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Generativity is a Core Value of the ESJ: A Decade of Growth

Erik Erikson (1902-1994) was one of the great psychologists of the 20th century[1]. He explored the nature of personal human identity. Originally named Erik Homberger after his adoptive father, Dr. Theodore Homberger, he re-imagined his identity and re-named himself Erik Erikson (literally Erik son of Erik). Ironically, he rejected his adoptive father's wish to become a physician, never obtained a college degree, pursued independent studies under Anna Freud, and then taught at Harvard Medical School after emigrating from Germany to the United States. Erickson visualized human psychosocial development as eight successive life-cycle challenges. Each challenge was framed as a struggle between two outcomes, one desirable and one undesirable. The first two early development challenges were 'trust' versus 'mistrust' followed by 'autonomy' versus 'shame.' Importantly, he held that we face the challenge of **generativity** versus **stagnation in middle life**. This challenge concerns the desire to give back to society and leave a mark on the world. It is about the transition from acquiring and accumulating to providing and mentoring.

Founded in 2010, the European Scientific Journal is just reaching young adulthood. Nonetheless, **generativity** is one of our core values. As a Journal, we reject stagnation and continue to evolve to meet the needs of our contributors, our reviewers, and the academic community. We seek to innovate to meet the challenges of open-access academic publishing. For us,

[1] Hopkins, J. R. (1995). Erik Homburger Erikson (1902–1994). *American Psychologist*, 50(9), 796-797. doi:http://dx.doi.org/10.1037/0003-066X.50.9.796

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generativity has a special meaning. We acknowledge an obligation to give back to the academic community, which has supported us over the past decade and made our initial growth possible. As part of our commitment to generativity, we are re-doubling our efforts in several key areas. First, we are committed to keeping our article processing fees as low as possible to make the ESJ affordable to scholars from all countries. Second, we remain committed to fair and agile peer review and are making further changes to shorten the time between submission and publication of worthy contributions. Third, we are looking actively at ways to eliminate the article processing charges for scholars coming from low GDP countries through a system of subsidies. Fourth, we are examining ways to create and strengthen partnerships with various academic institutions that will mutually benefit those institutions and the ESJ. Finally, through our commitment to publishing excellence, we reaffirm our membership in an open-access academic publishing community that actively contributes to the vitality of scholarship worldwide.

Sincerely,

Daniel B. Hier, MD

European Scientific Journal (ESJ) Natural/Life/Medical Sciences

Editor in Chief

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Impact of Cashew Nut Trade Policy on Household and Government Revenues in Senegal: A Dynamic Computable General Equilibrium Model Analysis

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Abstract

The objective of this paper is to assess the medium and long term sectoral impacts of a trade policy on the cashew nut sector in Senegal. Thus we used the dynamic computable general equilibrium model which was inspired by the dynamic PEP model (PEP-1-t) developed by Decaluwé et al (2010) to simulate the impact of a 10% tax on raw cashew nut exports on the sectors of activity and on household and government income. The accounting framework of the model is the 2017 Senegal Social Accounting Matrix (SAM), from which we disaggregated the agricultural branch to isolate the cashew sector. The results of the simulation showed that a policy of taxing raw cashew nut exports from Senegal at a rate of 10% would have a negative impact in the medium and long term on the value added of the cashew nut sector, as it would decrease over the period 2017 to 2022. This decline would be explained by a drop in export demand for the product, which is linked to the sector's loss of competitiveness. On the other hand, this policy would benefit the other sectors, particularly the agricultural sector for which the value added would increase during the period. This policy would also negatively

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affect the income and savings of urban and rural households. However, the government would benefit from the measure since its income would increase over the period.

Keywords: Dynamic computable general equilibrium model, Households, Cashew nuts, Senegal, Export tax

1. Introduction

Agriculture is a very important sector in sub-Saharan Africa, through its contribution to job creation, wealth creation and in reducing food insecurity for the rural population. However, agricultural productivity is relatively low in Africa compared to other developing countries (Hemming et al. 2018). In other words, agricultural production growth in Africa comes mainly from an increase in factor quantities (Denning et al. 2009; Hemming et al. 2018), while productivity is the only way to develop the sector (Diouf, 2020).

The agricultural sector is the driving force of the primary sector in Senegal and is a main source of income for most rural households. Agriculture has a special place in the Emerging Senegal Plan (PSE), which serves as a reference framework for public policies over the period 2014-2035. It contributes 62.8% of the value added of the primary sector and 9.4% of national GDP (SEN. ANSD, 2020).

Like most Sahelian countries, Senegal is facing a relatively difficult food situation due to the gap between national production and the growing needs of the population. Several causes are generally put forward to explain this situation. These are mainly the decline in soil fertility, low price incentives and the abandonment of agricultural support policies (Kidane et al. 2006). Thus, there is a decline in farmers' income.

In order to improve their financial situation, most farmers diversify their agricultural activities by investing more in cash crops such as cashew nuts. Cashew nut production has expanded rapidly in Senegal due to the income it provides to producers and the high global demand for cashew nuts, especially from Asian countries. This growing demand for raw cashew nuts is having a positive impact on cashew plantations in the country.

Cashew (*Anacardium occidentale*) is a species belonging to the Anacardiaceae family, native to tropical America, and cultivated in tropical areas for the production of cashew nuts (or cashew) and cashew apple (Sero et al. 2020.) It is a growing cash crop in Africa due to the export of its nuts (Dedehou et al. 2015) Cashew cultivation has been selected among the high value-added agricultural sectors to be promoted because of its strong capacity to contribute to job creation and improve the income of the most vulnerable populations, especially youth and women (Sero et al. 2020). This agricultural activity helps to solve both economic, social and environmental problems in

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the world (Tandjiékpon et al. 2003; Dwomoh et al. 2008; Hammed et al. 2008; Yabi et al. 2013; Balogoun et al. 2014). Cashew exports are a potential source of foreign exchange for producing countries. In West Africa, Nigeria is the leading producer of the product, followed by Cote d'Ivoire and Benin (Balogoun et al. 2015). For the latter, cashew represents the country's second agricultural export product after cotton (Houndahouan et al.2018).

The main constraints to cashew production are related to maintenance difficulties, pest attacks, fire and nut theft (Balogoun et al. 2015). But also, cashew anthracnose is a dreaded disease for cashew production, it can cause up to 72% of cashew production losses under favorable conditions for its development (Houndahouan et al. 2018). In addition, climate change affects cashew plantation production (Tchétangni et al. 2016). Indeed, according to the authors, prolonged drought followed by a rainfall deficit, poor distribution of rainfall are the most recorded climatic events and constitute the major constraints to cashew production in the commune of Savalou in Benin. The other causes that lead to the decrease in cashew tree yields are animal rambling and poor plant material used by cashew orchard owners.

Thus, appropriate measures such as access to agricultural credits, development of integrated pest management methods as well as training and sensitization of producers must be taken by stakeholders at various levels (State, researchers, technical and financial partners) in order to provide solutions to the problems that plague cashew production (Balogoun et al. 2015).

Cashew nuts can be used for several purposes. They can be consumed in the form of "snacks" in the same way as peanuts, but also, they can enter the composition of products in the chocolate or confectionery industry (Ndiaye et al. 2017). Nuts can also be used in the form of powder, granules in the food industry of biscuit, pastry and yoghurt (Ricau, 2013). They can also be processed into butter to be used as sandwich dough.

However, Senegalese cashew nuts are mainly exported in unprocessed form through entrepreneurs from India. Thus, it is estimated that between 75-95% of the national production would be exported in raw form, whereas by carrying out shelling and primary processing activities, local economic operators can capture additional income of up to 16% of the consumer selling price in export markets (UNCTAD, 2017).

Despite this significant level of exports, no tax related to this activity has been implemented in Senegal so far, which constitutes a loss of revenue for the state, since export taxes are very often used by developed countries to generate income. It is therefore important to analyse the response of the cashew sector and other sectors to exogenous shocks. The interest of this study is to understand the sectoral effects of the introduction of a tax on raw cashew

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nut exports, but also the impact of such a policy on household and government income in Senegal.

According to Liefert and Westcott (2016) there are four main reasons for implementing an export tax or other form of export restriction: i) to generate revenue; ii) to exploit the country's market power by increasing the price of the good sold in the world market; iii) to allow domestic processors using the exported good as an intermediate input to have a cost advantage over foreign competitors; iv) and to lower the price of the product for the benefit of local consumers with the aim of improving food security. But there are no best practices in tax reform policy (Jason, 2020) and the agricultural sector is considered the most difficult sector to tax (Criclivaia, 2016 and Rajaraman, 2004). Since 2004, inputs specific to the agricultural sector have been exempt from Value added tax (VAT) in Senegal (Diouf, 2020). Tax incentives have been ineffective in improving agricultural productivity, indeed, the higher the weight of exemptions in production costs, the less productive the plot is (Diouf, 2020). This relationship could come from a decrease in allocative efficiency. In other words, farmers have overinvested in exempted inputs, at the expense of inputs subject to VAT, which have no significant effect on productivity. It is therefore necessary to remove the policies that cause VAT residuals, which would make VAT exemptions unnecessary, by including agriculture in the scope of VAT and removing exemptions for finished products (Diouf, 2020).

Several works have shown that export taxes are, on the one hand, a source of increased state revenue and, on the other hand, a factor that negatively affects the income of domestic producers (Liefert and Westcott, 2016; Bouet and Debucquet, 2010; Josling et al. 2009). Thus Araujo- Bonjean and Chambas (2001) proposed a coherent, incentive-neutral levy system based as much as possible on the contributory capacity of farmers. They advocate an income tax levied on exports, complemented by a property tax. The extension of the value-added tax to all agricultural products would avoid distortions against producers by shifting the burden of this tax to consumers. On the other hand, price increases due to the introduction of an export tax negatively affect the poorest consumers and seriously threaten food security (Josling et al. 2009).

This work is part of the debate related to the effects of an export tax on the revenues of stakeholders in the sector. Thus, the main objective of the work is to simulate the medium- and long-term impact of a 10% tax on raw cashew nut exports on the income of stakeholders in Senegal.

In order to achieve this objective, we assume that a 10% tax on raw cashew nut exports would affect government and household income in the medium and long term. This hypothesis is linked to the measure taken by some producing countries such as the Ivory Coast to apply a 10% tax on raw cashew

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nut exports. The cashew sector is the subject of much attention from the governments of producing countries and from researchers, due to its growing economic weight.

For the simulation, we will use the dynamic computable general equilibrium model based on the dynamic PEP model (PEP-1-t) developed by Decaluwé et al. (2010).

For the rest of the paper, section 2 is about the methodological framework that allows to present the structure of the model, the data of the model and the closure of the model, section 3 will be devoted to the presentation and discussion of the results, section 4 will conclude and finally section 5 will present policy recommendations.

2. Methodological framework

As mentioned above, this study evaluates and empirically analyses the impact of a fiscal policy on the cashew nut sector (export tax). The impact of this policy can be analyzed through simulations that can be carried out using computable general equilibrium (CGE) modeling.

Computable general equilibrium models (CGE models) are widely used to analyze the effects of policy changes and/or shocks on the economy as in general. They address the length of time it takes for an economy to move from one equilibrium to another in response to a policy change or shock. For this purpose, a recursive-dynamic computable general equilibrium (CGE) model is used in this study.

A dynamic computable general equilibrium specification has advantages such as: the possibility not only to generate a medium- and long-term trajectory, but also to analyse structural changes over time.

2.1. Model specification

In principle, the simulation results obtained through a CGE model depend largely on the assumptions made on the functional forms (Cobb-Douglass or Leontief function, for example), the parameters adopted in the production and demand functions (transformation elasticity's or substitution elasticity's), the balancing mechanisms (investment/savings equilibrium, etc.) and the macroeconomic closure (classical or Kaldorian closure, etc. and the choice of exogenous variables). Our model starts from the basic PEP dynamic computable general equilibrium model (PEP-1-t) developed by Decaluwé et al. (2010). The detailed and/or complete specification of this model will not be presented for the sake of simplicity. Nevertheless, the key structures of the model and the specificities for the needs of this analysis will be described. The model assumes a small economy for which world prices are given (i.e., price taker).

