normal

Exhibit 2, shows that returns in both periods I and II do not follow a normal distribution as the probability value is less than 0.05 at 5 percent level of significance in both the period for BSE and NSE thus the null hypothesis, Ho: Test distribution is Normal is rejected. It can be said that the returns are not normally distributed.

3.3 Run Test

The results of the run test are given in the following Exhibit. Exhibit 3 gives the values of the run test for period -I i.e. the period before GST was passed in parliament and the value for period II i.e. the period after GST was passed.

Exhibit -3: Runs Test

	Period -I		Period - II	
	BSE	NSE	BSE	NSE
Test Value	25033.69	34920.34	7565.80	10583.65
Cases < Test Value	492	489	492	489
Cases >= Test Value	492	489	492	489
Total Cases	984	978	984	978
Number of Runs	14	24	16	20
Z	-30.555	-29.817	-30.428	-30.073
Asymp. Sig. (2-tailed)	.000	.000	.000	.000

Source: Authors Calculation

Ho: The Variable is random

From period – I, it is seen that the p-value for both BSE and NSE is less than 0.05, as well as Z values, are more than +1.96. So H_0 : The Variable is random null hypothesis is rejected at a 5 percent level of significance. Both BSE and NSE do not follow random walk during this period, thus implying that BSE and NSE are weak form inefficient.

For the period – II, the p-value for both the index is less than 0.05 thus means that even after the passing of GST the market does not follow a random walk. It is concluded that the market is weak form inefficient.

3.4 Unit Root Test

The unit root test is used to test the existence of non-stationarity in the time series data. If the series is nonstationary in level form and stationary in first difference form, then it is expected that the series contains unit roots. The results of the level form and first difference are given in the following part.

H_0 : The null hypothesis of unit root states that the series does not contain unit root.

3.4.1 Augmented Dickey-Fuller (ADF) Test

The results of the ADF Augmented Dickey-Fuller Test of the unit root are given in Table 4a for the period I, which is before the GST was passed in parliament and Table 4b for the period). after the GST was passed.

Table – 4.a: Unit Root Test (Period - I)
 Augmented Dickey-Fuller (ADF) Test

	Level				First Difference		
Symbol	Lag length	ADF statistic	p-value		Lag length	ADF statistic	p-value
BSE	1	-1.306200	0.6286		0	-28.28554	0.0000
NSE	1	-1.165089	0.6913		0	-28.13814	0.0000

Exogenous: Constant

Lag Length: 1 (Automatic - based on SIC, maxlag=21)

MacKinnon (1996) one-sided p-values.

Deterministic terms: Intercept

Values in exhibit 4.a, show the ADF test regarding the stationarity of data at level form and first difference form. From the p-value we can see at the level form for both BSE and NSE the series is non-stationary whereas in the first difference, it is stationary. Which means that the time series data contains a unit root. Therefore, from period – I data it can be concluded that both BSE and NSE do not follow random walk. The markets in this period are considered to be weak form inefficient.

Exhibit – 4.b: Unit Root Test (Period - II)
 Augmented Dickey-Fuller (ADF) Test

	Level				First Difference		
Symbol	Lag length	ADF statistic	p-value		Lag length	ADF statistic	p-value
BSE	6	-1.694727	0.4337		5	-12.37102	0.0000
NSE	7	-2.040736	0.2694		5	-12.42774	0.0000

Exogenous: Constant

Lag Length: 1 (Automatic - based on SIC, maxlag=21)

MacKinnon (1996) one-sided p-values.

Deterministic terms: Intercept

Values in Tablet 4.b, show the ADF test regarding the stationarity of data at level form and first difference form. From the p-value we can see at the level form for both BSE and NSE the series is non-stationary whereas in the first difference, it is stationary. This means that the time series data contains a unit root.

Therefore, from period – II data it can be concluded that both BSE and NSE do not follow random walk. The markets in this period also are considered to be weak form inefficient.

3.4.2 Phillips-Perron (PP) Test

PP test is another method of testing the stationarity in time series data. The results of the PP test for the period before the passing of GST in parliament (Period-I) and the period after the GST was passed by parliament (period-II) are given in Table 5a and Table 5b respectively.

Table– 5.a: Unit Root Test (Period - I)
 Phillips-Perron (PP) Test

	Level				First Difference		
Symbol	Bandwidth	P-P test statistic	p-value		Bandwidth	P-P test statistic	p-value
BSE	6	-1.250367	0.6542		9	-28.14498	0.0000
NSE	6	-1.099996	0.7177		9	-27.98825	0.0000

Exogenous: Constant

Bandwidth: Newey-West using Bartlett kernel

MacKinnon (1996) one-sided p-values

Deterministic terms: Intercept

Table 5.a, shows the PP test rejects the null hypothesis. Ho: The series does not contain a unit root. Both the market data of BSE and NSE are non-stationary in level form whereas at the first difference level, it is stationary. This implies that both BSE and NSE do not follow a random walk and can be said as weak form inefficient in period – I.

Table – 5.b: Unit Root Test (Period - II)
 Phillips-Perron (PP) Test

	Level				First Difference		
Symbol	Bandwidth	P-P test statistic	p-value		Bandwidth	P-P test statistic	p-value
BSE	2	-1.550830	0.5074		5	-33.32141	0.0000
NSE	2	-1.718662	0.4215		4	-33.02507	0.0000

Exogenous: Constant

Bandwidth: Newey-West using Bartlett kernel

MacKinnon (1996) one-sided p-values

Deterministic terms: Intercept

Table 5.b, shows the PP test rejects the null hypothesis. Ho: The series does not contain a unit root. Both the market data of BSE and NSE are non-stationary in level form whereas at first difference level, it is stationary. This implies that both BSE and NSE do not follow random walk in the second period also and can be said as weak form inefficient in period – II.

3.5 Auto Correlation Function (ACF)

The ACF is used to determine the independence of stock index changes. It measures the amount of linear dependence between observations in time series that are separated by lags.

Table – 6: Autocorrelation Function

Lags	Period I			Period II	
	BSE	NSE		BSE	NSE

1	.995	.995		.994	.993
2	.991	.990		.988	.987
3	.986	.986		.982	.979
4	.982	.981		.975	.972
5	.977	.977		.969	.964
6	.973	.973		.961	.955
7	.970	.969		.954	.948
8	.966	.965		.947	.939
9	.962	.961		.939	.930
10	.958	.957		.932	.922

Source: Authors Calculation

Table 6, shows the ACF which reflects a high degree of dependence on previous series data when the lag is low. However, as the lag is increased the dependence is decreased. For BSE the autocorrelation values range between .995 and .958 and for NSE it ranges between .995 and .957 for period I. For a market to be efficient in weak form the autocorrelation should be around Zero. For period I and for period II no correlation is found to be Zero thus implying that the market is inefficient in weak form.

4. Conclusion

The efficiency in stock markets explains the extent to which the stock prices reflect all available information in the market and therefore by relying upon this information, one can decide between buying or selling the stocks. Relevant investment strategies could be adopted after deciding whether the market is efficient or not. Based on the results of the data in section 5, we concluded that the Indian stock market does not show weak-form market efficiency and doesn't follow a random walk for both periods. The implementation of GST has no impact on the efficiency in both the period. There are possibilities of earning abnormal returns from BSE and NSE because the market is inefficient as a result future prices can be predicted using historical data. The Augmented Dickey-Fuller (ADF) Test Phillip Perron test results show that both BSE and NSE don't follow random walk. The study concludes that the market is inefficient in weak form. The condition of weak-form market inefficiency may be beneficial for investors as they can earn abnormal returns from the market. If the investors use historical market data, they can earn abnormal returns from the market

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Inflation of Insurance Damages Through Damages Paid by Insurance Companies in Albania

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Abstract. *The insurance sector as an industry plays a very important role in the economy and development of the non-financial market of developing countries, such as the case of Albania. Such a development of the insurance market in relation to other non-banking financial markets has been noticed not only in Albania but also in most other European countries due to the nature and dynamics that characterize this market. This market, which offers products and services to both individuals and businesses, includes only private companies as the only state-owned company was privatized in 2016. The development of the insurance market has been long, complex and delayed compared to other countries. This is also the reason that this sector in Albania occupies a relatively low weight in the Albanian financial system. The main role of the insurance company is to act as a risk transfer mechanism and to protect the insured from the risks provided in the insurance policy, which may be material or physical. Insurance compensates the insured for property claims, for permanent or temporary bodily injuries, and for this reason, the reserve for future claims must be estimated as accurately as possible by taking into consideration the claim inflation, which in Albania is almost impossible to evaluate due to the lack of data and the application of different models for its evaluation.*

Keywords: Average Claim Method; Consumer Price Index; Claim Inflation; Claim Triangle; Insurance; Reservation.

JEL Codes: G2, G21

Introduction

Claims inflation is one of the key assumptions used by non-life actuaries. An estimate of the claims inflation rate is needed in almost all areas where non-life actuaries are involved, including reserving, pricing, capital planning and modelling (Booth, P., Chadburn, et al 2020). For reserving, understanding historical claims inflation rates is of primary importance, while for capital planning and modelling, the actuary must forecast expected future rates.

For pricing, both past and future rates are needed to put past years on a comparable basis with the current year and the latter to project results into the next year. Unfortunately, claims inflation is very difficult to measure with a degree of certainty (Paldynski, H. 2015). It is difficult to accurately assess the progress of the level of inflation of claims in the past years.

This is due to the fact that there are numerous other factors can skew claims statistics, including shifts in the business environment, adjustments to policy terms, deductibles, and limits, as well as adjustments to settlement trends. Furthermore, estimating the future level of claims inflation is considerably more challenging than quantifying previous inflation rates (Liljestrand, J., & Nyberg, F., 2023).

This is because claims data is skewed by many other factors such as changes in the business climate, changes in policy limits, deductibles and policy terms, and changes in settlement patterns. And, as difficult as it is to put numbers on past inflation rates, it is even more difficult to estimate the future level of claims

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inflation. Although, opportunities from online innovators, mobile phone manufacturers, and a variety of non-banking businesses are the next challenges (Ilollari, et.al., 2022).

The purpose of this paper is to analyse how insurance claims evolve, considering the inflation factor and its impact on the reserve. The study of claims inflation and its calculation will enable insurance companies to have adequate reserves as well as a more accurate estimate of expenses and premiums for future years.

Providing a comprehensive conceptual framework regarding claims inflation and its impact on insurance company reserves. Reviewing the factors in the size and frequency of claims as well as the methods used for estimating claims inflation will present a complete overview of the possibility of estimating claims inflation and its use in reserving methods. This study seeks to answer the question: Can the inflation of insurance claims be estimated by taking into consideration the claims paid by insurance companies in Albania?

1. Economic inflation, claims inflation and their importance

What exactly is claims inflation and how does it affect non-life insurance liabilities?

To assess and understand claims inflation, one must first define economic inflation, which can be defined as a sustained increase in the general price levels of goods and services in an economy over a period of time. More briefly, by inflation, we will understand the continuous increase in the general level of prices. Inflation is usually measured by monitoring the price of an average basket of goods and services over time (Partachi, I., & Motelica, V. 2015).

Both non-life and life insurance are badly impacted by inflation. This is typically caused by the inability to accurately estimate technical reserves, the difficulty in forecasting future performance, and the declining outlook for the presentation of financial assets in insurance portfolios. By raising the percentage of mandatory insurance, rising inflation has an impact on the insurance market's structure (Prodanov, et al., 2022).

The Harmonized Index of Consumer Prices is used to calculate inflation for the entire euro area (HICP). This index is infamous for being disturbed by significant price variability in specific goods, but it correctly captures changes in the average price of the complete household consumption basket. Thus, one must also keep an eye on core inflation, which is more stable. According to Lalliard, A., & Robert, P. A. (2022), this is often assessed in the euro area as the change in prices excluding energy and food.

This is the consumer price index which is also used in Albania by the Institute of Statistics to estimate economic inflation (INSAT). In general, inflation is divided into three categories:

1. Moderate inflation which expresses the slow increase in the general level of prices and this stage of inflation is low, usually 2% to 3%
2. Galloping inflation which is characterized by high price levels and in the situation of galloping inflation, rates are 2 digits (13-16%).
3. Hyperinflation. In the hyperinflation phase, every economic process is deregulated and this type of inflation is deadly for the economy. However, hyperinflation is a very rare phenomenon and can only happen in the case of war.

But we need to understand how 'ordinary' inflation relates to claims inflation. What is the basket of goods and services in the context of insurance? Insurers sell the promise to pay the insured an indemnity or benefit after an event of a loss caused by the insured perils, subject to any limitations, for a premium received in advance as agreed upon in the insurance policy. Therefore, the products sold by an insurer are the

future claims payments and the basket of goods and services is determined by the insurance contracts, the terms describing the policies and the expected costs of the claims.

As with ordinary inflation, where the cost of the basket is derived from the items purchased, in the insurance context the items purchased are the frequency and severity of claims.

So, claims inflation is the change in the level of the expected cost of claims for an insurance policy in an economy over time (Ahlgrim, K. C., & D'Arcy, S. P. 2012).

The cost of claims is subject to limitations by the wording of the policy. As evidenced above, the basket of goods and services in the insurance context are the policy terms that describe the indemnity or benefits, the deductible and limits, the risks or exposures insured and the risks covered.

Accurately estimating claims inflation is important for several reasons:

- Sufficiency of reserves in the financial statements;
- Business strategy: the risk of under-reserving and underpricing of products;
- Premiums and expenses in the coming years;
- Effective management of requests;
- More accurate price estimation;
- Cost reduction and increased profitability;
- Long-term stability.

Economic inflation can be easily calculated if the basket of goods and services does not change (Tobin, J. 1978). But we live in a world that changes every day and new products are developed and others are no longer used. So, the calculation of economic inflation becomes difficult and needs frequent adjustment. Also, different sectors have faced several obstacles as a result of the pandemic situations and emergencies, such as lower demand, supply chain interruptions, and operational constraints brought on by lockdowns and social distancing efforts (Ilollari, et.al 2024).

Similarly, insurance contracts change over time when customers require changes to deductibles, include or exclude certain risks, or make changes to the underlying exposure, and in all those cases considerations should be given to how they will be valued. Customers know their products and characteristics, but they should be more convincing and persistent in improving their marketing skills (Ilollari et.al.,2022).

In the case of claims inflation, it is important to consider the frequency and magnitude of claims separately (Hong, L., & Mommaerts, C. 2024).

Total claims inflation is clearly a combination of trends in frequency and severity, but very different factors drive trends in these two elements. Consequently, only by analyzing them in isolation from each other can one fully understand what affects claims inflation. So many aspects make it difficult to estimate an accurate level of claims inflation.

2. Methodology

A claims reserve is a reserve of money set aside by an insurance company to pay liabilities that have arisen or are expected to arise from insurance policies.

The claims reserve is the sum between the reported and unsettled claims RBNS (Reports But not Settled) and the incurred but not reported Incurred But Reported (IBNR) claims. An insurance company will set a

claim reserve for each file by reflecting its best estimate of the eventual settlement amount (Reid, D. H. 1978), (Raeva et.al., 2021).

This study will rely on the use of a well-known reserving methodology (the average claims method) to measure the amount of inflation that would produce the least variance in the claim's triangles. This method (Amir Ahmad Dar & Sai Varshini 2017), considers two key elements which are the number of claims and the average value of claims.

This method consists of developing triangles for the total value of claims as well as for the number of claims. By dividing the data into the two triangles formed, a third triangle will be created that reflects the average value of the claims and then the claims will be projected using the development factors and thus the reserve will be calculated. This methodology will be based on numerical methods. After constructing the triangles and estimating the claims inflation generated from the data, the result will be compared to the consumer price index to get an idea of how these two inflations differ from each other. For the model, claims were selected from a Motor Third Part Liability (MTPL) portfolio for the period *July 2016 to December 2020*.

MTPL portfolio was selected due to several considerations:

First: This has historically been and still remains the most important portfolio for Albanian non-life insurers both in the volume of premiums and in its contribution to gross profitability.

Secondly: and partly as a result of the first consideration, the volume of data available from such a portfolio is much higher than the similar volume of other products, giving more credibility to our calculations.

3. Analysis

For MTPL's portfolio, data on claims were collected from July 2016 to December 2020.

They are divided into 2 groups; a). date of accident and b). date of settlement.

For each of the claims, the amount is attached. The data were collected and grouped, and the average claim triangle was constructed (triangle of paid claims/triangle of the number of claims):

Table 1 Average claim triangle (triangle of paid claims/triangle of number of claims)

average claim		+1 year				+2 years				+3 years				+4 years				+5 years	
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
2016	1																		
	2																		
	3	25,000	73,813	73,813	73,813	73,813	73,813	73,813	73,813	73,813	73,813	73,813	73,813	73,813	73,813	73,813	73,813	73,813	73,813
	4	59,063	78,075	82,913	128,025	128,025	126,096	126,096	126,096	126,096	126,096	126,096	126,096	126,096	126,096	126,096	126,096	126,096	126,096
2017	5	98,336	110,056	106,980	156,550	155,948	183,201	183,201	183,201	212,597	212,597	212,597	212,597	212,597	212,597	212,597	212,597	212,597	212,597
	6	64,956	67,258	68,809	77,060	100,645	132,093	132,093	136,628	136,628	136,628	136,628	136,628	136,628	136,628	136,628	136,628	136,628	136,628
	7	79,944	80,860	90,872	90,584	94,308	101,893	101,893	122,955	122,955	122,955	139,463	146,473	146,473	150,492	150,492	150,492	150,492	150,492
	8	73,327	73,491	90,592	90,592	93,321	95,014	95,167	95,167	95,167	95,167	95,167	109,179	112,754	113,406	113,406	113,406	113,406	113,406
2018	9	74,066	71,137	76,831	89,943	108,314	108,314	107,901	107,188	123,063	123,063	123,063	123,063	123,610	124,324	124,324	124,324	124,324	124,324
	10	75,489	86,010	82,416	100,170	102,616	102,616	102,616	116,995	137,006	137,006	137,006	140,182	140,805	141,619	141,619	141,619	141,619	141,619
	11	134,890	119,220	139,043	136,502	132,839	136,736	136,736	136,736	141,090	141,090	143,358	146,681	147,332	148,184	148,184	148,184	148,184	148,184
	12	105,426	86,259	82,788	81,612	80,921	117,076	117,076	131,580	152,941	152,941	155,399	159,001	159,708	160,631	160,631	160,631	160,631	160,631
2019	13	54,263	65,583	64,132	65,786	64,523	64,523	64,523	100,184	107,594	107,594	109,322	111,857	112,354	113,003	113,003	113,003	113,003	113,003
	14	171,305	117,531	106,614	105,468	104,556	119,965	126,962	136,110	146,177	146,177	148,526	151,969	152,644	153,526	153,526	153,526	153,526	153,526
	15	86,763	69,242	68,685	67,815	82,498	87,889	88,324	94,688	101,691	101,691	103,325	105,721	106,190	106,804	106,804	106,804	106,804	106,804
	16	106,772	93,803	94,715	96,393	117,942	129,260	129,900	139,260	149,560	149,560	151,963	155,486	156,177	157,079	157,079	157,079	157,079	157,079
2020	17	94,995	81,368	79,094	96,481	102,152	111,955	112,509	120,616	129,537	129,537	131,618	134,669	135,268	136,049	136,049	136,049	136,049	136,049
	18	100,505	118,753	116,497	129,720	137,344	150,525	151,270	162,170	174,164	174,164	176,962	181,065	181,869	182,920	182,920	182,920	182,920	182,920
	19	77,864	74,904	76,644	85,343	90,359	99,031	99,521	106,692	114,583	114,583	116,424	119,123	119,652	120,344	120,344	120,344	120,344	120,344
	20	85,028	84,133	86,087	95,858	101,492	111,232	111,783	119,837	128,701	128,701	130,769	133,800	134,395	135,171	135,171	135,171	135,171	135,171

(Source: Authors)

This triangle is then fully developed according to the chain ladder method (weighting the factors according to the average size of the claim). Up to this point, this is a standard average claim reserving method. We assume that claims inflation does not exist and that all similar claims will always be settled for the same amount regardless of the date of the accident. Thus, we would expect all claims of a similar nature to cluster close to the average, exhibiting a low standard deviation. So, by taking the average for each column (representing a certain lag period), we at least separate claims that are supposed to have the same characteristics.

We then calculate the difference between each triangle cell and its corresponding average by constructing the error triangle:

Table 2 Error Triangle

Error	+1 year				+2 years				+3 years				+4 years				+5 years	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
2016	1																	
	2																	
	3	(62,111)	(12,382)	(14,383)	(24,394)	(30,166)	(40,145)	(40,709)	(48,961)	(58,041)	(58,041)	(60,160)	(63,265)	(63,874)	(64,670)	(64,670)	(64,670)	(64,670)
	4	(28,048)	(8,119)	(5,282)	29,819	24,046	12,139	11,575	3,323	(5,757)	(5,757)	(7,876)	(10,982)	(11,591)	(12,386)	(12,386)	(12,386)	(12,386)
2017	5	11,225	23,862	18,784	58,344	51,969	69,243	68,679	60,428	80,743	80,743	78,625	75,519	74,910	74,115	74,115	74,115	74,115
	6	(22,155)	(18,936)	(19,387)	(21,146)	(3,333)	18,135	17,571	13,855	4,775	4,775	2,656	(450)	(1,059)	(1,854)	(1,854)	(1,854)	(1,854)
	7	(7,166)	(5,334)	2,676	(7,622)	(9,671)	(12,064)	(12,628)	182	(8,898)	(8,898)	5,491	9,395	8,786	12,010	12,010	12,010	12,010
	8	(13,784)	(12,703)	2,396	(7,614)	(10,657)	(18,943)	(19,354)	(27,606)	(36,686)	(36,686)	(38,805)	(27,899)	(24,933)	(25,077)	(25,077)	(25,077)	(25,077)
2018	9	(13,045)	(15,057)	(11,365)	(8,264)	4,335	(5,644)	(6,620)	(15,585)	(8,791)	(8,791)	(10,909)	(14,015)	(14,077)	(14,159)	(14,159)	(14,159)	(14,159)
	10	(11,622)	(184)	(5,780)	1,964	(1,362)	(11,341)	(11,905)	(5,778)	5,153	5,153	3,034	3,104	3,118	3,136	3,136	3,136	3,136
	11	47,780	33,026	50,847	38,295	28,880	22,778	22,214	13,963	9,237	9,237	9,385	9,603	9,645	9,701	9,701	9,701	9,701
	12	18,315	65	(5,408)	(16,594)	(23,057)	3,118	2,554	8,807	21,088	21,088	21,427	21,923	22,021	22,148	22,148	22,148	22,148
2019	13	(32,848)	(20,612)	(24,064)	(32,420)	(39,455)	(49,434)	(49,998)	(22,589)	(24,260)	(24,260)	(24,650)	(25,221)	(25,333)	(25,480)	(25,480)	(25,480)	(25,480)
	14	84,194	31,337	18,418	7,261	577	6,008	12,441	13,337	14,323	14,323	14,553	14,891	14,957	15,043	15,043	15,043	15,043
	15	(347)	(16,952)	(19,511)	(30,391)	(21,481)	(26,068)	(26,197)	(28,085)	(30,162)	(30,162)	(30,647)	(31,357)	(31,497)	(31,679)	(31,679)	(31,679)	(31,679)
	16	19,662	7,609	6,520	(1,813)	13,963	15,303	15,379	16,487	17,706	17,706	17,991	18,408	18,490	18,596	18,596	18,596	18,596
2020	17	7,884	(4,826)	(9,102)	(1,726)	(1,827)	(2,002)	(2,012)	(2,157)	(2,317)	(2,317)	(2,354)	(2,409)	(2,419)	(2,433)	(2,433)	(2,433)	(2,433)
	18	13,394	32,559	28,301	31,513	33,366	36,568	36,749	39,397	42,310	42,310	42,990	43,987	44,182	44,437	44,437	44,437	44,437
	19	(9,247)	(11,290)	(11,552)	(12,863)	(13,619)	(14,926)	(15,000)	(16,081)	(17,270)	(17,270)	(17,548)	(17,955)	(18,035)	(18,139)	(18,139)	(18,139)	(18,139)
	20	(2,083)	(2,061)	(2,109)	(2,348)	(2,486)	(2,725)	(2,738)	(2,936)	(3,153)	(3,153)	(3,204)	(3,278)	(3,292)	(3,311)	(3,311)	(3,311)	(3,311)

(Source: Authors)

This triangle is calculated as the difference between each triangle cell and its respective average and is used to measure the goodness-of-fit of our very simple model (that claims for the same delay period should cluster around the average). This pattern indicates whether the sample data represents the data we would expect to find in the actual population.

To calculate "Goodness of Fit" we will use the "Least Squares Method", such as 1-D/O, where D stands for the sum of the squares of the detailed errors in the error triangle, and O stands for the sum of the squares of the average triangle of claims detailed in Table 1. At this point, this equals 95.19%, a surprisingly good result for a variable portfolio like MTPL (Du, H., & Bentler, P. M. (2022)).

To make the model more complete we will include inflation where for each claim the "distance from the beginning" will be calculated, i.e. the number of years that have passed since the payment until December 31, 2020.

Indexing is compounded and takes the form of $P \cdot (1+i)^d$

where,

P is the amount of the payment,

i is our measure of inflation, and

d is the distance from the beginning, measured in years.

Now we need to find the inflation rate that maximizes the fit of the model, that is, the value that minimizes the size of the average claim group of the same lag period. We will use MX Excel's Solver, a tool for finding numerical solutions to complex formulas. The model gives an unexpected value of -0.1%, with almost no claim inflation during the period from July 2016 to December 2020.

Since we have a non-normal value perhaps more could be done to separate the claims of the different characteristics. We thus address the effect of abnormally large claims in our data set, defined as claims large enough to affect the results and yet rare enough not to be evenly distributed across different accident dates.

Returning to the database, we choose (judgmentally) cut-off points of 1.8 million ALL (before indexing) and remove from the triangle all claims equal to or above this amount. Only 10 claims out of a total of 1,624 were found, which happened to be relatively early, indicating that our first measurement of inflation was an underestimate.

Thus, the triangle of average claims and the triangle of error excluding large claims are as follows:

Table 3 Average claim triangle without large claim.

average claim	+1 year				+2 years				+3 years				+4 years				+5 years	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
2016	1																	
	2																	
	3	27,815	81,853	81,853	81,853	81,853	81,853	81,853	81,853	81,853	81,853	81,853	81,853	81,853	81,853	81,853	81,853	81,853
	4	65,483	86,364	91,607	140,726	140,726	138,464	138,464	138,464	138,464	138,464	138,464	138,464	138,464	138,464	138,464	138,464	138,464
2017	5	108,229	120,930	117,526	118,181	121,454	152,719	152,719	152,719	152,719	152,719	152,719	152,719	152,719	152,719	152,719	152,719	152,719
	6	71,043	73,444	75,072	83,884	85,089	85,089	90,639	90,639	90,639	90,639	90,639	90,639	90,639	90,639	90,639	90,639	90,639
	7	86,883	87,663	98,327	97,988	101,928	109,887	109,887	131,807	131,807	131,807	146,596	155,687	155,687	159,582	159,582	159,582	159,582
	8	79,233	79,171	97,362	97,362	100,191	101,891	102,029	102,029	102,029	102,029	102,029	102,029	105,709	106,374	106,374	106,374	106,374
2018	9	79,427	76,134	82,128	95,933	95,933	95,933	95,672	95,090	111,789	111,789	111,789	111,789	112,359	113,066	113,066	113,066	113,066
	10	80,510	91,515	87,622	106,212	108,748	108,748	108,748	123,451	143,656	143,656	143,656	144,889	145,628	146,544	146,544	146,544	146,544
	11	143,123	125,954	146,554	143,864	139,980	143,834	143,834	143,834	148,059	148,059	150,668	151,961	152,736	153,697	153,697	153,697	153,697
	12	111,039	90,623	86,923	85,649	84,909	84,310	84,310	99,852	122,194	122,194	124,346	125,414	126,053	126,846	126,846	126,846	126,846
2019	13	56,814	68,406	66,792	68,452	67,126	67,126	85,325	89,995	89,995	91,580	92,366	92,837	93,421	93,421	93,421	93,421	93,421
	14	178,181	93,085	89,221	88,438	87,690	104,211	111,735	118,931	125,440	125,440	127,650	128,745	129,402	130,216	130,216	130,216	130,216
	15	89,680	71,336	70,695	69,783	84,583	89,942	90,465	96,291	101,561	101,561	103,350	104,237	104,769	105,428	105,428	105,428	105,428
	16	109,709	96,074	96,908	98,564	120,114	126,008	126,740	134,902	142,285	142,285	144,792	146,034	146,779	147,703	147,703	147,703	147,703
2020	17	97,022	82,859	80,484	97,815	100,901	105,852	106,467	113,323	119,525	119,525	121,631	122,675	123,301	124,077	124,077	124,077	124,077
	18	101,941	119,945	117,592	126,665	130,661	137,072	137,868	146,747	154,779	154,779	157,506	158,857	159,668	160,672	160,672	160,672	160,672
	19	78,525	75,226	77,376	83,346	85,975	90,193	90,717	96,559	101,844	101,844	103,638	104,528	105,061	105,722	105,722	105,722	105,722
	20	85,172	82,773	85,139	91,708	94,601	99,242	99,819	106,247	112,062	112,062	114,036	115,015	115,602	116,329	116,329	116,329	116,329

(Source: Authors)

Table 4 Error triangle without large claims

Error	+1year				+2years				+3years				+4years				+5years	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
2016	1																	
	2																	
	3	(63,842)	(7,222)	(9,768)	(16,837)	(19,950)	(24,945)	(25,565)	(32,483)	(38,741)	(38,741)	(40,866)	(41,919)	(42,550)	(43,333)	(43,333)	(43,333)	(43,333)
	4	(26,174)	(2,711)	(15)	42,036	38,923	31,665	31,045	24,127	17,870	17,870	15,745	14,691	14,060	13,278	13,278	13,278	13,278
2017	5	16,572	31,854	25,905	19,491	19,650	45,920	45,300	38,382	32,124	32,124	30,000	28,946	28,315	27,533	27,533	27,533	27,533
	6	(20,614)	(15,631)	(16,549)	(14,807)	(16,714)	(21,709)	(22,330)	(23,698)	(29,955)	(29,955)	(32,080)	(33,133)	(33,765)	(34,547)	(34,547)	(34,547)	(34,547)
	7	(4,774)	(1,412)	6,706	(702)	124	3,088	2,468	17,470	11,212	11,212	25,877	31,914	31,283	34,396	34,396	34,396	34,396
	8	(12,425)	(9,904)	5,740	(1,329)	(1,612)	(4,908)	(5,390)	(12,308)	(18,565)	(18,565)	(20,690)	(21,743)	(18,695)	(18,812)	(18,812)	(18,812)	(18,812)
2018	9	(12,230)	(12,941)	(9,493)	(2,757)	(5,870)	(10,865)	(11,747)	(19,247)	(8,805)	(8,805)	(10,930)	(11,983)	(12,045)	(12,120)	(12,120)	(12,120)	(12,120)
	10	(11,147)	2,440	(3,999)	7,522	6,944	1,949	1,329	9,114	23,061	23,061	20,937	21,117	21,224	21,358	21,358	21,358	21,358
	11	51,466	36,879	54,933	45,174	38,177	37,035	36,415	29,497	27,465	27,465	27,949	28,189	28,333	28,511	28,511	28,511	28,511
	12	19,382	1,548	(4,698)	(13,041)	(16,894)	(22,489)	(23,109)	(14,485)	1,599	1,599	1,627	1,641	1,650	1,660	1,660	1,660	1,660
2019	13	(34,843)	(20,569)	(24,829)	(30,238)	(34,678)	(39,673)	(40,293)	(29,012)	(30,600)	(30,600)	(31,139)	(31,406)	(31,566)	(31,765)	(31,765)	(31,765)	(31,765)
	14	86,524	4,010	(2,400)	(10,252)	(14,114)	(2,588)	4,316	4,594	4,845	4,845	4,931	4,973	4,998	5,030	5,030	5,030	5,030
	15	(1,977)	(17,739)	(20,926)	(28,907)	(17,221)	(16,856)	(16,954)	(18,046)	(19,033)	(19,033)	(19,369)	(19,535)	(19,635)	(19,758)	(19,758)	(19,758)	(19,758)
	16	18,052	6,999	5,287	(126)	18,311	19,209	19,321	20,565	21,690	21,690	22,073	22,262	22,376	22,516	22,516	22,516	22,516
2020	17	5,365	(6,216)	(11,137)	(875)	(902)	(947)	(952)	(1,013)	(1,069)	(1,069)	(1,088)	(1,097)	(1,103)	(1,110)	(1,110)	(1,110)	(1,110)
	18	10,283	30,869	25,971	27,975	28,858	30,274	30,449	32,410	34,184	34,184	34,786	35,085	35,264	35,486	35,486	35,486	35,486
	19	(13,132)	(13,850)	(14,246)	(15,345)	(15,829)	(16,605)	(16,702)	(17,777)	(18,750)	(18,750)	(19,081)	(19,244)	(19,343)	(19,464)	(19,464)	(19,464)	(19,464)
	20	(6,485)	(6,302)	(6,482)	(6,983)	(7,203)	(7,556)	(7,600)	(8,090)	(8,532)	(8,532)	(8,683)	(8,757)	(8,802)	(8,857)	(8,857)	(8,857)	(8,857)

(Source: Authors)

Running Solver again, we find that a measure of 2.5% compounded annual inflation yields a maximum fit of 96.02%, a slight but noticeable improvement. This rate, much more reasonable and consistent with our expectations, is the best approximation that can be achieved with the limited amount of information available.

For the period 2016-2020, the average inflation is approximately 1.76%. So, we have a claim inflation that is 35% higher than price inflation, again a result in line with our expectations as well as the market.

4. Results and Discussions

Using a simple model such as the average cost per claim model and some basic statistics, it is possible to estimate a claim inflation rate, which based on the data used is slightly higher than price inflation. The values calculated by the study are higher than price inflation, which means that claims in our country are affected by more factors than the basket of goods and services. This is a more accurate value compared to price inflation because it has been proven that the severity and frequency of claims are influenced by many factors, which is not the case for the basket of goods and services that are included in the calculation of the Consumer Price Index.

This method used to estimate claim inflation can be used in the future to predict how claims will develop and when building triangles, it can be assumed without performing calculations that claim inflation will be higher than price inflation for the reasons mentioned above. In the euro area price inflation is usually measured as the change in prices excluding energy and food.

Since the study found that inflation has a significant impact on insurance companies claims, the following is recommended:

-The Financial Supervisory Authority (FSA) as well as the insurance companies must coordinate and cooperate to design the necessary framework in order to develop appropriate models and use the data of all actors for the assessment of the claims inflation with the aim of the most accurate reserving and their sufficiency in the financial statements, the effective management of claims as well as the reduction of costs and the increase of profitability. For the development of these models that are currently not applied in the Albanian insurance market, it will probably be necessary to cooperate with reinsurers who are present in our market as they have the necessary experience and expertise to assist all actors in the construction, development and application of claims inflation assessment models.

- The Institute of Statistics can be an important actor in the development of a model to calculate claims inflation, possibly by cooperating with the FSA and with insurance companies or by cooperating with sister international institutions that can provide the necessary assistance for the development of claim inflation assessment models.

- Since the study concludes that inflation generally affects the size of claims, it is recommended that company management should draft policies/instructions and revise policy conditions to minimize the factors that affect claims inflation. So, it is necessary to minimize as much as possible the factors that influence the severity and frequency of claims.

The study also recommends that insurers should remain vigilant in monitoring inflation. Insurers can reduce their exposure to inflation risk through carefully designed terms and the use of reinsurance. The pandemic and other emergencies have presented a number of challenges for countries in the EU, especially an increase in the claims inflation rate for insurance companies. Based in the paper's explained conclusion, insurance businesses in Albania require to consider innovation and technology as major achievements. This might lower the cost for customers and cut costs for insurance companies.

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Trade war: the steel and aluminium markets and the trade governance

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Abstract. *The international institutionalism has been under debate. The World Trade Organization (WTO) has not been immune to strong criticisms that have been exacerbated in recent years. A turning point in this process was the trade war between the United States and China that began in 2018. It was characterized by tariff increases that persist. The contribution of this work is to show how these measures taken by relevant global players (such as the United States and China) have significantly affected the international markets and it impacted third countries, not only in terms of trade flows but also when considering the international trade regulatory framework. The drop in the demand from the United States implied a fall in global demand that caused a fall in international prices. Moreover, it is shown that Trump's measures were successful given that China was substituted by other suppliers. Finally, his protectionist strategy against China was accompanied by a broader strategy against the World Trade Organization by blocking not only the negotiations during the Buenos Aires Ministerial Conference but also the Dispute Settlement System.*

Keywords: trade war, China, United States, international institutionalism

JEL Codes: F14, F51

1. The trade war between the United States and China

Since China became a WTO member, in 2001, the global competition between China and the United States has intensified. At that time, the manufacturing industry in the United States suffered the effects of Chinese competition as various sectors decreased their activity and employment levels (Bartesaghi and Melgar, 2020). Something similar took place in Mexico, where not only local companies registered negative effects, but also the United States was displaced as a supplier. Since then, the competition has been deepened at a global level (Ortiz Velásquez, 2017).

During his electoral campaign, Trump had promised protectionist measures with the aim, according to him, of promoting the local manufacturing industry and the creation of new job positions. The increase in tariffs was considered as a measure to reduce the country's trade deficit and, in particular, the trade deficit with China.

The first measure taken in 2018 by the Trump administration involved increasing tariffs on imports of washing machines and solar panels. According to the United States International Trade Commission, imports of these products were harming American manufacturers and the application of tariffs was recommended.

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Although these measures were applied globally, in both cases, China was especially affected since it was one of the main suppliers (United States Trade Representative, 2018a).

In March 2018, Trump announced that tariffs would be imposed on steel and aluminium, 25% and 10% respectively. The argument focused on the Article XXI of the GATT, protectionist measures can be taken for those goods of military application considered essential for national security. Once again, China was among the main affected trade partners (Li, 2018).

In addition, also in March, the United States Department of Commerce presented a report in which it was stated that China carried out unfair practices that affected the transfer of technology, intellectual property and the granting of technological licenses (United States Trade Representative, 2018b). Given this, Trump announced the increase in tariffs on imports from China for US\$ 50,000 million. This action was taken under section 301 of the Trade Act of 1974 (White House, 2018a and United States Trade Representative, 2018c).

China's response did not take long to materialize and in April, it announced the imposition of tariffs of up to 25% on the import of 128 products from the United States to which another 106 products were added later. Soybeans were included which represented one of the main products exported by the United States to China. In July 2018, the Trump government presented a new list of products and this time the tariffs would rise to 25% (United States Trade Representative, 2018d). China's response was to present a new list with more than 500 products whose tariffs would also be high.

At the same time, in August 2018, China requested WTO dispute consultations regarding United States solar cell duties and renewable energy measures. It was argued that these safeguard measures were inconsistent with some GATT articles (WTO, 2018).

In September, the United States Department of Commerce published a new list of 6,000 Chinese products that would be affected by tariffs of 10% and it was announced that the Department was considering an increase to 25% as of January 2019. China responded by announcing plans to increase tariffs on United States products between 5% and 10%. Both measures entered into force in September 2018 (United States Trade Representative, 2018e).

In December 2018, during the G-20 meeting held in Argentina, the presidents of the United States and China, Donald Trump and Xi Jinping, met and agreed to postpone the imposition of new tariffs for 90 days and to restart negotiations. Trump assured that the United States promised not to materialize the 10% increase in tariffs announced for January 2019 and China promised to acquire a large quantity of industrial and agricultural products and energy resources from the United States (White House, 2018b).

In May 2019, China sent an agreement proposal to the United States, but it did not include issues that had been highlighted as sensitive by the United States Department of Commerce (changes in laws related to intellectual property, technology transfer, regulation of competition and access to the financial sector). Given this, Trump announced that from May, the increase in tariffs that had been postponed by the truce would take place. In addition, also in May 2019, the United States prohibited local companies from selling parts and technological components to the Chinese company Huawei. The measure was based on the close ties between this company and the Chinese government, the latter could obtain data from American companies or from the government itself. Given this, in June, China increased 25% of the tariffs that had been increased in 2018 (between 5% and 10%).

In June 2019, during another G-20 summit in Japan, Trump and Xi Jinping met again and agreed to a new truce, although the tariffs would remain in place, both leaders agreed to avoid new increases in tariffs. In addition, the United States would cancel the prohibition of selling components to Huawei and China would cancel the restriction on importing agricultural products from the United States.

However, this agreement was short-lived and in July, Trump stated that China was not complying with the purchase of agricultural goods and in August, he announced the increase in tariffs to 10% for a new list

of Chinese products. Some of these increases were postponed so as not to affect local consumers during Christmas (United States Trade Representative, 2019). In August, China suspended all agricultural purchases from the United States and the government allowed a sharp depreciation of the yuan which, according to the Central Bank of China, reflected the mood of the market given the protectionist measures that were being implemented. In addition, in August, more plans were announced to increase tariffs on products from the United States that would take place in September and December, including oil. Given this, Trump responded by asking American companies to look for other alternatives to replace China as a supplier and assured that the government was studying new increases in tariffs.

In September 2019, given the investigation carried out by the United States Department of Commerce, the government approved new antidumping measures of up to 141% of the value of structural steel imports from China (United States Department of Commerce, 2019). In addition, the Commerce Department exempted 400 Chinese products from 25% tariffs.

In January 2020, the negotiations finished and the "Economic and Trade Agreement between the Government of The United States of America and the Government Of The People's Republic of China, Phase One" was signed, which entered into force in February 2020. From this agreement, among other things, China is committed to increasing its purchases of goods and services from the United States by at least US\$200 billion. The United States promised to halve (to 7.5%) the tariff on the products included in the September 2019 list and to nullify the announced increase from 25% to 30%, which included cell phones, computers, toys and clothing (United States Department of Commerce, 2019). However, the 25% tariffs applied since 2019 would be maintained and their reduction would be part of the "Phase Two" negotiations of the agreement.

It is worth remembering that the "Phase Two" deal between China and the United States was not implemented given that both parties argued that the other country had unfulfilled the commitments that were assumed in the Phase I deal.

On one hand, China has claimed that the tariffs are still in force, there were few exemptions given the Section 301 Tariff exclusions on imports from China and given the pandemic a set of tariffs was reduced (United States Trade Representative, 2022). More recently, due to inflationary pressures due to the war in Ukraine, President Biden announced that the United States was evaluating the elimination of tariffs imposed on China, especially on inputs from China that are affecting the competitiveness of some companies. However, at the same time, it has been recognized that it is a process that would take a long time to implement.

On the other hand, the United States has claimed that China has not increased its imports from the United States as was assumed in the "Phase One" deal to reduce the trade deficit (see Figure 1). It had been negotiated that China would increase its purchases by US\$200 billion in goods and services before December 31st, 2021. However, it has not taken place, Bown (2021) showed that China would have acquired 57% of the amount and the author argued that it meant a remarkable failure even when it is also recognized that, from a diplomatic point of view, the mere fact of signing an agreement stopped the spiral of the trade war that lasted at least 18 months. In terms of the future agenda between these leading economies, it is also noteworthy that the "Phase One" deal supposed that the negotiations would continue given that both parts recognized the need to negotiate a "Phase Two" deal to include more sensitive issues such as cybersecurity, piracy and technology transfers.

Fig. 1: United States trade in goods with China

(Source: own elaboration based on Trade Map)

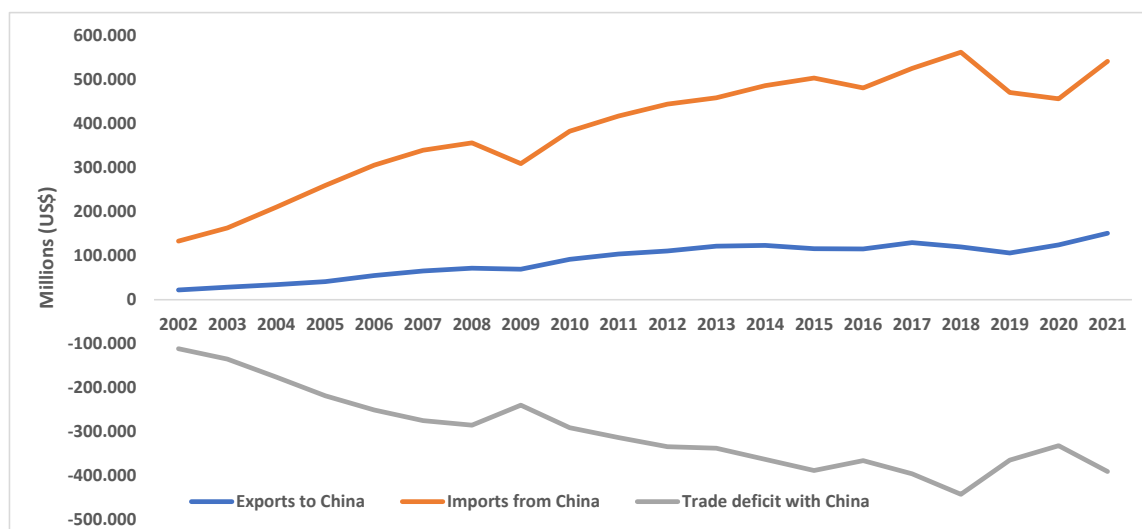
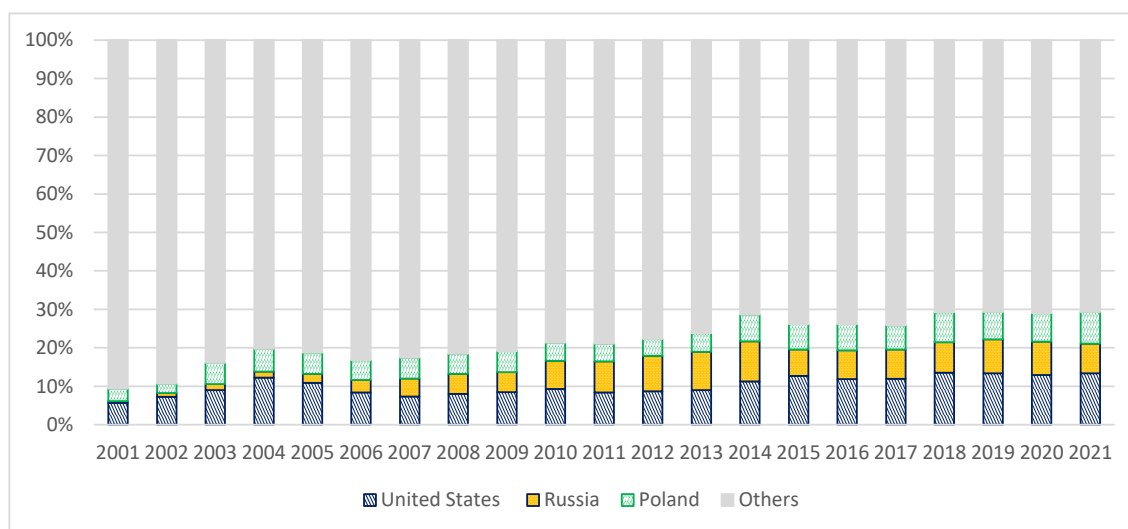


Fig. 2: Most relevant importers of wires of silico-manganese steel, in coils (excluding bars and rods)

(Source: own elaboration based on Trade Map)

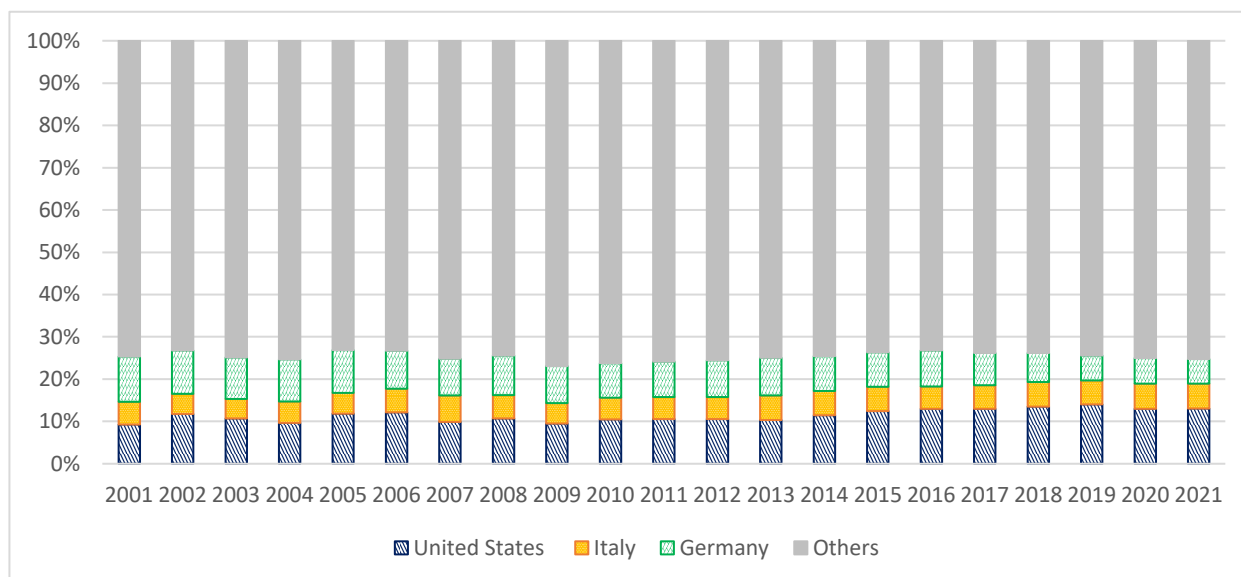


Fig. 3: Most relevant importers of aluminium foil, not backed, rolled but not further worked, of a thickness of ≤ 0.2 mm
 (Source: own elaboration based on Trade Map)

1.1. Case 1: wires of silico-manganese steel (HS code 722920)

Regarding steel, the selected product was a wire of silico-manganese steel. Its exports from China to the United States began in 2005 and until 2017, they grew at relevant rates. Considering the period 2005-2017, the annual (linear) growth rate for imports from the United States reaches 7.8%. In this period, China was gaining ground as a supplier to the United States and imports from China grew at an annual rate of 24.0%, they varied from almost US\$2.8 million in 2005 to US\$36.1 million in 2017.

The trade policy implemented by Trump marked a break in this trend. Although in 2018 imports from the United States continued to grow, they fell in 2019 and 2020 and even when they grew in 2021, China has lost relevance as a supplier. Considering the entire period, 2005-2021, the annual growth rate for United States imports of this product is 10.3%, while those from China were up 13.7%, evidencing the significant drop registered since 2018.

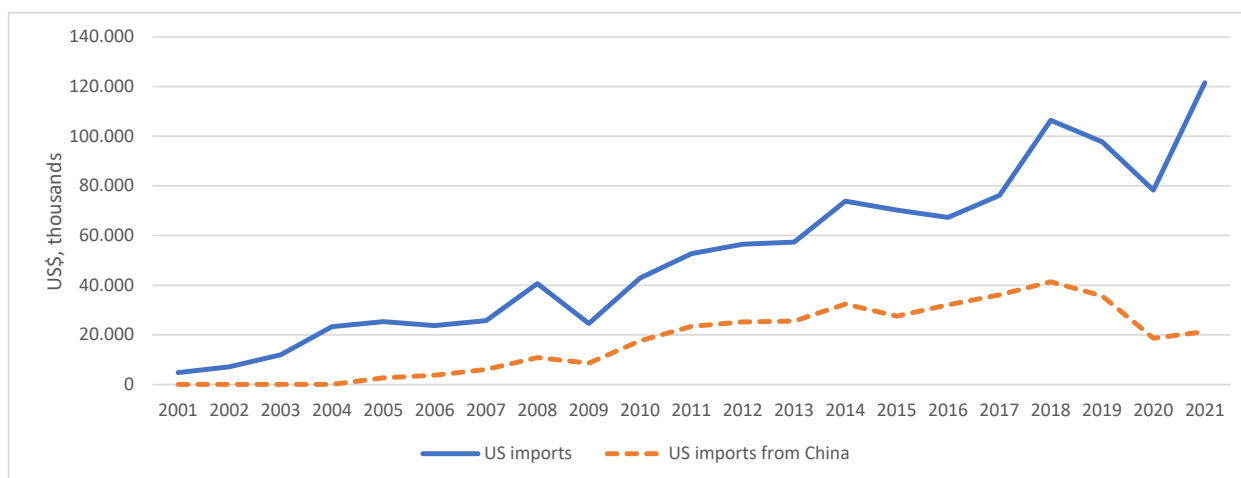


Fig. 4: United States imports of wires of silico-manganese steel (HS code 722920) and the role of China
 (Source: own elaboration based on Trade Map)

Therefore, the changes in trade policy had notorious impacts on the functioning of the market, since, although there was a fall in the demand from the United States in 2019 and in 2020, China's share fell by several percentage points and, at the same time, other countries gained ground as suppliers. For example, before the trade war, China's share of the market was around 47.5% (2016 and 2017). Since then, it has fallen to almost 39% in 2018 and to 17.5% in 2021.

The group of countries that benefited most from this process are Mexico, Vietnam and the Republic of Korea. Their participation was up markedly in the period 2018-2021. In the case of Mexico, this ratio rose from 8.8% to 21.2%, for Vietnam varied from 7.1% to 30.7% and in the case of South Korea, it increased from 3.8 % to 5.4%.

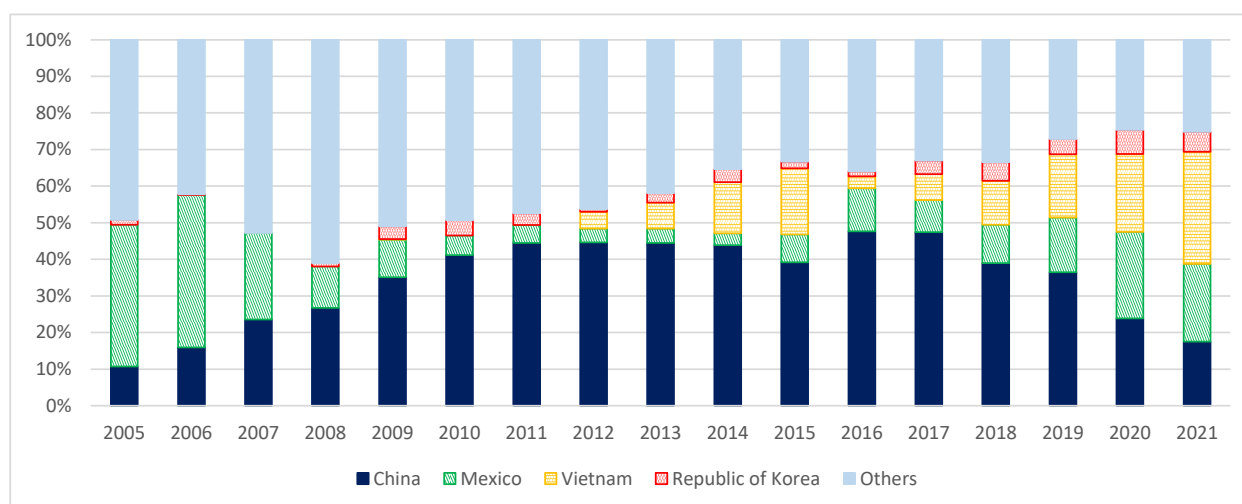


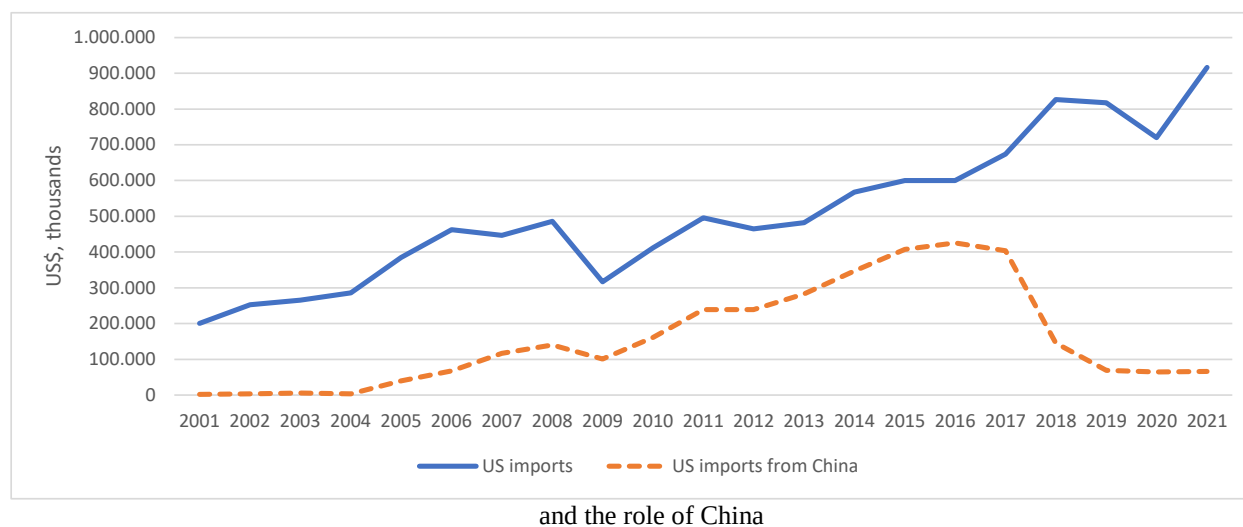
Fig. 5: Wires of silico-manages steel (HS code 722920): key suppliers of the United States
 (Source: own elaboration based on Trade Map)

1.2. Case 2: aluminium foil, not backed, rolled but not further worked, of a thickness of ≤ 0.2 mm (HS code 760711)

Regarding aluminium, the selected product was aluminium foil, not backed, rolled but not further worked, of a thickness of ≤ 0.2 mm (HS code 760711). Since 2001, imports from the United States have grown at relevant rates. Considering the period 2001-2017, the annual (linear) growth rate reaches 7.9%. During this period, China's participation as a supplier to the United States increased significantly and imports from China grew at an annual rate of 39.4%, going from almost US\$2 million in 2001 to US\$403.3 million in 2017.

Even when United States imports of this product maintained the annual growth rate, it is also 7.9% when considering the period 2001-2021, the growth in imports from China is 19.2% (much lower than the value registered in the period 2001-2017, 39.4%). The distribution of the market among the key suppliers varied notoriously given the changes in trade policy implemented by the Trump administration. The data shows that, while imports from the United States continued to grow in 2018, they fell in 2019 and 2020 and as happened in the previous case, they grew again in 2021 but China's share as a supplier has decreased considerably.

Fig. 6: United States importers of aluminium foil, not backed, rolled but not further worked, of a thickness of ≤ 0.2 mm,



(Source: own elaboration based on Trade Map)

In this case, the changes in trade policy also had significant effects on the market. Although there was not a relevant decrease in this demand, China's participation was down, and other countries gained ground as suppliers. For example, before the trade war, the United States had bought at least 60% of this product from China (the share in 2015, 2016 and 2017 had reached 67.9%, 70.9% and 59.8%, respectively) while in 2018 it was reduced to 17.6% and in 2019 and 2020, it was only 8.5% and 9.0%, respectively.

In this market, the three countries that have benefited the most were South Korea, Turkey and Oman. The most relevant progress has been registered in the case of South Korea, whose participation was very low, for example, in the period 2015-2017, on average it was 2% while, in 2018, it reached 13.2%. and in 2021, it rose to 15.5%. In the case of Turkey, exports of this product to the United States began in 2016, its share was

only 0.3% and 2% in 2017. Since 2018, and given the impacts of the trade war, this ratio increased markedly, it reached 7.3% in that year and 8.8% in 2021. Finally, in the case of Oman, export flows of this product started in 2018, and its share was 3.1% and in 2021 it rose to 4.8%.

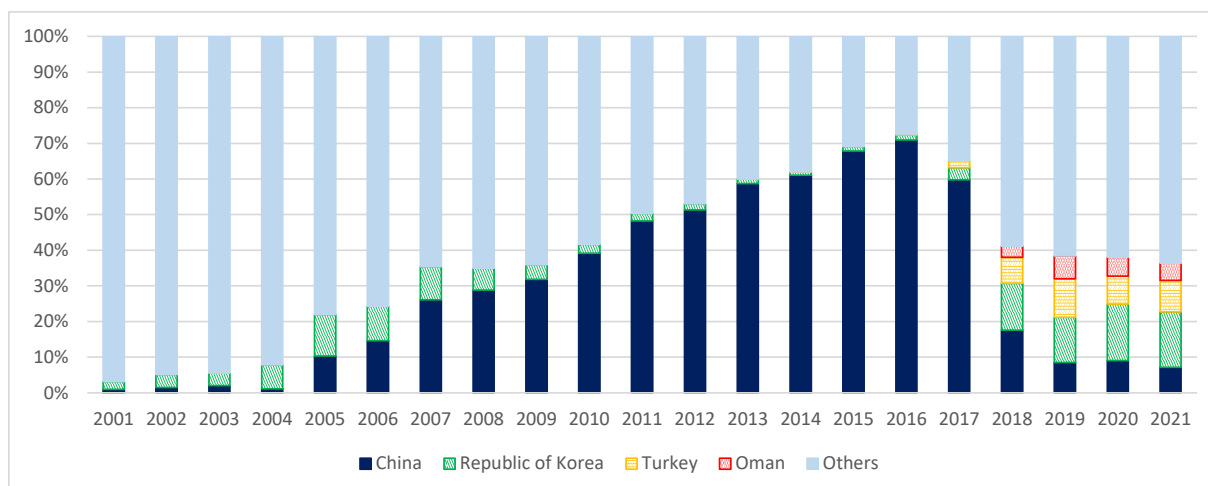


Fig. 7: Aluminum foil, not backed, rolled but not further worked, of a thickness of ≤ 0.2 mm (HS code 760711): key suppliers of the United States
 (Source: own elaboration based on Trade Map)

2. Trade governance

Although the complications in the multilateral trading system increased during the Trump administration, some debates about its functioning are long-standing since the leading global economies have shown different negotiating positions in an institution that, over time has incorporated not only new members but also more negotiating topics (Bartesaghi and Pérez, 2010). Moreover, according to Zelicovich (2019), globalization is in crisis and given this scenario, several international organizations have been criticized and the WTO has been one of them.

To understand the current challenges that international organizations are facing, it is worth briefly reviewing the development of multilateral negotiations in recent decades, especially since the creation of the WTO with the GATT remaining as a part of the WTO agreement. In fact, since 1947, only the Doha Round failed to close which was the first Round after the creation of the WTO.

From the GATT and later with the WTO, the achievements of the global trade regulatory system have been very clear. For example, the significant reductions in tariffs and the implementation of other trade regulations have favoured trade flows in recent decades. In addition, the number of members has grown and reached 164 countries that account for 98% of global trade¹ and new issues have been incorporated. The largest negotiating instrument of the GATT/WTO has been the Trade Rounds, which reached eight since 1947, registering substantial progress in the last three.

¹ Retrieved from: https://www.wto.org/spanish/thewto_s/history_s/history_s.htm.

Table 1: Evolution of issues covered in the WTO/GATT rounds

Year	Location/ Denomination	Topics	Number of countries (when the Round started)
1947	Geneva	Tariffs	23
1949	Annecy	Tariffs	13
1951	Turkey	Tariffs	38
1956	Geneva	Tariffs	26
1960 - 1961	Geneva (Dillon Round)	Tariffs	26
1964 - 1967	Geneva (Kennedy Round)	Tariffs and antidumping measures	62
1973 - 1979	Geneva (Tokyo Round)	Tariffs, non-tariff measures and legal framework	102
1986 - 1994	Geneva (Uruguay Round)	Tariffs, non-tariff measures, regulations, services, intellectual property, dispute settlement, textiles, agriculture, creation of the WTO, among others.	123
From 2001	Doha Round	Deepening of the agreements and the incorporation of new issues.	154 in 2021 and nowadays it reaches to 164

Source: own elaboration based on WTO

In the Kennedy Round, members agreed to reduce tariffs and anti-dumping practices began to be part of the discussions, while in the Tokyo Round, non-tariff barriers began to be addressed, an issue that became very relevant. Finally, the outstanding Uruguay Round managed to establish a multilateral trade system with the creation of the WTO and the regulation of the trade in services through the signing of the GATS (Lizarazo, 2019). In this Round, with the creation of the WTO, it is worth highlighting the importance given to the dispute settlement system, it is one of the most debated issues.

The Doha Round was very ambitious, and negotiations have deadlocked. The main reasons were that the negotiation mechanism was based on what is defined as the "single undertaking" (every item of the negotiation is part of a whole and indivisible package and cannot be agreed separately) and the change in the strategies of the main economies such as the United States and the European Union towards the signing of bilateral agreements (a trend that later spread to Asia, Oceania and some Latin American countries) This scenario was deepened by the position held by the United States during the D. Trump administration.

Even when progress has been made since the Doha Round was launched, it is undeniable that it is in difficulties. The Ministerial Conferences should be taken into account, for example, the Trade Facilitation Agreement (Bali in 2013) and the new commitments on Export Competition (Nairobi in 2015). The complexity and ambition of the issues covered by the Doha Round, also based on China's entry into the WTO led to a process of institutional weakening of the multilateral trade system. This process was accompanied by political and social crises given the negative effects of globalization that led to greater support for protectionist policies. For example, D. Trump took restrictive policies that affected trade.

D. Trump took a significant number of protectionist measures that affected several trade partners and started the trade war with China. Regarding the WTO, he questioned the position towards China because he argued that China was not complying with its multilateral commitments and given his disconformity, D. Trump Administration avoided any progress at the Buenos Aires Ministerial Conference held in 2018 and it obstructed the Dispute Settlement System (DSS). In concrete, they blocked the system from appointing new members in its Appellate Body, a situation that remains unchanged to date.

Even when there was no progress in terms of the DSS, to unblock the Appellate Body, the results achieved at the 12th Ministerial Conference held in Geneva in June 2022, should be mentioned given that the delegations achieved concrete results on various issues while the opposite was true during the previous Ministerial Conference (in Buenos Aires). There were relevant agreements regarding Food Safety and food products (a key issue due to the War in Ukraine), an agreement for patents related to COVID-19 vaccines, an

agreement on fishing subsidies that was one of the biggest challenges for the WTO, and an agreement on a work program on e-commerce².

Regarding the DSS, it would seem contradictory that the United States increased sharply the number of disputes between the United States and China since 2018 and it agreed with the result of the historic dispute between Boeing and Airbus companies (which could indicate that this country continued to trust in this system). It is worth highlighting that the United States, the European Union, China, and Japan are the countries that more frequently requested the intervention of the DSS³. According to Herreros (2021), in the case of Latin America and the Caribbean, even when the number of claims is low (only 13 between 2015 and 2020), in any case, their participation in the DSS is greater than their share of world trade. In this region, the country that has made more claims is Brazil, followed by Mexico and Argentina (Herreros, 2021).

The Appellate Body is a central pillar of the WTO's DSS, which was defined as the "jewel in the Crown" by former Director General Pascal Lamy (Herreros, 2021), since most of the disputes have requested the intervention of that body, which can confirm, modify or revoke what was concluded by the special group and its resolution will be binding. This body has seven members with renewable 4-year terms, the procedure has been questioned by the United States since Trump took office.

The differences in the criteria of the process of renewal or re-election of the members generated an unprecedented situation of vacancies that affected and paralyzed the system. It is highlighted that not only the United States but also other countries have requested changes in the independence of action of the DSS's members. In particular, it was argued that some interpretations went beyond the multilateral norms (Arredondo and Godio, 2019) and the perception that the resolutions constitute precedents. It should also be considered that the United States hold that China has not complied with the commitments assumed in 2001 when it joined the organization, a claim that is strongly supported by the European Union (Herreros, 2021).

The WTO crisis is not only based on the Appellate Body blockade, but it has also been a long-standing phenomenon in the organization, and it has already been observed in the negotiations, especially since the launch of the Doha Round and in particular, given the results achieved at the Buenos Aires Ministerial Conference. The debates on the future of the institution are focused on its adaptive capacity given the changes in the production processes and international trade, the emergence of new key players and the efficiency in the negotiation modality, "Single Undertaking" (Lizarazo, 2019).

Nowadays, there is consensus that the WTO needs to discuss its reform to deal with a new international scenario that goes beyond the current trade agreements that have not followed the trends in some issues that are becoming more relevant on the global agenda. Among others, it is worth highlighting environmental phenomena and issues related to the digital economy and security (Herreros, 2021). Although the WTO received favourable signals due to the results reached at the 12th Ministerial Conference, especially those related to the agreements on fisheries subsidies and environmental issues, key issues that are affecting WTO's functioning continue without resolution. For example, the debate on its reform was postponed for the 13th Ministerial Conference.

On the other hand, there are also agreements with maintaining a solid system to regulate international trade that is becoming increasingly important in the case of small and developing economies. In fact, the WTO gained certain dynamism after the election of its new general director, a woman and an African for the first time, who clearly showed her leadership to successfully carry out the 12th Ministerial Conference that was postponed several times. However, the WTO continues to face the debate about the postponement of the historical agenda (it includes agriculture and the incorporation of new trade issues such as the environment, gender issues and the relevance of the SMEs) that is of great interest to the developing economies.

² Retrieved from: https://www.wto.org/spanish/thewto_s/minist_s/mc12_s/documents_s.htm

³ Retrieved from: https://www.wto.org/spanish/tratop_s/dispu_s/dispu_by_country_s.htm#complainant.