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- ***Production structure***

The industries or sectors carry out production t. by maximizing their profits in perfect competition, considering the prices of inputs and factors. The production technology is described by the production and value-added equations for each period. Within each sector, including the cashew sector, output (XS) is expressed as a Leontief function combining fixed shares of value added (VA) and intermediate consumption (CI):

$$XS_{j,t} = \min\left[\frac{CI_{j,t}}{io_j}, \frac{VA_{j,t}}{v_j}\right] \quad (1)$$

In the market sectors, value added is a CES function that combines composite labour (LDC) and composite capital (KDC):

$$VA_{j,t} = BA_j^{VA}\left[\beta_j^{VA} LDC_{j,t}^{-\rho_j^{VA}} + (1-\beta_j^{VA}) KDC_{j,t}^{-\rho_j^{VA}}\right]^{-\frac{1}{\rho_j^{VA}}} \quad (2)$$

Value added is formulated differently in different sectors: in the non-market sector, value added is a CES function that combines composite labour and public capital.

The total intermediate consumption (CI) of an industry is a fixed part of its output:

$$CI_{j,t} = io_j XS_{j,t} \quad (3)$$

The demand for the composite good (DI) is a fixed share of the total intermediate consumption of sector j. Each product i represents a fixed share (aij) of the total intermediate consumption of sector j:

$$DI_{i,j,t} io_j CI_{j,t} \quad (4)$$

The factors of production (composite labour and composite capital) are combined according to a constant elasticity of substitution (CES) function, while the various intermediate inputs are used in fixed proportions (Leontief function). The demand for labour and capital in each industry is determined by the first-order profit-maximization condition.

The productivity factor $\left(B_j^{VA}\right)$is a function of human capital $\left(KH_{j,t}\right)$research and development$\left(RD_{j,t}\right)$physical investment $\left(IP_{j,t}\right)$ and the ratio of aggregate public capital to private capital in the sector $\left(\frac{KDpubG_t}{KDpriv_{j,t}}\right)$and the sensitivity of productivity to these different arguments, given by the respective elasticity's ε_k , ε_r et ε_i .

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The overall stock of public capital creates a positive externality $\left(KDpubG_t\right)$ or each productive activity that affects the overall productivity of the sector's factors.

The productivity factor B will thus be affected by the distribution of the flow of public investment between human capital, research and development and physical investment, but also by the magnitude of the externalities from which the sector benefits and the elasticity of productivity to the various arguments:

$$B_j^{VA} = \overline{B}_{j,t}\left[\left(KH_{j,t}\right)^{\varepsilon_k}\left(RD_{j,t}\right)^{\varepsilon_r}\left(IP_{j,t}\right)^{\varepsilon_i}\left(\frac{KDpubG_t}{KDpriv_{j,t}}\right)^{\varepsilon_k}\right] \quad (5)$$

- ***Agents[1] : Government income and savings***

Government revenue (YG) is equal to the sum of total government revenue from taxes on production and imports (TPRCTS), total government revenue from other taxes on production (TPRODN), transfers received from other institutions (YGTR), including direct taxes collected from households (TDHT) and firms (TDFT), as well as the remuneration of capital (YGK):

$$YG_t = YGK_t + TDHT_t + TDFT_t + TPRODN_t + TPRCTS_t + YGTR_t \quad (6)$$

Total government revenue from taxes on production and imports is equal to the sum of indirect taxes (TICT) on domestic sales, export taxes (TIXT), import taxes (TIMT):

$$TPRCTS_t = TICT_t + TIMT_t + TIXT_t \quad (7)$$

Total indirect taxes (TICT) are equal to the sum of indirect taxes collected on domestic sales:

$$TICT_t = \sum_i TIC_{i,t} \quad (8)$$

Total import taxes (TIMT) are equal to the sum of import taxes collected on imported products:

$$TIMT_t = \sum_m TIM_{m,t} \quad (9)$$

Total export taxes (TIXT) are equal to the sum of export taxes collected on exported products:

$$TIXT_t = \sum_x TIX_{x,t} \quad (10)$$

Import taxes (TIM) are a linear function relating the tariff rate (ttim), the world price (PWM), the exchange rate (e) and the quantities imported (IM):

$$TIM_{i,t} = ttim_{i,t} PWM_{i,t} e_t IM_{i,t} \quad (11)$$

[1]At this level we present only a specification of the Government agent insofar as one of its main sources of income is at the centre of our analysis.

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Export taxes (TIX) are a linear function of the export tax rate (ttix), the world price (PE) and the quantities exported (EXD):

$$TIX_{i,t} = ttix_{i,t}\left(PE_{i,t} + \sum_{ij} PC_{ij,t} tmrg^{x}_{ij,t} \right) EXD \tag{12}$$

The government's savings are calculated as the difference between government revenues (YG), government expenditures (G) and transfers to other agents:

$$SG_t = YG_t - \sum_{agng} TR_{agng,govt,t} - G_t \tag{13}$$

- ***Interactions with the outside world***

To consider the constraints of Senegalese exporters on the external market, we introduce an export demand function into the model. This function has a finite elasticity and is a function of the ratio between the world price and the fob price. Indeed, local producers are obliged to reduce their export price to increase their market share abroad. Therefore, an increase in imports of one group of goods and services requires an increase in exports of other groups of goods and services in order to maintain a balanced current account. The exchange rate, the change in inventories is also fixed.

$$EXD_{i,t} = EXD_i^0 \, pop_t \left[\frac{e_t PWX_{i,t}}{PE_{i,t}^{FOB}} \right]^{\sigma_i^{XD}} \tag{14}$$

Producers maximize their profit, given the constraints of the domestic and foreign markets (CET function). They substitute local sales for foreign sales and vice versa, given the relative shares of their sales in the two markets, the domestic and foreign sales prices, and the transformation elasticity of the CET function.

$$EX_{j,i,t} = \left[\frac{1-\beta_{j,t}^{X}}{\beta_{j,t}^{X}} \frac{PE_{i,t}}{PL_{i,t}} \right]^{\sigma_{j,i}^{X}} DS_{j,i,t} \tag{15}$$

The domestic product supply of the importing industries is a combination of imports (IM) and production sold locally (DD), defined according to a constant elasticity of substitution (CES) function, commonly known as the "Armington function"; in which $B_i^M, \beta_i^M et \rho_i^M$ are, respectively, the scale parameter, the relative shares of imports, and the elasticity of substitution of the CES function.

$$Q_{i,t} = B_i^M \left[\beta_i^M IM_{i,t}^{-\rho_i^M} + \left(1-\beta_i^M\right) DD_{i,t}^{\rho_i^M} \right]^{\frac{-1}{\rho_i^M}} \tag{16}$$

The level of imports is derived from the cost minimization of the "Armington function". Domestic agents substitute imports for local sales, and vice versa,

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given the relative shares of imports, prices, and the elasticity of substitution of the Armington function.

$$IM_{i,t} = \left[\frac{\beta_i^M}{1-\beta_i^M} \frac{PD_{i,t}}{PM_{i,t}} \right]^{\sigma_i^M} DD_{i,t} \tag{17}$$

- ***Model Dynamics***

On the dynamic side, the economy is driven by capital accumulation and population growth. The increase of capital through investment is the main source of economic growth. Investment covers the depreciation of capital and contributes to its accumulation from one period to another.

The end-of-period sectoral private capital stock $\left(KD_{k,j,t+1}\right)$is equal to the beginning-of-period stock $\left(KD_{k,j,t}\right)$net of the consumption of fixed capital (or depreciation) of the period at a rate $\left(\delta_{k,j}\right)$plus the volume of capital accumulated during the period $\left(IND_{k,j,t}\right)$.

$$KD_{k,j,t+1} = KD_{k,j,t}\left(1-\delta_{k,j}\right) + IND_{k,j,t} \tag{18}$$

Public investment demand is the product of the average price of public capital and the sum of public sector investment demand.

$$IT_t^{PUB} = PK_t^{PUB} \sum_{k,pub} IND_{k,pub,t} \tag{19}$$

Private investment demand is the product of the average price of private capital and the sum of investment demand from the private sector.

$$IT_t^{PRIV} = PK_t^{PRIV} \sum_{k,bus} IND_{k,bus,t} \tag{20}$$

The average price of capital (private or public) is a weighted sum of consumer prices, the weight being the relative share of the demand for good or service i in the aggregate demand for investment (by origin):

$$PK_t^{PUB} = \frac{1}{A^{K-PUB}} \prod_i \left[\frac{PC_{i,t}}{\gamma_i^{INVPUB}} \right]^{\gamma_i^{INVPUB}} \tag{21}$$

$$PK_t^{PRIV} = \frac{1}{A^{K-PRIV}} \prod_i \left[\frac{PC_{i,t}}{\gamma_i^{INVPRIV}} \right]^{\gamma_i^{INVPRIV}} \tag{22}$$

The sectoral accumulation rate of private capital $\left(\frac{IND_{k,bus,t}}{KD_{k,bus,t}} \right)$in period t is an increasing function of the cost-benefit ratio of capital $\left(\frac{R}{U} \right)$in the same period, but the rate of increase of the accumulation rate, under the effect of this ratio, is decreasing.

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$$\frac{IND_{k,bus,t}}{KD_{k,bus,t}} = \varphi_{k,bus}\left[\frac{R_{k,bus,t}}{U_{k,bus,t}}\right]^{\sigma^{INV}_{k,bus}} \quad (23)$$

The user cost of capital in an industry is equal to the average price of capital (PK) multiplied by the sum of the interest rate (IR) and the depreciation rate $(\delta_{k,.})$:

$$U_{k,pub,t} = PK_t^{PUB}\left(\delta_{k,pub} + IR_t\right) \text{ and } U_{k,bus,t} = PK_t^{PRIV}\left(\delta_{k,bus} + IR_t\right) \quad (24)$$

- ***The parameters of the functional forms***

The specification of the production, household consumption and import and export demand functions requires parameters including income elasticity of product demand, Frisch parameter, elasticity of substitution between capital and labour, elasticity of substitution between imported and domestic products, elasticity of transformation between foreign and domestic sales, and elasticity of foreign demand.

In the absence of long series, these parameters have not been estimated on Senegalese data. They were borrowed from the CGE literature, and from empirical studies in other developing economies. All other parameters of the model were calibrated using SAM data, in order to ensure consistency with base year data.

- ***Balance and closure of the model***

The balancing procedure involves balancing several variables in the model.

The supply of the composite product (Q) is the sum of household final consumption (C), government expenditure, intermediate demand (DIT), private investment (INV), changes in inventories (STK) and margins (MRGN):

$$Q_{i,t} = \sum_h C_{i,h,t} + CG_{i,t} + INV_{i,t} + VSTK_{i,t} + DIT_{i,t} + MRGN_{i,t} \quad (25)$$

Labour supply equals labour demand

$$LS_{l,t} = \sum_j LD_{l,j,t} \quad (26)$$

The supply of and demand for capital also equalize:

$$KS_{k,t} = \sum_j KD_{k,j,t} \quad (27)$$

The sum of total investment and stocks by value is equal to the sum of household (HS), firm
(FS), government (GS), and rest of the world (ROW) savings, valued in local currency:

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$$IT_t = \sum_h SH_{h,t} + \sum_f SF_{f,t} + SG_t + SROW_t \quad (28)$$

$$IT_t^{PRIV} = IT_t - IT_t^{PUB} - \sum_i PC_{i,t} VSTK_{i,t} \quad (39)$$

The supply and demand of local products for the domestic market are equalized:

$$DD_{i,t} = \sum_j DS_{j,i,t} \quad (30)$$

The supply and demand for export products also equalize:

$$EXD_{i,t} = \sum_j EX_{j,i,t} \quad (31)$$

In the model's closure procedure, public spending is fixed. On the labour market, labour supply is assumed to be exogenous and capital demand is assumed to be fixed. Moreover, the current account balance is assumed to be fixed, which isolates the situation where an inflow of capital would allow the financing of domestic policies.