Moreover, the debate on the systemic problems continues even when Biden has shown a less rigid position. For example, he supported the designation of the new General Director and his contributions to the 12th Ministerial Conferences that successfully concluded. However, the United States maintains deep differences with the European Union regarding the DSS and there are different opinions on relevant issues with China and India, these leading economies have a protectionist profile that prevents the promotion of some reforms and new multilateral agreements.

3. Conclusions

The main contribution of this article is to provide evidence of the significant global effects of the protectionist measures taken by the Trump Administration. In particular, they have affected China and other economies with the capacity to supply the products mainly protected by the United States.

Firstly, it is observed that the United States demand for the two products that were considered has decreased and the increase in costs due to the rise in tariffs may be one of the drivers. Secondly, and given the relevance of the United States as a consumer of these products in the global market, this drop in demand significantly affects the global demand. This fall in global demand caused international prices to go down and this change affected suppliers worldwide. Finally, Trump's measures were successful given that China was substituted by other suppliers.

On the other hand, in systemic terms, the success of the measures implemented by the United States is questionable because it applied them without respecting multilateral rules. On the contrary, the strategy of applying tariffs against imports of sensitive products, especially against China, was accompanied by a broader strategy against the WTO, blocking not only the negotiations during the Buenos Aires Ministerial Conference but also the DSS.

Another central aspect is that the two leading economies at the global level decided, bilaterally, to resolve their trade disputes, signing the mentioned "Phase One Agreement" that contradicted the WTO rules and had direct effects on global trade flows. This is a worrying precedent that could encourage other economies to follow the same path and may cause a loss in the confidence provided by the WTO.

When Biden took office, there was hope that he would promote a strengthening of the WTO and in line with this, Biden's Administration gave clear signals when, in agreement with China, the United States unlocked the selection of the General Director and the debates that were paralyzed during the Trump administration were restarted. The results of the 12th WTO Ministerial Conference could confirm a significant change from Trump's position to Biden's position. However, it seems unclear whether Biden's support is definitive given the lack of consensus in discussing the WTO's reform and, regarding the DSS and the Appeals Body. On the other hand, the pandemic and the war in Ukraine have deepened the tensions between the United States and China. In this context, the compliance of "Phase One" deal and the negotiations of a "Phase Two" deal have been relegated to bilateral agendas that have been focused on geopolitical and geostrategic disputes that go far beyond trade and they have deepened given the war in Ukraine and the increased tensions over Taiwan.

In this scenario, the role of other relevant global players such as the European Union, Japan and India will determine the reform agenda and especially, how to deal with the disputes among members. Developing countries (most of the members) should show a more active role in the issues debated in Geneva since there are no doubts that this group of countries would be the losers in a scenario characterized by a weakened WTO where the leading economies may resolve their differences bilaterally.

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The Inefficiency of Bitcoin and the COVID-19 Pandemic

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Abstract. *From the perspectives of asset pricing, market outreach, regulatory framework, and investor ethos, crypto markets differ substantially from traditional financial markets. Given these fundamental differences, it is interesting to examine how the notions of market efficiency apply to crypto markets, especially because the arguments of the efficient market hypothesis (Fama, 1970) and the adaptive market hypothesis (Lo, 2004, and Lo, 2008) were originally developed in the context of traditional financial markets. Research on the informational efficiency of crypto markets has attracted increasing attention in recent years. This paper examines the evolving efficiency of Bitcoin, the leading cryptocurrency, especially during the period when economies around the world were devastated by the COVID-19 pandemic. For a newly-emerged cryptocurrency with a market that is essentially global, a global shock like the COVID-19 pandemic presents ideal conditions for assessing how efficiency evolves as the market faces a series of shocks. Employing a fixed-length rolling window approach, this paper carries out the following tests: the automatic portmanteau test of Escanciano and Lobato (2009), the wild bootstrap automatic variance ratio test proposed by Kim (2009), the generalized spectral test of Escanciano and Valesco (2006), and the test proposed by Dominguez and Lobato (2003). The results provide evidence of episodes of inefficiency in a market that is efficient over extended periods. The inefficiency index constructed in this study shows that the Bitcoin market went through proportionately longer and more frequent episodes of inefficiency during the COVID-19 period. This is in line with the adaptive market hypothesis and has practical significance for investors and regulators.*

Keywords: Adaptive Market Hypothesis, Bitcoin, Cryptocurrency, COVID-19 Pandemic, Market Efficiency.

JEL Codes: G01, G12, G14

1. Introduction

Academic interest in crypto assets and markets has been increasing exponentially. Crypto assets provide a particularly fertile ground for academic research in economics and finance because they emerged as a new asset class trading in essentially global markets. Crypto markets differ from traditional stock, currency, or commodity markets in several fundamental ways. Firstly, as compared to traditional assets, the pricing of crypto assets is far less understood. The opinion of experts varies from one extreme dismissing it as an outright scam to the other extreme passionately holding the vision that it is the beginning of a revolution. Secondly, crypto markets transcend national boundaries and can be construed as representing global conditions. In comparison to traditional asset markets, crypto markets are less influenced by the local conditions of a particular country. The third factor that differentiates crypto markets from traditional markets is the lack of regulation, making them open to unhindered use of various prohibited practices like insider trading, pump and dump schemes, and other scams. Finally, the most remarkable distinguishing feature of the crypto markets has been the all-for-one ethos (see e.g. Nicolle and Kharif, 2022) that runs across the communities of crypto investors. This is in sharp contrast with the behavior of investors and traders in the stock markets.

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Given these fundamental differences in asset pricing, market outreach, regulatory framework, and investor ethos, it is interesting to see how the notion of market efficiency applies to crypto markets, especially because the arguments of the Efficient Market Hypothesis (Fama, 1970) and Adaptive Market Hypothesis (see e.g. Lo, 2004, and Lo, 2008) were originally developed in the context of traditional financial markets.

As argued by Damodaran (2017), cryptocurrencies cannot be valued like stocks because they do not generate cash flows. However, like fiat currencies, they can be priced in terms of other currencies. What determines the price of cryptocurrencies is far from clear and has emerged as an active field of research. The emerging body of literature on the identification of the determinants of cryptocurrencies' prices has proceeded along several interesting themes. An incomplete list of such themes would include ongoing research on adoption and usage of cryptocurrencies (e.g. Polasik et al. 2015, Athey et al. 2016, Tasca et al. 2018, and Foley et al. 2019), transactional and speculative motives for holding cryptocurrencies (e.g. Yermack, 2013, and Bolt and Van Oordt, 2020), impact of the media coverage on the price of cryptocurrencies (e.g. Garcia et al. 2014, and Wang and Vergne, 2017), impact of network factors, production factors, equity factors, macroeconomic factors, and other factors on cryptocurrency returns (Liu and Tsyvinski, 2021 and Liu et al. 2022), etc. Needless to say, the issue of identification of the determinants of cryptocurrencies' prices remains far from settled and continues to draw the attention of researchers.

Despite this lack of understanding of the determinants of cryptocurrency prices, it is possible to test the weak-form informational efficiency of crypto markets. If a market is informationally efficient, it essentially implies that the price reflects all the information relevant to the determination of price. As explained by Halaburda et al. (2022), weak-form informational efficiency can be tested by checking whether the data-generating process exhibits predictability. Based on statistical tests, market can be considered inefficient if the data-generating process exhibits predictability. This has been utilized by various studies to assess the weak-form informational efficiency of cryptocurrency markets. Urquhart (2016) tested the weak form efficiency for the Bitcoin market and concluded that the Bitcoin returns do not satisfy the efficient market hypothesis but it may be in the process of moving towards efficiency. Nadarajah and Chu (2016) show that an odd integer power transformation of Bitcoin returns is largely weakly efficient. Wei (2018) examines 456 cryptocurrencies and concludes that efficiency is stronger in liquid cryptocurrency markets. Other studies on this theme include Bariviera (2017), Tiwari et al. (2017), Zheng and Kaizoji (2019), and Sensoy (2019).

The COVID-19 pandemic, being the most prominent global shock experienced by the crypto markets in their brief history of existence, provides an appropriate setting to study the evolution of market efficiency of crypto markets. This conclusion is supported by both empirical evidence and theoretical arguments. Historically, it has been observed that global shocks tend to have an impact on the informational efficiency of markets. Several empirical studies have been conducted to investigate this phenomenon. For example, Lazar et al. (2012) studied the impact of the 2008 global financial crisis on the informational efficiency of currency markets. Similarly, Jiang et al. (2014) have examined the weak-form efficiency of the WTI (West Texas Intermediate) crude oil futures market and found that the Gulf War reduced its efficiency. More closely related to our paper is the study by Okorie and Lin (2021) who examine the impact of the COVID-19 pandemic on the informational efficiency of stock markets. Intuitively, it is not difficult to see how a global shock like the COVID-19 pandemic can have an impact on the informational efficiency of markets, including the crypto markets. The pandemic induced widespread distress conditions such as health emergencies, lockdown, severely-constrained resources, and unanticipated loss of income, which can interfere with the decision-making process of market participants. For example, the criteria and objectives of

trading decisions under these circumstances may differ radically from those under normal conditions. Similarly, these extraordinary conditions can also affect the way information is distributed and processed by the market participants. Issues like panic, rumours, misinformation, slower distribution of information, and price manipulations may become more prominent. As a result, these mechanisms can lead to a noticeable impact on the informational efficiency of the markets, including the crypto markets.

This paper contributes to the literature in several ways. Firstly, it employs a fixed-length rolling window approach to assess the efficiency of the Bitcoin market every day with different sizes of the window to identify changes in the informational efficiency of the market as it endures various shocks, including the three waves of the COVID-19 pandemic. For a newly-emerged asset with a market that is essentially global, a global shock like the COVID-19 pandemic presents well-suited conditions for assessing how efficiency evolves as the market faces a series of shocks. Secondly, an efficiency index has been constructed for the periods of interest even though the rolling window approach makes a continuous assessment of efficiency. Thirdly, the efficiency tests employed in this paper are based on both linear and non-linear measures of dependence. This is intended to give a comprehensive assessment of the evolution of market efficiency. Finally, the empirical findings may have important policy implications from the perspectives of investment and regulation.

Following this introductory section, the remainder of this paper is organized as follows. Section 2 describes the methodology and data. Section 3 reports the empirical results and their interpretation. Section 4 concludes with a discussion of the main empirical findings and their implications.

2. Research Elaboration: Methodology and Data

To assess the market efficiency of Bitcoin markets, this study employs martingale difference hypothesis (MDH) tests based on both linear and non-linear measures of dependence because it is not clear whether the nature of dependency is linear or nonlinear. This is also in line with the recommendation of Charles et al. (2012).

It has been employed the following four tests:

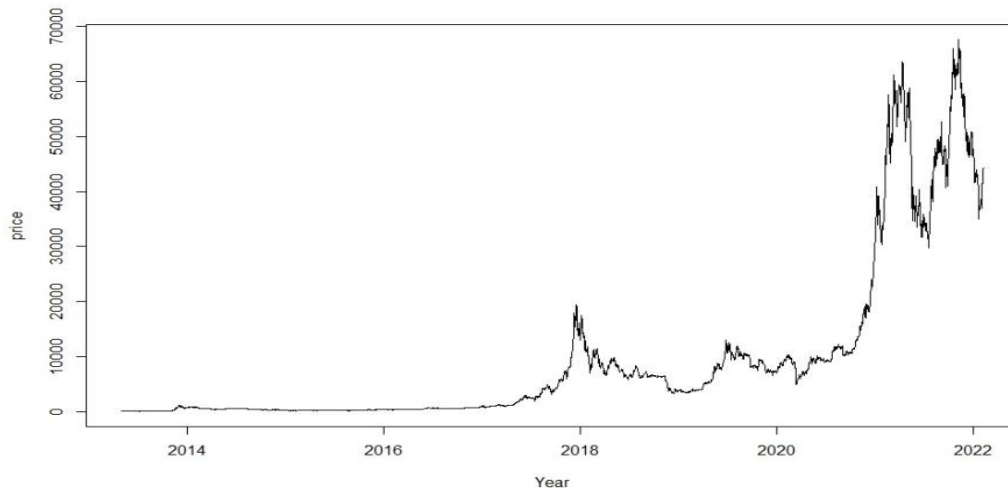
- Automatic Portmanteau (AP) Test of Escanciano and Lobato (2009): This is a robustified version of the Ljung-Box test (1978)
- Wild Bootstrap Automatic Variance Ratio (WBAVR) Test proposed by Kim (2009): This is essentially a wild bootstrap version of Choi's (1999) automatic variance ratio (AVR) test which is based on the variance ratio test of Lo and MacKinlay (1988)
- Generalized Spectral (GS) Test of Escaciano and Valesco (2006): It has generalized the spectral test of Durlauf (1991) to take into account both linear and nonlinear dependence in asset returns. The test is implemented by employing the wild bootstrap.
- Test proposed by Dominguez and Lobato (2003) based on Cramer-von Mises (CvM) and Kolmogorov-Smirnov (KS) statistics. The p-values for the test can be calculated from the wild bootstrap distribution.

Bitcoin price data has been taken from www.coinmarketcap.com, which represents an average of the prices in various crypto exchanges around the world. This kind of global averaging is justified because the Bitcoin market and the COVID-19 pandemic are essentially global. Daily prices from April 28, 2013, to February 9, 2022, with a total of 3210 observations, as shown in Figure 1, were used in the study.

The origin of the COVID-19 pandemic remains unclear. It started in December 2019 or earlier and the World Health Organization declared it a public health emergency of international concern on January 30, 2020. The exact date on which the pandemic started is not crucial to this study as it is based on rolling

estimation windows. However, for the purposes of basic statistics and calculation of the inefficiency index (described later), the beginning date of the COVID-19 period has been taken as January 9, 2020, which is the date of the first confirmed COVID-19 death.

Figure 1: Time-series graph of the daily price of Bitcoin



Efficiency tests were carried out on continuously compounded returns (R_t) calculated as follows:

$$R_t = 100 * \ln(P_t / P_{t-1}), \text{ where } P_t \text{ is the price of Bitcoin at time } t.$$

The basic statistics of the Bitcoin returns series are shown in Table 1:

Table 1: Descriptive statistics of Bitcoin returns series

	Full sample	Pre-Covid	Covid period
Mean	0.1807	0.1675	0.2231
Standard deviation	4.2214	4.267	4.0739
Skewness	-0.5287	-0.1538	-1.9046
Kurtosis	10.9456	7.7144	23.3473
Jarque-Bera statistic	16194***	6089***	17896***
Ljung-Box Q(10) statistic	33.22***	25.64***	26.22***
Ljung-Box Q ² (10) statistic	296.88***	515.62***	14.8
ARCH-LM (10) statistic	193.41***	316.17***	14.79

*** indicates 0.1% level of significance

As expected, the Jarque-Bera test rejects the null hypothesis of normality and the Ljung-Box test rejects the null hypothesis of no autocorrelation. ARCH-LM test shows that the null hypothesis of no autoregressive conditional heteroscedasticity (ARCH) effects can be rejected. Applying the Bai-Perron test on the Bitcoin price series, the optimal 4-segment partition reveals the following break dates: August 11, 2017, May 25, 2019, and October 16, 2020. The last breakpoint falls within the COVID-19 phase.

3. Results and Discussions

To study the evolution of market efficiency over time, this paper employs the rolling window approach. The four efficiency tests are performed for a fixed-length subsample starting at the beginning and moving it by one observation to create the next subsample. This process is continued till the end of the sample. Three sizes of fixed-length rolling windows are used: 100, 300, and 500. Time-varying p-values are plotted in Figure 2 for the four tests for different sizes of fixed-length rolling windows.

Figure 2: Time-varying p-values of the efficiency tests for different sizes of rolling window

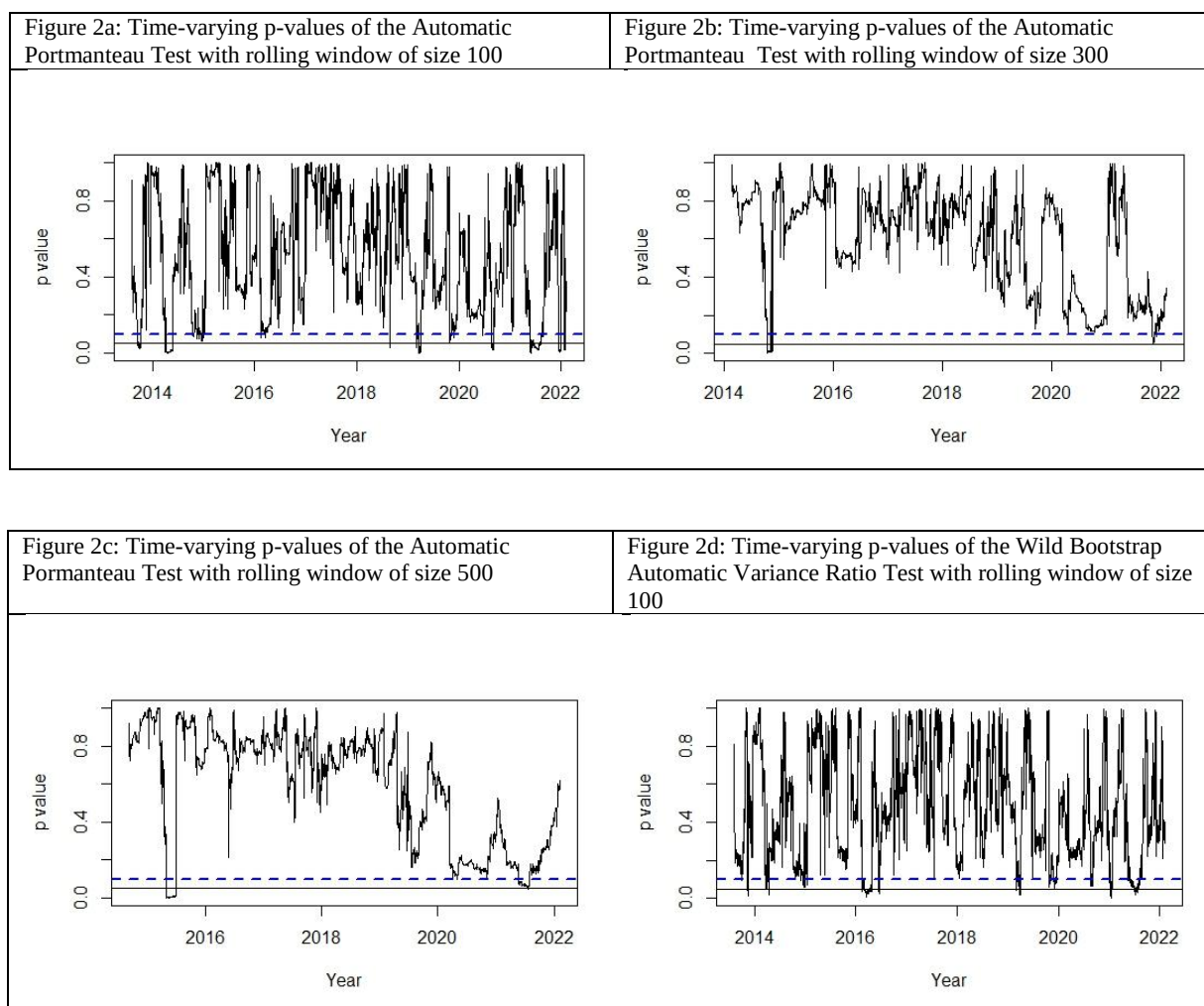


Figure 2e: Time-varying p-values of the Wild Bootstrap Automatic Variance Ratio Test with rolling window of size 300

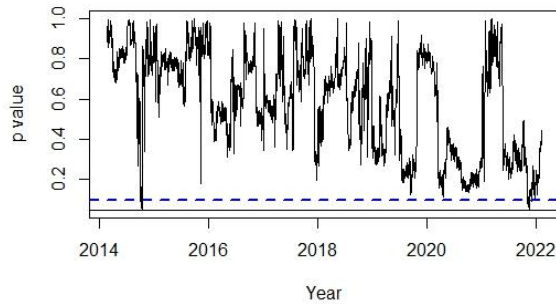


Figure 2f: Time-varying p-values of the Wild Bootstrap Automatic Variance Ratio Test with rolling window of size 500

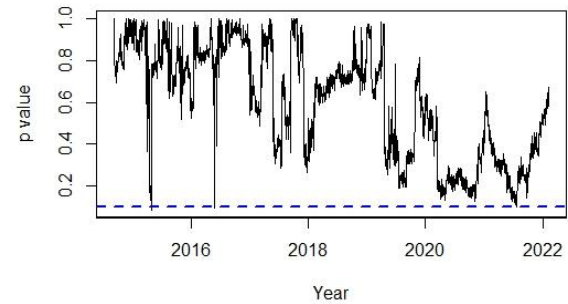


Figure 2g: Time-varying p-values of the General Spectral Test with rolling window of size 100

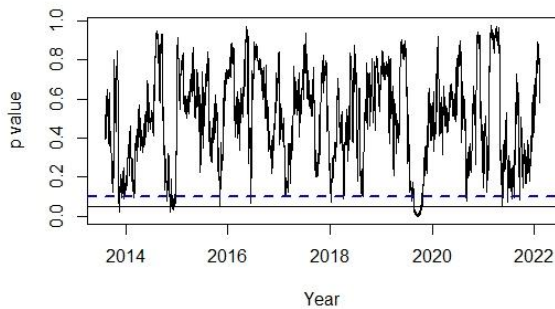
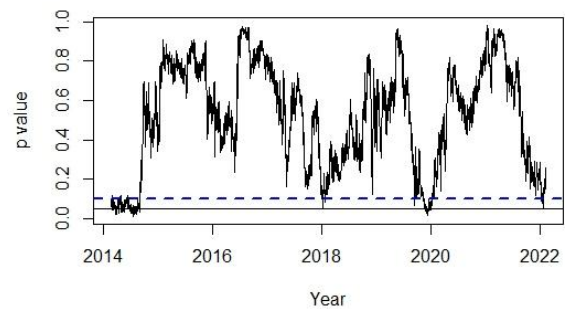
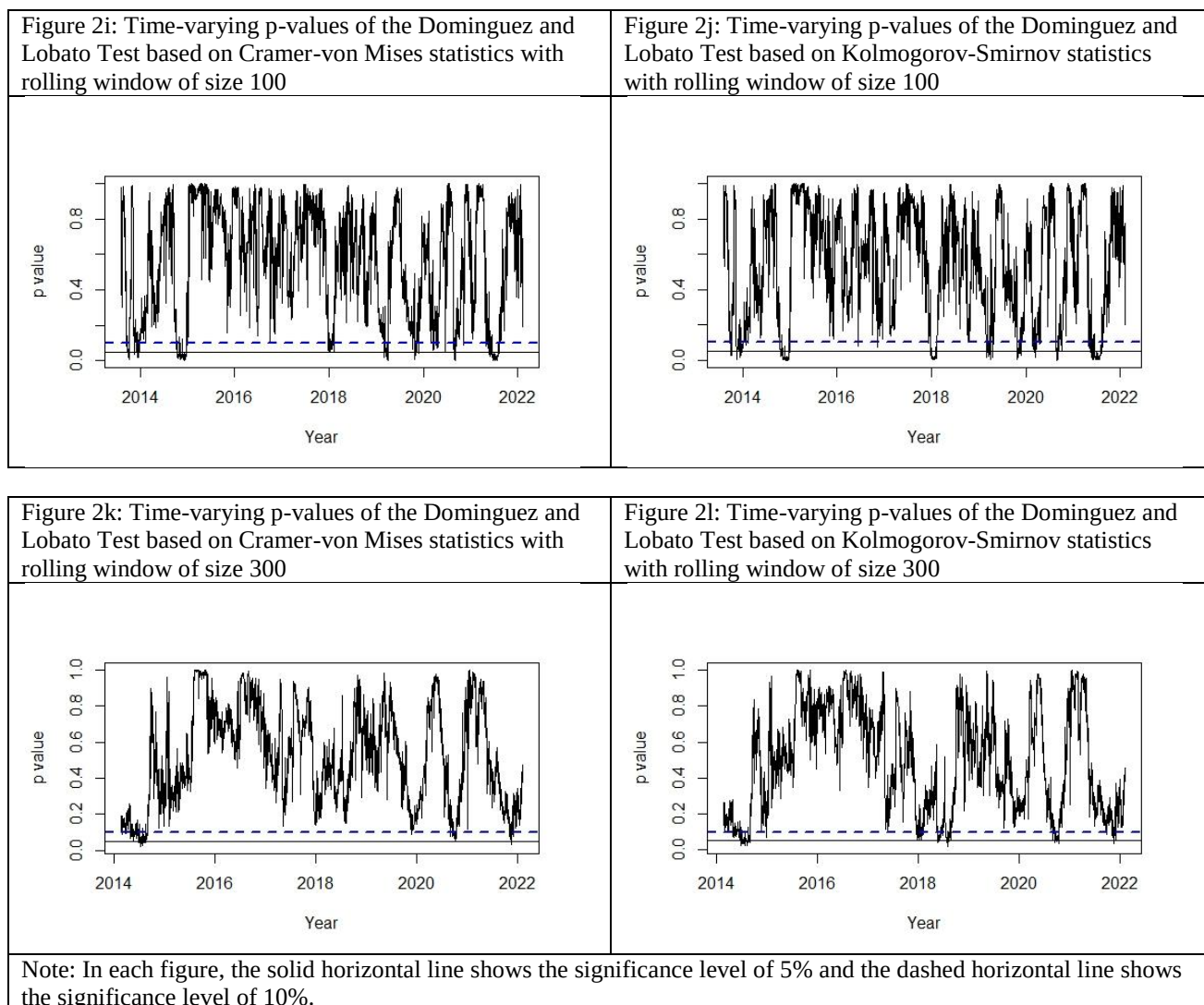


Figure 2h: Time-varying p-values of General Spectral Test with rolling window of size 300





The p-values of the Automatic Portmanteau Test depicted in Figures 2a-2c show that the Bitcoin market turned inefficient for extended periods. In Figure 2a, the longest episodes of inefficiency roughly correspond to the three waves of the COVID-19 pandemic: a period of 14 days from August 20, 2020 to September 2, 2020 during the first wave, a period of 89 days from May 22, 2021 to August 18, 2021 during the second wave, and a period of 18 days from December 11, 2021 to December 28, 2021 during the third wave. In Figure 2b, the longest episode of inefficiency during the COVID-19 phase is found from November 5, 2021 to November 17, 2021 (13 days). Similarly, in Figure 2c, the longest episode of inefficiency during COVID-19 phase runs from May 21, 2021 to July 27, 2021 (68 days). Figures 2d through 2f capture the p-values for the Wild Bootstrap Automatic Variance Ratio Test. In Figure 2d, the longest period of inefficiency during the COVID-19 phase stretches from June 6, 2021 to August 8, 2021 (64 days). For Figure 2e, such an extended period of inefficiency is found in November 2021 (11 days). Figures 2g and 2h plot the p-values of the General Spectral Test. What is remarkable about these tests is that the incidence of inefficiency is proportionately higher in the pre-COVID-19 period. There are only a few instances of inefficiency during the COVID-19 phase, e.g. in Figure 2g, the longest stretch of inefficiency runs from May 12, 2021 to May 18, 2021 (7 days).

Figures 2i through 2l depict the results of the Dominguez and Lobato Test. In Figure 2i, the longest period of inefficiency extends from June 13, 2021 to August 2, 2021(51 days). Figure 2j shows a stretch of 55 days from June 13, 2021 to August 6, 2021 during the COVID-19 phase when the market is inefficient. Such patches of inefficiency are from September 29, 2020 to October 5, 2020 (7 days) in Fig 2k, and from September 24, 2020 to October 11, 2020 (18 days) in Fig 2l.

An interesting pattern emerges in the test results described above. To give a quantitative estimate of the difference, an inefficiency index has been constructed based on the number of days on which the p-value of an efficiency test was less than or equal to 10% as a proportion of the total number of days on which the test could have been conducted. Table 2 shows the Inefficiency Index for the three periods of concern. Tests based on linear measures clearly demonstrate an increase in inefficiency after the start of the COVID-19 pandemic. However, the evidence from the remaining tests is mixed. Two variants of the Dominguez and Lobato test indicate an increase in inefficiency after the pandemic while two other variants of the Dominguez and Lobato test and the General Spectral test show the opposite change in inefficiency after the onset of the pandemic.

Table 2: The Inefficiency Index of the Bitcoin market based on various tests

Test	Inefficiency Index		
	Full sample	Pre-COVID-19 period	COVID-19 period
Automatic Portmanteau Test with rolling window of size 100	9.32	6.86	19.43
Automatic Portmanteau Test with rolling window of size 300	1.82	1.58	4.09
Automatic Portmanteau Test with rolling window of size 500	4.94	3.29	25.38
Wild Bootstrap Automatic Variance Ratio Test with rolling window of size 100	7.68	6.05	14.61
Wild Bootstrap Automatic Variance Ratio Test with rolling window of size 300	0.52	0.14	2.59
Wild Bootstrap Automatic Variance Ratio Test with rolling window of size 500	0.11	0.1	0.38
General Spectral Test with rolling window of size 100	4.53	5.41	2.11
General Spectral Test with rolling window of size 300	8.73	11.5	1.29
Dominguez and Lobato Test based on Cramer-von Mises statistics with rolling window of size 100	9.58	8.05	15.36
Dominguez and Lobato Test based on Cramer-von Mises statistics with rolling window of size 300	4.43	4.33	3.02
Dominguez and Lobato Test based on Kolmogorov-Smirnov statistics with rolling window of size 100	11.83	10.14	16.72
Dominguez and Lobato Test based on Kolmogorov-Smirnov statistics with rolling window of size 300	7.73	8.24	3.45

4. Conclusions

While there are some differences in the results of the four tests applied in this paper, the findings are consistent with the adaptive market hypothesis. Despite being a relatively new market, the Bitcoin market exhibits weak-form efficiency over extended periods with episodes of inefficiency which may be linked to global shocks, including the COVID-19 pandemic. This study does not attempt to explore any causative links but the inefficiency index shows that the market went through proportionately more frequent episodes of inefficiency as the pandemic ravaged the world. The empirical evidence is consistent with the concept of market efficiency as a time-varying characteristic and not as a static characteristic that remains fixed over time. Instead of describing the Bitcoin market as an inefficient market moving towards efficiency (Urquhart 2018), our empirical evidence supports the view that it is a market that exhibits time-varying efficiency and goes through extended episodes of inefficiency. The inefficiency index associated with all the tests except for the Generalized Spectral Test and one version of the Dominguez-Lobato Test went up after the onset of the COVID-19 pandemic. This suggests that the market went through proportionately longer and more frequent episodes of inefficiency as the pandemic ravaged the world. These findings are important from the perspective of traders, regulators, and researchers. For traders, evidence of market efficiency can be crucial in devising suitable trading strategies. The use of technical trading rules, for example, may be justified if the market goes through extended episodes of inefficiency. Regulators need to consider the efficiency characteristics of the cryptocurrency market to design an appropriate regulatory framework. For researchers, it contributes to the growing literature on the efficiency of cryptocurrency markets and the literature on the impact of the COVID-19 pandemic.

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Corporate governance in relationship to value relevance and accounting conservatism: SBF 120 firms

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Abstract: *This study examines the relationship between disclosure quality as measured by value relevance and accounting conservatism and the corporate governance mechanisms such as the characteristics of the financial market, board of directors and ownership structure of French companies listed on the SBF 120. The result shows that the companies can have a high-value relevance of accounting information or practice accounting conservatism when they are featured by the existence of a high number of financial analysts who follow the company, are listed on a US stock exchange or have a dispersed structure capital. The findings show also that the significant institutional shareholders, foreign ownership, a board with small size, separation of functions as well as the creation of a supervisory board, as well as high performance and a low level of leverage contribute to improving the quality of accounting value. We can argue that the results may be of practical interest to potential investors in the SBF 120 firms. This study recommends the usefulness that companies invest in the financial disclosure policy to increase the credibility perceived by the users. of the annual report as to the quality of the information disclosed. In addition, we can argue that the outcomes that emanate from this research work are of interest to the information users who are concerned with the search for quality financial information. Indeed, our results reveal that SBF 120 companies have a divergence in the quality of their financial disclosures, which is why the managers of these companies must invest in the publication of financial information in accordance with the expectations of the different stakeholders.*

Keywords: value relevance; accounting conservatism, board of directors, ownership structure, financial market.

JEL Codes: G44, M41

1. Introduction

It is generally accepted that certain business characteristics affect the quality of financial disclosure. However, what specific feature of the business is supposed to affect the quality of financial disclosure? Several variables concerning performance and firm characteristics can explain the quality of financial information, such as the size of the company, leverage, profitability, audit quality and the stock market listing (Elshandidy et al., 2018; Glaeser, et al., 2020). A second category of factors influencing the quality of financial information includes corporate governance characteristics (Michelon et al. 2020; Elberry, & Hussainey 2020).

The quality of financial communication is assessed through the study of the statistical relationship between a stock market value and the published accounting and financial figures. This technique corresponds to the approach of "accounting value relevance" and it consists of evaluating the relevance of the accounting figures by determining whether these figures are associated with the share prices of companies (Dennis et al., 2019, Fortin et al., 2019, Burke et

al., 2020, Amel-Zadeh, et al., 2020, Rahmat et al., 2020, Liao et al., 2020). Thus, there are two steps to the relevance assessment process, the first of which is to consider a decision to be made (as well as an accounting figure related to that decision). The second step is to consider a variable that is likely to be modified following the publication of the information.

Several models have been used to evaluate the change in stock price that reflects the information investors use in the decision-making process (Ohlson 1995), these studies focus mainly on the coefficients in regression models on the one hand, as well as on the association test between the dissemination of accounting data and the change in the value of the action.

Based on Ohlson's 1995 and Basu's 1997 models, this study aims to present the determinants of value relevance and accounting conservatism of listed French companies. These determinants are related and specifically represented by firms' characteristics and corporate governance.

The remainder of this study is structured as follows: a literature review and research hypotheses followed by a description of the study methodology, a discussion presentation of the results, and a conclusion and professional and managerial involvement of the study.

2. Literature review and research hypotheses

Veltri, et al., (2020) present the importance of institutional factors and the cost of capital in explaining information disclosure in the annual report. Indeed, corporate governance has become like a subset of a company's contracts that help align the actions and choices of managers with shareholder interests (Christensen et al., 2019; Glaeser et al., 2020; Cheng et al., 2020).

Regarding results of recent research on accounting aims, Li et al., 2020, Do & Zhang, 2020, Driskillet al., 2020, Druz et al., 2020; Frenkel, et al., 2020 provide that external consultants positively affect the quality of publicly available information. Flores et al.; 2019; Cormier et al., 2019; Hassan, & Marston 2019; Araújo et al., 2020; Frenkel et al., 2020; Gavana, et al.; 2020; Zhang et al., 2020 show that firms that disclose more voluntary information can increase the number of financial analysts who are interested in it. The empirical results lead to a positive association between the number of financial analysts who follow the value of the company and financial disclosure. Considering these advances, the following hypothesis have been formulate:

H1.a: *Ceteris paribus* number of financial analysts affects accounting value relevance and conservatism.

Early studies state that cross-listing allows companies to lower their cost of capital, increase liquidity, increase visibility, and facilitate the flow of information (Areneke, & Kimani, 2019; Healy, & Serafeim, 2020; Liu, & Li, 2020, et al., 2020). Businesses extending their business abroad can benefit from some publicity, which attracts media attention and tends to meet the needs of local users. In conclusion, it can be argued that cross-listing pushes companies to respect the regulations of various places, which has the effect of forcing them to have a quality financial disclosure. The following hypothesis has been formulated:

H1.b: *Ceteris paribus* cross-listing affects accounting value relevance and conservatism.

After the Enron financial scandal, several US laws such as the Sarbanes-Oxley Act, standardization organizations (the SEC...), and the New York Stock Exchange have increased the requirements for quality financial disclosure. Compared to the continental countries, the Anglo-Saxon markets are more developed and their obligations in terms of disclosure of financial information are more restrictive. In this sense, taking care of the quality of financial disclosure becomes an essential condition to gain access to the American market. Ghadhab, (2019); Li et al., (2019) show that companies listed on the US market, and particularly those listed on the New

York Stock Exchange, face significant financial reporting. The following hypothesis has been formulate:

H1.c: Ceteris paribus listing in a US market affects accounting value relevance and conservatism.

Enache, & García-Meca. (2019) characterize the board as "the heart of governance". Indeed, this control mechanism is responsible for representing the interests of the shareholders, defending their interests, and fighting against incompetent managers. Several authors have highlighted the difficulties of organization and coordination in large boards (Dennis et al., 2019). Nguye et al., 2019, Al-Shaer, & Harakeh, 2020) point out that a large group presents a risk of individual demotivation coupled with coordination problems in management decisions, which has negative consequences for the decision-making process. In the same perspective, several authors, relying on the principles of group cohesion and problems of coordination between administrators, have argued that a small board is more efficient (Enache, & García-Meca, 2019, Nguye et al., 2019). The following hypothesis has been formulated:

H2.a: Ceteris paribus board size affects accounting value relevance and conservatism.

The first quality of a board of directors is related to its composition: the presence of loyal directors, including the operation of the company's business, defending the interests of all groups of shareholders and effectively participating in the definition of corporate strategy (Bouton report, 2002). Al-Shaer, & Harakeh, (2020) suggest that one of the foundations of board effectiveness would be the degree of independence from the leadership.. Enache, & García-Meca (2020) conclude that there is a positive and significant relationship between the percentage of independence of the board and the extent of the voluntary dissemination of information in the annual report of the companies studied. Nasr & Ntim 2018; Liao et al., 2020; Harakeh et al., 2020, Agyei-Mensah et al., 2020, have observed the independence and experience of directors urge executives to publish more information voluntarily. The following hypothesis has been formulated:

H2.b: Ceteris paribus board independence affects accounting value relevance and conservatism.

In practice, two forms of organization are observed in French companies with a board of directors: the first form is characterized by the dissociation of the two functions within the board of directors, some authors predict that this form facilitates the control of the company and the monitoring of the leaders. The second form is characterized by the choice to retain a CEO while creating specific committees as provided by the Viénot I report. This specificity of the French context leads to the motivation to examine whether the choice of governance can influence the quality of the financial disclosure of listed companies. Empirically, the work of (Nasr & Ntim 2018; Goergen et al., 2019; Yin et al., 2020), highlighted a positive relationship between the quality of financial disclosure via the annual report of companies and the separation of the functions of CEO/chairman. The following hypothesis has been formulated:

H2.c: Ceteris paribus CEO/chairman duality affects accounting value relevance and conservatism.

Some research such as those of Agyei-Mensah et al., 2020, Lin et al., 2020, De Silva Lokuwaduge, & de Silva, 2020, emphasized the importance of setting up an audit committee to ensure the transparency of information disseminated in the financial market. As for, the nomination committees, their mission is the appointment of new directors, to palliate the

resignation of the directors of the board, or to comply with the requirements and expectations of investors in terms of director independence (Gantyowati, & Fitria, 2020). Potepa, (2020) provides that "the definition and control of remuneration policies is a key element of the management framework of managerial latitudes", and proposes to create separate committees (remuneration and appointment) to ensure maximizing their respective effectiveness (Al-Shaer, & Harakeh, 2020, Elmagrhi et al., 2020). Given these theories and the results of previous research, the following hypothesis has been formulated:

H2.d: *Ceteris paribus* creation of supervisory committees within the board affects accounting value relevance and conservatism.

The ownership/control separation generates conflicts of interest within the company between managers and shareholders. Karajeh, (2019) has shown that the ownership concentration in the hands of a small number of majority shareholders can anchor company managers, as they are less and less subject to governance by members of the company. Board of directors, and so the majority shareholders can increase the costs of the agency and benefit from the control costs they hold (Crawford et al., 2020). Several empirical studies have shown a positive association between ownership structure and the quality and/or extent of information disclosure (Fiandrino et al., 2019, Viana & Crisóstomo 2019, Karajeh, 2019, Albitar et al., 2020, Hegde et al., 2020). Through this research, the results show that companies whose ownership structure is more dispersed disseminate more voluntary information to meet the needs of their minority shareholders. The following hypothesis has been formulated:

H3.a: *Ceteris paribus* ownership concentration affects accounting value relevance and conservatism.

Cheng et al., (2020) emphasize that institutional investors are considered the most demanding agents in terms of regular financial disclosure, and are attracted to companies that widely disseminate their information. If institutional investors become shareholders in a company, they can respond to financial disclosure practices in different ways. The same observation was obtained by (Dai, & Ngo, 2020) who have shown that the participation of institutional investors in the capital of companies broadens the scope of voluntary corporate disclosure. As Elliott et al., (2020) suggest in their research, the institutional investment horizon and the ability of institutional investors to gather information determine their attitude to the disclosure strategy. In addition, Huan et al., (2020) indicate that institutional investors offer good protection for the interests of minority shareholders in civil law countries, where investors' rights are not protected. The following hypothesis has been formulated:

H3.b: *Ceteris paribus* institutional investors affect accounting value relevance and conservatism.

The explanation of the relationship between the quality of information disclosure and the presence of foreign investors is based on the arguments advanced by the agency theory and the signal theory. Indeed, it is more difficult for foreign investors in a country, than for those nationals, to collect the financial information disclosed. The presence of foreign investors is an indicator of information asymmetry between shareholder groups (Wang et al., 2019, Tsang, et al., 2019; Cheng et al., 2020, Araújo, et al., 2020) Indeed, the publication of increased information by the company's managers reduces the asymmetry of information and reassures foreign investors. The following hypothesis has been formulated:

H3.c: *Ceteris paribus* foreign investors affect accounting value relevance and conservatism.

In the context of the relationship between the officers and the shareholders of the company, the conflicts of interest related to the fact that the agent seeks the profit maximization of the company at the expense of its stock market value are more marked in the case where the managers hold a small share of the capital of the company. Budiharta et al., (2020) predict that the larger the share of ownership held by the managers, the lower the divergence of their interests with those of the shareholders. These theoretical arguments have been tested by empirical studies by (Solichah, & Fachrurrozie, 2019; Florackis et al., 2020) who have shown that low participation of managers in the capital of the firm widens the gap between their interests and the interests of the shareholders, and leads to increased demand for transparent financial disclosure (Tsang, et al., 2019; Cheng et al., 2020, Araújo, et al., 2020, Choi, & Nam, 2020). The following hypothesis has been formulated:

H3.d: Ceteris paribus managerial ownership affects accounting value relevance and conservatism.

3. Research Methodology

The initial sample of this study consists of companies listed on the French SBF 120 index. Indeed, according to the accounting literature, banks and financial and insurance companies are excluded from the initial sample. The ignorance of these entities is due to the structure of their activity and their specificity concerning informational obligation. The choice of SBF 120 companies is justified by several reasons, including:

- The importance of the market capitalization of the companies that make up this index: indeed, this index contains 120 SBF: of which the first 40 stocks that make up the CAC 40 index beyond the 80 other securities (SBF 80 created since the year 1997). So the SBF 120 is wider and more diverse than the CAC 40 index.
- The diversification of industries and sectors of activity.
- The size of the companies (over 300,000 people employed, turnover, world rank of these companies).
- From this population, we have excluded banks, and financial and insurance companies since they are subject to specific rules.

Table 1: Sample of firms during the period of 2008-2013

Companies forming the SBF 120 index.	120	100%
Banks, Insurance and Holding Companies	20	16,67%
Absence of data during the study period	20	16,67%
Final sample	80	66,66%
Number of observations	480	

Based on the work of Ohlson (1995), whose variation in the market price of the firm (dependent variable) is explained through the accounting data as presented in the following equation:

$$P_{it} = \gamma_0 + \gamma_1 EPS_{it} + \gamma_2 BV_{it} + \varepsilon_{it} \quad (\text{eq. 1})$$

P_{it} : Share price of the company i six months after year-end Ohlson (1995); Areneke, & Kimani. 2020, Burke et al., 2020, Amel-Zadeh et al., 2020.

EPSit: Earnings per share of a company i at time t, Ohlson (1995); Choi, & Nam, 2020, Cormier, et al., 2020, Liao et al., 2020, Dennis et al., 2020.

BVit: Carrying amount of equity per share of company i at time t; (Ohlson (1995), Fortin et al., 2019, Areneke, & Kimani, 2019, Dennis et al., 2020,

Pit: the closing price of the company's shares six months after the end of the financial year (t). That is three months after the publication of the financial statements of the company following the work of Ohlson (1995); Areneke, & Kimani, 2019, Gavanet al., 2020, Liao et al., 2020, Rahmat et al., 2020.

Several studies on accounting information relevance, based on the share price model in different contexts, concluded the importance of the book value of shareholders' equity per company share (BV) and the earnings per share EPS in explaining the market value of the firm. Based on this result we expect a positive effect book value of equity per company share (BV) and earnings per share (EPS) on the Market value of the company

(Arenek & Kimani, 2019, Azar et al., 2019; Fortin et al., 2019, Gavan et al., 2020, Liao et al., 2020) the following model proposes to test the effect of governance mechanisms and accounting data in the assessment of the market price of the company.

$$Pit = \gamma_0 + \gamma_1 EPSit + \gamma_2 BVit + \gamma_3 NBRA + \gamma_4 COTMLit + \gamma_5 COTUSAit + \gamma_6 TAILCOMit + \gamma_7 BINDit + \gamma_8 DUALit + \gamma_9 COMSURVit + \gamma_{10} OWNCONCEit + \gamma_{11} OWINSTit + \gamma_{12} OWNEXTit + \gamma_{13} OWMANAGit + \gamma_{14} SIZEit + \gamma_{15} ROAit + \gamma_{16} GEARit + \epsilon it \quad (eq. 2)$$

Pit: Share price of the company i six months after the closing of the financial year t;

EPSit: Earnings per share of company i at time t;

BVit: Carrying amount of equity per share of a company i at time t;

NBRAit The number of financial analysts who follow the company

COTMLit Binary variable that takes the value 1 if the company is listed on two or more stock markets and 0 otherwise.

COTUSAit Binary variable that takes the value 1 if the company is listed on a US market, and 0 otherwise.

TAILCONit Total number of directors on the board of directors.

BINDit The proportion of independent directors of the board of directors

DUALit Binary variable takes the value 1 in the case where the functions of president and general manager are assumed by the same person and 0 otherwise.

COMSURVit Coded binary variable 1 if the firm has one or more specialized committees and 0 otherwise.

OWNCONCEit is the sum of the squares of the percentages of shares held by the first and second shareholders.

OWINSTit The proportion of shares held by French and foreign institutional investors.

OWNEXTit The proportion of ordinary shares held by foreign investors,

OWMANAGit The proportion of ordinary shares held by company executives.

SIZEit Natural logarithm of total assets of the company.

ROAit the profitability of invested capital

GEARit the ratio of long-term debts

Table 2 summarizes the trend of each of the variables in the relevance model of the accounting data, the average value of the variable P is of the order of 46.55681. For the EPS variable, the average is 3.657567, while the average book value of equity per share is around 25.10118.

Table 2: Descriptive statistics of variables in the accounting data relevance model

Variable	Mean	Standard Dev.	Min	Max
P	46,55681	29,60848	5,95178	151,65
EPS	3,657567	1,903488	-0,6270784	5,33
BV	25,10118	21,05904	0,6661521	103,3168

The interpretation of the results presented in the table below allows us to put forward some analyses concerning the general characteristics of the empirical model as well as the validation of the hypotheses of research carried out by the multivariate analysis. Indeed, the value taken by the explanatory power of the first adjusted R2 model of the first model $R^2_{\text{adjusted}} = 0.5723$ reflects a good quality of the model, with an adjusted R2 of 57.23% making useful the judgment of a good quality of the empirical model. The adjusted pseudo R2 resulting from the estimation of the second model takes the value of 0.6167. This assumption implies that the integration of the different explanatory variables explains 61.67% of the variation of the dependent variable. The estimation of the second model shows that the integration of the new explanatory variables makes it possible to improve the quality of the model compared with the first model, which reflects a strong association between accounting figures, corporate governance, and the value of the market. This result is consistent with the work Azar et al., 2019; Rahmat et al., 2020, Liao et al., 2020, Amel-Zadeh et al., 2020, Burke et al., 2020, Firmansyah, & Yusuf, 2020. Following the confirmation of the quality of the evaluation models, we will mobilize the theoretical framework of the argumentation of the results of the multivariate analysis which justifies the relation between the relevance of the accounting data and corporate governance

Regarding the result of the γ_1 estimate (table 3), we can emphasize that the regression coefficient for the EPS variable, which is the net income per share, is positive and significant at the 1% level. Comparing the estimation result of the model (eq.1) with that resulting from the estimation of (eq.2), we find that the integration of the different assumptions related to the hypotheses ensures the connection between the market value, the corporate governance mechanisms, and book value. This postulates that fair value makes accounting information more relevant, so it can be seen as a common thread in the convergence of accounting and finance. The results obtained confirm the expected signs and corroborate the results of previous work (Ohlson 1995, Li, et al., 2019, Crawford et al., 2020 Francis et al., 2020, Rahmat 2020 et al., 2020, Driskil et al., 2020) which prove the positive effect of earnings per share on the share price of the company.

Regarding the result of the estimation, we can emphasize that the coefficients relating to the variable BV, denoting the carrying amount of equity per share, are positive and significant at the 1% level respectively for both the first model and the second model. This assumption implies that an increase in the carrying amount of equity per share is equal to the increase in the market value of the shares. Like the results of the work of (Ohlson 1995, Wang et al., 2019), the results of our

study indicate that the accounting information of own funds better reflects the share price of SBF 120 companies.

An examination of the γ_3 coefficient (Table 3) is used to assess the intensity of the relationship between the relevance of accounting data and the number of financial analysts. Indeed, said association is positive but not significant. Indeed, having a positive sign implies that the higher the number of financial analysts, the more likely it is that it sends a signal to the market about its importance and that it broadcasts more relevant information (Flores, et al., 2019, Gleason, et al., 2019, Li, et al., 2020). This signal is justified by the influence on investors' expectations and its brand image.

The results give the elements of acceptance of the hypothesis of the cross-listing indeed, an unexpected sign of the coefficient of this variable leads to the conclusion that the cross-listing on several stock exchanges makes an interest for the company which diffuses relevant accounting figures at a significance rate of 1%. Such a positive association indicates that SBF120 companies that are listed in two or more overseas markets need to enforce different regulations and face a demand for information that is more relevant than the domestic financial market (Ghadhab, 2019).

The results show the existence of a positive association between listing in a US market and the relevance of accounting data. The coefficient relative to the variable COTUSA, denoting the quotation on a US market, is positive and significant at 10% Such a positive association indicates that an SBF120 company listed on a US market and that complies with its developed and binding regulations, sends a signal on the quality of the accounting figures which allow it to attract potential US investors, face a demand for information that is more relevant than the domestic financial market. This proves that for American investors, the price of the company's stock constitutes an "optimal signal" that directs the allocation of resources to the capital markets (Ghadhab, 2019).

The regression coefficient of the variable TAILCON, denoting the size variable of the board of directors, is negative and statistically significant at a rate of 5%, this indicates that the smaller the Boards are they are associated with a higher market valuation (Cormier et al., 2019).

The results give the elements of acceptance of the hypothesis of the independence of the members of the board of directors. Indeed, an expected coefficient sign of this variable leads to the conclusion that the percentage of independent directors positively but not significantly affects the share price of SBF 120 companies. The results found highlight the importance of the effect of the BIND variable on the market value (Areneke, & Kimani, 2019, Adeabah et al., 2019).

About the result of the estimation of the second model, the results give the elements of acceptance of the hypothesis of the duality of the functions indeed, an expected coefficient sign of this variable leads to the conclusion that the duality of functions Chairman and CEO negatively affects the share price of SBF 120 companies at the level of 1%. The results found highlight the importance of the effect of the DUAL variable on the market value (Areneke, & Kimani, 2019, Almujaed, & Alfraih, 2020).

The regression coefficient of the COMSURV variable, designating supervisory committees within the board, is positive and statistically significant at a rate of 1%. This assumption implies a strong positive association between the value of the enterprise market and the creation of a supervisory board (Elmagrhi et al., 2020).

The results give the elements of acceptance of the property concentration hypothesis indeed, an expected coefficient sign of this variable leads to the conclusion that a concentrated property structure negatively affects the share price of the property. enterprise of SBF 120 companies at a significant rate of 5%. The results found highlight the importance of the effect of the OWNCONCE variable on the market value (Fiandrino et al., 2019, Karajeh, 2019, Hegde et al., 2020).

As for the variable OWINST, denoting the proportion of shares held by French and foreign institutional investors, it has a positive and significant regression coefficient). This assumption shows that an increase in the institutional ownership of a unit is worth the increase in the market value (Cheng et al., 2020, Dai, & Ngo, 2020).

For the outcome of the second model estimate, the regression coefficient for the variable OWNEXT, which is the proportion of common shares held by foreign investors, is positive and statistically significant at a level of 10%. This assumption implies the existence of a strong association between the market value of the company and the proportion of shares held by foreign investors. This indicates that the ownership of foreign investors is considered an important determinant of portfolio choice by investors and therefore of the company's stock price (Cheng et al., 2020, Araújo, et al., 2020).

The regression coefficient of the variable OWMANAG, derived from the estimation of the second model, is negative but statistically insignificant. This assumption implies the existence of a negative association between the value of the enterprise market and the managerial property (Tsang, et al., 2019, Choi, & Nam, 2020).

As for the other control variables, the GEAR variable, denoting the level of indebtedness of the company, is negatively and statistically significant during the action. The variables SIZE and ROA, respectively designating the size of the firm and the profitability of the capital invested, have positive but not significant effects on the accounting value relevance (Florackis et al., 2019, Albitar et al., 2020).

Table 3: Regression results

Variables	(eq. 1)			(eq. 2)		
	Coefficient	t-student	p-value	Coefficient	t-student	p-value
Cons	21.27144	15.39***	0.000	45.54742	1.27	0.203
EPS	.2811724	5.81***	0.000	.3213659	6.75***	0.000
BV	.9663673	22.10***	0.000	.9643095	2.28***	0.000
NBRA	.	.	.	.1400492	0.96	0.336
COTML	.	.	.	3.551134	3.77***	0.000
COTUSA	.	.	.	4.910342	1.98*	0.090
TAILCON	.	.	.	-.5771624	-2.15**	0.032
BIND	.	.	.	1.968087	0.34	0.738
DUAL	.	.	.	-6.47528	-3.09***	0.002
COMSURV	.	.	.	.9675125	5.26***	0.000
OWNCONCE	.	.	.	-5.110372	-2.09**	0.025
OWINST	.	.	.	1.602975	1.57*	0.061
OWNEXT	.	.	.	4.121193	1.96*	0.051
OWMANAG	.	.	.	-1.959664	-0.73	0.466
SIZE	.	.	.	4.673368	1.16	0.249

ROA	.	.	.	1.35781	0.87	0.930
GEAR	.	.	.	-.3536059	-1.33***	0.085
F(2, 477)	321.41			F(16, 463)		49.16
Prob > F	0.0000			Prob > F		0.0000
R2	0.5740				0.6295	
R2 adjusted	0.5723				0.6167	

Note: ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

The accounting conservatism approach

To appreciate the degree of conservatism practised by the French companies of the SBF 120, we will use the model of Basu (1997) also called the differential in the speed of publication in the result of bad and good news (the differential timeliness of earnings with respect to bad and good news. The general form of Basu's (1997) model equation is:

The basic model of conservatism developed by Basu (1997):

$$\frac{X_{it}}{P_{it-1}} = \beta_0 + \beta_1 D_{it} + \beta_2 R_{it} + \beta_3 R * D_{it} + \varepsilon_{it} \text{ (eq. 3)}$$

To establish the validity of the implication of corporate governance on accounting conservatism, we will proceed to the use of a modified model of Basu (1997), which integrates in addition to the explanatory variables of Basu's model.

$$\begin{aligned} \frac{X_{it}}{P_{it-1}} = & \beta_0 + \beta_1 D_{it} + \beta_2 R_{it} + \beta_3 R * D_{it} + \beta_4 NBRA + \beta_5 COTML_{it} + \beta_6 COTUSA_{it} + \\ & \beta_7 TAILCOM_{it} + \beta_8 BIND_{it} + \beta_9 DUAL_{it} + \beta_{10} COMSURV_{it} + \beta_{11} OWCONCE_{it} + \\ & \beta_{12} OWNINST_{it} + \beta_{13} OWNEXT_{it} + \beta_{14} OWMANAG_{it} + \beta_{15} SIZE_{it} + \beta_{16} ROA_{it} + \\ & \beta_{17} GEAR_{it} + \varepsilon_{it} \end{aligned} \text{ (eq. 4)}$$

X_{it} The earnings per share of firm i for fiscal year t .

P_{it-1} The price per share i at the beginning of the fiscal year t .

R_{it} : The firm's yield per share for twelve months beginning nine months before the end of the fiscal year t (P_{t-1}) and ending three months after and ending three months after the end of the fiscal year t the year tax t (P_t),

D_{it} : A dichotomous variable is equal to 1 if $R_{it} < 0$ and 0 otherwise.

Descriptive statistics

The results present the trend of each of the accounting conservatism model variables. During the study period, concerning the practice of accounting conservatism, we note that the value of the Profit / Price ratio varies between -.5840761 and 0.82, with a standard deviation of .1911776 and an average of .0375848. means that the distribution of results is off-axis to the left (or negatively off-axis). This is consistent with the intrinsic characteristics of accounting figures that underestimate the value of the company due, in particular, to the practice of accounting conservatism. The results are consistent with those of previous research (Rahmat et al., 2020).

Table 4: Descriptive statistics

Variable	Moyenne	Ecart-type.	Minimum	Maximum
$X_{it}/P_i(t-1)$	.0375848	.1911776	-.5840761	.82
D	.3333333	.4718963	0	1
R	.0604915	.838029	-1.9011494	2.591796
RD	-.0755545	.1480259	-1.9011494	0

Multivariate Analysis: Results and Interpretations

The interpretation of the results presented in the table below allows us to put forward some analyses concerning the general characteristics of the empirical models as well as the validation of the hypotheses of research carried out by the multivariate analysis. In fact, the value taken by the explanatory power of the first adjusted R² model of the first model $R^2_{adjusted} = 0.4426$ reflects a good quality of the model. The adjusted R² resulting from the estimation of the second model takes the value of 0.4804. This assumption implies that the integration of the different explanatory variables explains 48.04% of the change in accounting conservatism of the companies in the sample. The estimation of the second model shows that the integration of the new explanatory variables improves the quality of the model compared with the first model, which reflects a strong association between conservatism, and the variable corporate governance of the basic model. Basu 1997. This result is consistent with the work (Zulfikara, et al., 2020, Yin et al., 2020)

After confirming the quality of the evaluation models, we will mobilize the theoretical framework of the argumentation of the results of the multivariate analysis that justifies the relationship between accounting conservatism and corporate governance mechanisms.

As regards the result of the estimation β_1 (Table 5), we can emphasize that the regression coefficient relating to the variable D, which takes a value of 1 if the yield per share of the firm $R_{it} < 0$ and 0 otherwise, is negative but not significant for the first evaluation model (eq.3). This shows that the importance of this variable as a determinant of accounting conservatism level. By integrating the different explanatory variables in the second model (eq.4), the results are similar to those obtained with the estimation of the first model (eq.3). The regression coefficient related to variable D takes a significant value. By comparing the estimation result of the model (eq.3) with that resulting from the estimation of (eq.4), we find that the integration of the different assumptions related to the hypotheses ensures the connection between the stock market return, the mechanisms of corporate governance and accounting conservatism. The results obtained confirm the expected signs and corroborate the results of the previous studies (Nasr, & Ntim, 2018, Solichah, N., & Fachrurrozie, 2019, Nguyen et al., 2019, Rahmat et al., 2020) provide the negative effect of the dummy variable related to stock market performance on the level of conservatism of the company.

In Basu's (1997) model, the interaction between accounting conservatism and positive return, which is the proxy for good news, is evaluated by the β_2 coefficient. About the result of the estimate, we can emphasize that the coefficients relating to the variable R, designating the yield per share of the firm i during twelve months starting nine months before the end of the fiscal year t (P_{t-1}) and ending three months after and ending three months after the end of the fiscal year t (P_t), are positive and significant at the 1%, for the second model. The positive sign of the

coefficient assigned to the firm's return-by-share variable presents a response for good and bad news spread by the companies. Like the results of the work of (Nasr, & Ntim, 2018, Nguyen et al., 2019, Rahmat et al., 2020, Dai, & Ngo, 2020), the results of this study indicate that all regression coefficients are positive and that only constant and the β_2 coefficient are statistically significant at the conventional 1%. This means that listed French firms practice accounting conservatism.

The relation between the accounting result and the negative returns, which represent the substitution variable of bad news, is measured by the sum of the coefficients β_2 and β_3 . Concerning the result of the estimation, we can emphasize that the coefficients relating to the variable. DR, denoting the response coefficient that detects the effect of bad news, has positive values and significant values at levels of 10% and 1% respectively for the first model of Basu as well as for the second model of Basu (1997) modified. Referring to the work of Nasr, & Ntim, 2018, Nguyen et al., 2019, Rahmat et al., 2020, Dai, & Ngo, 2020, the β_3 coefficient measures the sensitivity of the results to negative returns.

The comparison of the explanatory power of the Basu (1997) R2 basic model applied to the study sample with that of the Basu model (1997) modified by the integration of the governance mechanisms, reveals that the implication of the mechanisms of governance shows that the accounting results of French listed companies are faster to incorporate the bad news than the good news. Indeed, the fact of having a coefficient of determination R2 of the model (eq. 4) is clearly greater than the R2 of the model (eq. 3). This coefficient of determination is of the order of 46.13% in the (eq. 4), while it reaches 44.61% in the (eq. 4). Based on the coefficient of determination, it seems that the governance mechanisms contribute to the explanation of conservatism practices of French firms. These results are broadly in line with those found by the empirical research of (Nasr, & Lobo et al., 2020, Dai, & Ngo, 2020).

Examining the β_4 coefficient allows us to assess the intensity of the relationship between earnings and the number of financial analysts. Indeed, the association is significant and positive at a level of 5%. Indeed, having a positive sign implies that the higher the company is followed by a higher number of financial analysts, the greater the probability that it practices accounting conservatism (Nasr, & Ntim, 2018; Healy, & Serafeim, 2020; Liu, & Li, 2020, Rahmat et al., 2020, Dai, & Ngo, 2020). This signal is justified by the influence of good news and bad news on earnings per share.

The results give the elements of acceptance of the hypothesis of the cross-listing indeed, a positive sign of the coefficient of this variable leads to the conclusion that the companies listed on two or more markets practice more accounting conservatism than those of the financial market. Such a positive association indicates that companies listed in two or more markets practice more accounting conservatism than those in the domestic financial market (Flores et al., 2019; Do & Zhang 2020, Driskill et al., 2020, Druz, et al., 2020).

The results show the existence of a positive association between listing in a US market and accounting conservatism. The coefficient relative to the variable COTUSA, denoting the quotation on a US market, is positive and significant at 10%. Such a positive association indicates that companies listed on a US market practice more conservatism accounting than those listed on other trading areas (Ghadhab, 2019; Li et al., 2019).

The regression coefficient of the variable TAILCON, denoting the size variable of the board of directors, is negative and statistically significant at 1%, this indicates that the more the advice

of administration is small plus the more effective, because of the ease of coordination (Enache, & García-Meca, 2019, Yin et al., 2020).

The results give the elements of acceptance of the hypothesis of the independence of the members of the board of directors. Indeed, an expected coefficient sign of this variable leads to the conclusion that the percentage of independent directors positively affects the accounting conservatism practice. The results found highlight the importance of the effect of the BIND variable on the practice of corporate accounting conservatism (Nguyen et al., 2019, Nguyen, et al., 2020, Al-Shaer, & Harakeh, 2020).

With regard to the result of the estimation of the second model, the results give the elements of acceptance of the hypothesis of the duality of the functions indeed, an expected coefficient sign of this variable leads to the conclusion that the duality of functions Chairman and Chief Executive Officer negatively affects the share price of SBF 120 companies.

The results found highlight the importance of the effect of the DUAL variable on the market value several researches show that no significant effect can be exerted by the combined structure on the decision-making of disclosure. On the contrary, other studies found that firms with a combined structure exert a greater demand for accounting conservatism to offset the weakness of corporate governance. Like the works of Goergen et al., 2019, and Arayssi et al., 2020), the results of the study show a negative and significant association between the combined structure and the level of accounting conservatism practice of the companies in the study sample. The regression coefficient of the COMSURV variable, designating supervisory committees within the board, is positive and statistically significant at the 1% level. This assumption implies a strong positive association between the value of the enterprise market and the creation of a supervisory board (Agyei-Mensah et al., 2020, Budiharta et al., 2020).

The results give the elements of acceptance of the property concentration hypothesis indeed, an expected coefficient sign of this variable leads to the conclusion that a concentrated property structure negatively affects the share price of the property. SBF 120 companies at a significant rate of 5%. The results found highlight the importance of the effect of the OWNCONCE variable on the market value (Viana & Crisóstomo 2019, Karajeh, 2019).

As for the variable OWINST, designating the proportion of shares held by French and foreign institutional investors, it has a positive and statistically significant coefficient. This assumption shows that an increase in institutional ownership of one unit is worth the increase in the market value (Tran, & Beddewela 2020).

Regarding the result of the estimation of the second model, the regression coefficient of the variable OWNEXT, denoting the proportion of ordinary shares held by foreign investors, is positive and significant at the level of 10%. This assumption implies the existence of a strong association between accounting conservatism and the proportion of shares held by foreign investors. This indicates that the ownership of foreign investors is considered an important determinant of portfolio choice by investors and therefore of the company's stock price (Tsang et al., 2019).

The regression coefficient of the variable OWMANAG, derived from the estimation of the second model, is negative but statistically insignificant. This assumption implies the existence of a negative association between the value of the enterprise market and the managerial property ($\beta_{14} = -1.959664$ and t-student = -0.73). Solichah, & Fachrurrozie 2019, Zulfikara et al., 2020, Dai, & Ngo, 2020 obtained similar results that show that managerial property is negatively related

to accounting conservatism. As for the other control variables, the variable GEAR, denoting the level of indebtedness of the company, is negatively and statistically significant. According to the theory of the agency, the separation between ownership and management, and the existence of creditors give rise to an agency conflict, the information asymmetry between them leading to an asymmetrical loss function, which induces an accounting conservatism (Ahmed, et al., 2020; Kim, 2020). The variables SIZE and ROA, respectively designating the firm's size and the profitability of the capital invested, have positive but not significant effects on the level of conservatism of French companies (Ahmed, et al., 2020; Burke et al., 2020).

Table 5: Regression results of accounting conservatism models

Variables	(eq. 1)			(eq. 2)		
	Coefficient	t-student	p-value	Coefficient	t-student	p-value
Cons	.0300471	3.68***	0.000	.602285	0.82	0.415
D	-.0226887	-1.13	0.259	-.0346252	-4.55***	0.000
R	.0322298	18.74***	0.000	.1935427	18.13***	0.000
RD	.0581806	2.26**	0.062	.1470169	6.94***	0.000
NBRA	.	.	.	.000758	2.01**	0.045
COTML	.	.	.	.0391704	1.34	0.191
COTUSA	.	.	.	.0047104	2.05*	0.071
TAILCON	.	.	.	-.0009531	-2.02*	0.092
BIND	.	.	.	.0301298	2.23*	0.054
DUAL	.	.	.	-.0250242	-2.07*	0.070
COMSURV	.	.	.	.0079034	1.74	0.116
OWNCONCE	.	.	.	-.1306518	-3.98**	0.018
OWINST	.	.	.	.0327626	1.37	0.171
OWNEXT	.	.	.	.2186745	2.36**	0.026
OWMANAG	.	.	.	-.0523342	-1.51	0.164
SIZE	.	.	.	.0713705	0.85	0.395
ROA	.	.	.	.010788	0.25	0.799
GEAR	.	.	.	-.0001386	-0.27	0.802
F(2, 477)	127.80			F(16, 463)		
Prob > F	0.0000			Prob > F		
R2	0.4461			0.4804		
R2 ajusté	0.4426			0.4613		

Note : ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Conclusion

Through this research, we have attempted to study the determinants of the quality of the financial disclosure of companies listed on the SBF 120 stock exchange during the periode 2012 to 2018. We found that a company may have a high probability that its financial disclosure is of high quality associated with the existence of a large number of financial analysts who follow the company, a listing on a US stock exchange, and the structure of the company. dispersed capital, shareholders of institutional investors hold a significant stake in the capital of the company, foreign shareholders are important, a board of directors is characterized by a small size, a large

proportion of independent directors, a separation of functions as well as the creation of a supervisory board, as well as a high performance and a low level of debt. The results obtained, by the estimation of (eq. 1) relating to the choice of the model of relevance and accounting conservatism, have shown that the evaluation of market quotation by the fair value better reflects the economic and financial reality of the company than that based on the historical cost. This implies that quality information disseminated by the company has become a preferred tool for investors in their investment choices.

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The Effect of Negative Interest Rate Policy on Investment in the Euro Area (2014-2019)

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Abstract. *This study investigates the effect of the Negative Interest Rate Policy (NIRP) on investment spending in the Eurozone over the period 2014-2019 using a panel data approach. The literature on this relation is relatively thin which pinpoints the contribution of this study. Both qualitative analysis and quantitative analysis are adopted. On the econometric side, Kao cointegration test and Fully Modified OLS technique are carried out. Both the descriptive and empirical findings indicate that interest rate after adopting the NIRP has a negative effect on the investment level. This finding is consistent with the neoclassical school of thought.*

Keywords: Negative Interest Rate Policy, Monetary Policy, Investment; Modified Ordinary Least Squares, Panel Data.