2.2. Accounting framework of the model: The Social Accounting Matrix (SAM)

The accounting framework of the model is provided by the social accounting matrix (SAM). The latter is constructed using data from the Input-Output Table the Balance of Resources-Employment Table by Commodity, and the Government Financial Transactions Table, the balance of payments and survey data for household information. We use the SAM constructed by the ANSD[2] for the year 2017.

The model thus specified with the SAM incorporates two types of capital factors (capital and land) and two types of labour factors (from the segmentation of the labour market into skilled and unskilled labour). The standard institutional units are maintained. However, for the specific needs of the study and insofar as farmers, more specifically cashew farmers, are more localized among rural households, the household institutional unit is disaggregated into urban and rural households. The model also integrates 8 branches and product accounts with a highlighting of the cashew nut branch and product resulting from the disaggregation of the agricultural branch and the agricultural product, this for the specific needs of the study.

[2] National Agency for Statistics and Demography (ANSD)

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3. Simulation and discussion of results

3.1. Simulation and justification

The aim of this simulation is to evaluate the medium- and long-term impact of a trade policy on the cashew nut sector in order to measure its sectoral effects and its impact on household and state income in Senegal. Thus, our simulation focuses on the introduction of a 10% tax on the country's raw cashew nut exports. This policy was inspired by the one applied by the government of Ivory Coast in February 2017 to benefit more from this activity in the country because, most of the production is exported in its raw state. Indeed, in Senegal it is estimated that between 75 to 95% of cashew production is exported in the raw state and the country's government would consider applying a similar policy. This policy is envisaged to promote job creation and increase government revenues. The reference situation concerns the cashew nut sector, which is a sub-sector of the agricultural sector where there is no taxation on exports.

3.2. Results and discussion

3.2.1. Impact on external trade

A ten percept (10%) tax on raw cashew exports would negatively affect Senegal's foreign trade. Indeed, during the period from 2017 to 2022, the country would record a continuous decline in raw cashew nut exports. Thus, Senegal, which does not have a monopoly on the world market for the product, would be less competitive due to the additional cost of applying such a tax. This trade policy would benefit Senegal's direct competitors such as Guinea Bissau, but also leading countries in West Africa such as Nigeria, Ivory Coast and Benin. Such a situation would increase the smuggling of the product which is a common practice between the southern part of Senegal (Kolda, Sédhiou and Ziguinchor) and Guinea Bissau. Indeed, despite drastic measures taken by the authorities of both countries to curb the illegal trade of cashew nuts at their common border, Senegalese producers in search of a better price for the product would be tempted to sell their production in the markets of neighboring countries, which would offer a better price. Senegal would then lose most of the added value of this activity, which would be a huge loss of income for the country.

The loss of income that Senegalese producers would suffer as a result of the introduction of this tax on cashew exports would lead them to switch to other cash crops such as groundnuts or cotton, which were once the country's main cash crops and are largely destined for export. On the other hand, local processors of the product should benefit from a drop in exports, as this would allow them to obtain better supplies of raw materials at good prices.

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Table 1: Change in exports (% compared to bau scenario)

	2017	2018	2019	2020	2021	2022
Agriculture	0.000	-6.111	-5.873	-5.653	-5.450	-5.261
Cashew	0.000	-6.230	-6.355	-6.457	-6.545	-6.622
Livestock	0.000	-6.165	-5.993	-5.835	-5.689	-5.554
Fishing	0.000	-7.639	-7.505	-7.377	-7.255	-7.138
Leather industries	0.000	-4.319	-4.272	-4.206	-4.122	-4.023
Other industries	0.000	-4.760	-4.754	-4.726	-4.679	-4.616
Market services	0.000	-6.425	-5.951	-5.513	-5.107	-4.732

Source: authors' simulation, September, 2021

3.2.2. Impact on the value added of the sectors of activity

The introduction of a 10% tax on raw cashew nut exports would have a negative impact on the value added of the cashew nut, fishing and industrial sectors. Indeed, the value added of the cashew sector would fall by about 6% per year during the period 2017 to 2022. On the other hand, the effects on the other sectors would be positive, particularly for the agriculture and livestock sectors. Thus, the value added of agriculture would increase by 0.68% in 2018, against approximately 1.40% in 2022, while that of livestock would increase by 0.65% in 2018, against 1.03% in 2022. The drop in the value added of the cashew sector would be a direct consequence of the decline in demand for cashew exports from Senegal due to the additional costs borne by importers as a result of the new export tax. This decline would lead to a drop in revenue for Senegalese producers. Such a situation would negatively affect the well-being of producers, as revenue from cashew plantations is the main source of income for many farming households in Senegal, particularly in the southern part of the country. Indeed, farmers have progressively abandoned groundnut and cotton crops, which were once the main cash crops in Senegal, in favour of cashew plantations, which require less physical effort and almost no inputs. Moreover, there is a strong fluctuation in the producer price due to the presence of several intermediaries between producers and importers, so producers do not fully benefit from the fruits of their activity.

Table 2: Change in value added (in % compared to the bau scenario)

	2017	2018	2019	2020	2021	2022
Agriculture	0.000	0.680	0.875	1.059	1.232	1.396
Cashew	0.000	-6.068	-6.181	-6.281	-6.367	-6.367
Livestock	0.000	0.647	0.745	0.841	0.936	1,029
Fishing	0.000	-3.278	-3.155	-3.032	-2.911	-2.792
Leather industries	0.000	-0.161	-0.087	0.006	0.115	0.239
Other industries	0.000	-0.391	-0.370	-0.327	-0.264	-0.016
Market services	0.000	-0.016	0.359	0.708	1.034	1.338
Non-market services	0.000	0.501	0.510	0.517	0.524	0.530

Source: authors' simulation, September, 2021

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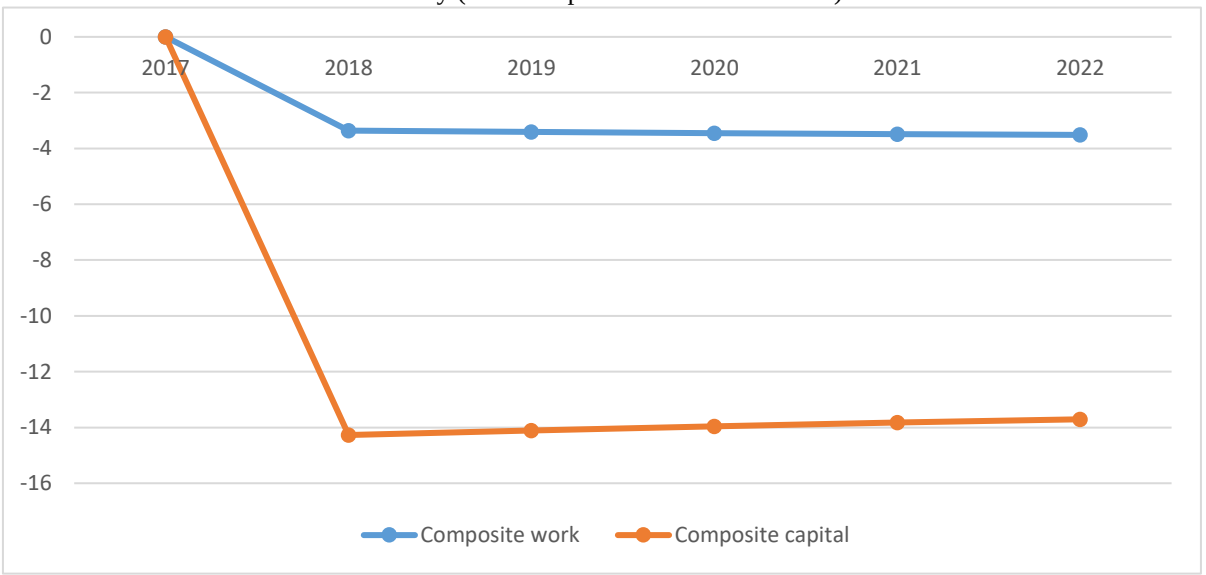
3.2.3. Impact on the remuneration of factors of production

A decrease in the value added of the cashew sector would have negative effects on the demand for production factors. Indeed, there would be an oversupply of labour and a surplus of capital in relation to the needs in this activity. This would lead to a decline in the remuneration of labour and capital factors during the period 2017 to 2022. Faced with such a situation, many farmers will be tempted to migrate to large urban centres in search of paid jobs, which would accentuate the phenomenon of rural exodus in the country, particularly in Dakar, which according to estimates concentrates more than 80% of Senegal's economic activities. Thus, there would be an increase in the overpopulation of Dakar, which covers less than 5% of the national territory but concentrates about a quarter of the Senegalese population.

Moreover, the sector is also very much affected by climate change phenomena. Indeed, the value added in the sector depends on the yield which is linked to climate change. In other words, good rainfall generally leads to a better yield, i.e., an improvement in the sector's added value, whereas poor rainfall often results in a drop in yield.

Graph 1: Variation in the rate of remuneration of factors of production in the cashew nut industry (in % compared to the bau scenario)



Source: authors' simulation, September, 2021

3.2..4. Impact on household and government revenues

A 10% tax on raw cashew exports would have differential impacts on agents' income. Indeed, the government would benefit from this policy, since its income and savings would increase over the period 2017 to 2022. On the other hand, households would be negatively affected by this trade policy, since the incomes of rural households (Mrurals) and urban households (Murbans)

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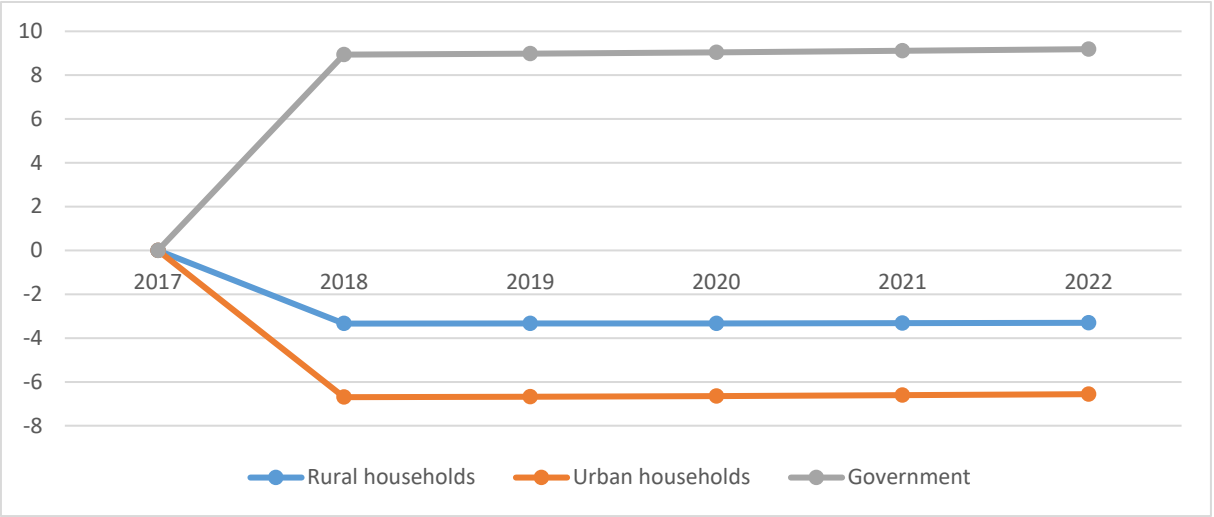
would fall during the period. These results corroborate the work of Liefert and Westcott (2016), Bouet and Debucquet (2010) and Josling et al. (2009) who found that the export tax increases government revenue but decreases the income of local producers. The decline in household income would be a direct consequence of the decline in the remuneration of the factors of labour and capital and therefore of value added. This situation would constitute a danger for the food security of rural households in Senegal, particularly those in the southern zone who derive a large part of their income from the sale of cashew nuts. Indeed, there is a strong tendency to abandon other crops such as groundnuts and cereals in favour of cashew plantations since the advent of Indian importers who offer a relatively high price per kg of cashew nuts.