JEL Codes: E220, E430, E520.

2. Introduction

Negative Interest Rate Policy (NIRP) has become the latest innovation in central banks' toolkit of unconventional monetary policies, implemented during the last decade after the 2008–09 global financial crisis when traditional interest rate instruments reached the zero lower bound (ZLB)¹ (Brunner & Wu, 2017; Lopez-Penabad et al., 2022). After nearly half a decade with NIRP seemed nearly impossible, it has become rooted as part of the mainstream economic consensus (Randow & Takeo, 2019).

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¹ ZLB refers to an expansionary monetary policy tool, whereby central banks push short-term interest rates to the zero level to stimulate the economy and promote growth.

Before the global financial crisis in 2008–09, interest rate cuts and rises through the nation's central bank would be cyclical and mainly to the tune of the respective recessions and booms that economies go through. As interest rates are the primary tool of monetary policy they are directed to stimulate investment and employment and to contain inflation. The theory states that low interest rates encourage investment and spending, sparked by the opportunity cost effect of insufficient returns offered by savings accounts. The financial crisis has decoupled this relationship and rendered interest rates struggling to stimulate investment spending and economic growth. Since then, the developed world has witnessed an unprecedented period of low-interest rate environments (Borio & Hofmann, 2017).

With conventional policy options proven ineffective in reviving economic damages caused by the crisis and recession (Randow & Takeo, 2019), the European Central Bank (ECB) responded to the crisis with a major additional monetary stimulus through standard and even non-standard measures. Such measures incorporated the reduction of policy rates to levels near the ZLB, targeting longer-term refinancing operations for banks along with large-scale asset purchases equivalent to Quantitative Easing (QE) (Riet, 2017).

In June 2014, the ECB became the first major central bank to cut one of its main policy rates—the deposit facility rate, or Interest Rate paid on Excess Reserves (IOER)—below zero and has subsequently lowered this deposit facility rate to the negative 0.5% as of September 2019 (Brruning & Wu, 2017).

Generally, low-interest rates intend to stimulate the economy by reducing money market rates and bond yields, depreciating the exchange rate, inducing banks and investors to rebalance their portfolios toward riskier assets, and boosting credit to the economy (Hannoun, 2015; Arteta, Kose, Stocker, & Taskin, 2016). A NIRP that effectively taxes banks for holding deposits (that exceed regulatory requirements) at the central bank, increases banks' incentives to reduce these excess reserves through bank lending or purchases of alternative assets. Overall, NIRP provides an environment where banks and investors may be more sensitive to both conventional and unconventional monetary policy accommodations that encourage them to rebalance their portfolios toward riskier investments/assets with higher yields. This raises a question regarding whether NIRP constitutes simply a continuation of conventional interest rate instruments or if it causes a fundamental change in the monetary policy transmission mechanism (Brruning & Wu, 2017). In other words, while positive interest rates represent the incentive that drives investors to risk their money by lending, negative rates remove the incentive (and even punish) those who are averting risk by hoarding cash (Randow & Takeo, 2019).

The new era of negative rates has recently been the subject of a debate about whether the policy adopted by the ECB was able to achieve its goals to ward off the threat of deflation (or a spiral of falling prices that could have deepened economic distress), jolt lending, stimulate investment spending, and reinvigorate economic growth in the Euro-zone countries or on the contrary has caused a distortion in financial markets and crippled banks and investors (Randow & Takeo, 2019).

This paper contributes to this debate by focusing on the empirical investigation of the effect of negative interest rates on investment spending in Euro-zone countries for the period 2014-2019 using a panel data model. The selection of this period meant to tackle the period during which NIRP was adopted in the Euro-zone area while excluding the COVID-19 pandemic period starting in 2020 that could have affected the relationship between NIRP and investment, especially with the tendency of advanced central banks to tighten their monetary policy after the pandemic.

The paper is organized as follows. Section 2 provides the theoretical framework behind the relationship between the interest rate and investment with a focus on the theoretical background of NIRP, along with a review of the empirical literature that investigates this relation. Section 3 analyses in detail the economic environment of the Euro-zone countries correlated with the adoption of negative rates by the ECB and proceeds with a qualitative analysis of their effect on investment. Section 4 provides an econometric analysis to further investigate the relationship between the two variables for the Euro-zone countries throughout the period 2014-2019. Finally, Section 5 presents the conclusion of this study.

3. Research Elaborations

3.1. Theoretical framework:

NIRP once existed in literature as an anarchistic theoretical fantasy that has now become a part of the mainstream economic consensus. Although NIRP may appear relatively new, it represents a continuation of pre-Keynesian, neoclassical macroeconomic reasoning that regained ascendancy in the late 1970s, and has been shaping macroeconomic policies for over four decades. This continuation could be highlighted through the focus on interest rates as a critical tool for stimulating investment and consumption in a demand-driven recession, as well as for stabilizing the economy and ensuring full employment in a deflationary environment (Ilgmann & Menner, 2011). This part of the paper presents a concise review of the theoretical origins of NIRP and the theoretical debate regarding its role in stimulating investment in the economy (Ilgmann & Menner, 2011; Palley, 2016a; Palley, 2016b).

3.1.1. Loanable funds theory of interest:

The classical theory of interest rate and investment presented by David Ricardo, A.C. Pigou, Marshall, Walras, Taussig, Cassels, and Knight, sets an inverse relationship between interest rate and investment. Interest rate is the price of investment or cost of borrowing, so a high interest rate reduces investment and a low interest rate encourages higher investment. According to this classical theory, the interest rate is determined by equilibrating the goods market through equating demand for investment and supply of household savings in the goods market. This theory is also known as the real theory of interest rate as it only takes into consideration real factors affecting goods markets like productivity and thrift without taking into consideration relevant monetary factors (Pal, 2018).

The old classical model was reformulated by the neoclassical school in the 19th century to incorporate and account for monetary factors in addition to the real determinants of saving and investments. The new formulation is called the loanable funds theory of interest. This theory is associated with the names of Wickells and several other Swedish economists. It is considered the core economic theory behind NIRP and ZLB economics of the contemporary mainstream economic consensus (Palley, 2016a; Pal, 2018). While in the classical theory, only saving from current income is available for investment, the loanable funds theory of interest includes disinvestment, dis hoarding, bank loans, and

bank credit² as other sources of funds available for investment to the borrowers. So, the loanable funds theory is often referred to as both the real and monetary theory of interest (Pal, 2018). According to the loanable funds theory, the real interest rate is the critical mechanism, that adjusts to coordinate saving and investment in the goods market and ensure that aggregate demand (AD) equals aggregate supply (AS). This equilibrium, according to the monetary overinvestment theories, occurs when the Natural Rate of Interest (NRI) equals the policy interest rate in the loanable funds market (Palley, 2016a; Hoffmann and Schnabl, 2016).³

Afterwards, Neo-Keynesian economists added a twist to the canonical neoclassical macro model. That twist is a central bank that is responsible for interest rate targeting. In this contemporary formulation, the neo-classical interest rate adjustment mechanism is managed by the central bank's nominal interest policy (Palley, 2016a). Thus, whereas the loanable funds market sets the interest rate in the classical model, the central bank in the Neo-Keynesian model takes over the interest rate setting function (Palley, 2019). The central bank sets the nominal interest rate targeting an inflation rate that is consistent with the aforementioned belief regarding the required loanable funds' real interest rate through a four-step procedure (Palley, 2016a). First, it announces a credible inflation target, Second, it estimates NRI, third, it sets a nominal interest rate target that equals the estimated NRI plus the inflation target, and fourth, the central bank adjusts the nominal interest rate targeting NRI (Palley, 2019).

An economic downswing occurs when the NRI exceeds the internal interest rate of investment projects, so investment turns out unprofitable (Klausinger, 2011). The fall in the investment of some firms negatively affects the investment of other firms as expected returns fall, causing further disinvestment (cumulative downward process). This leads to a downward shift in the investment curve, making a policy interest rate above the NRI. Thus, credit supply is restricted further such that saving is higher than investment. In this situation, the central bank should cut its base rate to contain the downward spiral (Hoffmann and Schnabl, 2016). However, problems arise for the central bank when the nominal interest rate approaches the zero level, which minimizes the effectiveness of conventional monetary policy (Palley, 2019).

The ZLB becomes relevant when the nominal interest rate cannot adjust to deliver the NRI needed to clear the loanable funds and the goods markets. This occurs when the NRI (full employment interest rate) is below the negative inflation rate, at a nominal interest rate equal to zero, (i.e. since real interest rate = nominal interest rate – inflation rate). Consequently, both the goods market and the loanable funds market are in excess supply at the prevailing real short-term interest rate (RI) (Palley, 2016c).

3.1.2. ZLB economics:

The idea of removing ZLB was first suggested by Silvio Gesell at the beginning of the 20th century via taxing money. However, it was shortly forgotten in the literature until it was renewed with the Japanese financial crisis in the early 1990s. This crisis rendered monetary policy ineffective in fighting recession and deflation when reaching the ZLB. This has revived discussions regarding the implications

² Disinvestment means the sale or liquidation of assets. While dishoarding is the activity of investing money or selling gold, silver, etc. after a period during which investors have saved them. Bank credit is an amount of funds that a person or business can borrow from a bank. Or money that banks have lent or have available to lend.

³ According to the overinvestment theories, the natural interest rate is the one that balances the demand for capital (investment) and supply (saving).

of ZLB and possible remedies. The ZLB economics was first introduced by Krugman, Dominquez, & Rogoff (1998) who originally developed it to explain Japan's stagnation after the collapse of its asset price bubble in 1991. However, as the majority of developed countries had enjoyed a period of stable growth previous to the global financial crisis of 2008-09, the risk of nominal rates hitting the zero floor was considered very small, especially in the light of high inflation rates. Thus, the ZLB was not considered an important issue for mainstream economists (Ullersma, 2002; Buiter, 2005; Ilgmann & Menner, 2011). The global financial crisis of 2008-09 followed by global recession and stagnation along with the unresponsiveness of the economy to the massive monetary and fiscal stimulus, has prompted a search for a theoretical explanation. An explanation was then provided by new Keynesian economists; Eggertsson and Krugman (2012). Their analysis is based on the ZLB to nominal interest rates that supposedly obstructed the clearing of the loanable funds market for attaining full employment savings and investment.

The Eggertsson–Krugman approach is part of the new Keynesian consensus that considers the economy as a full employment system that only fails as a result of rigidities and market imperfections. ZLB economics adds the nominal interest rate to the list of these rigidities (Eggertsson & Krugman, 2012; Palley, 2016c; 2019). Eggertsson and Krugman (2012) deleveraging hypothesis argued that after the global financial crisis, some households tried repairing their balance sheets by paying back their debt and deleveraging. This process caused an increase in the supply of savings (loanable funds), initiating a fall in the NRI. However, that fall was blocked by the ZLB, causing an excess supply of loanable funds. Eliminating that excess supply resulted in a contraction of income and employment that lasted through the deleveraging process (Palley, 2016c).

3.1.3. Unconventional monetary policy recommendations:

As the central bank's base rate approaches zero, conventional monetary tools become ineffective in guiding or stimulating the economy, so scholars and economists have been searching for and suggesting unconventional monetary tools to escape ZLB. Bernanke (2016) suggests that with the base rate near zero, the central bank could next turn to a "forward guidance" approach that is, communicating the US Federal Reserve policy plans to markets and the public. If the central bank can convince market agents that short-term rates will remain low for some time, it can reduce longer-term rates, which are more important to investors, consumers, and businesses. Bernanke ensures that forward guidance can be very effective, and rate cuts along with guidance might be sufficient.

Another approach was presented by Gregory (2009). According to Gregory (2009), the central bank should commit itself to producing significant inflation. Since the RI equals the nominal interest rate minus expected inflation, a higher inflation rate lowers the RI. Thus, people will have the incentive to borrow and are confident that they can repay their debt in devalued money. The goal of such a policy is to induce enough inflation until the RI is sufficiently negative; however, this policy exposes the economy to the adverse effects of price instability.

Some ZLB economists argue that this goal can be achieved with monetary authority by driving up inflation expectations. However, Palley (2016a) argues that inflation expectations primarily are predetermined by expectations of real economic conditions rather than pronouncements by the monetary authority.

Another monetary policy tool that has been implemented by the US Federal Reserve in 2008 - and others – is to stimulate investment and encourage lending in the market by QE which refers to massive purchases of assets for the central bank's portfolio, financed by the created reserves in the banking system (Bernanke, 2016). Like the previously discussed monetary tools, QE aims to reduce longer-term interest rates encouraging borrowing, investment, and spending. Bernanke (2016) stated that, while QE has helped support the US recovery, central banks might be reluctant to apply it due to the market resistance to terminate it afterwards. So central banks should consider other options before undertaking QE (Bernanke, 2016). Thus, NIRP becomes the next policy of choice following simple extrapolative logic (Palley, 2016a).

3.1.4. Negative interest rate policy (NIRP):

NIRP has been presented on the macroeconomic level as an unavoidable last measure of monetary policy. In principle, the monetary authority can implement this strategy directly by setting its lending rate below zero, or it can adopt non-standard tools such as charging commercial banks for their deposits with the central bank using its base rate (official reserve rate) (Palley, 2016a).

In practice, this means that commercial banks are being charged on the reserves above a certain threshold instead of receiving interest on the reserves they hold with the central bank. Banks are expected to shift to other short-term assets, in response, driving down the yields on those assets as well. Ultimately, the efforts of banks and investors aiming to avert negative returns on short-term assets should cause declines in a broad range of long-term interest rates such as corporate bond yields and mortgage rates (Bernanke, 2016).

According to the reasoning embodied in ZLB economics (Palley, 2016a), such action would encourage business investment and consumer spending; making exports more competitive. Besides, it would lower the value of a country's domestic currency, increase the value of other risky assets; and increase expectations of future inflation, which can induce people to spend more now (Irwin, 2016).

The idea of negative interest rates still fascinates scholars, professional economists, and the public. As conventional wisdom states nominal interest rates earned on investments never go below zero because investors could alternatively hoard currency. Yet there are costs for holding currency, that are represented in the –huge cost to safeguard in large amounts, and the difficulty of using it for remote and large transactions, as it might be subject to physical destruction or theft (Anderson & Liu, 2013). McAndrews (2015) formulates this by stating that "different economic agents will be more or less willing to invest in negative rate investments to the extent that diseconomies of scale make their costs of handling currency higher or lower than others". He then readjusts his proposition to account for other dynamic considerations involving innovative actions to avoid negative rates, to be "different economic agents will be less willing to invest in negative rate investments over time to the extent that innovations reduce the costs of handling currency or make available other zero, or near-zero, interest rate economic arrangements".

Some scholars went even further seeking to fully remove the ZLB, liberating conventional monetary function which requires levying negative interest rates on the whole monetary base. They came up with various schemes for removing the zero bound via negative interest rates, where Buiter (2009) suggests separating the role of currency as a unit of account and the means of payment function, this follows the idea presented by Gaitskell et al. (1969), but was initially introduced by Eisler (1932) with the motivation

of shielding the economy from the negative effects of inflation. Nonetheless, the most commonly thought method for removing the ZLB is taxing money which was first introduced by Silvio Gesell at the beginning of the 20th century and revived by Gregory (2009) in his article in the New York Times, concerning periodic taxation or partial confiscation of base money, with both components of the monetary base subject to this tax, simple arbitrage will be supposedly sufficient to ensure that all components of the money supply will also yield negative nominal interest (Ilgmann & Menner, 2011).

3.2. Empirical Review:

Regarding the topic of the relationship between negative interest rates and investment, the majority of studies that tackle negative interest rates do not present a direct relationship between such variables and investment. Instead, the studies that discuss negative interest rates focus more on the relationship between such variables and their effect and implementation on the banking sector and equity markets. The contribution of this study is shown by conducting empirical evidence in the 19 countries of the Euro-zone from 2014 to 2019; the aim shall be to fill the gap in the literature between NIRP and investment. However, there is an abundance of empirical studies that tackle the relationship between positive interest rates and investment from which the majority state a negative relationship between the interest rate and investment. Besides, some studies find a positive relationship between the two variables in question. The following results summarize different studies conducted within this field based on the main empirical findings.

As an example, for the studies that investigate the effect of NIRP on banks' profitability, risk-taking, and stock prices, Boungou (2019) conducted research using a panel dataset of 2442 banks operating in 28 EU countries over the period from 2011 to 2017. The study investigates the effects of NIRP on bank profitability and risk-taking. Boungou (2019) found that NIRP has contributed to a reduction in banks' risk-taking. In addition to stating that, the effects of NRIP on the banks' profitability and risk-taking differ among banks, depending on their balance sheet characteristics.

Also, according to Jurkšas (2017), the impulse-response functions of the created VAR model for the European Union (EU) from 2000 to March 2017 confirm the following results: an interest rate reduction decreases borrowing, deposit rates, and net interest margins but positively affects confidence, bond, and equity prices, leading to higher expectations of economic growth and inflation in the longer term.

3.3. Descriptive analysis:

3.3.1. Overview of the NIRP in the Euro-zone:

The period of ultra-low and negative interest rates in Europe started when the ECB was battling the global financial crisis of 2008-09. The immediate financial shocks related to these crises have been resolved. But a decade later their effects on the real economy, including low inflation and subdued growth, continued to rank, requiring further unconventional policies such as NIRP. The ECB was the second bank in the world that implement a negative interest rate after Denmark in June 2014. The goal is to maintain the inflation rate under 2%. Also, it is designed to relatively weaken the euro to provide some assistance to Euro-zone exporters (Wang, 2017).

The ECB started by lowering the remuneration on its deposit facility to 0.10 percent in June 2014. Subsequently, during September 2014, December 2015, and March 2016, there were four additional steps of 10 basis points cuts. In September 2019, the ongoing rate of – 0.50 percent was reached (Eisenschmidt

& Smets, 2019). The decision to adopt NIRP was part of a more comprehensive monetary policy easing package, which eventually also included the introduction of targeted long-term refinancing operations and a large-scale Asset Purchase Program (APP) of private and public sector bonds. The sole motivation for the ECB's decision to set rates below zero was the desirability to provide additional monetary easing to the whole economy in response to the emerging deflation risks. Given the ECB's focus on providing additional monetary policy accommodation with its negative deposit facility rate, raises a question about the effectiveness of the NIRP (Eisenschmidt & Smets, 2019).

While the transmission of NIRP to financial market rates is complete, a different picture arises when looking at rates paid by banks for household and Non-financial Corporations (NFC) deposits. Comparing the distribution of deposit rates through a representative sample of Euro-zone banks in June 2014 and June 2019, it is obvious that these two types of deposit rates have declined during the NIRP period, with both distributions having most of their value at zero. This accumulation of deposit rates at zero suggests the existence of a ZLB for bank deposits, although some banks do report rates below zero for their NFC deposits and households (Eisenschmidt & Smets, 2019).

While the effect of NIRP on investment spending is yet to be examined, some scholars claim that NIRP has put European banks into a spiral of declining margins and instability in their business models. As it drove down to what banks earned on the money they lent, they still, and to a great extent had to pay customers for their deposits. The resulting profit compression left many European banks complaining that the ECB was making it harder for them to lend, not easier (Randow & Takeo, 2019). Besides, banks have paid the ECB more than €20 billion in negative interest fees, providing a tangible demonstration of its crippling effects.

To consider the consequences of such a policy, there is a need to look at the portfolio investments outflowing the countries with higher real interest. The financing entities, which do not want to make a loss, withdraw their capital from the financial companies and retain them. Furthermore, keeping the money outside the financial system in which the necessary audits and controls are done causes an increase in the number of unrecorded transactions, which means that, it will affect investment and also growth (Yilmaz & İçellioğlu, 2016).

However, many other factors affect the investment environment such as investment costs, financing conditions, price expectations, profit possibilities, and uncertainties. Also, the effectiveness of a NIRP depends on whether there will be an uptrend from savings to investments or not.

3.3.2. Initial Assessment of Euro-zone Data:

This section highlights the initial assessment of the relationship between NIRP and investment in a more descriptive way. The analysis is conducted using the data of the Eurozone regarding the two variables of interest to indicate the relationship between them. The first variable is nominal interest rate and the other one is Gross Fixed Capital Formation as % of GDP (GFCF). The coming graph plots the two variables under study together to have initial interpretations of the relationship.

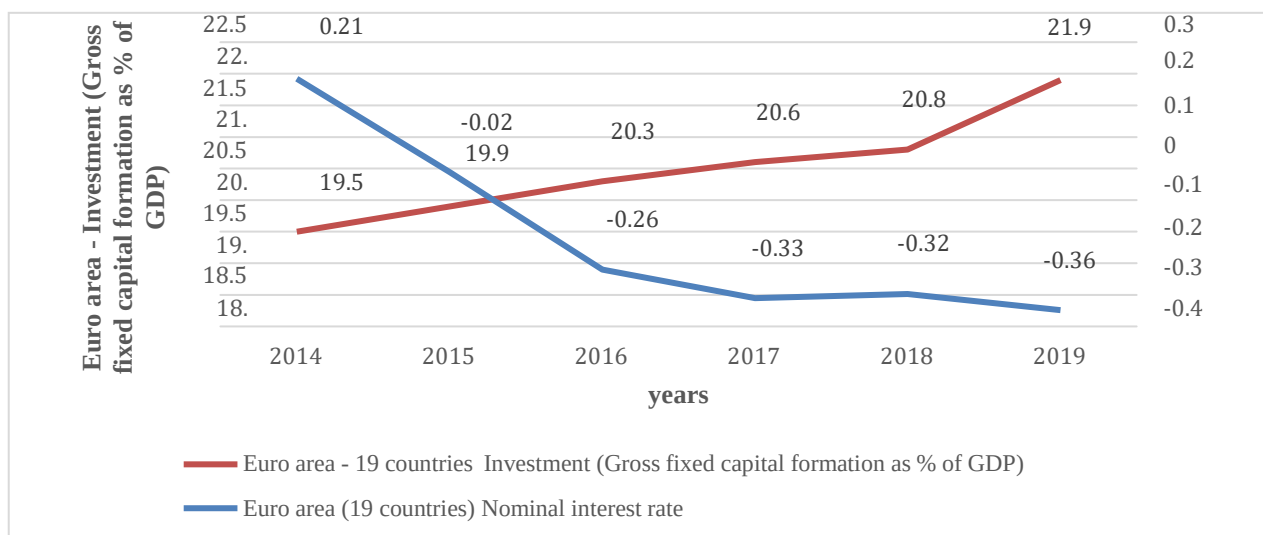


Fig. 1: Interest rate and gross fixed capital formation in the Euro-zone from 2014 to 2019
 (Source: done by the researchers based on data from Eurostat & OECD, 2020)

It can be concluded from Figure (1) that while the nominal interest rate has been experiencing a sharp fall starting from 2014, the GFCF is showing a nearly constant upward slope with almost no fluctuations. It is worth mentioning that the two variables nominal interest rate and GFCF are integrated in the first order as mentioned later in the next section. Therefore, to be able to comment on the correlation, the First difference between the two variables is plotted together against time in Figure (2).

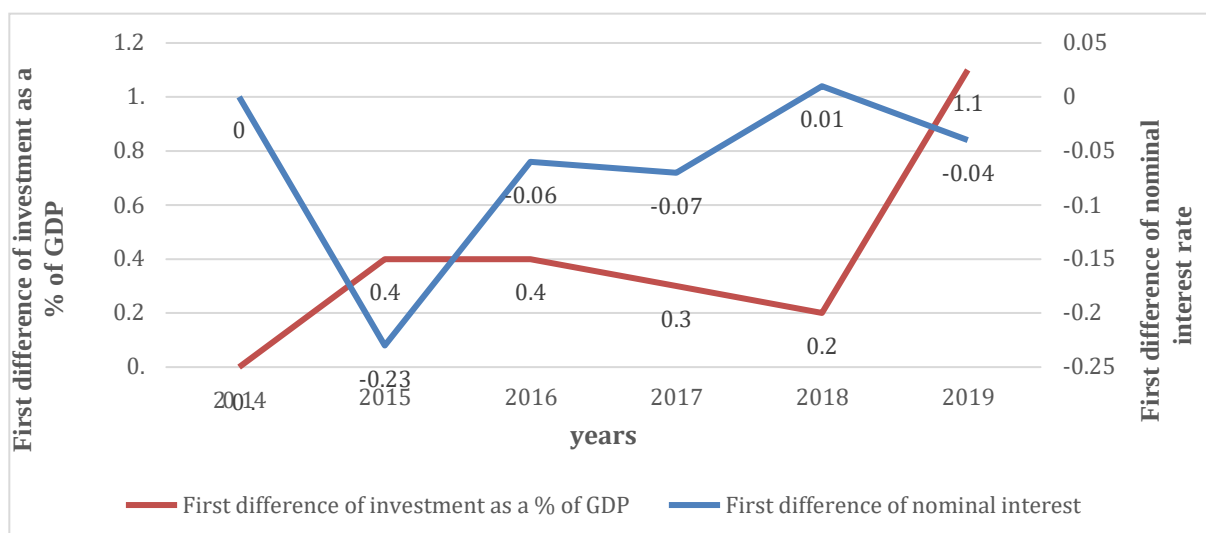


Fig. 2: The first difference of both interest rate and gross fixed capital formation in the Euro-zone (2014 - 2019)
 (Source: done by the researchers based on data from Eurostat & OECD, 2020)

From Figure (2), it can be observed through the transition from 2014 to 2015 that there is a slight negative correlation between the two variables in question. But starting from 2016, it can be stated that there is nearly no correlation between both variables. Besides the correlation coefficient between both variables is estimated to be (-0.1415) which indicates a weak negative correlation between variables.

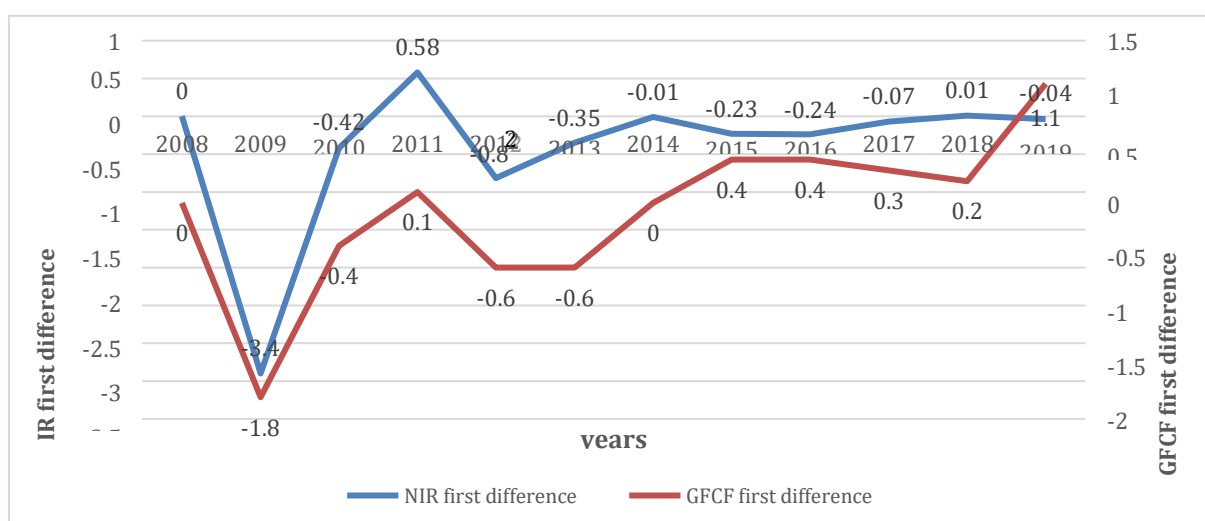


Fig. 3: the first difference of negative interest rate and gross fixed capital formation in the Euro-zone (2008 - 2019)
 (Source: done by the researchers based on data from Eurostat & OECD, 2020)

To further identify whether such a weak negative correlation between interest rate and investment is triggered by the adoption of NIRP or not, the study investigates the correlation between the two variables since 2008 (i.e. before the adoption of the NIRP in the Euro-zone) (as depicted in Figure 3). It is obvious from Figure 3 that throughout the period from 2008 to 2013, there has been a near-perfect positive correlation between the two variables. The calculated correlation coefficient between the two variables from 2008 to 2013 is (0.9792). However, since 2014, a significant change occurred not only in the strength of the correlation between the two variables but even in its direction, producing a sharp sudden change in the trend that dominated the previous period which presents an adjustment in the relationship between the two variables under study. This observation is consistent with ZLB economics' claim that the adoption of NIRP and going below the ZLB would have revived the effectiveness of monetary tools (including interest rates) to operate according to their conventional functions. However, stating that the adoption of NIRP was the only cause for such change would be an inaccurate assessment, as the decision to adopt NIRP was accompanied by other easing measures such as the APP, which had a significant downward effect on long-term bond yields, and the program targeting long-term refinancing operations, which provided long-term funding to banks at negative interest rates under certain conditions (Eisenschmidt & Smets, 2019).

Also, this could be interpreted by the recovery of the economies from the 2008-09 financial crisis and its ramifications and repercussions that lasted till 2013. So, the degree to which the adopted NIRP

contributed to reshaping the relation could be impossible to determine accurately using the aforementioned descriptive analysis.

3.4. Empirical Analysis:

3.4.1. Data and Variables

In an attempt to study the relationship between NIRP and investment for the 19 countries of the Euro-zone, annual data for the period 2014-2019 is applied using the panel data econometric technique. The variables employed are GFCF as a percentage of GDP as a proxy for investment, real per capita gross fixed product (RPGDP), real short-term interest rate, and Financial Development Index (FDI). All data are extracted from the online services of Eurostat, OECD, and International Financial Statistics reported by the International Monetary Fund and World Bank data services (Ucan, 2014).

The definitions of the incorporated variables are as follows:

- **The Gross Fixed Capital Formation as a percentage of GDP (GFCF):** it is used as a proxy for the investment level and it consists of resident producers' acquisitions, less disposals, of fixed tangible or intangible assets. This covers in particular machinery and equipment, vehicles, dwellings, and other buildings (Eurostat, 2020).
- **The real per capita GDP (RPGDP):** it is calculated as the ratio of real GDP to the average population of a specific year. GDP measures the value of the total final output of goods and services produced by an economy within a certain period. It includes goods and services that have markets (or which could have markets) and products that are produced by general government and non-profit institutions (Eurostat, 2020).
- **The real short-term interest rate (RI):** it is used as a proxy for the real interest rate which is calculated according to the Fisher equation; by subtracting the inflation rate from the nominal interest rate. The nominal short-term interest rate is the rate at which short-term borrowings is affected between financial institutions or the rate at which short-term government paper is issued or traded in the market. Short-term interest rates are mainly averages of daily rates, measured as a percentage. Short-term interest rates are based on three-month money market rates where available. Typical standardized names are "money market rate" and "treasury bill rate" (OECD, 2020).
- **Financial development index (FDI):** it is an index that summarizes how developed the financial institutions and financial markets are in terms of their depth (size and liquidity), access (the ability of individuals and companies to access financial services), and efficiency (the ability of institutions to provide financial services at low cost and with sustainable revenues and the level of activity of capital market) (Svirydzenka, 2016).

2.3.2 Model specification:

According to the neoclassical theory, the investment level is mainly determined by the interest rate, besides other variables such as GDP and the level of financial development (Pal, 2018). Consequently, in this paper, the GFCF is the dependent variable. The independent variables incorporate RPGDP, RI, and FDI. The following functional form is used in the analysis:

$$GFCF_{it} = f \left(\begin{matrix} RPGDP_{it} & RI_{it} & FDI_{it} \\ (+) & '(-)' & (+) \end{matrix} \right) \quad (1)$$

4. Results and Discussions

4.1. Empirical findings:

4.1.1. Test for stationarity:

There are different methods for testing the unit root of the variables. Particularly, the unit root test using Levin, Lin & Chu (LLC), Augmented Dickey-Fuller test (ADF), and Phillips-Perron Fisher Chi-square (PP) methods are used for the different variables to guarantee the accuracy of the results (Maddala & Wu, 1999). The test results are shown in Table (1)

Table (1): LLC, ADF & PP test results:

Variable	At level			At first difference			Result
	LLC	ADF	PP	LLC	ADF	PP	
GFCF	17.0610	10.7663	11.5140	-5.8387***	102.688***	98.6910***	I(1)
RPGDP	14.2143	0.20104	0.15316	-4.0514***	51.0976*	52.4805**	I(1)
RI	0.41020	23.4998	24.0053	-7.0013***	80.6363***	79.7031***	I(1)
FDI	0.65547	38.7794	42.7195	-10.632***	146.794***	146.751***	I(1)

1. Newey-West bandwidth selection using Bartlett kernel.
2. Common effects for LLC and Individual Effects for both ADF and PP
3. (***) represent variables significant at 1%, (**) represent variables significant at 5%, (*) represent variables significant at 10%.

(Source: done by the researchers based on the empirical findings on the model)

The lag length used in this unit root test is zero according to Schwarz information criteria. Table (1) shows that all variables are integrated in the first order. Since at level, the P-value of all variables is greater than 10% and at the first difference, the P-value of each one of them is less than 10% which induces rejecting the null hypothesis of unit root at first difference.

4.1.2. Co-integration test:

Since all the variables are non-stationary and have the same order of integration, the cointegration test can be performed to examine the existence of any long-run equilibrium relationship between the variables. The test used is the Kao panel cointegration test with the null hypothesis of no cointegration (Kao, 1999).

Table (2): Kao panel cointegration test:

	t-Statistic	Prob.
ADF	-5.728927	0.0000

1. Newey-West bandwidth selection using Bartlett kernel.
2. Lag length is zero based on SIC.

(Source: Done by the researchers based on the empirical findings on the model)

In Table (2), since the P-value is 0 which is less than 5%, thus the null hypothesis will be rejected indicating that there is a long-run relationship between the variables.

4.1.3. Fully modified ordinary least square model (FMOLS):

To test the long-run relationship between the variables, a fully modified ordinary least square (FMOLS) model for heterogeneous cointegrated panels is estimated (Pedroni, 2000).

Table (3): FMOLS model:

Variable	Coefficient	Prob.
RPGDP	0.000745***	0.0000
RI	-0.057414***	0.0000
FDI	23.57917***	0.0000

(Source: Done by the researchers based on the empirical findings on the model)

From Table (3), the FMOLS equation is:

$$GFCF_{it} = 0.000745 RPGDP_{it} - 0.057414 RI_{it} + 23.57917 FDI_{it} \quad (2)$$

According to Table (3), all the variables have a significant effect on GFCF since their P-value is equal to 0 which is smaller than 5%. The recorded coefficients in Table (3) represent long-run coefficients. The PRGDP has a positive effect on the GFCF and increasing it by 1 % would increase the investment level as a percentage of GDP by 0.0745%. The real interest rate has a negative effect on the GFCF and increasing it by 1 % would decrease the investment level as a percentage of GDP by 0.057% which goes along with the theory that expects that there is a negative relationship between the interest rate and investment level. The financial development index -which summarizes the level of development of the financial institutions and financial markets- has a positive effect on the investment level.