Graph 2: Change in agents' disposable income (in % compared to the bau scenario)



Source: authors' simulation, September, 2021

3.2.5. Impact on household savings and consumption budgets

The drop in household income would result in a decline in their consumption budget but also in their savings (graph 3). This situation would negatively affect the well-being of households.

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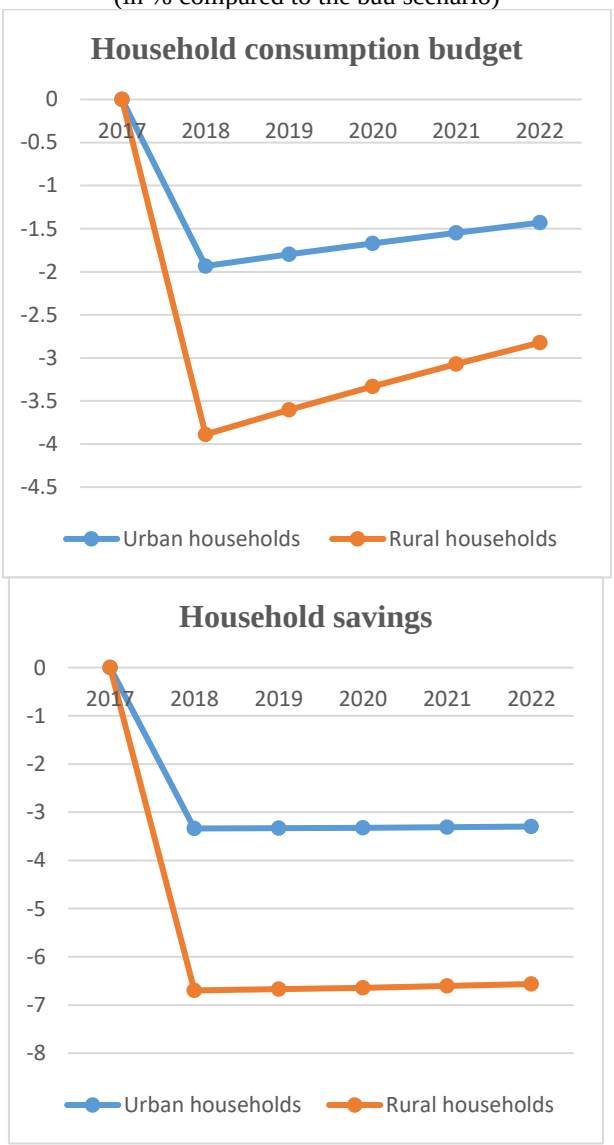
Graph 3: Change in real household consumption budget (in % compared to the bau scenario)



Source: authors' simulation, September, 2021

3.2.6. Impact on economic growth

Agriculture is the driving force of the primary sector in Senegal and is an important source of income for the country's rural households. It occupies a privileged place in the PSE, which is a reference framework for public policies over the 2014-2035 period. According to the ANSD (2020), the agricultural sector contributes 62.8% of the value added of the primary sector and 9.4% of national GDP. The application of a 10% tax on raw cashew nut

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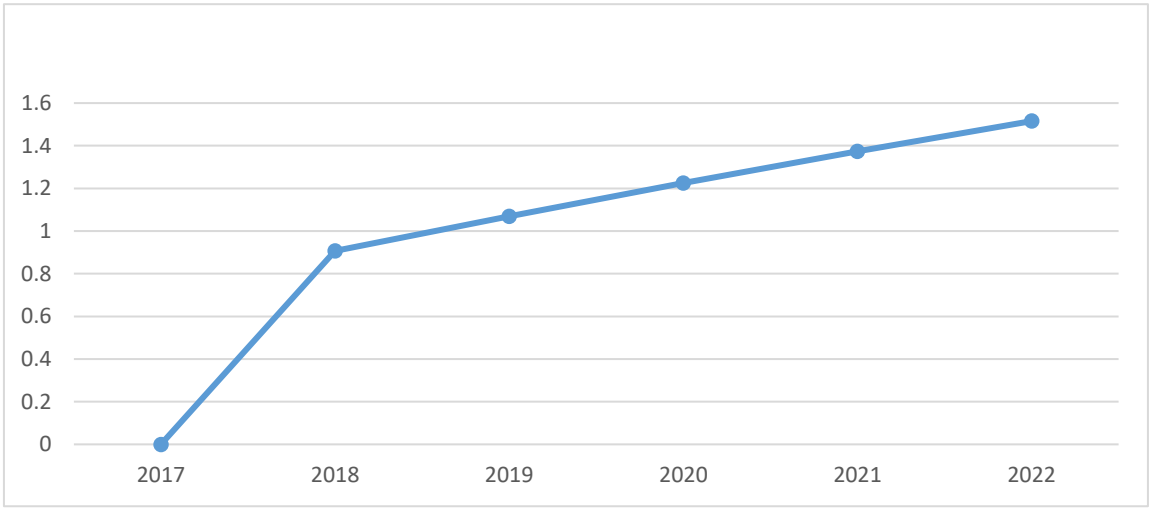
exports would have a positive impact on Senegal's real GDP over the period 2017 to 2022. In other words, the decline in cashew sector value added following the application of a trade policy on the sector would not affect the country's wealth creation. Thus, the increase in value added in the other sectors following the reallocation of resources to them would result in an increase in real GDP during the period 2017 to 2022 as shown in the graph below.

Graph 4: Change in real GDP at market prices (% relative to the bau scenario)



Source: authors' simulation, September, 2021

Conclusion

The objective of this paper is to evaluate the medium- and long-term sectoral impacts of a trade policy on the cashew sector in Senegal. We simulated the impact of a 10% tax on raw cashew nut exports on the various sectors of activity and on household and state income. For the choice of 10%, we were inspired by the policy applied by the Ivory Coast government in 2017 to benefit more from this activity because most of the country's production is exported in its raw state. Senegal is in the same situation as Ivory Coast, since it is estimated that between 75 and 95% of the country's cashew production is exported in the raw state and the country's government would consider applying a similar policy. For the simulation, we used the dynamic computable general equilibrium model which was based on the dynamic PEP model (PEP-1-t) developed by Decaluwé et al. (2010). The accounting framework of the model is the 2017 Senegal Social Accounting Matrix (SAM), from which we disaggregated the agricultural branch to isolate the cashew sector.

The results of the simulation show that a policy of taxing raw cashew nut exports from Senegal at a rate of 10% would have a negative impact in the medium and long term on the value added of the cashew nut sector, as it would decrease over the period 2017 to 2022. This decline would be explained by a

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drop in export demand for the product, which is linked to the sector's loss of competitiveness. On the other hand, this policy would benefit the other sectors, particularly the agricultural sector for which the value added would increase during the period. This policy would also negatively affect the income and savings of urban and rural households. However, the government would benefit from the measure since its income would increase over the period.

These different results found confirm the controversies on the relevance of a taxation policy on raw products in developing countries. Indeed, taxes on primary products can promote industrialization and job creation. Industrial development, in turn, is conducive to economic growth, which helps to eradicate poverty. But the absence of an enabling environment for industrial development is detrimental to economic growth and increases dependence on export earnings.

Policy recommendations

Several policy lessons can be drawn from this study.

i. The first lesson is that the government should apply this tax on raw cashew exports, since it would benefit from it through increased income.
ii. The government will then have to use the revenues generated to expand its policy of subsidies to producers to compensate for the losses suffered by the latter.
iii. Most of Senegal's raw cashew production is exported in its raw state, and the country loses a large part of the added value of this activity. There is a need to create more processing units so that the country can better benefit from this activity.
iv. Also, the government should apply a minimum price policy for the cashew trade, as it often does for groundnuts, which would increase the income of local producers.
v. In addition, in the cashew trade, intermediaries between producers and lessors benefit from a large part of the income derived from the activity. Thus, the government needs to reduce the number of intermediaries so that producers can better benefit from their activity.

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Energy Market Investment Methodologies

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Abstract

As more and more renewable energy market investment opportunities come to the fore, investors intend to optimize their assets through risk-return diversification. In the light of Markowitz's modern portfolio theory aimed at recognizing the potential for higher returns and lower risks, the identification of different energy market segments has become essential. In this regard, through the research of the conventional and alternative/ renewable energy market segments, as well as various international statistical models, the optimal methodology was identified. The optimal methodology allows the aggregation of different energy and alternative/ renewable energy ETFs into international investment portfolios using a variable weighing of assets and is expected to result in an adequate outcome.

Keywords: Energy Market, Investment, ETF, Alternative/ Renewable

Introduction

In the light of the international energy trends and climate policy measures, a new emerging paradigm started to exert its effect on the economy. The so-called sustainability idea ringed over all areas of the economy. Due to the actions aimed at the reduction of CO_2 emissions, acceleration of renewable energy deployment and energy efficiency, new capital market investing opportunities appeared in recent years (Reboredo et al., 2017; Rezec & Scholtens, 2017; Sadorsky, 2012; Silva & Cortez, 2016). As a result of the paradigm shift in widespread financial trends, green financing or the so-called socially responsible investment (SRI) took over the place of traditional investments and subsequently affected investments in the electricity, gas, oil,

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and alternative energy sectors. The declining popularity of fossil energy use and the global aim to reduce CO_2 emissions have led to the use of innovative technologies in both developed and emerging countries for the exploration and development of conventional energy oil and gas reserves, oil refining, and gas drilling. On the other hand, the new trends have brought a shift towards the introduction of sustainable energy initiatives, which have resulted in significant advances in alternative energy production, storage, and efficiency development. Due to technological advancements, more feasible alternative power generations methods have been developed. The global sustainability objectives led to greater incentives for renewables, and the alternative/ renewable energy sector became an attractive investment branch in the capital markets.

Through the dynamic evolution of the international energy trends and climate policy measures, the alternative/ renewable energy sector underwent a fast growth over the last decades and is expected to continue this accelerated pace. Respectively, the expanded global investment market with the new green energy opportunities has now become a priority research field. Besides the conventional energy commodities and financial instruments, alternative and renewable energy-related stocks, futures, options, and exchange-traded funds (hereinafter mentioned as ETFs) have aroused more and more individual and institutional investors' interest due to their risk-return diversification potential. In recent years, several studies based on modern portfolio theory demonstrated the raison d'être of diversification. The modern portfolio theory approved the benefits of diversification through a wide range of investment opportunities, illustrating the potential for higher returns and lower risks (Markowitz, 1952). Through their investments, international investors can participate directly in the economic development of other countries, offset exchange rate risk in their investments, reap the benefits of diversification, and take advantage of opportunities offered by global market segmentation. Despite the many proven benefits of portfolio diversification, the risks and conditions of international portfolio investments arose. International capital investments proved to be risky, not only because of their exposure to exchange rate and political risk but also because of many institutional exposures and obstacles, as well as tax issues. To overcome these barriers of various natures, several international statistical models have been introduced, allowing market segmentation to be exploited.

Objectives

The main objective of this paper is to explore the methodology used to present the investment opportunities offered by the conventional and alternative/ renewable energy market segments. The conventional energy sector encompasses gas and oil, while the alternative energy sector

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encompasses wind, solar, geothermal, biomass, biofuels, hydro, wave, and tidal energies on their portfolios.

Furthermore, there was an introduction to the alternative/ renewable energy market segment into the concept of investment portfolio diversification, which in contrary to the conventional energy market segment, is unknown to the wider public.

To identify the differences between the two energy market segments, conventional and alternative/ renewable ETFs will be used as investing instruments. The reason ETFs was chosen is because ETFs are passive investment tools just like equities with the difference that ETFs can reflect more of the performance of an entire sector or a market benchmark. There are thousands of index-tracking and capital market sector ETFs that broaden the concept of investment diversification by adapting to asset allocation needs. Consequently, instead of using stock market index investments which are sometimes unavailable to some, as used in previous studies, research can be expected to have broader implications by using ETFs that are predictable for all individual and institutional investors.