5. Conclusion:

The purpose of this paper is to empirically investigate the relationship between the interest rate and investment level after adopting the NIRP. The study was conducted on a panel of the 19 countries of the Euro-zone over the period 2014 to 2019. To achieve this goal, first, a descriptive analysis of the variables under question is conducted then an econometric analysis is carried out.

The descriptive analysis is conducted over two periods to assess the effect of the NIRP on the investment level and conclude if there are any changes in this relation after adopting the NIRP in 2014. From 2008 till 2013, the descriptive analysis suggests a strong positive relationship between the interest rate and investment level in the Eurozone. This positive relationship could be attributed to the existence of the financial crisis in 2008-09, which negatively affected the investment levels in the Euro-zone (Ksantini & Boujelbène, 2014). Despite all the consecutive declines in the interest rate by the ECB, the investment levels continued their decreasing trend. Leaving the ECB with no other choice rather to adopt an NIRP that contributed to adjusting the relationship between those two variables. Specifically, during the period from 2014 to 2019, there was a negative but weak correlation between NIRP and investment levels which is following the expected

theoretical direction as presented by the neoclassical school of thought. Consequently, the adoption of NIRP was inevitable to rebuild this relationship.

Then an econometric analysis is performed to investigate the relationship between those variables. Kao panel co-integration test is employed. The cointegration analysis suggests that incorporated variables, namely, gross fixed capital formation, real per capita GDP, financial development index, and the negative interest rate, are cointegrated. To quantify this relationship, FMOLS technique is employed. The model suggests that all the explanatory variables within the study have a significant impact on the investment level. It concludes that both real per capita GDP and financial development index have a positive effect on the investment level, while the interest rate, after adopting the NIRP in the Euro-zone, has a negative effect on the investment level. This relation is consistent with the results of the descriptive analysis which are all in harmony with the neoclassical theory.

The implications of this study are crucial for central banks. Given the tendency of central banks to adopt the NIRP post the global financial crisis as one of the unconventional monetary policy tools employed to revive the economy. Investigating the impact of the NIRP on investment and assessing its success in simulating growth could guide central banks and policymakers about the effectiveness of this policy and whether it could be employed in the future or not.

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THE ASYMMETRIC EFFECT OF MONETARY POLICY ON CORE INFLATION IN JORDAN: NARDL MODEL

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Abstract. *This study aimed to estimate the asymmetric impact of monetary policy on core inflation rates in Jordan during the period 2000-2020 using the Nonlinear Autoregressive Distributed Lag Model (NARDL) Based on quarterly data. The unit root tests showed the different degrees of integration by applying the Augmented Dickey-Fuller Test (ADF) and Philip Perron (P.P). and have a cointegration relationship using Johansson's test, and the Bound test. Also, there is a nonlinear relationship in the time series using the waled test. The study used Core Inflation (CORINF) as a dependent variable (calculated based on excluding energy and food prices method) and the overnight deposit rate (CBJR), the loan and advances interest rate (LR), the growth in money supply (GM2), and the growth in real GDP (GRGDP) used as independent variables. The results indicated that there are asymmetric effects of both CBJR and GM2 on core inflation, as a 1% increase in GM2 leads to an increase in the CORINF by 1.3%, while its decrease by 1% leads to a decrease in the CORINF by 1.2%, in contrast, an increase in the LR by 1% leads to a decrease in the CORINF by 0.15% and a decrease by 1% leads to a rise in the CORINF by 0.44%, and the study also found that a rise in LR by 1% lead to a decrease in the CORINF by 0.43%, while its decrease by 1% leads to a rise in the CORINF by 0.44%.*

Keywords: Nonlinear Autoregressive Distributed Lag Model (NARDL), core inflation, monetary policy, asymmetric effect.

JEL Codes: C32, E31, F31

1. INTRODUCTION

The role of monetary policy in economic thought has emerged since the nineteenth century, then its role increased after the occurrence of economic and monetary crises, especially during the Great Depression from the end of the twenties until the beginning of the thirties after the classic inability to find solutions to this crisis, until the economic and its balance and the development of thought in this field until quantitative theories and mechanisms of impact transmission the economist John Keynes came up with monetary ideas to confront this depression and try to return monetary stability to modern trends, which borrowed the use of price captive monetary tools such as overnight deposit window rate and interbank lending and the quantity such as the deposit window and certificates of deposit and repurchase agreement.

Many studies have proven that there is a typical transitional effect from the monetary sector to the real sector and an influential role in maintaining the stability of inflation rates by controlling monetary tools (Smets, 2018). It is reflected positively on the rate of Inflation, and therefore lower interest rates contribute to an increase in purchasing power and aggregate demand, which leads to an increase in the growth rate of GDP. Monetary policy is one of the most important economic policies that countries follow to confront economic problems by influencing economic variables, which prompted researchers to study the relationships between monetary policy indicators and economic variables to measure the effects that may be unclear due to the neutrality of money, as stated in the classical theory, however, that there are short-term and long-term relationships, and these relationships may have an asymmetric effect. Therefore, the

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importance of the study is manifested in the statement of the asymmetric effects of monetary policy on core inflation rates by estimating the Nonlinear Autoregressive Distributed Lag Model (NARDL) on Jordan's economy. The importance of the study comes from the importance of estimating nonlinear relationships, as it considers all the effects that may not be visible in linear relationships. Accordingly, the problem is not knowing the nonlinear effect between interest rates and the introductory inflation rate in Jordan. Accordingly, this study aims to estimate the effects using different variables compared to the previous study. It also employs the Nonlinear Autoregressive Distributed Lag Model (NARDL) on quarterly data for the Jordanian economy and estimates the monetary effect on core inflation, as it is characterized by giving more accurate results in the analysis of relationships rather than headline inflation.

2. LITERATURE REVIEW

Economic literature confirmed that Inflation is one of the reasons for the sustainability of economic activity, and it must be within a specific range consistent with the economic situation (Fakhri, 2011), as well as has pointed out the different theories in determining the sources of Inflation, in the classical theory is based on the money supply there is a positive and direct effect between money supply and Inflation as the increase in the money supply leads to increase of demand for goods and services this leads to a rise in the level of prices (decrease in purchasing power) (Anwar, 2021). Also, Fisher's rise in interest rates leads to a decrease in the demand for money (increasing the cost of credit), which leads to a decline in aggregate demand and lower prices (Mahdi, 2011). From the viewpoint of Keynesians, Inflation occurs as a result of a rise in aggregate demand for consumption, investment, and government spending, which is called demand-pull Inflation; the inflationary gap appears whenever aggregate demand increases at a rate higher than aggregate supply at the level of full employment so Inflation increases with this increase the gap, and he also emphasized the effective role of monetary and fiscal policy in reducing this Inflation by increasing taxes and controlling the money supply (Al-Zoubi et al., 2013). The Keynesian theory assumes another factor for Inflation that results from the rise in the cost of production causes a rise in commodity prices. Therefore, he called it cost-push Inflation and referred to the reason for cost-push Inflation as the result of the monopolistic companies raising the prices of goods to cover production costs and achieve profits which was also called profit-paying Inflation (Totonchi, 2011).

The monetary theory came in opposition to the ideas of Keynes and supported the classical theory in an edition of the positive impact of money supply and negative interest rates on the rate of Inflation, but this is in the long term as for the short term, it saw that there are non-monetary factors associated with financial procedures and the effects of cost payment and lack of supply, especially in the field of food and energy, which leads to higher prices, which may be associated with an excessive increase in the money supply the monetary point of view is summarized by what Friedman said that Inflation is a monetary phenomenon directly related to money supply and has nothing to do with employment costs or aggregate demand (Frimpong, 2021).

When analyzing individual consumption, we find that many elements in the consumer basket are affected by non-monetary factors that lead to remarkably high fluctuations in price levels in the short term; it is one of the problems that are difficult to control from the monetary authority of applying monetary policy these fluctuations are often linked to supply shocks, which constitute an obstacle to economic decision-makers in implementing monetary policy so that many studies such as (Amstad et al., 2014) and (Lao & Steyn, 2019) suggested ways to exclude the monetary policy unstable elements usually include food prices associated with weather fluctuations and seasonal fluctuations and energy prices that are determined globally and are linked to many global factors, including political turmoil in some countries.

Accordingly, the process of rebalancing the components of Inflation is carried out to derive core inflation. Hence the importance of core inflation emerged as an essential tool in making appropriate decisions to achieve stability in the general level of prices as a target for monetary policy as well as creating forecasts of inflation rates with high accuracy (Alassaf & Alawin, 2018).

The importance of core inflation has emerged in many studies, as Mankikar& Paisley (2002) referred to the role of core inflation for monetary policymakers as a good indicator for predicting inflationary trends and determining the expected course of the target inflation rate within a short period. (Cockerell,1999) He also showed the relationship between core inflation and monetary policy, as he referred to the role of core inflation in the conduct and management of monetary policy, as it provides a valuable analysis of current and future trends after excluding short-term price fluctuations.

Some studies presented opposing views to the ideas presented previously, such as the study (Bollard, 2011) which downplayed the importance of core inflation and focused on the headline inflation rate, arguing that monetary policy measures can be developed effectively to suit Fluctuations in prices without the need for measures of core inflation, as well as (Labonte, 2008) indicated that core inflation did not do any good in affecting the side of wages, wealth, returns, as well as social security payments. Therefore, family income is adjusted based on general Inflation, which represents the most significant part of the consumer basket and excludes core inflation.

Studies and research indicated that there is a linear relationship between monetary policy tools and Inflation, but the difference between them is like the impact, whether it is positive or negative. Additionally, few studies dealt with asymmetric effects, especially on the core inflation rate. The study (Lee & Yu, 2021) analyzed the impact of money supply on Inflation and economic growth in China during the period (1980-2018) using the ARDL model, and the study concluded that there is a positive impact of money supply on the inflation rate in the short and long term.

The study (Nagao & et al.,2021) examined the economic effects of monetary policy on macroeconomic variables in Japan based on the VAR model where the study concluded that higher interest rates lead to a significant decrease in Inflation and production rates and a decrease in the money supply leads to a decrease Inflation and production rates.

The study (Khan, 2020) estimated the causal relationship between the interest rate and Inflation in the United Kingdom during the period (1988-2017) using the VAR model, and the results of the study indicated that each variable causes the other in the short term while in the long term the interest rate it does not cause Inflation.

The study (Shokr& et al.,2019) aimed to study the effects of monetary policy and external shocks on production, Inflation, and the exchange rate in the Egyptian economy using the SVAR model based on quarterly data during the period (1991-2011), and the results indicated in the aspect of the impact on Inflation that there is a negative impact of interest rates on Inflation, as well as a positive impact of the money supply on Inflation.

In Russia, a study (Smirnov & Tlostanov, 2019) evaluated the impact of monetary policy on the inflation rate using the SVAR model where the study concluded that there is a positive impact of money supply on the rate of Inflation there are also indications of a positive effect of the interbank lending rate on the inflation rate.

The study (Nguyen & et al., 2019) an analysis of the impact of monetary policy on Inflation in the Vietnamese economy during the period 2000-2016 using the VAR model; the study found the rate of

Inflation that there is a negative impact on interest rates on the inflation rate in addition to a positive effect on the money supply on the rate of Inflation.

In Vietnam, the study (Tran, 2018) aimed to analyze the impact of monetary policy transmission channels on the inflation rate during the period (2001-2015) using the VECM model, and the results showed that the money supply is the primary determinant of the rise in the rate of Inflation while the rise in interest rates leads to a rise in the rate of Inflation which is inconsistent with the previous study.

The study (Honore, 2018) also examined the impact of monetary policy on Inflation and analyzed the nature of the relationship between money supply and Inflation in the Cameroon economy, and the study estimated the ARDL model on the data during the period (1980-2016), and the results of the study revealed that there is a long positive parallel relationship between money supply and Inflation, and a one-way causal relationship from money supply to Inflation.

3. Research Elaboration

This study used quarterly data during the period (2000-2020) for the Jordanian economy available in the Central Bank of Jordan study variables included the core inflation rate as a dependent variable, the overnight deposit rate, the interest rate on loans and advances, as well as the money supply (M2), and the GDP growth. Core inflation was calculated based on the method of excluding energy and food prices from overall Inflation. Also, Data is filtered from seasonal effects using X-12-ARIMA quarterly seasonal adjustment Method.

The study applied a standard nonlinear model represented in the Nonlinear Autoregressive Distributed Lag Model (NARDL) to achieve the study's goal of measuring the effect between variables. The model took the following form for the equation:

$$cor_{inf_t} = \alpha_0 + \alpha_1 EC_{t-1} + \beta_1^+ CBJ_{R_{t-1}}^+ + \beta_2^- CBJ_{R_{t-1}}^- + \beta_3^+ LR_{t-1}^+ + \beta_4^- LR_{t-1}^- + \beta_5^+ GM2_{t-1}^+ + \beta_6^- GM2_{t-1}^- + \beta_7 GRGDP_{t-1} +$$

$$\sum_{i=1}^p \theta_{1i}^+ \Delta CBJ_{R_{t-i}} + \sum_{i=1}^p \theta_{2i}^- \Delta CBJ_{R_{t-i}} + \sum_{i=1}^p \theta_{3i}^+ \Delta LR_{t-i} + \sum_{i=1}^p \theta_{4i}^- \Delta LR_{t-i} + \sum_{i=1}^p \theta_{5i}^+ \Delta GM2_{t-i} + \sum_{i=1}^p \theta_{6i}^- \Delta GM2_{t-i} + \sum_{i=1}^p \theta_{7i} \Delta GRGDP_{t-i} + Ut \dots \dots 1$$

Where: COR INF: Core inflation rate, which was calculated by excluding the food and energy group from overall Inflation and performing a rebalancing of the relative importance of the remaining items. CBJR: overnight deposit interest rates, LR: The interest rate on lending, GM2: Growth rate in money supply (M2), GRGDP: Growth rate in real GDP, $\alpha \beta \theta$: Estimation parameters, EC: Error correction, U: Random error in the model, - Negative effect, + Positive effect.

To find sound economic decisions and appropriate measures aimed at maintaining price stability, a distinction must be made between transient and continuous changes included in total Inflation by recalculating Inflation based on core inflation measures to exclude the most affected elements in seasonal effects and demand shocks and temporary display especially since food and energy components in Jordan are the most vulnerable to changes in their prices in response to fluctuations in the prices of imports and oil prices globally. Therefore, this must be considered in the formulation of decisions. Figure No. (1) shows the trends of the consumer price index in Jordan during the period 2006-2020; after applying the measures of excluding food and energy prices, it is noted that there is a convergence in the trends of the three gauges in most years and stability in other years, so there are no significant deviations between the values which indicate to assist decision-makers in setting practical measures to create a monetary policy aimed at stabilizing Inflation within limited rates and predicting future inflation trends.

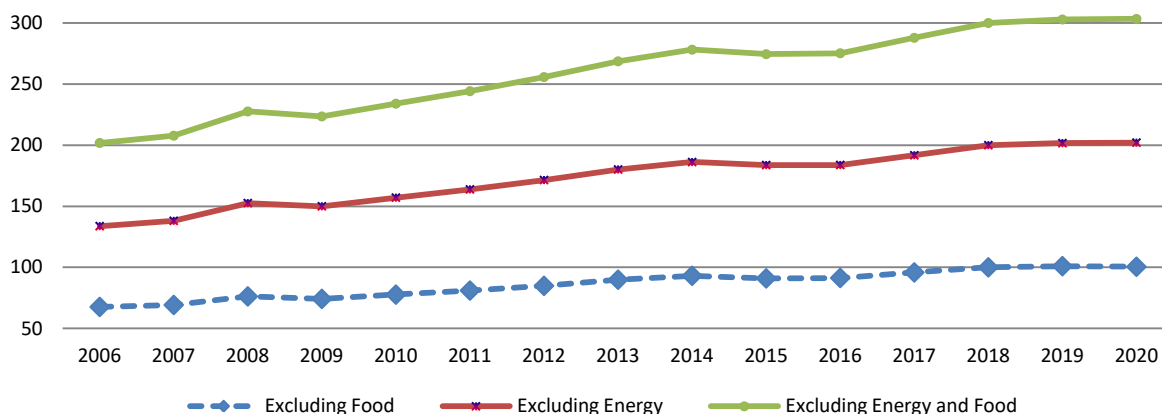


Figure (1): consumer price index in Jordan
 (Source: Central Bank Annual Statistical Bulletin, 2022)

It is noted in Figure (2) that the movements of Central Bank interest rates (overnight deposit rates) are in line with the core inflation rate. When the inflation rate rises, the Central Bank seeks a direct deflationary policy by increasing interest rates to reduce the volume of liquidity and lower aggregate demand and thus lower Inflation. We noticed the fluctuations of interest rates as they decreased at the beginning of the period until 2010 because of Jordan's impact on the repercussions of the global financial crisis and expectations of a slowdown in economic activity to keep interest rates in line with the core inflation rate. Interest rates witnessed the lowest rate in 2015 after the decline in inflationary pressures and the increase in economic activity as interest rates are in line with economic developments and local indicators such as the decline in the inflation rate and the slowdown in the growth of output with the GDP. By tracing the path of core inflation and the extent to which it is in line with interest rate movements, we find that there is a compatibility of the movements for each of the interest rates on the overnight deposit rate, as in Figure 2 or the interest rate for loans and advances as in figure (3), which gives a clear vision of the extent of interdependence and the impact of these prices on core inflation which excludes fluctuations resulting from supply shocks, especially those related to the prices of oil derivatives and short-term fluctuations in food prices which are partly due to seasonal effects, therefore, it is considered worth analyzing this path through a standardized impact assessment.

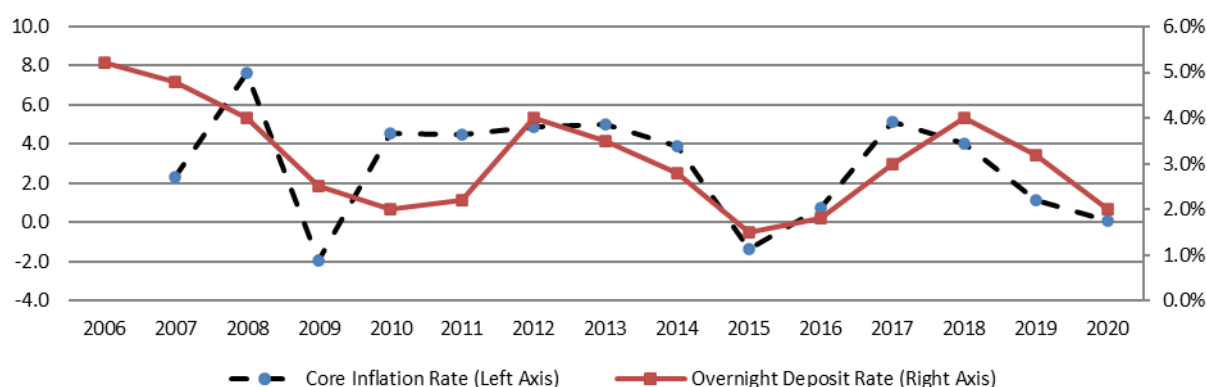


Figure 2: Overnight Deposit Rate, core inflation rate
 (Source: Central Bank Annual Statistical Bulletin, 2022)

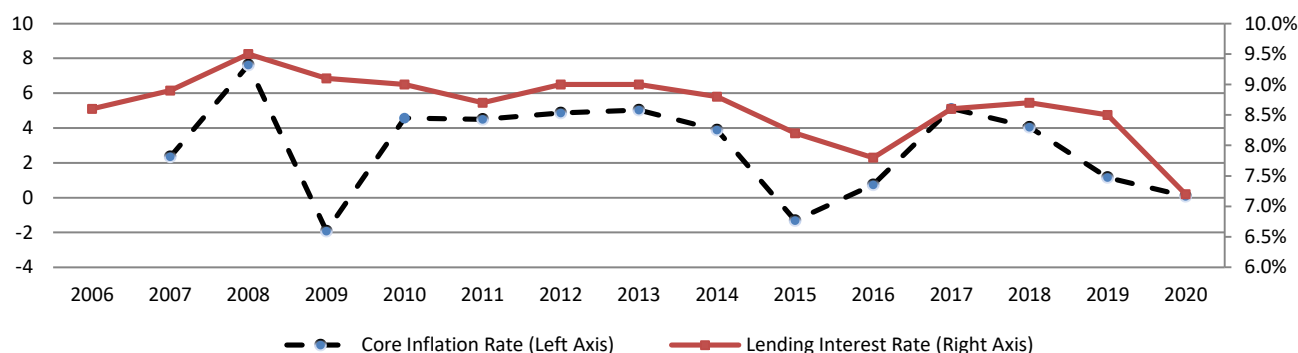


Figure 3: Lending Interest Rate and core inflation rate
 (Source: Central Bank Annual Statistical Bulletin, 2022.)

4. The Empirical Results and Discussions

To determine the stationarity of the time series, the unit root test using the Phillips-Perron (P.P) test was applied, which is based on correcting the Autocorrelation in the residuals of the root test equation the unit using a non-parametric method of model variance to take into account the existence of the autocorrelation problem and reflect the dynamic nature in the series to make sure that there is no unit root problem by determining the degree of stationarity of the time series, and the test depends on the null hypothesis represented by the non-stationarity of the variable at the level. It is noted in Table no. (1) the different degrees of integration of the variables after applying the test, which is the initial condition for applying the NARDL model.

Table No 1: Results of the Philip Perron test

			CORE_INF	GRGDP	CBJ_R	GM2	LR
At level I(0)	With constant	T value	-3.46	-1.05	-4.34	-8.15	-2.25
		probability	0.012	0.731	0.001	0.000	0.192
		Result	**	No	***	***	No
	With a constant and trend	T value	-3.17	-2.46	-4.44	-9.3	-2.22
		Probability	0.097	0.349	0.003	0.000	0.473
		Result	*	No	***	***	No
At first difference I(1)	Without a constant and trend	T value	-2.08	-0.88	-2.12	-3.6	-2.03
		Probability	0.369	-0.88	-2.12	-3.6	0.041
		Result	**	No	No	***	**
	With constant	T value	-7.06	-8.17	-10.98	-35.83	-8.17
		Probability	0.000	0.000	0.000	0.000	0.000
		Result	***	***	***	***	***
	With a constant and trend	T value	-7.12	-8.72	-10.92	-35.2	-8.1
		Probability	0.000	0.000	0.000	0.000	0.000
		Result	***	***	***	***	***
	Without a constant and trend	T value	-7.13	-8.17	-11.05	-35.73	-7.88
		Probability	0.000	0.000	0.000	0.000	0.000
		Result	***	***	***	***	***

Where: CORE_INF: core inflation, GRGDP: growth in real GDP, CBJ_R: overnight deposit rate, GM2: growth in money supply, LR: the interest rate on loans and advances. (*): significant over 10%. (**): significant over 5%, (***): significant over 1%, (no): not significant. P value based on Mackinno (1996.)

The existence of cointegration - which is the second condition of the NARDL model - was tested, and the existence of a long-term relationship between the variables was evaluated by applying the Johansson and Juselius technique to determine the number of common integral vectors (r). The integration test results in a (Trace) and) Eigenvalue) statistic, as shown in Table no. (2), indicates that there are two cointegration relationships for monetary policy variables selected in the study on the core inflation rate. Also, The Bounds test was applied within the ARDL model, which is based on the Fisher F statistic, where the existence of long-term relationships is indicated when the value of F is higher than the upper limits of critical values, and here the null hypothesis indicating the absence of long-term relationships is rejected. Furthermore, accept the alternative hypothesis that indicates the existence of long-term relationships between the variables.

Table No 2: Co-integration test results

Johansson Test				
critical values	Eigenvalue	Trace statistic	Critical Value	Probability
None	0.459	100.062	69.819	0.000
At most 1	0.296	50.35	47.856	0.029
At most 2	0.164	21.919	29.797	0.303
At most 3	0.085	7.424	15.495	0.529
At most 4	0.003	0.213	3.841	0.645
Bound test				
F	critical values	%10	%5	%1
326.7	Minimum	2.03	2.32	2.96
	Maximum	2.93	3.21	4.26

The results of the estimation of the Nonlinear Autoregressive Distributed Lag Model (NARDL) showed that there is a long-term cointegration relationship, where the coefficient of the error term is negative and less than one, which is -0.496, significant, and the speed of adjustment is 2.13 time (a quarter). The results shown in Table (3) indicate that there are asymmetric effects, as the increase in the growth in the money supply by one percentage point leads to a rise in the core inflation rate by 1.3%. The results also indicated the significance of this effect. This result is consistent with the economic theories in this field, as the increase in the money supply leads to a rise in the aggregate demand for goods and services, and as a result, the general level of prices rises, and this result was supported by many previous studies (Nguyen & et al., 2019), (Ogunmuyiwu et al., 2018), (Honore, 2018). On the other hand, a decrease in growth in the money supply by one percentage point leads to a decrease in the core inflation rate by 1.2 percent. This effect is significant, as shown in the Table below, where the probability was less than 5%. It is also noted in Table No. (3) that there is a disproportionately negative impact of interest rates on the core inflation rate, as an increase in the overnight deposit rate by one percentage point leads to a decrease in the core inflation rate by 0.15 percent, and the results indicated the significance of this relationship. While the decrease in the overnight deposit rate by one percentage point leads to a rise in the core inflation rate by 0.44%, this result is not significant, as the probability is 0.12, which is higher than the level of significance of 5%.

Table No 3: Results of estimating long-term relationships

variable	Coefficient	Error value	Value t	Probability
GM2_POS	1.26	0.067	18.75	0.000
GM2_NEG	-1.22	0.081	-15.08	0.000
GRGDP	-48.5	5.231	-9.28	0.000
CBJ_R_POS	-0.15	0.094	-1.57	0.122
CBJ_R_NEG	0.44	0.1	4.37	0.000
LR_POS	-0.43	0.508	-0.85	0.396
LR_NEG	0.44	0.158	2.78	0.007
error coefficient	-0.469	0.014	-33.322	0.000

Where: *CORE_INF*: core inflation, *GRGDP*: growth in real GDP, *CBJ_R*: overnight deposit rate, *GM2*: growth in money supply, *LR*: the interest rate on loans and advances.

The results also indicated in the field of interest rate on loans and advances that there is an asymmetric effect on the core inflation rate, as the increase in the interest rate on loans and advances leads to a decrease in the inflation rate by 0.43% and the probability is 0.39, which is an insignificant result. The decrease in the interest rate on loans and advances leads to a rise in the core inflation rate by 0.44 %, and the results indicated the significance of this relationship. This result was supported by a study (Ahiabor, 2013). The growth in Real Gross Domestic Product (GDP) showed a negative impact on the core inflation rate, as the increase in output growth by 1% led to a decrease in the core inflation rate by 48.5%. This finding is consistent with economic theories and previous studies.

Four robustness Tests

The structural stability test of the model was analyzed in this study, which aims to ensure that the model parameters enjoy high stability over the time on which the study is based, depending on the cumulative sum of residuals (CUSUM) and CUSUMSQ statistics and to achieve the stability of the estimated parameters. The graph must lie between the two confidence limits (the upper bound and the lower bound) at the 5% significance level and not exceed that. It is clear from Figure (4) in the CUSUM test that the graph is confined within the confidence limits at a significant level of 5%, which indicates that the parameters estimated in the model are stable throughout the study period. The (CUSUMSQ) test indicated, as shown in Figure (5), the structural stability of the study model and the absence of deviations that affected structurally during the study period, as the test statistic line fell within the confidence limits at the 5% level of significance.

Figure No 5 : CUSUMSQ. Test Results

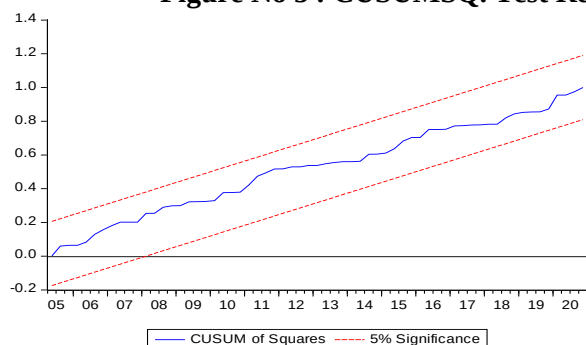
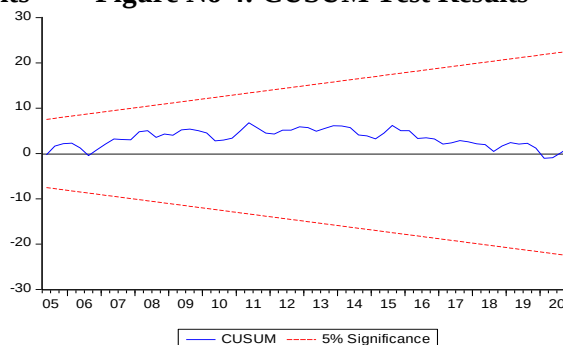


Figure No 4: CUSUM Test Results



To test the multicollinearity problem in the model, the variance inflation factor (VIF) test was used, as Table No. (4) shows the absence of the problem, as the statistical value is less than 10%.

Table No 4: VIF Test Results

Variable	Variance	VIF value
GM2	0.0379	1.339
GRGDP	134.44	1.595
CBJ_R	0.078	1.608
LR	0.0918	1.307

Where: CORE_INF: core inflation, GRGDP: growth in real GDP, CBJ_R: overnight deposit rate, GM2: growth in money supply, LR: the interest rate on loans and advances.

The Breusch-Pagan-Godfrey test has been applied to test the heterogeneity of the variance in estimation errors until the Null-Hypotheses that there is a heteroscedasticity problem between variables the results in Table (5) indicate that there is no heteroscedasticity problem. It also applies to the (Serial Correlation) test, where the Null-Hypotheses are rejected in the presence of Autocorrelation between variables. Here the Null-Hypotheses is rejected, with a probability value of 0.072.

Table No 5: Results of the Heterogeneity Test and the Autocorrelation Test

	Statistical Value	Probability
Variation Heteroskedasticity test*	0.833	0.649
Autocorrelation Test**	2.746	0.072

*Test F adopted in "Breusch-Pagan-Godfrey."

** Test chi-square adopted in "LM-Test."

According to Wald Test Table No. (6) there are asymmetrical relationships between variables since the probability value was less than 5% which means rejecting the null hypothesis that the negative effect is equal to the positive effect.

Table No 6: The Results of the Wald Test

Null-Hypotheses	χ^2	Probability	Result
$\beta_{GM2_pos} = \beta_{GM2_NEG}$	102.5	0.000	There is asymmetry.
$\beta_{cbj_R_Pos} = \beta_{cbj_R_NEG}$	14.47	0.041	There is asymmetry.
$\beta_{LR_POS} = \beta_{LR_NEG}$	270.0	0.000	There is asymmetry.

5. Conclusion

The diagnostic tests indicated that the variables are stationary at different levels between level I(0) and the first difference I(1). the Johansen Test (Cointegration Johansen Test) and the Bounds Test, indicating there is a cointegration relationship, in addition to the results of the Wald Test indicating there is a nonlinear relationship between variables, leading to the possible estimated of the (NARDL) model, the results of the analysis showed asymmetrical effects between the variables and the core inflation rate. Higher growth in the money supply by one percentage point leads to a rise in the core inflation rate of 1.3%, an increase in the core inflation rate. Based on this result, the central bank must pay attention to the asymmetry of the effects of

monetary policy variables when targeting the impact on core inflation rates. In monetary policy, the result found that there was an asymmetric negative impact of the overnight deposit rate on the core inflation, as an increase in the overnight deposit rate by one percentage point led to a 0.15% reduction in the core inflation rate. At the same time, the reduction of the overnight deposit interest rate by one percentage point leads to an increase in the core inflation rate by 0.44%. Based on this finding, the study recommends that monetary policy be focused on the overnight deposit interest rate if the core inflation rate is raised.

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NEGOTIATION EFFECTIVENESS IN COMPANIES OF THE AGRICULTURAL SECTOR: ARE THERE SIGNIFICANT DIFFERENCES BETWEEN INTERNATIONAL AND NON-INTERNATIONAL TRADERS?

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1. ABSTRACT

The purpose of this paper is to know about the impact of the international trade on the negotiation effectiveness of companies in Ecuadorian's agricultural sector.

The used methods were quantitative with a deductive logic and a non-experimental design with a correlational scope in which it was found that depending on the activity of the company, this is an exporter or an importer, the sales level will be increased through the negotiation effectiveness with other companies. However, if the company is engaged in these two activities at the same time, it will not significantly influence its sales levels.

the results observed after the validation of the statistical model, the companies that decide to operate in international markets will also be able to achieve effective negotiations. Without any doubt, they will opt for exit trade to expand sales, reduce risks, and acquire resources; on the other hand, they will choose entry trade if they require inputs or raw materials for their production processes.

Keywords: Growth; Efficiency; Economy; Sales; Market Access.

JEL Codes: A10

2. INTRODUCTION

In, Ecuador, the agricultural sector realized by companies contributes 8% to the total annual production of the country (GDP). Farmers generate sources of employment in the rural sector, thereby contributing to reducing poverty in the countryside. Besides, it is the main source of employment since more than 1.6 million people work in this sector. The development of the agricultural sector realized by Ecuadorian companies leads to marketable surplus (Ventanilla Única de Inversiones Ecuador, 2024).

Associated Equipment Distributors (2021) mentioned that as the country develops, more and more people will be engaged in mining, manufacturing, and other nonagricultural sectors, and all these people depend on the production of food that they can obtain from a marketable surplus. However, one part of the population remains in the activities of the agricultural sector, or the entrepreneurs have their own crops of raw materials to export or to manufacture and commercialize in international markets. While the agriculture develops, production increases and the marketable surplus also expands, and these products can be sold to other countries. In this context, Ecuador is always working to expand its international trade signing free trade agreement with other countries. Agriculture has been the source of raw material for the main industries such as cereals, corn, sugar, edible and inedible oils, etc. all of which depend directly on agriculture. From above, it can be said that agriculture occupies an important place in the development of an economy. In fact, it is a precondition for economic growth.

Unfortunately, the agricultural sector in Ecuador is not going through its best moment due to several discrepancies that do not allow its optimal development. For example, transport for the commercialization of agricultural products has been affected, meaning that many do not have a vehicle or their own means to travel to the city; on the other hand, external situations to the country have not allowed the export of products and this has meant low results in the financial sphere. Many countries have opted for generalized quarantines that restrict the movement of goods and people due to the global pandemic caused by COVID-19 and to minimize the number of infections (Moreano-Logroño, J.A., & Mancheno-Herrera, C.A., 2020).