In parallel with the above objectives, this study plan to later incorporate the conclusions of this paper into a larger energy market research of a wide range of investment opportunities in light of the theoretical and practical application of modern portfolio theory. After presenting the concepts on a theoretical level, this study further intend to explore the investment potential of conventional and alternative/ renewable energy markets, influenced by higher returns and lower risks, using Markowitz's modern portfolio theory.

Exchange Traded Funds (ETFs)

From the analysis of the previous empirical literature aimed at exploring the optimal methodology to present the investment opportunities of the conventional and alternative/ renewable energy market segments, this paper focuses on examining different multivariate volatility and linear regression models. To make the models result in comprehensive outcomes in terms of finding the optimal energy market investment opportunity, ten energy ETFs (five conventional and five alternative/ renewable energy ETFs) was applied as financial market instruments.

ETFs were chosen as financial market instruments due to several reasons. First of all, ETFs are the latest innovative indirect global investment vehicles in the capital market that proved to be beneficial investment concepts in terms of risk diversification, liquidity, and rational cost-sharing. Various ETFs provide good chances for risk-return optimization through the potentially lower risk they offer. On the other hand, ETFs are open-ended investment funds with a diversified equity portfolio, which are subject to stock

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exchange trading regulation. The investment value of ETFs, similarly to that of mutual funds, is based on equity holdings, given the difference that the latter are priced once a day, while the former are priced several times during the day. ETFs, in contrast to mutual funds, generally charge lower fees and offer more liquidity, transparency, and tax efficiency. ETFs follow a benchmark index and allow trading at a price set by the market. The value of an ETF, similarly to that of other financial instruments, is determined by supply and demand. Concerning conventional energy ETFs, it should be noted that global energy supply and demand greatly affect the performance of the sector and are not static. Oil and gas producers generally perform better when oil and gas prices are high and, consequently, their performance declines when the value of the product also declines. When crude oil prices fall, oil refineries benefit from declining raw material costs for the production of petroleum products such as gasoline. This attribution thus makes the traditional energy sector more sensitive to policies that often cause changes in oil prices.

ETFs and equities present a similar picture in terms of stock exchange trading and therefore contribute greatly to the real-time exploitation of diverse investment market developments. For specific energy and alternative/ renewable energy ETFs, corporate activity is divided into a wide range of types, regions, and risk profiles. For ETFs, both conservative and aggressive investment strategies are possible. ETFs, unlike mutual funds, allow the use of short-selling and margin trading strategies. However, the review of the ETF‘s composition is highly recommended especially in the case of volatile markets such as energy. Any special sector-based ETF, such as energy, can add volatility to a portfolio. It is worth being careful as many alternative/ renewable energy companies in the industry are still considered risky investments in their category.

Literature Review

A typical periodic portfolio selection problem was originally formulated during a non-linear double-criteria system optimization process, taking into account maximizing expected return and minimizing risk (Markowitz, 1952).

The Capital Asset Pricing Model (hereinafter mentioned as CAPM) was developed as a follow-up to Markowitz’s portfolio model based on the largest capital markets. The purpose of the CAPM is to analyze the pricing of financial instruments available on the international capital markets. In the case of integrated capital markets, optimal diversification is obtained through the creation of an international portfolio of financial instruments in which all the risks associated with the assets are taken into account. Consequently, the rethought model is the International Capital Asset Pricing Model (hereinafter

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mentioned as ICAPM), and is formulated by Bartram and Dufey (2001) as follows:

$$E[R_i] = R_F + \beta^w{}_i RP^w + \sum_{K=1}^{K} \gamma_{ik} RP_k \quad (1)$$

In ICAPM, RP^w and RP_k are the risk premiums of the international portfolio and exchange rate, while R_F is the risk-free rate. The model is based on the assumption that national risk and return influence the investment decision. In an international context, not only the risk associated with the portfolio's assets but also the exchange rate risk must be taken into account when creating the investment portfolio.

However, in the case of ICAPM, the mean-variance efficiency of all assets cannot be determined automatically. Deviations from PPPs pose a real exchange rate risk, so a common risk-free rate does not exist in reality. In the case of national capital markets, value-weighted portfolios are often used as benchmarks, but the use of value-weighting in an international context is a more complex issue. Appropriate weighting of volatility clusters and returns, over time, is closely related to the concepts of asset allocation and active portfolio management (Brinson et al., 1991). Asset allocation and active portfolio management require restoring the balance of the existing portfolio in order to continuously improve the performance of the managed portfolio while adapting to specific market conditions. International capital markets are segmented, investors have different risk preferences, and expected risk and return change over time. So it is a question of which international benchmark should be applied as the international portfolio is created based on the individual market capitalization, thus its mean-variance is inefficient (Solnik & Noetzlin, 1982).

Multiple complex investment models were developed to adapt more to the international environment. Theoreticians have created approaches based on the assumption that the homogeneity of investor preferences does not necessarily prevail internationally. In addition, they expanded categories of financial assets used in the models. As a result, the role of the risk premium and investor wealth in asset pricing strengthened in the segmented capital markets.

While the equity's constant value parameters, such as the expected returns and variance, determined the traditional CAPM, more and more evidence pointed out that these factors are time-dependent. Therefore, in order to measure the temporary changes, the expected return, and the variance, they introduced the so-called conditional models. In the case of the Autoregressive Conditional Heteroskedasticity Model (hereinafter mentioned as ARCH model), the variation of financial returns was demonstrated to be not constant

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over time, but autocorrelated or conditional to/ dependent on each other. In other words, the ARCH process explicitly recognized the difference between the unconditional and the conditional variance allowing the latter to change over time as a function of past errors. Stock returns are typical examples of autocorrelated financial returns, where periods of return volatility tend to be clustered together. In the ARCH, the weighted mean square of the estimated margin of error became the conditional variance. To model a time series using an ARCH process, let ε_t denote the error terms (return residuals, with respect to a mean process), i.e., the series terms. These ε_t are split into a stochastic piece z_t and a time-dependent standard deviation σ_t characterizing the typical size of the terms so that

(2) $$\varepsilon_t = \sigma_t z_t$$

The random variable z_t is a strong white noise process. The series σ^2_t modeled by

(3) $$\sigma^2_t = \alpha_0 + \alpha_1 \varepsilon^2_{t-1} + \ldots + \alpha_q \varepsilon^2_{t-q} = \alpha_0 + \sum_{i=1}^{q} \alpha_i \varepsilon^2_{t-i},$$

where $\alpha_0 > 0$ and $\alpha_i \geq 0, i > 0.$

An ARCH(q) model can be estimated using ordinary least squares. A methodology to test for the lag length of ARCH errors using the Lagrange multiplier test was proposed. During the process, the best fitting autoregressive model $AR(q)y_t$ is estimated as follows:

(4) $$AR(q)y_t = \alpha_0 + \alpha_1 y_{t-1} + \ldots + \alpha_q y_{t-q} + \varepsilon_t = \alpha_0 + \sum_{i=1}^{q} \alpha_i y_{t-i} + \varepsilon_t$$

The squares of the error $\hat{\varepsilon}^2$ are obtained and regressed on a constant and q lagged values as follows:

(5) $$\hat{\varepsilon}^2_t = \hat{\alpha}_0 + \sum_{i=1}^{q} \hat{\alpha}_i \hat{\varepsilon}^2_{t-i}$$

where q is the length of ARCH lags.

The null hypothesis, in the absence of ARCH components, is given as $\alpha_i = 0$ for all $i = 1, \ldots, q$. The alternative hypothesis is that, in the presence of ARCH components, at least one of the estimated α_i coefficients must be significant. In a sample of T residuals under the null hypothesis of no ARCH errors, the

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test statistic $T'R^2$ follows X^2 distribution with q degrees of freedom, where T' is the number of equations in the model which fits the residuals vs the lags (i.e. $T'=T-q$). If $T'R^2$ is greater than the Chi-square table value, the null hypothesis is *rejected* and it is concluded that there is an ARCH effect in the autoregressive-moving-average or the so-called ARMA model. If $T'R^2$ is smaller than the Chi-square table value, the null hypothesis is not rejected.

If an Autoregressive Moving Average model (ARMA) is assumed for the error variance, the model is a Generalized Autoregressive Conditional Heteroskedasticity (hereinafter: GARCH) model. In that case, the GARCH *(p, q)* model (where p is the order of the GARCH terms σ^2 and q is the order of the ARCH terms ε^2*)*, following the notation of the original paper, is given by:

(6) $$y_t = x'_t b + \varepsilon_t$$
$$\varepsilon_t | \Psi_{t-1} \sim N(0, \sigma^2_t)$$

(7) $$\sigma^2_t = w + \alpha_1 \varepsilon^2_{t-1} + \ldots + \alpha_q \varepsilon^2_{t-q} + \beta_1 \sigma^2_{t-1} + \ldots + \beta_p \sigma^2_{t-p} = w + \sum_{i=1}^{p} \alpha_i \varepsilon^2_{t-i} + \sum_{i=1}^{q} \beta_i \sigma^2_{t-i}$$

Generally, when testing for heteroskedasticity in econometric models, the best test is the White test. However, when dealing with time series data, this means to test for ARCH and GARCH errors. Exponentially Weighted Moving Average (EWMA) is an alternative model in a separate class of exponential smoothing models. As an alternative to GARCH modelling, it has some attractive properties such as a greater weight upon more recent observations, and also drawbacks such as an arbitrary decay factor that introduces subjectivity into the estimation.

The original GARCH model is formulated as shown below:

(8) *Conditional mean:* $$y_t = E(y_t | \Omega_{t-1}) + \varepsilon_t$$

(9) *Conditional variance:* $$h_t = \alpha_0 + \sum_{i=1}^{q} \alpha_i \varepsilon^2_{t-i} + \sum_{j=1}^{p} \beta_j h_{t-j}$$

where $\varepsilon_t = \sqrt{h_t} v_t$ is the residuals; v_t is the innovation; $v_t \sim I.I.D.$,which follows $E(v_t) = 0$, $E(v^2_t) = 1$. $E(y_t | \Omega_{t-1})$ is the expectation taking into account the information set, Ω_{t-1}, dated *t-1* and earlier. Non-negative integers, p and q, are the order of the variance equation, and $\alpha_0 > 0$, $\alpha_i \geq 0$, $(i = 1, 2, \cdots q)$; $\beta_j \geq 0$, $(j = 1, 2 \cdots p)$, respectively.

Since the introduction of the extension of the ARCH, or the generalized ARCH, also known as GARCH model, developed by Bollersev in 1986, that incorporates a moving average component together with the

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autoregressive component, many variations of GARCH have emerged. An example is the Nonlinear GARCH (NGARCH), which addresses correlation and observes the volatility clustering of returns, or the Integrated GARCH (IGARCH), which restricts the volatility parameter. The introduction of a moving average component allows the methodology to both model the conditional change in variance over time as well as changes in the time-dependent variance. Examples include conditional increases and decreases in variance. All GARCH model variations seek to incorporate the direction of returns (positive or negative) in addition to the magnitude (addressed in the original model). Each derivation of GARCH can be used to accommodate the specific qualities of the stock, industry, or economic data. In assessing risk, financial institutions incorporate GARCH models into their Value-at-Risk (VAR), maximum expected loss (whether for a single investment or trading position, portfolio, or at a division or firm-wide level) over a specified time period projections. GARCH models are viewed to provide better gauges of risk than can be obtained through tracking standard deviation alone.

In the case of the GARCH model, the conditional variance depends on the past error limit and the conditional variances. In the case of the GARCH model, the so-called structure-volatility estimates converge to the average volatility over the long run, and GARCH parameters can be optimally determined, so GARCH covariance matrices represent time-varying volatilities, and multivariate return distributions without bias (Xinodas et al., 2018).

Based on the available empirical literature, two methods of energy market analysis stand out. Using different multivariate volatility models, several authors have examined the optimal margin allocation and portfolio weighting options for two selected asset prices, such as crude oil spot and futures asset prices or oil and clean energy company share price (Sadorsky, 2012). Other authors examined the intermittent co-movement of the oil and renewable energy markets with continuous wavelet analysis and nonlinear Granger casuality. The analysis revealed that non-linear causality moves from clean energy indices to oil prices. On the other hand, other literature examined spill-over processes and interactions between energy and other markets and explored new dynamic correlations and margin-sharing opportunities to identify volatility correlations that fundamentally determine portfolio management (Henriques & Sadorsky, 2008).

Malinda and Jo-Hui (2016) proved that asset price returns are characterized by long-term memory and asymmetry in both conventional and alternative/ renewable ETFs, while there is a strong relationship between financial performance and other exogenous factors in renewable energy stocks.

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Several authors explored renewable energy performance using other linear regression models (Silva & Cortez, 2016). Others developed their linear regression models underpinning the methodology of alternative energy research based on risk factors (Fama & French, 1993). Each of the listed studies leads to the conclusion that the performance of renewable energies is significantly lower than the benchmark. Therefore the range of alternative and renewable energy investment opportunities is not very attractive. However, in contrast to the studies listed above, few authors proved that the potential for alternative energy ETF investments in renewable energy is real (Miralles-Marcelo et al., 2018). It was demonstrated that the VAR-ADCC-GARCH approach allows the analysis of the non-sample performance of different portfolio strategies by using estimated returns and volatilities. The VAR-ADCC-GARCH approach thus proved to offer real diversification opportunities that lead to higher returns.

The aim of the research is to create and analyze alternative investment strategies using out-of-sample estimated returns, volatilities, and covariances. Thus, the multivariate GARCH model proved to be feasible. Using the Asymmetric Dynamic Conditional Correlation (ADCC) model, Cappiello et al. (2006), Gupta ls Donleavy (2009), Kalotychou et al. (2014), Zhou and Nicholson (2015), Yuan et al. (2016), and Badshah (2018) demonstrated that the covariance asymmetry of the ADCC model contributes greatly to the economic value of the model through rapid, positive reversal of the correlation between conditional volatility, and financial returns after negative return-generation.

In order to improve the available literature, this paper uses the predictions of multivariate GARCH models such as DCC-GARCH models to study time-varying correlations and dynamic spill-over effects. This study aims to create an optimal portfolio by which it can easily compare the alternative and conventional energy sector performance rates. Consequently, in order to obtain well-grounded, practical predictions of returns, volatility and correlations based on the VAR-ADCC methodology, this paper decided to research alternative energy sector investment opportunities. In this analysis, four different investment strategies was constructed and applied through minimum and mean-variance optimization. The main objective was to compare the performance of five conventional energy and five alternative/ renewable energy ETFs.

The VAR-ADCC Approach

This paper aims to explore the methodology to present the investment opportunities of conventional on one hand and alternative/ renewable energy market segments on the other. Furthermore, the objective is to analyze the

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alternative investment strategies using out-of-sample forecasted returns, volatilities, and covariances obtained from a multivariate GARCH approach. Due to the above presented empirical literature, the Asymmetric Dynamic Conditional Correlation GARCH model (hereinafter mentioned as ADCC GARCH model) was selected. The ADCC GARCH model demonstrates the covariance asymmetry of such investment opportunities the best due to the fact that conditional volatility, and the correlation of financial returns, tend to rise more after negative return shocks than after positive ones of the same size. The Garch models have been proven reliable during different market conditions, especially during the periods leading up to and after the 2007 financial crisis.

The VAR Asymmetric Dynamic Conditional Correlation model (hereinafter mentioned as VAR-ADCC GARCH model) estimation is performed using a two-step approach. Firstly, a VAR-GARCH model for each time series is estimated. Specifying the correct mean equation in the model is crucial because its misspecification may lead to an incorrect estimation of the variance equation. Thus, the return generating process is conceptualized as:

(10) $$r_{i,t} = c_i + \sum_{\substack{i=1 \\ j=1}}^{5} \alpha_{ij}\, r_{i,t-1} + \varepsilon_{i,t}$$

$$\varepsilon_{i,t} | \Omega_{t-1} \approx N(0, H_t)$$

where $r_{i,t}$ are the daily returns for the ETFs, ci and αij are the parameters to be estimated, and $\varepsilon_{i,t}$ is a 5 × 1 vector of error terms which is assumed to be conditionally normal with zero mean and conditional variance matrix H_t. It is important that from each model, the conditional variances h_{it}, and the standardized residuals $\delta_{i,t} = \varepsilon_{i,t} / \sqrt{h_{i,t}}$, are generated separately. More precisely, the conditional covariance matrix is specified as:

(11) $$H_t = D_t R_t D_t$$

where $D_t = diag(\sqrt{h_{it}})$, is a diagonal matrix which contains the time-varying conditional volatilities of the previous GARCH models and R_t is a time-varying 3 × 3 correlation matrix with diagonal elements equal to 1 which is specified as:

(12) $$R_t = (Q_t^*)^{-1} Q_t (Q_t^*)^{-1}$$

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where $Q_t = \{q_{ij,t}\}$ is a covariance matrix of the standardized residuals denoted as:

(13) $$Q_t = (1-\alpha-\beta) - \gamma + \alpha(\delta_{t-1}\delta'_{t-1}) + \gamma\eta_{t-1}\eta'_{t-1} + \beta Q_{t-1}$$

$= E[\delta_t\delta'_t]$ is the unconditional correlation matrix of the standardized residuals; $Q_t^* = diag(\sqrt{q_{ij,t}})$ is a diagonal matrix containing the square root of the diagonal elements of the n × n positive matrix Q; $\eta_t = I[\delta_t < 0] \odot \delta_t$ ($I[\cdot]$ is a 3 × 1 indicator function which takes on value 1 if the argument is true and 0 otherwise while $\odot$ is the Hadamard product and $= [\eta_t\eta'_t]$. Positive definiteness of Q_t is ensured by imposing $\alpha + \beta + \lambda\gamma < 1$, where λ ¼ maximum eigenvalue $\lambda = [\ ^{-1/}\ ^{2-1/2}]$.

Investment Strategies

With the help of the forecasted returns, volatilities and correlations from the previous model, four investment strategies was constructed based on two classical portfolio optimization problems. The so-called minimum-variance portfolio is the first optimization problem to be solved, which is given by the following equation:

(14) $$\min_{w_t} \quad w'_t H_{t+1|t} w_t$$

where $w'_t H_{t+1|t} w_t$ is the portfolio risk equation to be minimized. Following this strategy, the investor is exclusively interested in minimizing volatility. However, it should be noted that this is not true in real life because investors are usually interested in obtaining profits from their investments. Meanwhile, the second optimization problem is the classic mean-variance strategy. The goal of this optimization problem is also to minimize the portfolio risk but it adds a target portfolio return constraint. Therefore, the optimization problem is given by:

(15) $$\min_{w_t} \quad w'_t H_{t+1|t} w_t$$

$$s.t. \quad w'_t E\{R_{t+1}\} \geq R^*$$

where R^* denotes the desired target return performance. This study uses the equally weighted portfolio, also known as the naïve portfolio, as the benchmark for R^*. Portfolios can be created with or without short-selling constraints. Initially, the optimization problem will be solved by excluding short-selling. Therefore, the general constraints $w'_t 1 = 1$ $w_i \geq 0$ $i = 1, 2, \cdots, N$

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are included. However, the evidence on the effect of short-selling constraints is mixed as pointed out by Grullon et al. (2015). Previous studies investigate the strategies of international portfolio management with or without short-selling constraints (Diether et al., 2009; Beber & Pagano, 2013; Omar et al., 2017), but the effects remain unclear. At this point, the findings of Bohl et al. (2016) should be considered as well. These authors found econometric evidence that the financial crisis was accompanied by an increase in volatility persistence and that this effect is particularly pronounced for those stocks that were subject to short-selling constraints. For that reason, it is also stated that the regulators should avoid imposing short-selling restrictions. The optimization problems not excluding the short-selling constraints should also be solved. In that case, only the constraints $w'_t 1 = 1 \; i = 1, 2, \ldots, N$ were included.

In both cases w_i is the weight of each asset from the portfolio vector, $w_t = [w_1, w_2, \ldots, w_N]$, and 1 is a vector of ones.

Finally, the performance of the optimization frameworks over the out of sample period $t = \tau + 1, \ldots, T$ can be evaluated in terms of the Sharpe ratio SR_p which is defined as the average out-of-sample returns divided by their sample standard deviation:

(16) $$SR_p = / \sigma_p$$

Database

The data used in this paper will be daily returns from January 1st 2010 through January 1st 2020 (by applying the usable observations) of ten ETFs, five Energy ETFs, and five Alternative Energy ETFs. A period of prosperity and development was chosen right after the economic crisis of 2007–2008 and just before the outbreak of the coronavirus pandemic that turned out to be only the origo point of an economically less stable period.

Furthermore, daily returns were used for a variable of reasons. For the VAR-ADCC GARCH methodology to work, the time series that is the best autocorrelated and predictable was found. Several studies that provided a wide range of results on the autocorrelation of stock returns were analyzed. First, Campbell et al. (1997) proved that significant positive autocorrelation exist for daily, weekly, and monthly stock index returns calculated from the CRSP database, but with the autocorrelation slightly stronger for daily data. Lo and MacKinlay (1990) further connected the positive autocorrelation in daily stock returns to nonsynchronous trading. However, Lewellen (2002) demonstrated momentum and autocorrelation of stock returns with monthly data from CRSP and reported negative autocorrelation, although the correlation was generally

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weak. On the other hand, daily stock market returns in stock markets turned out to be autocorrelated and not equal. Louhelainen (2005) tested the predictability of daily returns from the previous weekday's returns with the Periodic Autoregressive (PAR) model and proved that at least some weekday returns are periodically predicted. Consequently, daily returns in the model were used as the best autocorrelated and predictable time series.

The five Energy ETFs are Energy Select Sector SPDR (XLE), Vanguard Energy ETF (VDE), SPDR S&P Oil & Gas Exploration & Production ETF (XOP), iShares Global Energy ETF (IXC), VanEck Vectors Oil Services ETF (OIH). The five Alternative/ Renewable Energy ETFs are iShares Global Clean Energy ETF (ICLN), Invesco Solar ETF (TAN), First Trust NASDAQ Clean Edge Green Energy Index Fund (QCLN), First Trust Nasdaq Clean Edge Smart GRID Infrastructure Index (GRID), and Invesco MSCI Sustainable Future ETF (ERTH).

The five energy ETFs (XLE, VDE, XOP, IXC, OIH) mostly track U.S. companies that extract and process oil and gas and provide other conventional energy-related services. The five alternative energy ETFs (ICLN, TAN, QCLN, GRID, ERTH) bring together alternative energy companies with diverse portfolios interested in clean technologies, solar, wind and geothermal energy, biofuels, and energy-efficiency related services offer. In terms of asset value, all of these ETFs are the largest in assets in their market segment categories.

Conclusion

As the global green energy market investment opportunities became priority research fields, alternative and renewable energy-related stocks, options, and ETFs created risk-return diversification challenges. In recent years, various international statistical models emerged, and some studies based on modern portfolio theory have demonstrated the benefits of diversification through a wide range of investment opportunities by illustrating the potential for higher returns and lower risks.

The objective of this paper was to explore the methodology to present the investment opportunities of the conventional and alternative/ renewable energy market segments. Through the evolution of the investment models, the concepts of portfolio selection and optimal investment strategy was presented. The ICAPM, which aims to analyze the pricing of international financial instruments, taught us that optimal diversification is possible by creating an international portfolio of financial instruments on a global scale, taking into account the risk of all the assets that make up the portfolio. However, especially in an international environment, the model takes into account the assumption that risk associated with the portfolio's assets and return influence the investment decision. However, the exchange rate risk was excluded. As a

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result, more complex investment models developed to adapt to specific market conditions such as the so-called conditional models to temporarily measure the change in time, the expected return, and the variance. In the case of the ARCH model, the variation of financial returns turned out not to be constant over time but autocorrelated or conditional to/dependent on each other. It was further understood that if an ARMA model is assumed for the error variance, the model is a GARCH model that incorporates a moving average component together with the autoregressive component. The introduction of a moving average component allowed us to model the conditional change in variance over time as well as the changes in the time-dependent variance. Thus, it can be seen that the conditional variance in GARCH depends on the past error limit and the conditional variances; the so-called structure-volatility estimates converge to the average volatility over the long run, and GARCH parameters can be optimally determined, so GARCH covariance matrices represent time-varying volatilities and multivariate return distributions without bias.