Pawlak & Kolodziejczak (2020) mentioned that although most countries in the region have decreed the agricultural sector as essential to guarantee food security, the situation has brought several challenges related to the transportation of production, the procurement of inputs, the hiring of labor, uncertainty about prices and demand, and the lack of liquidity and credit, among others. Although all the problems mentioned above, international trade concerning exports and imports will always be related to the fact of negotiation effectiveness according to the number of products in terms of sales, the principal hypothesis to be probed in this paper. It is very important to mention that the success of the negotiation among the companies has a lean with the kind of relationship between the two countries where they belong to.

3. LITERATURE REVIEW

Due to the nature of this article, precisely, the definition of important concepts should be included in the literature review. International trade is a concept that can be broader and encompass the flow of international trade relations without reference to a specific country, that is, it is the set of commercial and financial movements and operations in general, whatever their nature, that are carried out between nations; it is therefore a universal phenomenon in which the various human communities participate (Osorio, 1995). International trade can be defined as trade that takes place between the states that make up the international community, either through official bodies or by means of formal organizations. International trade can also be considered as that which takes place between a state and a community (Garrone, 1986).

In international trade, open economies are distinguished by the degree of interventionism that states, through their leaders, tend to exert on their international trade activities; that is, the flow of trade that takes place depends on the level of protectionism or free trade in force in the country. Economies that have lower tariffs are considered free trade, while economies that set very high tariffs are known as protectionist economies. There are also closed economies, which are the opposite of open economies (Nanot, 2022).

For the commercialization process among companies, it is necessary to accomplish with the regulations and agreements previously established by the countries through their authorities in charge of fixing a commercial economic policy. This policy refers to tariff barriers, technical barriers in international trade; as well as the benefits of agreements among countries. These regulations are the ones that will allow the establishment of trade relations of mutual interest, legal and in accordance with international law among the countries with a direct impact on the companies.

This process is characterized by the exchange of different goods and services from one country to another and is subject to the variations of the world market (Euroinnova, 2022). International trade has transformed the world, as it has allowed various countries to exchange valuable goods, it is vital for exporting countries to grow. A clear example is Germany and China, which have boosted their economies with exports of all kinds. It improves conditions for the end consumer. Trade, in the long run, allows companies that produce with higher quality and, in some cases, lower costs to survive (Ceballos, 2022).

Fiallo (2017) mentioned that there are three fundamental aspects that can make agriculture an essential pillar in the Ecuadorian economy. Firstly, it should be mentioned that on average it represents 9% of the country's total gross domestic product (GDP). It is worth mentioning that it is the third largest source of income in the country. Similarly, we have the basis of the food sovereignty policy, which specifies that the State must ensure permanent food self-sufficiency. According to The World Trade Organization (WTO) estimates, global agricultural trade reached a record \$1,820 billion in 2018, which was 5% higher than the previous year. However, trade in agricultural products has its inherent drawbacks, such as its perishable nature, long supply chain, strong requirements to transport conditions, storage facilities, safety, and quality (Xu, 2015, cited in Vasylieva & James, 2020, p. 80). Large scale international commercial agriculture has also been successful in several Latin American countries where agricultural producers and exporters may have more than 100,000 hectares; nevertheless, smallholder production known as family farming is a key segment of global agriculture for the provision of food and services for agribusiness, normally these small farms grow up if they count on financial support and technical training. In Latin America, family farming coexists with commercial agriculture in most countries in the region (Alfaro, 2017).

According to estimates by (Hoekstra, 2010), if a comparison is done about the amount of water used for global agricultural production with the amount of water required to produce the same number of products if international trade did not occur, that is only domestic trade, international trade would reduce water use in agriculture by 5%.

As can be seen, agricultural production remains an indispensable and central link in all food systems; without it there is no food security. Only a systemic approach that recognizes the central role and contributions of agriculture to the SDGs will make it possible to make progress in achieving them (Arias, 2021).

In this context, the region's importance in international agri-food trade stands out. Indeed, agri-food exports from Latin American countries account for about 14% of the world's agri-food exports and a quarter of the region's total exports of goods (Rodriguez, 2021); being Ecuadorian products a very important part of this percentage.

The gross production of industry in the ISIC category according to the National Institute of Statistics and Census, the activity of agriculture, forestry and fishing has a growing behavior and in 2007 it imposes a growth of 80% in relation to the previous year (Merchan, et al., 2017). International trade contributes to the transformation of food systems, connecting them with each other and helping to make them more sustainable.

In 2009, Puchol, et, al. mentioned that a negotiation is considered as an activity in which two factions, both of which have interests that are on the one hand complementary and on the other hand opposing, try to reach an agreement that achieves maximum satisfaction of the interests of both, as well as facilitates the execution of new negotiations in the future. In 2019, Zurita described negotiation as the process that is carried out in order to find solutions when the interests of both parties involved are not aligned. In a business environment, where the objective is to increase profits and have a wide range of customers, negotiation can be categorized as a strategy, which when used correctly and applied in conjunction with tactics, means that it will be possible to obtain all the objectives proposed for the company. In a company, whether it is an exporter, importer, or mixed company, it is possible to observe the effectiveness of its negotiations with various companies in the sector at an international level through the objectives achieved by the company, which is it can be measured depending on the sales made. For this purpose, it is necessary for the company to plan the international negotiation, to know its plan B and the concessions it can make to its counterpart. The international market is wide and gives rise to several negotiations in the field of labor and sales, so the term "international negotiation" involves negotiation as a strategy for achieving general and specific objectives such as obtaining a greater number of customers and much more profitability in the company (Zurita, 2019, p.19).

Aims

Determine the impact of the international trade on the negotiation effectiveness of the companies that belong to the agricultural sector in Ecuador.

Hypothesis

International trade has a positive impact on the negotiation effectiveness within the agricultural sector Ecuadorian companies.

4. METHODOLOGY

Pramono et al. (2022) mentioned that, when talking about a quantitative approach, it is to use data in the form of numbers to analyze and detail predetermined variables. Prokešová defined quantitative research as "the collection and evaluation of data using statistical methods" (2022, p. 95).

Caicedo (2008) defined deductive logic as: Deductive logic is the theory of the validity of logical reasoning or logical inference. A necessary and decisive condition for the validity of a logical inference is the following: if the premises of a valid reasoning are true, then the conclusion must also be true" (p. 29). The principles of deductive logic can be seen in Euclid's axiomatization of geometry: making inferences to a whole field of mathematics from certain postulates (Ortiz, 2009). The design of this research is focused on non-experimental, because, by obtaining the data according to the initial collection, they are found without manipulation by experiments or stimuli to determine the cause of the problem. "Non-experimental or ex-post-fact research is any research in which it is impossible to manipulate variables or randomly assign subjects or conditions" (Kerlinger, 1979, p. 116).

For Cabezas et, al. (2018, cited in Arias et, al., 2020, p.4) described that a correlational scope, or better known as correlational level, has the purpose of being able to estimate the existing relationship between two variables, with the use of the application of statistical techniques, as well as, with the measurement of one variable, we will be able to find out what is the behavior of the other variable.

This research had a quantitative approach, a deductive logic, a non-experimental design, and a correlational scope. The population to be analyzed were the companies in the agricultural sector in Ecuador, registered with the Superintendence of Companies, Securities, and Insurance. A balanced panel of data of approximately 3811 companies was extracted for each year with the periods of analysis being 2019, 2020 and 2021. The variables used for the model are shown below in Table 1:

Table 1. Variables used for the model.

Variable	Description
Number Employees	Number of employees per company
Affix	Stock of Fixed Assets
Exports	Total Exports
Imports	Total Imports
Salary	Total Wage Cost
Equity	Total Equity
Dx	1 = Exporter, 0= non-exporter
Dm	1 = Importer, 0= non-importer
DxDm	Interaction of exporter and importer

Source: Own elaboration

To analyze the data and test the research hypotheses, two stages were carried out. The first stage consists of analyzing the data in a descriptive and exploratory way. The second stage consists of estimating the econometric model. To analyze the data and test the research hypotheses, two stages were carried out.

The first stage consists of analyzing the data in a descriptive and exploratory way. The second stage consists of estimating the econometric model. In the first stage of the results, a descriptive and exploratory analysis of the data was carried out, a data table was prepared in the periods 2019 - 2021, the metrics of central tendency and dispersion of the entire data set for the investigation are shown. The descriptive analysis contributes to see of the data set situation, however, this is an analysis of the variables at the present time, so it is necessary to know if this behavior will be sustainable given the predicted impact.

In correspondence the second step is to make an inferential model that evidences the research assumptions. Finally, in this first stage, a correlation analysis was estimated between the analysis variables with the application of logarithms to adjust the behavior of the variables by the variance obtained in the descriptive ones. In this correlation analysis, the Pearson correlation was applied, the which explains the strength of the relationship that the variables have with each other. The second stage consists of the application of a regression model for panel data, which is very useful because it takes advantage of the cross-sectional variability of the information. The functional form of a regression model for panel data responds to the following structure:

$$y_{it} = \alpha + \beta_1 X_{1it} + e_{it} \quad (1)$$

Where y_{it} represents the dependent variable at the i unit at time t , X_{1it} represents the matrix of independent variables at the i unit at time t and reflects the error of the estimated model. To be more precise, the regression model for Panel Data, estimated by generalized least squares, responds to the following structure:

$$totalincome_{it} = \alpha + \beta_1 Affix_{it} + \beta_2 Numberemployees_{it} + \phi_1 Dx_{it} + \phi_2 Dm_{it} + \phi_3 Dx Dm + \beta_3 Salary_{it} + \beta_4 equity_{it} \quad (2)$$

Where Dx and Dm are dummy variables that represent the presence of an exporting firm or an importing firm respectively, and $DxDm$ represents the interaction between exporting and importing, that is, the firm that has both characteristics at the same time. To estimate the model, several tests were carried out to guarantee the robustness of the results, including the Breusch multiplier test and the Pagan Lagrangian for random effects that allow determining the feasibility of using panel data for the estimations. In addition, the Hausman Test was performed to select the appropriate model between random effects and fixed effects. Finally, the Wooldridge test was performed to verify the existence of first-order autocorrelation between the independent variables and the modified Wald test was analyzed to detect heteroskedasticity problems in the errors.

By applying the panel data methodology, also known as panel data or longitudinal data, it allows to analyze a type of data set that contains observations of the same variables during multiple periods of time and/or between different individuals or units. For example, a panel data set might include information on the same set of variables for a group of people over several years, such as their income, age, education level, and employment status. Alternatively, you could include information on the same set of variables for a set of companies over multiple quarters or years, such as their revenue, profit, assets, and liabilities.

In this case, it is used in an econometric setting to analyze how variables change over time and how they are related to each other. Panel data analysis techniques can help researchers control for individual differences

and time-specific effects that could confound their findings if they were based only on cross-sectional or time series data.

5. RESULTS

Table 2. Variables to be analyzed.

Variable		Mean	Std. Dev.	Min	Max	Obs.
income~1	overall	2448403	1.63e+07	0	1.10e+09	N = 11433
	between		1.58e+07	0	7.96e+08	n = 3811
	within		4134983	-1.95e+08	3.07e+08	T = 3
Affix	overall	1512319	8310717	0	5.32e+08	N = 11433
	between		8100389	0	4.04e+08	n = 3811
	within		1860963	-8.82e+07	1.29e+08	T = 3
Number employee~s	overall	3.813.225	2.494.226	0	15085	N = 11433
	between		2.225.109	0	10491.67	n = 3811
	within		1.127.352	-3.931.868	7.973.132	T = 3
Export~s	overall	1022852	1.38e+07	0	1.00e+09	N = 11433
	between		1.33e+07	0	7.30e+08	n = 3811
	within		3556830	-1.81e+08	2.73e+08	T = 3
Import~s	overall	87412.77	1601234	0	8.68e+07	N = 11433
	between		1511278	0	5.90e+07	n = 3811
	within		529515.6	-1.79e+07	2.82e+07	T = 3
Salary	overall	230777.8	1247003	0	7.26e+07	N = 11433
	between		1224785	0	5.74e+07	n = 3811
	within		234906.3	-1.02e+07	1.54e+07	T = 3
Equity~o	overall	1081441	8023761	-5600518	5.16e+08	N = 11433
	between		7857461	-4546970	4.03e+08	n = 3811
	within		1628451	-7.36e+07	1.14e+08	T = 3

Source: Own elaboration

Table 2 shows the variables under analysis, the companies analyzed in this research have an average of \$2,448,403.00 dollars in revenues, with a maximum value of approximately \$1,100,000,000.00 dollars. Also, on average, exports per firm are higher than imports per firm. On the other hand, the average number of workers per company is more than 38 people, however, the maximum number of staff per company is 15085 employees.

To check that the application of the panel model is better than the classical ordinary least squares, a Breusch and Pagan Lagrangian multiplier test was performed and is shown below.

Table 3. Application of the Breusch and Pagan Lagrangian multiplier test for random effects.

Test	Var	sd = sqrt (Var)
income~1	2.66e+14	1.63e+07
e	1.83e+12	1351076
u	1.44e+13	3791991

Source: Own elaboration

Test: Var (u) = 0, chibar2 (01) =8048.60, Prob > chibar2= 0.0000

There are several alternatives to be able to similar an econometric model, however the use of panel data is relevant since it captures the variability not only at the cross-sectional level but also at the temporal level. Based on what has been indicated, it is necessary to be able to prove the implementation of this type of data by means of a statistical test. Table 3 shows the application of the Breusch and Pagan Lagrangian multiplier test, the P-value is less than 0.05 and therefore the null hypothesis recommending the non-application of panel data is rejected. Given the result shown, the application of panel data for data analysis is not rejected. Subsequently, the Hausman model was applied to determine the applicability of a fixed or random effects model as shown below.

Table 4. Application of the Hausman test for fe1 and re1 models

Var	Coeff (b) Fe1	Coeff B Re1	Difference b-B	S. E.
affix	- . 43082	- . 2141292	- . 2166908	. 007853
number of employees	191. 9135	376. 6907	- 184. 7771	.
exports	. 8547454	. 8154258	. 0393196	. 0029357
imports	. 6846093	1. 006814	- . 3222046	. 0106839
salary	. 37938	. 6241386	- . 2447586	. 0520954
equity	1. 13443	. 8407067	. 2937234	. 0107089

Source: Own elaboration

b = consistent under Ho and Ha; obtained from xtreg. B= inconsistent under Ha, efficient under Ho; obtained from xtreg. Test: Ho: difference in coefficients not systematic. chi2 (5) = 1351. 43. Prob>chi2= 0. 0000

The variability at the temporal and cross-sectional level is of great importance, therefore, it must be considered in the model. A fixed effects model may be a suitable alternative; therefore, it must be statistically validated at a minimum confidence level of 95%. Table 4 shows the application of the Hausman test for the fe1 and re1 models, which stand for fixed effects and random effects respectively. The p-value of the Hausman test is less than 0.05, therefore the null hypothesis that recommends the use of random effects is rejected, hence the application of a fixed effects model is recommended.

To rule out autocorrelation problems, the Autocorrelation Test (Wooldridge Test) was applied as shown below:

Table 5. Application of the Wooldridge test.

Wooldridge test for autocorrelation in panel data	
H0: no first – order autocorrelation	
F (1, 3810) =	0.502
Prob > F =	0.4785

Source: Own elaboration

The autocorrelation of the residuals can cause problems in the final estimation of the model; therefore, it must be analyzed in order to be able to fit the model. The autocorrelation test is shown below to guarantee

the robustness of the model. Table 5 shows as results the application of the Wooldridge test to detect first order autocorrelation problems. Since the p-value is greater than 0.05, the null hypothesis indicating that the model does not present problems of first-order autocorrelation is not rejected. Subsequently, a homoscedasticity analysis of the errors was performed using the modified Wald test as shown below:

Table 6. Application of the modified Wald test

Modified Wald test for groupwise heteroskedasticity	
H0: $\sigma^2(I) = \sigma^2$ for all i	
chi2 (3811) =	1.8e+35
Prob>chi2 =	0.0000

Source: Own elaboration

Table 6 shows the application of the modified Wald test to detect heteroskedasticity problems. Since the p-value is less than 0.05, the hypothesis is rejected, therefore, the model presents heteroskedasticity problems. Given the presence of heteroscedasticity in the model, a generalized least squares model for panel data is estimated. Once the different statistical tests have been analyzed, we proceed to analyze the significant difference in the negotiation measured in sales of companies that open up to international trade, through exports, imports and the interaction of both.

Table 7. Generalized least squares model estimation for panel data.

Income total	Coef.	Std. Err.	Z	P> z	Low [95% Conf. Interval]	Up [95% Conf. Interval]
Affix	.0642502	.0038104	16.86	0.000	.056782	.0717184
Number employees	4.144.725	2862667	14.48	0.000	3.583.652	4705797
dx	1816590	61770.66	29.41	0.000	1695522	1937658
dm	1768900	56372.16	31.38	0.000	1658412	1879387
dxmx	-494484.5	260798.8	-1.90	0.058	-1005641	16671.88
salary	395.958	.0448692	88.25	0.000	3.871.638	4047522
Equity	.5880353	.009703	60.60	0.000	.5690177	.6070529
_cons	-172663.5	3111974	-55.48	0.000	-178762.9	-166564.2

Source: Own elaboration

Cross – sectional time – series FGLS regression. Generalized least squares. No autocorrelation. Estimated covariances = 3811. Number of obs = 11,433. Estimated coefficients= 8. Wald chi2 (7) = 42212. 12. Prob > chi2= 0. 0000

Table 7 shows the estimation of the generalized least squares model for panel data where it is observed that the variables fixed assets, employees, exports, imports, wages, and equity are significant at a significance level of 5%. In addition, the direct relationship between the variables mentioned and the efficiency of a business measured in terms of sales is observed. It is important to note that, whether a company is an exporter or an importer, this is an incentive for its level of sales and therefore its effectiveness as a

negotiator. On the other hand, if these two variables interact, that is if a company is an exporter and an importer at the same time, this will not have a significant influence on sales levels and therefore on the effectiveness of the negotiation.

6. DISCUSSIONS AND CONCLUSIONS

In Ecuador, the agricultural sector is not going through a relatively favorable moment due to various factors, and in the same way, it has not been possible to export products, representing low results for the financial sphere. This research article managed to demonstrate the relationship between the effectiveness of negotiation with sales encompassed in international trade, focusing on Ecuadorian companies in the agricultural sector. In this project it was mentioned that the relationship between negotiation effectiveness and sales was positive, which showed that, if the company does not have a good level of sales, it means that it does not have a stable negotiation, in other words, it shows that the company is not competitive and is below others from the same sector.

The research of León and Noelia (2013), described that the strength of sales does influence the competitiveness of companies, becoming a fundamental part of the organization. In the same way, Freire, and Mera, mentioned that it is essential to have trainings for the development of negotiation, because this action involves two or more people, who seek to reach a mutual satisfaction (2017, cited in Quijije & Intriago p.8). It could be inferred that, if the company is dedicated only to one sector, it will increase its negotiation tactics, to improve and surpass its competition. However, if a company works in both sectors, imports, and exports, they will have a relatively stable level, having two participations, therefore, it does not influence their sales levels, consequently, they would be normal in their negotiating efficiency.

To conclude the negotiation effectiveness through the sales correlates positively with the agricultural sector in Ecuador, this means that the purpose of this paper has been accomplished due to the business practices where the relation between good negotiations and international trade normally take place in different kinds of companies. That is why the relationship between international trade and negotiation effectiveness are a very good combination to keep the Ecuadorian products position in foreign countries and to continue with imports to get manufacture.

This paper has used as a sample the companies that belong to the agricultural sector, which are registered in the Superintendence of Companies, Securities, and Insurance.

According to the analyzed population that belongs to the agricultural sector in Ecuador, a balanced panel of data was extracted from approximately 3811 companies for each year, being the periods of analysis 2019, 2020 and 2021. It could be determined that on average the exports of the companies were higher than the imports per company. Finally, it could be determined that the various variables such as: fixed assets, employees, exports and imports, wages and equity are relatively significant. It is worth noting that there is a direct relationship between the above variables, where the effectiveness of a negotiation is measured in terms of sales.

It is recommended to be clear that whether the company is an exporter or an importer, the level of sales will be encouraged through the negotiation effectiveness. Likewise, if the company is mixed, that is an importer and an exporter at the same time, it will not significantly influence the level of sales, in other words, the effectiveness of the negotiation. From the above, it could be drawn that international trade through exports or imports will be always a good mechanism to obtain effectiveness in negotiations.

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The motivation plan, a contemporary solution for increasing the effectiveness of motivation

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Abstract. *Motivation employees is a challenge to reach employee satisfaction at the workplace. Many existing studies have investigated the role of motivation and have evidenced the fact that motivation is a precursor to individual and organizational performance. This paper considers some of the motivation issues with a focus on the necessity of drawing up the motivation plan as a very important managerial document. This study has included 55 business managers. Terrain data were analyzed using SPSS. The findings provide important information for the theory of motivation and its application in practice. This study will serve as an incentive for managers with their approach to the motivation plan. The paper also proves the necessity of the commitment of relevant institutions for the support they should give to managers in this direction through training sessions. This paper aims to argue the importance of a motivation plan as a necessity to support managers to achieve organizational objectives and one more warranty for individual and organizational performance.*

Keywords: current needs of employees, Maslow pyramid, motivation, motivation plan,

JEL Codes: M12

1. Literature review

Motivation constitutes a key commitment for managerial success both in the personal aspect of the employee and in the organizational aspect. Based on Luthans (2006): "Motivation is a process that starts from physical and psychic deficiencies or needs that contribute to behaviours or impulses aimed at achieving organizational goals". While Martin (2003) admits that if an organization wants to be effective and aims to sustain success for a longer period of time, it is important for it to have a motivated workforce made up of employees ready to learn.

The foundation of motivation are the individual needs defined by Maslow. Motivation refers to a process that encourages individuals to behave in a way that uses every resource to achieve personal success and the company's objectives. Motivation refers to how a person's efforts are energized, directed, and sustained towards achieving a goal (Robbins & Coulter 2016). "Motivation is an impulse that comes from within the individual that arises due to shortcomings, needs, and desires to direct the direction of the individual's

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actions and behavior to meet the needs of both physical and psychic" Prasetya. et al. (2022). According to Motowildo et al. (1997), job performance is a construct that elicits behavior related to achievement with evaluative components. Motivation is very important, and this has led many researchers to engage in various studies on motivation. According to Landy & Becker (1987), over 140 definitions have been offered in the last couple of decades. However, Rainey (2009) indicates, that everyone has an intuitive grasp of motivation, but it remains a concept that is often poorly defined. Mathis & Jackson (2001) admit that motivation is one of the factors that influence the performance of employees. Even other researchers like McShane and Glinow (2018) also agree: "Motivation is one of the four essential drivers of individual behavior and performance". Other researchers also evidence the link between motivation, it is influencing factors and employee performance. Some studies have been devoted to the link between motivation and its constituent factors and employee performance in different organizations (Reizer et al. 2019).

According to different researchers, motivation can be perceived as a group of psychological processes that encourage certain behaviours with the sole purpose of achieving a certain result. Motivation itself has to do with the personal aspirations that an individual may have. If an individual achieves a certain goal, he/she is motivated by another factor to achieve upcoming his/her goal. According to Mathis & Jackson (2006), motivation has to do with the derivation of the word "motive" which means human emotion or need that prompts action.

The process of motivation is related to the identification of the person's needs, which drive a certain behaviour. Individuals try to solve the deficiencies and fill the gaps, which are encountered in different areas of life. Koontz, Weinrich (1998) stressed: "...more attention to how individuals can best be motivated and provision of an atmosphere that helps individuals to deliver on their mandates in accordance with the expectations of management". This is very important for the effectiveness of motivation. Because for Forson et.al (2021): "Motivation as a meaningful construct is a central pillar in the workplace. Thus, motivating employees adequately is a challenge as it has what it takes to define employee satisfaction at the workplace". Canco (2018) considering the Maslow pyramid admits that the needs of employees do not have the same importance in different periods of their lives. For this based on Canco (2018), needs can be classified: 1. urgent needs, 2. present needs and 3. potential needs. These needs change in different places and times for different individuals. They vary in time and space, not only in different individuals but also in the same individual. Given that time and space (place) are philosophical categories, considering these changes increases the quality of motivation and employee satisfaction. In this way, the effectiveness of motivation is possible. The effectiveness of motivation based on this classification demonstrates the necessity of designing a motivation plan based on the present needs of the employees, which are reflected in the behaviour of the employees and the changes that it causes from impulses derived mainly from the present needs. Human needs change, and progress continuously. For Cherry (2022): "Maslow's theory states that our actions are motivated by certain physiological and psychological needs that progress from basic to complex". While Fowler (2014): "There is nothing wrong with helping people satisfy what Maslow characterized as lower-level needs".

The motivation plan refers to urgent/current needs. It is putting employees in comparable conditions with their specified needs. In this way, designing the motivation plan constitutes a continuous managerial commitment. The design of the motivation plan places the motivation closer to the needs of the employees and does not make it a random process. This plan has an important role in the intensity of the impact of motivation on employees. The motivation plan has a financial invoice which is reflected in the company's balance sheet, thus enabling the manager to predict the possibility of its realization.

To evidence the present needs, the manager carefully observes the behaviour of the employees. Changes in the behaviour of employees should focus the manager's attention. Prasetya et al. (2022) referred to the American Encyclopedia in Hasibuan (2007) admit that: "Basis involves such factors as biological and emotional needs that can only be inferred from observation conduct". According to Steinmayr. et. al. (2019), McClelland emphasizes that: the need for achievement is measured by describing affective. McClelland (1953). While Sparfeldt & Rost (2011) demonstrated that operationalizing achievement motives subject-specifically is psychometrically useful and results in better criterion validities compared with a domain-general operationalization.

Based on the theoretical treatments, the hypothesis can also be formulated:

H₁: If the manager designs a motivation plan, the motivation process will be more effective.

Based on this hypothesis, the effects of motivation have been examined through the analysis of its special problematics with a focus on the motivation plan.

2. Research Methodology

The paper aims to analyse the problems of motivation for employees. For this, a review of the literature was made to highlight some of the problems of motivation. Many scientific articles have been considered for this. The scientific articles analysed for the preparation of this paper form the basis of providing theoretical facts. The research instrument is the interview. The interview was carried out using the face-to-face method to evidence details and to be able to use probing questions to clarify in detail the specific situations. The necessary data collected from the terrain were processed using SPSS statistical software.

3. Results and Discussions

Terrain data and their processing by statistical methods produce statistical indicators that are useful for characterizing economic phenomena. Peck. et. al (2008) admit that: "Statistics is not about numbers; it is about data-numbers in context. It is the context that makes a problem meaningful and something worth considering". Further, they emphasize "Because statistical methods are used to organize, summarize, and draw conclusions from data" Peck.et.al (2008).

Motivation, as an important managerial commitment, requires knowledge of this process in detail. Detailed knowledge presupposes analysis of this process by the manager. The basis of motivation lies with Maslow's pyramid. Therefore, its recognition by the manager is an important premise for the practical implementation of employee motivation. The following descriptive analysis clearly demonstrates this phenomenon. It refers to the indicator of the arithmetic mean and offers us a common situation regarding employee motivation. The average of the statement "I know the Maslow pyramid" is 2.91. While the arithmetic mean for the statement provided in the questionnaire "I implement motivation for employees" is 3.44. The arithmetic mean is an important indicator in statistical analysis, as it evidences the general trend of the analyzed

phenomenon. It has been evaluated by different researchers over the years. Based on Plackett (1958), the arithmetic mean as a concept was first used by Hipparchus - Greek astronomer. While Simpson (1957) appeared his justification for an attempt to show the advantage arising by taking the mean of several observations in practical astronomy. According to the Philosophical Transactions of the Royal Society: "In 1755, the English mathematician Thomas Simpson published "On the Advantage of Taking the Average of a Number of Observations, in Practical Astronomy"

To be sure of the precision of the mean, the standard deviation of the sampled mean is calculated. "This is mainly due to having to calculate the difference from the mean of each value" Omda & Sergent (2023). The term standard deviation was first used by Karl Pearson (1894). According to Dodge (2003), Pearson used it in lectures. Standard deviation (SD) is within the allowed limits $\pm 2SD$, which represents measurements that are closer to the true value. Based on Vetter (2017) "..... a large SD results from data with a large deviation from the mean, while a small SD shows the values are all quite close to the mean." According to Vetter (2017), Wissing & Timm (2012): "The standard deviation (SD) measures the extent of scattering in a set of values, typically compared to the mean value of the set." Taking standard deviation into consideration is important, even Omda & Sergent (2023) consider it an advantage and for this, they say: "Another advantage of reporting the SD is that it reports the scatter within the data in the same units as the data itself".

Table no.1

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
- I know the Maslow pyramid	55	1	5	2.91	1.567
- I implement motivation for employees	55	1	5	3.44	1.067
Valid N (listwise)	55				

Source: G. Canco file

Knowing the content of Maslow's pyramid and the implementation of motivation for employees demonstrates the managerial sensibility regarding motivation. Following the descriptive analysis, 10 statements about motivation were considered, presented in table no. 2.

Table no. 2 shows the mean level and SD characterizing each statement related to motivation and motivation plan. The descriptive analysis presented in the table above evidences the fact that out of ten analyzed statements, 50% of them have an average rating of over 3 points, while the rest of the analyzed statements

have an average rating that varies from 1.02 to 1.91 points out of 5 points, which is the maximum rating referred to the LIKERT scale. While, the standard deviation does measure how far typical values tend to be from the mean, for the second group of statements analyzed above, as well as a summary statistic, turns out to be low. This shows that the distribution of the data is clustered closely around the mean. The consideration of the average in this paper is important even if we refer to Simpson's works. Simpson's paper was "a landmark in statistical inference, as well as the earliest formal treatment of any data processing practice" (Hook & Norman, 2002).

The low value of the average with 1.91 and SD .293 for the statement "I have a motivation plan" and respectively with 1.02 and .135 for the statement "I have been trained to design the motivation plan" evidences the low level of involvement of managers in these important activities for the realization of motivation and its success. Also, the statement "I always draw up a motivation plan" has low indicators, which evidences the fact that the interviewed managers are involved little or not at all in this activity. The average of 1.40 results from extreme evaluations by the respondents that go from 1 minimum point to 2 maximum evaluation points. This data testifies to problems related to the design of the motivation plan. To be sure of the precision of the mean we obtained, refer to the standard deviation of the sampled mean. Even the value of SD is low, with .494, which shows that the distribution of the data is around the average. All these data show that the managers do not design a motivation plan, even though very few of them admit that they have a motivation plan. The situation is the same concerning the statement "The motivation plan gave me results" with an average of 1.82 and an SD of .611. All of these testify to a very low presence of the motivation plan and therefore the performance results of the managerial activity that are expected from this important managerial document.

However the respondents admit that they consider the actual importance of the needs of the employees. For this statement, the evaluations are also positive. Specifically, the mean is 3.60 and the SD is 1.011. Taking into consideration the current needs of the employees is important because through it the satisfaction of the employees is harmonized with the performance of the organization. Robins and Coulter (2005) admit that: "... the term motivation is the desire and willingness to exert a high level of inspiration to reach organizational goals, conditioned by the effort's ability to satisfy some individual need".

This evaluation is promising for managerial engagement in the design of the motivation plan, which is built on the current needs of the employees.

Table no. 2

	N	Minimum	Maximum	Mean	Std. Deviation
- I know the Maslow pyramid	55	1	5	2.91	1.567
- I implement motivation for employees	55	1	5	3.44	1.067
- I appreciate the motivation of the employees	55	1	5	3.84	1.244
- I believe in the effectiveness of motivation	55	2	5	3.84	1.032
- I have a motivation plan	54	1	2	1.91	.293
- I always draw up a motivation plan	55	1	2	1.40	.494
- I have been trained for the design of the motivation plan	55	1	2	1.02	.135
- I am committed to recognizing the needs of employees	55	2	5	3.82	.925
- I consider the current importance of the needs of employees	55	2	5	3.60	1.011
- The motivation plan has given me results	55	1	4	1.82	.611
Valid N (listwise)	54				

Source: G. Canco file

The interviewed managers evaluate and implement motivation for their employees and admit that this has resulted in the performance of employees and that of the business. For this, it refers to ANOVA analysis of variance. Based on Mishra et al. (2019) referring to the variance analysis, point out: "... statistical methods used in the testing of hypothesis for comparison of means between the groups". The consideration of the ANOVA analysis is important as it constitutes a point of reference for other analyses (statistical tests) in the future. The analysis of variance in this paper is presented in Table No. 3 as follows:

Table no. 3

ANOVA

	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	7.187	4	1.797	6.913	.000
Within Groups	12.995	50	.260		
Total	20.182	54			

Source: G. Canco file

The table above shows the variation between groups and within the group. The variation between groups is explained by the factor. While variation within the group is called variation due to errors and are random, unexplained or residual. This variation is assumed to follow the normal distribution, Gaussian distribution (Brereton, 2014). The normal (or Gaussian) distribution was first described by Carl Friedrich Gauss in 1809 in the context of measurement errors in astronomy. During the 19th century, this distribution was applied extensively in the developing area of applied probability and statistics (Gauss,1809).

To Kim (2014): "The ratio of MSB and MSW determines the degree of how relatively greater the difference is between group means (between-group variance) compared to within-group variance".

The impact of the implementation of motivation on the results derived from its implementation is significant. For Mishra et. al (2019) in general, the analysis of variance justifies intuitive judgments.

The motivation of employees is influenced by several factors that interact and intertwine between them. This entanglement complicates the interpretation of field data. Based on Montgomery (2001): "A significant interaction will often mask the significance of main effects". In this context, regression analysis is important. For this Cox (1958) suggests a lengthy discussion of interactions is available.

According to terrain data, it is observed that there is a correlation between the commitment of the manager to recognize the needs of the employee (I commit to recognizing the needs of the employees) and the result in motivation (The motivation plan gave me results).

For this, we refer to the regression analysis that shows the numerical relationship between the dependent variable and the independent one, the expression which numerically represents the degree and intensity of connections between phenomena is called the correlation coefficient. The representation of the linear regression model is done by means of the linear function of forms:

$$y = a + b \cdot x$$

In our case, the linear function takes this form:

$$y = 0.480 + 0.350 \cdot x + e$$

y - The motivation plan gave me a result (dependent variable)

x - commitment to recognizing the needs of employees (independent variable)

e - random term

A regression coefficient is a positive number, which represents the positive relationship between the independent variable and the dependent variable. This means that the increase in the levels of the independent variable, "I am committed to recognizing the current needs of the employees", also increases the impact of the indicator provided in the motivation plan, which is reflected directly in the motivation of the employees.

Referring to the Model Summary table, starting from the R^2 value, it results that the independent variable can explain the variation of the dependent variable. The R^2 value = .281 is not a random result.