To identify the differences between the two energy market segments, the conventional and alternative/ renewable energy ETFs was used as investing instruments due to their obvious benefits as passive investment vehicles that reflect the performance of a sector or a market benchmark. By applying the VAR-ADCC GARCH methodology, the theoretical basis of a larger energy market investment research, which is expected to result in return-risk diversification, was established. It was demonstrated that the selected approach allows the aggregation of different energy and alternative/ renewable energy ETFs into international investment portfolios by using a variable weighting of assets. The selected VAR-ADCC methodology turned out to expect out-of-sample one-step-ahead forecasts of returns, volatilities, and correlations. In conclusion, this model will allow us to construct four different strategies to further analyze the conventional and alternative/ renewable energy markets by using different constraints of the minimum-variance and mean-variance optimization approaches. However, despite the clear description of the characteristics of the models, it is still not clear and it requires further specification if and to what extent there is an empirical outcome of this research.

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New Technologies of Internet Employment: Reducing Costs With an Economic Value Model

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Abstract

This paper focuses on examining the effect of applying the classical model of the economic value of the order on the employment activities of human resources in an organization. Initially, based on the classical model, the economic value of the order is modeled and the value of unique costs of employment activities such as human resource management and related coordination is obtained. Thereafter, the status in the two cases before and after the implementation of this technology is compared and this situation is analyzed by providing a numerical example. The optimal costs of investment are increasing rapidly. On the other hand, the development of efficient technologies in the employment system has caused the total number of employees to be hired to always be higher than the minimum required level set in this model. Investment in this area has declined. The result shows that with the implementation of this technology, due to the reduction of existing costs, on the one hand, the economic value of order decreases and on the other hand increases the total optimal profit.

Keywords: Internet Employment Technologies, The Economic Value of the Order, Human Resource Management, Optimal Costs of Investment, Communication Technology

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1. Introduction

One of the fundamental changes in today's complex and dynamic world is the advent of information and communication technology, which brings many benefits. Despite the numerous potential benefits, the development and deployment of these technologies are not enough to enjoy these benefits (Çalışkan, 2015). Rather, technology must be accepted and used by users. On the other hand, in many cases, it can be seen that these technologies are not used properly and after a short time of use, they are generally discarded due to lack of proper use (Van Ark et al., 2016). If the entry of technology into the organization is accepted by its users, a more desirable efficiency will be achieved. If the new technology is not accepted and used by users, investment in the desired field will be fruitless (Mokyr et al., 2015). The digital economy based on internet technology has provided an important boost for economic growth. Internet technology progress directly promotes being employed in the industry. Inter-industry spillovers lead to positive effects of internet technology on employment in other industries and again on employment within one industry through various feedback loops between industries. Policy should promote internet technology in various industries, especially those closely linked to other industries to develop employment and growth (Wang et al., 2020). The digital transformation narrative emphasizes that digital technologies help firms become more productive and contribute to economic performance and competitiveness at the firm, regional, and national levels (Bertschek et al., 2013; Martinez-Caro et al., 2020; Norris, 2020; Tranos et al., 2020). Due to the importance of this issue, research has been conducted in this regard in different countries. The main concern of which is the adoption and use of new technology, and among the most important of them is information and communication technology (Mickoleit, 2014). All non-automated work will eventually be rendered redundant by digital technologies and robotics wokers. Based on a report by McKinsey Global Institute, at least a third of the activities in half of the occupations can be automated by 2030 (Manyika et al., 2021). Internet employment has brought many benefits such as no time and space restrictions, easy access to information, reducing the cost of services, and saving time for job seekers which has led to the rapid growth of the use of internet employment services (Marcolin et al., 2016). The use of internet employment services is one of the solutions to gain a competitive advantage for the job search firm and has caused close competition in this field. In such circumstances, the level of expectation of job seekers to receive such services has also increased (Frey & Osborne, 2017). Employment agencies have realized the importance of differentiating themselves from other sources of internet employment through new service distribution channels, as the use of new distribution channels increases access to job seekers (DeStefano et al.,

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2017). Thus, with the expansion of business thinking around the world, especially concerning the provision of reemployment services, job firms, due to their special nature, are more efficient users in using online technology (Bessen, 2015). According to Toffler, in the developed age of information and knowledge, there is a need for greater change in society. At present, human beings have started a new era in which most things, including employment in that society, need to be done virtually (Berlingieri et al., 2017). Therefore, the introduction of information technology and especially the internet in the employment industry has changed the competitive environment of this industry. Given the vast changes in global markets and increasingly fierce competition, the global customer interaction experience online is a differentiation strategy. Online hiring is a way to reduce costs and stay competitive compared to traditional hiring (Autor, 2015). Internet recruitment is a growing phenomenon all over the world, especially in countries where the appropriate infrastructure for online recruitment is well developed. According to the latest statistics of the World Telecommunication Union, Iran currently has an internet penetration rate of 10.8 percent and this is in the context that the average internet penetration rate in the world is estimated at 16.7 percent. The estimated number of internet users in Iran in 2000 was about 250,000, which can be compared to the current estimate published in the second half of 2008. The number of internet users in Iran has grown by more than 9100% over eight years. Furthermore, the highest growth of internet penetration rate in the period (2000 to 2008) belonged to Iran, Syria, and Saudi Arabia with percentages of 9100%, 7006%, and 3000% (Arntz et al., 2016). The development of information technology and the use of new tools and concepts provide information expansion and easy and low-cost access for people and facilitate the rapid exchange of information and cultural interactions (Peters et al., 2014). For example, the ability of customers to access employment services without physical presence with a secure connection and by reducing the time of receiving services is one of the consequences of information technology, which in turn increases productivity.

Therefore, the present study was conducted with the aim of developing the model of the economic value in order to reduce the costs of new technologies for internet employment.

2. Theoretical Foundations and Research Background

Internet employment is one of the important phenomena resulting from the use of information and communication technology as well as information management. This has had a profound change in the way of hiring and employing human resources, so that on the one hand it increases the level of communication with job seekers and on the other hand it has expanded some job seekers (McGowan et al., 2017). Information technology encompasses all

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advanced technologies, how to communicate and transfer data in communication systems. This system can be a telecommunication network with several computers connected to and connected to the telecommunication network, the internet, as well as the programs used in them (Ahmad & Schreyer, 2016). Undoubtedly, information and communication technology has brought about wide-ranging changes in all social and economic spheres of humanity, and its impact on human societies is such that the world today is rapidly becoming an information society. This is a society in which knowledge and the level of access and beneficial use of knowledge plays a pivotal and decisive role. The wide range of applications and their effects on various aspects of life today and the future of human societies has become one of the most important topics in the world and has attracted the attention of many countries (European Commission, 2017). The online recruitment process begins with submitting the requested organizational posts on a company website or online recruitment sites that allows applicants to submit their resumes electronically via form or email (European Commission, 2016). Therefore, internet employment in the company improves the process and speed of doing things (Cooper et al., 2016). One of the results of the growth of internet employment technologies has been easier and more efficient job search (Brynjolfsson & McAfee, 2014). Internet recruitment has emerged as a useful method more than traditional recruitment methods in this field (Bowles–Bruegel, 2014). In addition, with the advancement of technology and the emergence of methods that facilitates and increase the process and operations of companies, now global companies use the (.com) domain as a development tool that defines a dedicated website for hiring job seekers. These domains provide a direct route for easier access to available job opportunities for seekers. DotJob is a unique domain because the organization puts part of its name in the domain name at the time of registration. For example, the domain (www.shrm.jobs) provides a simple, fast, and compatible way for the HRM to establish a direct online connection between the organization's recruitment page and job seekers using the internet (Autor, 2015). The importance of internet employment has also been recognized in Asia, and developing countries in Asia have benefited from a steady pace of internet employment. Managers of companies in Malaysia believe that internet employment can lead them to a new competitive position in the regional labor market due to the importance of workers' knowledge and resource-based competition (Arntz et al., 2016; Kenney & Zysman, 2016). Similarly, Pakistani employers have confirmed the validity of this claim and acknowledged the significant impact of online hiring on their business processes (Jäger et al., 2015). Web-based businesses in Iran have been slowly expanding in the last 15 years. The development of information and communication technology-based tools in the country has been effective in

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creating e-commerce. Examples of online job searches in Iran are increasing recently and this issue shows the need for the community to use web job search services in the information society (Butzin et al., 2014). Reasons such as lower investment costs, shorter hiring cycle, reaching a wider range of applicants, better quality of applicants, an opportunity to target a specific market, and attracting passive job seekers can be potential reasons for using online hiring (Heckman et al., 2013).

In line with this discussion, it showed that key factors that are important to the job applicant can include job duties, the company itself, opportunities for advancement, potential relationships with colleagues, salary, and job security (Harrison et al., 2014). Some relevant research has also shown that the level of salary, the opportunity to acquire knowledge and skills, and the challenging and interesting nature of the job have a significant impact on the applicant's decision to accept a position (Greenan & Guellec, 2000). In many studies, the effect of advertising on job selection shows that more than 20% of job seekers simply rejected the job opportunity due to poor website design (Michaels, 2015). There is also the fact that in the case of job search companies, website management is part of the success of the online recruitment process. Furthermore, many websites with highly sophisticated designs have lost about three-quarters of all job seekers (Goos et al., 2014).

Findings in other studies also show that providing accurate information about the job has also played an important part in requiring the applicant to use the website and submit an application for a suitable job (Friedman, 2014). In addition, it is shown that organizational advertising is the only predictive tool that shows significant ongoing direct effects on the number of applicants and the quality of their performance (Frey & Osborne, 2017). Therefore, by examining the above literature in addition to the fixed costs set in organizations, the use of these new tools imposes additional costs on the body of the organization. Investigating and determining the minimum amount of these costs is one of the main objectives of this article and has shown that with a simple development in the method of economical order quantity, these costs can be reduced to the lowest level in the management organization (Ford, 2015).

3. Proposed Research Model

This study examines the components of fixed employment costs, demand-based recruitment coefficient, surplus costs, and labor shortages. This research is applied in terms of purpose and descriptive survey in terms of implementation. The data obtained from this study were analyzed using descriptive and inferential statistics.

In this article, the process of online recruitment is defined as a broad company with employment activities and methods that use a variety of online

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tools throughout the recruitment process. Over the past decade, companies have invested heavily in online hiring technologies to reduce investment costs and improve the hiring process. Hence, the content of this article has shown internet employment technologies to be cost-effective and efficient in internet employment. These studies provide the best descriptive results and examine the trade-off between investment costs and benefits that has not yet been clearly defined.

Various studies of large IT companies show that many business organizations invest heavily in IT but rarely achieve higher financial returns. To fill the gap in the content of this paper, an economic decision model for investing in internet recruitment technology and analyzing the relationship between investing in internet recruitment technology and total recruitment costs is presented. This model allows the conditions under which it is better for the company to invest in online recruitment to be identified and to gain a better insight into the various reasons why private companies decide to invest in recruitment systems.

The selection of the proposed model has been done with the help of search engine rankings and the selection of the most visited job search website in Iran. Research to reduce the cost of hiring shows that most companies, such as the company selected in this study, have considered the cost of hiring as a fixed variable. Therefore, this has been the subject of discussion in this study because it is not always a fixed numerical value and other components. It has also played a key role in this amount, which is further developed by expanding this issue and combining a new variable that includes other possible costs.