Table no. 4

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.530 ^a	.281	.267	.523

a. Predictors: (Constant), I am committed to recognizing the needs of employees

Source: G. Canco file

Table no. 5

ANOVA^a

Model	Sum of Squares	Df	Mean Square	F	Sig.
Regression	5.670	1	5.670	20.708	.000 ^b
Residual	14.512	53	.274		
Total	20.182	54			

a. Dependent Variable: The motivation plan has given me results

b. Predictors: (Constant), I am committed to recognizing the needs of employees

Source: G. Canco file

The statistical test "t" in this model in relation to the control of individual regression coefficients, results different from zero $t = -4.551$ and $p < 0.001$, which means that the variables make a significant contribution to the model and *therefore the raised hypothesis in this study is accepted.*

Table no. 6

Coefficients^a

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence Interval for B	
	B	Std. Error	Beta			Lower Bound	Upper Bound
1 (Constant)	.480	.302		1.589	.118	-.126	1.087
I am committed to recognizing the needs of employees	.350	.077	.530	4.551	.000	.196	.505

a. Dependent Variable: The motivation plan has given me results

Source: G. Canco file

The implementation of motivation is also influenced by the level of education of the managers. According to the results of terrain, it turns out that 38 managers or 70% of the respondents who apply motivation above the average level have completed a Bachelor's degree and a Master's program. This evidences the fact that there is a strong connection between the level of education and the implementation of motivation.

Table no. 7

		I implement motivation for employees					Total
		Not at all	Somewhat	Average	I rate it	I rate it very much	
Education level	High school	1	7	4	2	0	14
	University	0	1	12	4	5	22
	Master	0	1	5	5	7	18
Total		1	9	21	11	12	54

Source: G. Canco file

The implementation of motivation is a very important aspect of the manager's work. In the current period, a scientific treatment of this problem is required. The scientific treatment considers the design and implementation of the motivation plan. From the field research related to the motivation plan, the situation is presented as follows:

Table no. 8

			I always draw up a motivation plan		Total
			Not at all	Somewhat	
Education level	High school	Count	14	0	14
		% within Education level	100.0%	0.0%	100.0%
		% within I always draw up a motivation plan	43.8%	0.0%	25.9%
		% of Total	25.9%	0.0%	25.9%
	University	Count	10	12	22
		% within Education level	45.5%	54.5%	100.0%
		% within I always draw up a motivation plan	31.2%	54.5%	40.7%
		% of Total	18.5%	22.2%	40.7%
	Master	Count	8	10	18
		% within education level	44.4%	55.6%	100.0%
		% within I always draw up a motivation plan	25.0%	45.5%	33.3%
		% of Total	14.8%	18.5%	33.3%
Total	Count	32	22	54	
	% within education level	59.3%	40.7%	100.0%	
	% within I always draw up a motivation plan	100.0%	100.0%	100.0%	
	% of Total	59.3%	40.7%	100.0%	

Source: G. Canco file

59.3% of the respondents admit that they have never drawn up a motivation plan and 40.7% only a few times. These figures have differences between different educational levels. The study of the motivation plan requires the commitment of the management team. It requires a detailed knowledge of needs by classifying them in advance.

Mohamad, Embi & Nordin (2016): "Motivation can be categorized in two levels: The first level is an individual's needs, wishes, satisfaction, challenges or purposes together with a belief about whether it is within one's power to satisfy the desire or accomplish the goal. The second level is the manner of using the will, or

volition, which refers to a process for changing intentions into actions such as recognition and compensation. The distinction is between will and action".

Above all, it is understood that the drafting of the motivation plan requires preliminary work to evidence the needs of the employees in respect of the above classification. For this, managers must be trained about the staffing plan. The surveyed managers have evaluated the statement "I have been trained to design the motivation plan" with a minimum of 1 point and a maximum of 2 points, with an average of 1.02 points and SD .135.

Even the profiling of managers' education is an influencing factor. The majority of managers, 37 of the respondents or 69.8 % have evaluated the implementation of motivation from an average level to very good, as shown in the following table:

Table no. 9

	I implement motivation for employees					Total
	Not at all	Somewhat	Average	I rate it	I rate it very much	
Branch Economic science	0	2	11	4	6	23
Technical science	1	6	7	6	3	23
Social science	0	1	3	1	2	7
Total	1	9	21	11	11	53

Source: G. Canco file

The above analysis mainly evidenced the fact that managers recognize and value motivation. However, only evaluation is insufficient for a motivation process and for this process to have a positive performance. For this, it is necessary to design and respect the motivation plan.

4. Conclusions

The findings expand the knowledge regarding the role of motivation and specifically the motivation plan in the achievements of employees. The statistical analysis proved the necessity of recognition by the manager of the present needs of the employees, which is a prerequisite for the design of the motivation plan. This finding, which is based on the development of Maslow's theory of needs, shows that the classification of needs into urgent, present and potential needs is a promising approach that increases the role of the motivation plan, because "... the truth is individuals, can experience higher-level motivation anytime and anywhere." (Fowler 2014). The managerial commitment in the design of the motivation plan will improve the manager's work in relation to the differentiated motivation of the employees referring to their needs. In this way, the impact on individual performance and therefore also on the business increases. The motivation plan compares from a

financial point of view the needs of the employees with the possibilities of their fulfillment. Another finding is the lack of training in this field. The importance of motivation has not affected the awareness of the Chamber of Commerce for the training of managers. Therefore, it is recommended to train managers on how to draw up a motivation plan.

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Farmers' Awareness on Land Degradation and Conservation Measure Adoption in Vietnam

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Abstract: *This study aims to investigate farmers' awareness on land degradation and conservation measure adoption in Vietnam where land degradation is regarded as one of the country's most pressing issue. In addition to the secondary data, primary data were gathered through the direct interviews of 826 farm households in three selected regions of the country. The study shows that most of the survey farmers reported observing degradation of their agricultural land. Decline in land fertility was considered a key indicator of land degradation while inappropriate agricultural practice was seen as the foremost cause of land degradation. For preventing the land degradation, farmers in different regions adopted different sustainable land management practices such as agroforestry model, crop rotation, and use of compost and organic fertilizers. The factors influencing the adoption of sustainable land management include genders of household heads, number of land plots in the farm households, household income, extension accessibility and credit accessibility of the farm households. For enhancing the adoption of sustainable land management, it is crucial to improve the awareness of farmers on land degradation and advantages of conservation measures. In addition, extension services and financial supports for farm households through credit program should be improved.*

Key words: Awareness, land degradation, sustainable land management , farm households

JEL Code: Q01, Q15, Q56

1. Introduction

Land degradation is a significant worldwide problem affecting both ecological systems and development (Bai *et al.*, 2008). It involves several processes that lower land productivity such as decreased soil biological diversity and activities, erosion by water, loss of soil structure, acidification, salinization, waterlogging, nutrient depletion and contamination (World Bank, 2006). These consequences impede agricultural progress, escalate vulnerability and poverty, and generate social tensions due to increased demand on scarce natural resources from growing populations. Land degradation is driven by natural factors such as high annual precipitation and steep landscapes, and poor land management practices (Etter, 2015). Farmers' responses to land degradation, including the adoption of Sustainable Land Management (SLM) practices, are influenced by their awareness and various other factors. The concept of "awareness" can cover two interconnected facets: it can denote the understanding gained through personal experiences and perception, and it can also equate to cognizance, which involves acknowledging something perceived or felt (Ziadat, 2010). Awareness of land degradation refers to the understanding and recognition of the processes and impacts associated with the deterioration of the land's productive capacity and its ecosystems. This includes knowledge about the causes, such as deforestation, overgrazing, improper agricultural practices, and climate change, as well

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as the consequences, which can include soil erosion, loss of biodiversity, reduced agricultural productivity, and disruption of water cycle (Alemayehu, 2017).

Vietnam is located in the center of the Southeast Asian region and agriculture is considered as a key sector of the country. However, land degradation is regarded one of the nation's most pressing issues (Vu *et al.*, 2014). According to the Vietnam National Action Program to Combat Desertification for 2006-2010 period and orientation to 2020, around 9.3 million hectares are impacted by desertification. This land area supports the livelihoods of about 22 million people, constituting roughly a quarter of the country's total population. Despite the Vietnamese government's recommendations for implementing SLM practices, non-SLM practices or inappropriate land management practices such as erosive farming techniques, monoculture and excessive use of chemical fertilizers and pesticides remain widespread in many locations (Pham Manh Cuong, 2005; Pham Van Toan, 2011; Tran Thi Hien & Vo Quang Minh, 2014). Increasing the adoption rate of SLM or conservation farming measures is therefore crucial for preventing land degradation. According to numerous global scholars, inadequate awareness of land degradation among farmers and other constraint factors affect farmers' willingness to adopt SLM practices. However, in Vietnam, there are very few researches examining farmers' awareness of land degradation, their responses of adopting SLM and the contributing factors. This study is therefore designed with the aim to explore Vietnamese farmers' current awareness of land degradation, their responses to adopting SLM practices, the influencing factors, and then propose measures to enhance the SLM adoption of the farm households in the coming time.

2. Methodology

Land degradation poses a significant challenge across the country of Vietnam with certain regions experiencing significantly severe impacts. The Northwest mountainous area, the Central coastal region, the Mekong Delta, and the Central Highland are particularly affected (UNCCD NAP, 2007). For exploring the awareness of farmers on land degradation and their response of adopting SLM, one representative district was selected from each region based on consultation with land management experts to ensure the representativeness of the study sites. As the result, Dabac district in Hoabinh province was chosen for the Northwest region. This district features diverse terrain, including the high mountains (some exceeding 1000 meters high), hill, rivers and streams with slopes averaging 35 degree and an average elevation of 560 meters above the sea (Dabac DPC – District People Committee, 2023). In the Mekong Delta, Codo district in Cantho province was selected, known for its flat fields primarily dedicated to rice cultivation (Codo DPC , 2023). The Central coastal region is represented by Hailang district in Quangtri province, characterized by sandy soil with low fertility and prone to severe drought during the dried season (Hailang DPC, 2023). By selecting these representative districts, the study aims to capture farmers' awareness and response to land degradation in these diverse regional contexts.

In each district, consultations were conducted with district officials to identify communes for interviews, ensuring representation of various land management practices, including both SLM and non-SLM approaches. Between 239 and 300 farm households per district were chosen for face-to-face interviews for face-to-face interviews, using a stratified sampling method that initially categorized households into SLM adopters and non-SLM adopters. Sample households were then randomly selected from each category. The research team worked very closely with local staff of the districts and communes to get the insights into SLM adoption trends and identify suitable households for interviews across the selected districts and communes. The household survey was conducted in 2017 and details on numbers of SLM adopter and non-SLM adopter households per

study sites were presented in table 1. Subsequently, both primary data and secondary data were gathered, organized and categorized for analytical purposes.

Table 1. Number of interview farm households in study sites

District	Adoption rate estimation (%)	SLM adoption households	Non-SLM adoption households	Total survey households
1. Dabac district – Hoabinh province	30-40	181	119	300
2. Hailang district - Quangtri province	20-30	110	129	239
3. Codo district - Cantho province	10-15	123	164	287
Total	10-40	414	412	826

Descriptive statistics and comparative analyses are main methods for describing the farmers' awareness on land degradation and their responses of adopting SLM or non-SLM practices. Meanwhile, the binary logistic model is used to identify the effects of various factors on the SLM adoption of the farm households. The model consist of dependent and independent variables:

$$\text{Log}[P_i/(1-P_i)] = \beta_0 + \beta_1 X_1 + \dots + \beta_{12} X_{12} + \varepsilon_i$$

where the dependent variable takes the value of 1 if the farm households adopt the SLM practice and value of 0 if the farm household do not do so. The definitions and measurement of the independent variables are presented in table 2.

Table 2. Variable definition and measurements

Variable	Definition and measurement
Education	Number of the years in school of the household heads
Gender	Gender of the farm household head (1 for male and 0 for female)
Plot	Number of agricultural land plots of the farm households
Income	Household income in the survey year (in million VND)
Extension access	Do the farm households receive technical guidance through extension training or visit by extension workers (Yes = 1, and No = 0)
Age	Age of the farm household heads (in year)
Credit access	Do the farms receive the loan in the survey year (Yes = 1, and No = 0)
Agri_labor	Number of the agricultural laborers in the households.
Poverty	Is the farm household is poor or not (Yes = 1, No = 0)
Plot Area	The area of the farming plot (in squared meters)
Dabac district	If the farm households is in Dabac district, Hoabinh province (Yes = 1, No = 0)
Codo district	If the farm households is in Codo district, Cantho province (Yes = 1, No = 0)

3. Study results

3.1. Demographic information of the survey households

As mentioned above, 826 farm households encompassing both those practicing sustainable methods and those not, were chosen for in-person interviews. The demographic details of the respondents and the households

surveyed are summarized in Table 3. The average age of the respondents was 47.7 year, with a majority having completed the secondary school. Each surveyed household averaged 4.7 members, with 4.1 members aged 12 and above. Additionally, the average number of agricultural workers per household was 2,2.

Table 3. Demographic information of survey farmers and households

	N	Age	Educational level	Family size (persons)	Members over 12 years old	Agri-labor
1. Dabac district	300	45.7	1.7	4.4	3.6	2.4
- Adopters	181	46.0	1.7	4.5	3.6	2.4
- Non-Adopters	119	45.2	1.7	4.3	3.6	2.4
2. Hailang district	239	49.7	1.9	4.9	4.3	1.8
- Adopters	110	48.7	2.0	4.7	4.3	2.0
- Non-Adopters	129	50.6	1.9	5.0	4.4	1.7
3. Codo district	287	48.2	2.1	5.0	4.4	2.3
- Adopters	123	48.4	2.1	4.8	4.0	2.0
- Non-Adopters	164	48.0	2.2	5.0	4.6	2.5
4. Total	826	47.7	1.9	4.7	4.1	2.2
- Adopters	414	47.4	1.9	4.6	3.9	2.2
- Non-Adopters	412	48.0	2.0	4.8	4.2	2.2

(Note for *educational level*: Primary school = 1; Secondary school = 2; High school = 3; College/ University = 4)

(Source: Household survey, 2017)

There was little variation in household size, and agricultural workforce between the groups practicing sustainable methods and those not, as statistical tests did not reveal significant differences in these areas. However, noticeable disparities in age and educational background were apparent across the regions. Respondents in coastal region (Hailang district) were four years older than those in mountainous region (Dabac district) and 1.5 years older than those in Mekong delta (Codo district). with these age differences proving statistical significance at $p < 0.1$. Furthermore, survey farmers in Codo district had higher levels of education in comparing to those in Dabac and Hailang districts with the educational differences between districts statistically significant at $p < 0.01$. While surveyed households in Codo district had more family members and individuals aged 12 and above, those in Dabac district had the highest number of agricultural workers per households. This disparity could be attributed to Dabac district's focus on agricultural activities due to limited non-agricultural job opportunities, whereas residents in Hailang district had relatively better access to non-agricultural employment opportunities.

3.2. Farmers' awareness on land degradation

- Awareness on land degradation occurrence**

According to the survey findings, a significant majority of respondents (over 82.7%) reported observing degradation of their agricultural land. However, awareness of land degradation varied significantly across different regions. In coastal and mountainous areas, nearly all farmers (100% and 82.7%, respectively) acknowledged experiencing land degradation on their farms. In contrast, only a minority of farmers (30%) in the Mekong Delta region believed they were witnessing land degradation. This difference in awareness among farmers can be attributed to the visibility of the land degradation in each region. In coastal and mountainous

region, issues such as reduced crop yields and soil erosion make the degradation more apparent to farmers, enabling them to observe these tangible signs firsthand. Conversely, in the Mekong Delta where signs of land degradation may be less pronounced, farmers may find it more challenging to identify and acknowledge its presence on their agricultural land.

Table 4. Respondents' awareness of land degradation occurrence (%)

District	Where is land degradation occurring?	SLM adopters	Non-SLM adopters	All survey households
1. Dabac	In my agricultural land	82.9	82.4	82.7
	In agricultural land of others	97.8	95	96.7
2. Hailang	In my agricultural land	100	100	100
	In agricultural land of others	100	100	100
3. Codo	In my agricultural land	4.9	44.5	27.5
	In agricultural land of others	8.1	44.5	28.9
Total	In my agricultural land	64.3	72.8	68.5
	In agricultural land of others	71.7	76.5	74.1

(Source: Household Survey, 2017)

The proportion of the survey farmers who reported experiencing land degradation on their agricultural land was similar between SLM adopters and non-adopters in both the coastal and mountainous region. However, a significant difference was observed between adopter and non-adopter groups in the Mekong delta region (table 4). Among adopters, only 4.9% reported encountering land degradation on their agricultural land whereas this figure was significantly higher at 44.5% among non-adopters. This highlights the effectiveness of adopting SLM practices in mitigating or preventing the land degradation specifically in the Mekong Delta. The clear contrast in reported occurrences of agricultural land degradation between SLM-adopters and non-adopter households emphasized the crucial role of SLM practices in preserving the health and productivity of agricultural land in this region.

• Awareness on indicators reflecting land degradation

The majority of respondents (81.7%) identified the decline in land fertility as a key indicator of agricultural land degradation, followed closely by reduced crop yield (around 80%), stunted crop growth (56.3%), and salinity (48.7%). Only around 47% of the respondents considered weed proliferation and bare land as indicators of land degradation while just 35% seen land erosion as the indicator. Interestingly, a small percentage (7.2%) of respondents viewed declining land fertility as the most critical indicator (Table 5). In contrast, 17.9% of respondents identified soil erosion as the primary indicator. Regional topography significantly influenced respondents' awareness of land degradation indicators. In mountainous area, around 87% of survey farmers recognized soil erosion as an indicator, with nearly half of them considering it as the most significant. However, survey farmers in the Mekong Delta and coastal regions did not share this perspective, likely due to the flat terrain where soil erosion is less visibly apparent.

There was a notable difference in how SLM-adopters and non-adopters perceived indicators of agricultural land degradation. While more than 87% of the adopters recognized the reduction in crop yields as indicator, this view was held by only around 72% of the non-adopters. Similarly, adopters showed higher awareness of other indicators such as soil erosion, weed growth and decline in land fertility compared to non-adopters. This

suggests that adopters of SLM practices demonstrated a more comprehensive understanding of agricultural land degradation indicators than their non-adopting counterparts.

Table 5. Indicators of agricultural land degradation by respondents

	Yes, this is an indicator			Yes, this is the most important indicator		
1. Decline in land fertility	88.6	74.8	81.7	10.2	4.2	7.2
2. Reduction in crop yield	87.4	72.3	79.9	19.8	5.8	12.8
3. Stunted crop	58	54.7	56.3	4.1	1	2.6
4. Salinity	55.9	41.4	48.7	3	3	3
5. Bare land	71.7	22.6	47.3	2.2	0	1.1
6. Weed growth	60.7	33.3	47	8.3	1.2	4.8
7. Inadequate water absorption	64.7	26.5	45.7	1.2	0.5	0.9
8. Rocky land	43.6	27.4	35.6	4.4	2	3.2
9. Soil erosion	40	30	35	19.3	16.6	17.9

(Source: Household Survey, 2017)

• The reason for land degradation

The vast majority of survey participants (more than 80%) recognized inappropriate agricultural practices as the foremost cause of agricultural land degradation, closely followed by excessive chemical use (around 80%) and knowledge gaps (over 70%). Policies and deforestation were cited as significant contributors to agricultural land degradation by only around one-fourth and one-third of survey farmers, respectively (Table 6). Noticeably, in the mountainous area, nearly 95% of respondents pinpointed deforestation as the primary driver of agricultural land degradation, with around 37% considering it as the most critical factor. Substantial differences in awareness regarding the main causes of land degradation were observed between adopters and non-adopters. SLM-adopters appeared to emphasize these reasons more than non-SLM adopters. For example, more than 87% of SLM adopters highlighted the overuse of chemical fertilizers and pesticides as a primary cause of agricultural land degradation, whereas this figure among non-adopter group was only 70%. This trend was similarly observed for other reasons such as knowledge gaps and inappropriate farming practices.

Table 6. Primary cause of agricultural land degradation by respondents' assessment (%)

	Yes, this is an indicator			Yes, this is the most important indicator		
1. Inappropriate farming practices	87.2	73.4	80.3	23.7	10.5	17.1
2. Overuse of agro-chemical	87.6	70.2	78.9	16.6	6.6	11.6
3. Lack of knowledge	80	60.4	70.3	9.5	1.2	5.4
4. Deforestation	41	30.1	35.5	14.4	12.5	13.4
5. Related policies	30.2	18.7	24.5	0.8	0.5	0.6

(Source: Household Survey, 2017)

When questioned about the main cause driving agricultural land degradation, SLM adopted farmers showed a notably apparent understanding in comparison to non-SLM adopters. More than two-third of SLM adopters provided a response whereas only one-third of non-adopters managed to do so. Among those who did respond, the majority pointed to inappropriate agricultural practices as the major cause of agricultural land degradation.

3.3. Farmers' response to land degradation

- **Farmers' understanding on land conservation measures**

To gauge respondents' awareness of land improvement techniques, a series of inquiries were made. The responses indicated a generally robust understanding of the concepts (Fig. 1). Approximately 93% of participants acknowledged that adopting organic practices could enhance soil quality. Moreover, 85.7% of the surveyed farmers recognized that implementing the crop rotation with legumes could help to improve land fertility. Additionally, more than 80% of survey farmers understood that overuse of agro-chemicals could degrade soil fertility. However, around 50% of the survey farmers agreed with the notion that SLM practice should only applied reactively in response to the apparent signs of the agricultural land degradation, even if the soil remains productive. This reveals some knowledge gaps and suggests a tendency to apply conservation measures reactively rather than taking proactive steps to prevent degradation..

The feedback from SLM adopted farmers indicated a clearer recognitions of agricultural land degradation and methods for improved land, particularly concerning no-tillage cultivation, crop rotation with legumes, mulching and the timing of soil conservation measures. A significant majority of adopters (over 90%) acknowledged the benefits of mulching for enhancing soil quality while only around half of non-SLM adopted households shared this perspective. Likewise, 33.8% of the adopted households believed in implementing conservation measures regardless of current soil productivity, contrasting with 55.2% among non-adopters. These findings underscore persistent knowledge gaps among respondents in general. Moreover, SLM adopters demonstrated a more nuanced understanding of conservation practices aimed at improving land than non_SLM adopters.

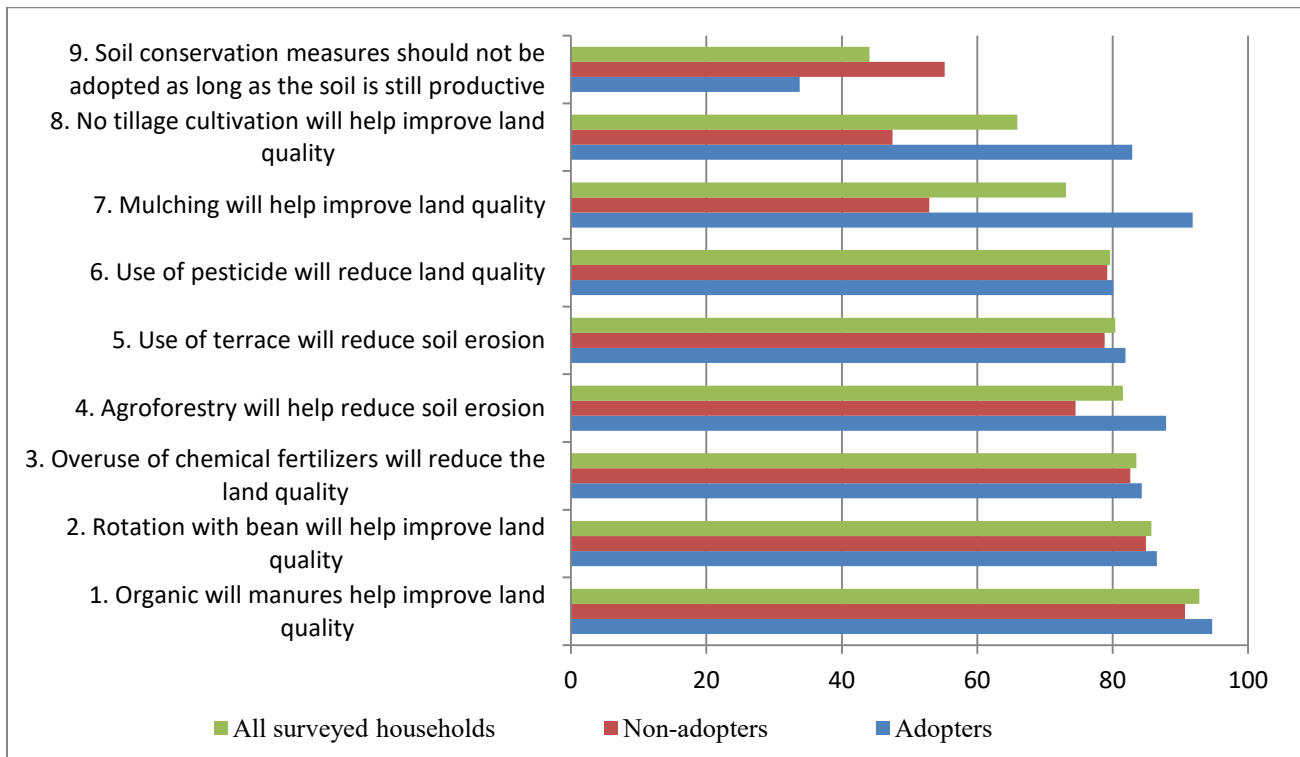


Fig 1. The rate of respondents agreed with the statement

• Farmers' responses to agricultural land degradation

Farmers' responses to land degradation include adopting measures such as agroforestry, contour plowing, terracing, and crop rotation. The implementation of these conservation practices, or SLM practices, varies significantly across regions due to socio-economic context and natural conditions. Even within the same region, diverse soil conservation measures are observed (Bui & Nguyen, 2022). This variability may stem from differing levels of farmers' awareness on agricultural land degradation and the unique characteristics of individual farmers and their households.

In the rugged terrain of Dabac district, SLM practices encompass a variety of approaches such as crop rotation and agroforestry models involving legumes and maize (Do & Bui, 2023; Nikolic *et al.*, 2008). In contrast, non-SLM practices are characterized by the monoculture of crops like dual maize crops, dual rice crops, sugarcane and cassava. Another prevalent non-SLM method involves crop rotations featuring edible canna or cassava such as cassava-maize or edible canna-maize which often result in the depletion of soil organic matter and nutrients in the region. Essential features of soil conservation measures or SLM practices in the area include maintaining robust land cover and enhancing soil quality. The findings from survey show a significant rate of SLM-adopted farm households (65.2%) adopt agroforestry models with combinations like acacia integrated with upland crops being the most common (Table 7). Other notable SLM practices include styrax with cash crops (around 13%) and Meliaceae with cash crop (around 10%). Conversely, non-SLM practices

consist of maize monoculture (around 32%), intercropping cassava with maize (around 20%), single cassava plantation (nearly a quarter), and various other practices (more than 10%)

Table 7. Rate of survey households by SLM and non-SLM adoption

Region	SLM practice		Non-SLM practice	
	Type of SLM practice	Rate of adopted households (%)	Type of non - SLM practice	Rate of households (%)
Mountainous region (Dabac district)	Styrax with cash crops	13.3	Maize – maize	31.9
	Acacia with cash crop	65.2	Cassava	24.4
	Meliaceae with cash crop	9.9	Maize and cassava (intercrops)	29.4
	Others	11.6	Others	14.3
	Total	100.0	Total	100.0
Coastal region (Hailang district)	Maize+peanut - Maize+bean	9.1	Rice - rice	54.6
	Chives + bean + cassava	22.7	Cassava	21.8
	Chives + cassava	27.3	Sweet potato	19.3
	Cococynth + bean	21.8	Others	4.2
	Cassava + bean -melon	19.1	Total	100.0
	Total	100.0		
Mekong Delta (Codo district)	Rice rotation with sesame	73.2	3 rice	94.5
	Rice rotation with melon	3.3	2 rice	2.5
	Rice rotation with bean	11.4	Others	3.0
	Rice rotation with maize	12.2	Total	100.0
	Total	100.0		

(Source: Survey data, 2017)

In Hailang district in Quangtri province (Coastal region), non-SLM practices predominantly involve the cultivation of single crops such as rice, cassava or sweet potato. These approaches often lead to reduction of soil nutrients and organic matters, exacerbated by overuse of agro-chemicals and exposure of soil during dry seasons. The household survey reveals that rice monoculture is the most predominant practice among non-SLM households, making up 54.6%. Single cassava plantation constitutes 21.8% while sweet potato monoculture accounts for 19.3% (Table 6). Conversely, SLM practices in Hailang district encompass intercropping models featuring legumes like mung beans, peanuts, or soybeans, alongside chives. These practices are designed to maintain soil nutrient balance, leveraging the nitrogen-fixing properties of legumes. Additionally, local farmers frequently employ mulching techniques by returning crop residues post-harvest and applying organic fertilizers and compost which supports soil moisture retention, enhances organic matter levels, and reduces surface degradation. The primary SLM models observed among surveyed households involves intercropping chives with cassava (more than a quarter). Other significant soil conservative measures include combinations such as chives with beans and cassava (22.7%), colocynth with beans (21.8%), and cassava with beans and melons (19.1%).

In the Mekong delta region, the practice of continuous rice monoculture – whether with three crops annually or two crop per year, is classified as a non-SLM practice. This extended cultivation in paddy fields leads to soil degradation due to persistent submergence and overuse of chemical fertilizers (Soong, 2006). Over time, continuous rice farming has been observed to rapidly deplete soil nutrients, cause soil compaction and disrupt soil structure and aeration under flooded condition (Vu *et al.*, 2023). According to the survey of non-SLM households, the predominant practice involves cultivating rice with three crops annually, accounting for 94.5%, while those with two rice crops per year constitute only 2.4%. In contrast, an SLM approach in the delta involves implementing a crop rotation system that incorporates upland crops, particularly legumes to improve soil fertility and nitrogen levels through biomass return and nitrogen fixation. Among surveyed households, a significant SLM practice observed is rice rotation with sesame, comprising the majority at 73.2%. Conversely, rice rotation with beans or maize shows smaller shares, approximately 11-12%.

3.4. Factors affecting the adoption of SLM practices

For analyzing the effects of the multiple variables on the probability of SLM adoption by individual farm households, the binary logistic regression is used. The dependent variable in the model is the adoption status of the survey households (dependent variable get value of 1 if farms adopted SLM and get value of 0 for otherwise). Omnibus tests of Model Coefficients with Chi-square of 142.62 confirm the statistical significance of the model (The Pseudo R-Square of the model is 0.125).

Table 8. Results of binary logistic model on the SLM adoption

Variable	Coeff.	Z	P> z
Education	-0.0862	-0.67	0.500
Gender	0.5075	2.43	0.015**
Plot	-0.3104	-2.63	0.008***
Income	8.53E-06	3.85	0.000***
Extension visit	1.1553	6.31	0.000***
Age	-0.0087	-1.00	0.319
Loan	-0.8902	-4.94	0.000***
Agri_labor	-0.0959	-1.07	0.284
Poverty	0.0471	0.20	0.839
Plot Area	-6.48E-06	-0.99	0.320
Da_Bac district	0.778	3.18	0.001***
Can_Tho District	-1.2341	-3.83	0.000***
cons	0.4387	0.59	0.554
Log Likelihood = -499.14366		Number of Obs.= 826	
		LR Chi2 = 142.62	
		Prob > Chi2 = 0.0000	
		Pseudo = 0.125	

The results of the logistic regression show that independent variables of gender of the household heads, number of land plots in the households, household income, visit of extension, loan of the households and the

region are statistically significant on the probability of SLM adoption. Meanwhile education level and age number of agricultural labor in the households are not statistically significant (table 8).

Gender of household heads statistically places significant impacts on the SLM adoption in the farm households. If the household head are male, the probability of SLM adoption is higher. Households with more plots tend less to adopt SLM.

The income of the households has positive effects on the SLM adoption at statistical significance of $p < 0.01$, however the effect is very little since the coefficient is very small. This finding is similar to the study by Okyoe (1998) in Nigeria and Gensa & Tebeje (2020) in Ethiopia.

Typically, the adoption rate would be high if farmers receive regular guidance from skilled extension agents and are supplied with adequate support materials in an organized manner (Andesina *et al.*, 2000; Akudugu *et al.*, 2012). In Vietnam, agricultural extension play important role in adopting the advanced agricultural practices as well as SLM as agricultural extension system in Vietnam is quite developed and useful. As variable of extension services has positive coefficient at statistical significance of $p < 0.01$ so that if the extension workers come to visit farm households more, the households have higher probability of SLM adoption. Farmers in mountainous region have higher probability to adopt SLM than farmers in other regions.

4. Conclusion and implications

Agriculture is vital to Vietnam's economy, but the sector is currently challenged by severe land degradation, affecting around 9.3 million hectares of agricultural land. Due to difference in topography, the appearance of agricultural land degradation varies by regions such as soil erosion in mountainous area and crop yield reduction in coastal region and Mekong Delta. More than 80% of respondents reported observing degradation of their agricultural land. Decline in land fertility was considered a key indicator of land degradation while inappropriate agricultural practice was seen as the foremost cause of land degradation. For preventing the land degradation, farmers in different regions adopted different sustainable land management practices such as agroforestry model, crop rotation, and use of compost and organic fertilizers. It is noted that SLM adopters tend to have better awareness on land degradation and measures for land improvement in comparison to non-SLM adopters. The results of binary logistic regression show that the factors affecting the farmers' adoption of sustainable land management includes genders of household heads, number of land plots in the farm households, household income, extension accessibility and credit accessibility of the farm households.

Given the crucial role of mass and local media in enhancing farmers' awareness of land degradation and the advantages of SLM, it is essential to design more radio bulletins and TV news segments that introduce SLM practices and their specific benefits for each specific region . These broadcasts should be distributed through mass media and local outlets, such as provincial TV channels and newspapers, to ensure local farmers can easily access them. The broadcasts should include clear evidence of SLM benefits to improve persuasiveness for local farmers.

Since the confirmation of the significant role extension services play in SLM adoption, there is a critical need for enhanced extension services, especially in providing technical guidance for SLM adoption. As a result, it is imperative for governments and policymakers to prioritize improving the expertise of extension staff, increasing their numbers, and ensuring their availability for the organized and effective dissemination of SLM technologies across all regions, thereby benefiting farmers directly. Furthermore, training programs should be

implemented for farmers to learn and apply SLM practices effectively. Additionally, establishing SLM demonstration sites would enable farmers to visit and learn practical, viable application methods. It is also recommended to consider implementing credit programs or financial support for SLM farmers, offering loans at low interest rates or with simplified procedures. This is crucial given the high costs associated with adopting SLM practices and the positive impact observed on SLM adoption through improved access to credit. Priority should be given to providing these supports to low-income households and those residing in mountainous regions.

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