3.1. Formulation of Economic Employment Decision Model

Mathematically, the cost of hiring in each recruitment cycle is defined as follows:

$$RC = C_e T_e (N_e / 2)\theta + C_s T_s ((N - N_e) / 2)\theta + C_a + C_c N \quad (1)$$

The total cost of hiring new staff over a planning period is then derived by:

$$Min\ TRC = \frac{C_e N_e{}^2 T\theta}{2N} + \frac{C_s (N - N_e)^2 T\theta}{2N} + \frac{C_a E}{N} + C_c E \quad (2)$$

Taking N_e from the first derivative according to Equation 2, and setting its value to zero and solving it, the optimal value N_e^* is given as:

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$$N_e^* = N \frac{C_s}{(C_e + C_s)} \tag{3}$$

By substituting the term N_e^* in TRC and taking the first derivative of Equation 4 in terms of N, and equating its value with zero and solving the equation, the desired number of employees to be recruited in each cycle N^* is obtained.

$$MinTRC = \frac{C_e N \left[\frac{C_s}{(C_e + C_s)}\right]^2 T\theta}{2} + \frac{C_s N \left[\frac{C_e}{(C_e + C_s)}\right]^2 T\theta}{2} + \frac{C_a E}{N} + C_c E \tag{4}$$

$$N^* = \sqrt{\frac{2C_a E (C_e + C_s)}{C_e C_s \theta}}, \quad (T = 1) \tag{5}$$

4. Results

4.1. Development of Economic Decision Model for Investing in Internet Job Search Technology

In the previous employment economic decision model, the fixed cost of employment is assumed to be fixed. In this section, it is assumed that the exponential function is grounded so that the cost of investing in *S* internet employment reduces the fixed cost of hiring. Billington proposes a similar exponential function with the basis for determining the optimal investment cost to reduce start-up costs in the classical model of the economic value of the order. Porteus has proposed a model for the economic value of the order in order to study the optimal investment to reduce the start-up cost for both the logarithmic function and the power-up cost function. In this paper, Equation 2 has been developed in order to include the investment costs *S* mentioned in the research literature and its results are shown in Equation 6.

$$MinTRC = \frac{C_e N \left[\frac{C_s}{(C_e + C_s)}\right]^2 \theta}{2} + \frac{C_s N \left[\frac{C_e}{(C_e + C_s)}\right]^2 \theta}{2} + \frac{C_a E}{N} + C_c E + S \tag{6}$$

The exponential investment function is defined for the reduction C_a in Equation 7 below.

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$$C_a = L + (H - L)e^{-\lambda S}, S \geq 0 \quad (7)$$

As H is the highest fixed cost of hiring, there is a time when no investment in online hiring technologies has been made and L as the lowest fixed hiring cost will be achievable by S investment. In order to obtain the optimal solution for investing in technology, the first derivative of Equation 6 is taken with respect to S and then equated to zero and solved. The results are equal to:

$$\frac{\partial TRC}{\partial S} = \frac{C_a{}'E}{N} + 1 \quad (8)$$

$$\frac{\partial C_a}{\partial S} = -\frac{N}{E} \quad (9)$$

The first derivative of Equation 7 is taken with respect to S and its results are equal to:

$$\frac{\partial C_a}{\partial S} = -\lambda(H - L)e^{-\lambda S} = -\lambda(C_a - L) < 0 \quad (10)$$

By equating Equation 9 and 10 and substituting the value of N in Equation 11 with Equation 5, Equation 12 is obtained. Then, by solving Equation 12, the optimal fixed cost C_a^* is derived through Equation 13.

$$-\frac{N}{E} = -\lambda(C_a - L) \quad (11)$$

$$\lambda E(C_a - L) = \sqrt{\frac{2C_a E(C_e + C_s)}{C_e C_s \theta}} \quad (12)$$

$$C_a^* = d + \sqrt{d^2 - L^2} \quad (13)$$

So:

$$d = L + \frac{(C_e + C_s)}{C_e C_s \theta \lambda^2 E} \quad (14)$$

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After obtaining the optimal fixed cost C_a^*, the optimal investment values S^* and N^* will be obtained through Equations 15 and 16 respectively.

$$S^* = \frac{\left(\ln \frac{(C_a^* - L)}{(H - L)} \right)}{-\lambda} \tag{15}$$

$$N^* = \lambda E (C_a^* - L) \tag{16}$$

In order to determine the minimum number of employees to be employed during a planning period for optimal investment, Equation 13 less than or equal to the value of H is solved and Equation 17 is formed.

It should be noted that the minimum number of employees derived from Equation 17 can also be calculated without the desired solution. Therefore,

$$\frac{2(C_e + C_s)H}{C_e C_s \theta \lambda^2 (H - L)^2}$$

can be used as a threshold value for investment decisions.

$$E \geq \frac{2(C_e + C_s)H}{C_e C_s \theta \lambda^2 (H - L)^2} \tag{17}$$

The Main Research Question: Is fixed cost of employment one of the effective components on internet employment?

Table 1. Investigating the Effect of Fixed Cost of Employment on Internet Employment

	β	β Standard	t	p-value	R	R^2	Regression significance test	
							F	p-value
Fixed value	2.372		8.269	0.001	0.366	0.134	18.682	0.001
Fixed cost of employment	0.347	0.366	4.322	0.001				

According to the value of F and p-value related to the main hypothesis of the research, which is less than 0.05, it can be inferred that regression is significant at the level of 0.05. The value of the coefficient of determination obtained from the test was equal to 0.134, and this coefficient of determination indicates that 13.4% of the changes related to the fixed cost of employment

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have been explained based on the implementation of internet employment. The correlation coefficient obtained from the test is positive and equal to 0.366. This result means that the relationship between these two variables is direct. In other words, the growth of online recruitment leads to performance development. Therefore, the respondents confirm the above relationship and consider the implementation of online recruitment to be effective in terms of performance.

The First Research Question: Is the demand-based recruitment coefficient effective on internet employment?

Table 2. Investigating the Effect of Demand-Based Recruitment Coefficient on Internet Employment

Regression significance test		R^2	R	*p-value*	t	β Standard	β	
p-value	F							
0.001	279.677	0.698	0.835	0.001 0.001	8.812 16.724	0.835	1.252 0.650	Fixed value Demand-based recruitment coefficient

Considering the value of F and p-value related to the first hypothesis of the research, which is less than 0.05, it can be inferred that regression is significant at the level of 0.05. The coefficient of determination obtained from the test is equal to 0.698, and this coefficient of determination indicates that 69.8% of the performance-related changes are explained based on the dimension of the absorption coefficient based on demand. The correlation coefficient obtained from the test is positive and equal to 0.835. This result means that the existing relationship is direct, i.e., the demand-based power absorption coefficient increases performance. Therefore, the respondents have confirmed the above relationship and believe that the demand-based recruitment coefficient has a significant effect on internet employment.

The Second Research Question: Does the effect of labor shortage affect internet employment?

Table 3. Investigating the Effect of Labor Shortage on Internet Employment

Regression significance test		R^2	R	*p-value*	t	β Standard	β	
p-value	F							
0.001	572.446	0.826	0.909	0.001 0.001	18.827 18.926	0.909	1.602 0.549	Fixed value Labor shortage

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According to the value of F and p-value related to the second hypothesis of the research, which is less than 0.05, it can be inferred that regression is significant at the level of 0.05. The value of the coefficient of determination obtained from the test is 0.826, and this coefficient of determination indicates that 82.6% of the changes related to performance are explained based on labor shortages. The correlation coefficient obtained from the test is positive and equal to 0.909. This result means that the relationship between these two variables is direct. In otherwords, labor shortages reduce performance growth. Therefore, the respondents confirm the above relationship and believe that managing labor shortages is effective for internet employment.

The Third Research Question: Does the effect of excess costs affect internet employment?

Table 4: Investigating the Effect of Excess Costs on Internet Employment

Regression significance test		R^2	R	*p-value*	t	β Standard	β	
p-value	*F*							
0.001	383.609	0.761	0.872	0.001	10.187		1.242	Fixed value
				0.001	19.586	0.872	0.622	Excess costs

Considering the value of F and p-value related to the question of the third hypothesis, which is less than 0.05, it can be inferred that regression is significant at the level of 0.05. The coefficient of determination obtained from the test was 0.761, and this coefficient of determination indicates that 76.1% of the performance-related changes are explained based on excess costs. The correlation coefficient obtained from the test is positive and equal to 0.872. This result means that the relationship between these two variables is direct. Therefore, the respondents confirm the above relationship and believe that the fashion of excess costs affects internet employment.

Conclusion

The purpose of this study is to assess the impact of different components of internet employment. In doing so, the components (fixed employment costs, demand-based recruitment coefficients, surplus costs, and labor shortages) were examined.

The labor market faced a number of challenges even before the advent of digitalization. A lack of job security, an extended workday or out-of-hours work, physical and mental illness, and lack of motivation or long-term unemployment are just some of the factors that influence people (Pirosca et al., 2021). According to the results of this study, online recruitment is effective

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in increasing performance. A growing number of large companies are now providing accurate job information on their professional job search websites in an effort to promote long-term relationships with job seekers, explain their work cultures and benefits, and explain the benefits they offer. Internet employment promotes growth and development in the industries, agriculture, and services of countries around the world. This model is very effective in reducing costs in the economy (Research Findings, 2022). Although online recruitment is extremely popular, there are few statistics available on the return on investment in various online recruitment technologies and the effectiveness of their management practices. As a complement to the previously described studies, which are mostly descriptive, in this paper, two analytical models of decision-making in the field of inventory management were presented based on the classical economic model of order (Research Findings, 2022).

By considering both the optimal investment in internet recruitment technologies and the decisions made in the initial model, the extended model of this study has developed the initial model. Managers can use the developed model to make good investment decisions in the employment systems of different organizations. The costs of making optimal investment decisions are determined by four main components: the fixed cost of employment, the recruitment coefficient, the surplus cost, and the labor shortage.

By including the unemployed, digitalization should aim to reduce the average working time. Either way, a less-stressful future lies ahead according to the general claim. Despite the fact that work has been conducted the same way in the past despite technological advancements, there are arguments that the digital revolution will bring about major disruption (Pirosca et al., 2021).

It is in many ways a revolution that the internet has transformed the way information is disseminated, exchanged, and presented.
Revolutionary in this sense means that economic, social, cultural, political, and technological principles were changed gradually.

Using this technology has many advantages, including streamlining processes and reducing costs.

Although, in this study, a basic exponential function is used as an investment function, other functional forms can be applied to the model, and optimal investment decisions can be made easily using computer software such as Excel software. As measured by the proposed model, the level of employment increases optimal investment costs more than before when investment costs are added to the initial model. Nonetheless, with more cost savings, this issue can also be reduced (Research Findings, 2022).

Based on the level of awareness, this is the first study to develop internet labor market investment models and analyze the cost savings for large employers as a result of internet employment technology. This study provided

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valuable insight into the advantages and costs associated with online hiring technologies. Managers will be able to make better investing decisions if they consider the proposed decision model and other complementary factors as well.

As a result, managing the superiority of online hiring technologies and processes is the key to obtaining a strategic advantage of hiring systems, not investing excessively in technology.

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Fisher Equation and Modigliani-Cohn Hypothesis in the Financial Markets

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Abstract

Fisher equation in its conventional form suggests that nominal interest rate is the sum of real interest rate and expected inflation and, as such, it has been utilized as a standard component in economic literature to predict the behavior of nominal and real interest rates or to analyze investment returns. Nevertheless, Fisher equation has its flaws well documented in the empirical literature. This paper focuses on enriching contemporary theoretical underpinnings by paying attention to Fisher´s illusory nature of nominal interest rate, revisiting original roots of Fisher equation, and contrasting them with modern conventional form of Fisher equation. Consequently, implications will be derived for the relevance of a particular form of Fisher equation. Another important contribution is the connection of Fisher's equation with money illusion through Modigliani-Cohn hypothesis (1979). This phenomenon might be responsible for an imperfect adjustment of the interest rate to expected inflation, thereby leading to substantial implications in financial markets.

Keywords: Fisher Equation, Money Illusion, Modigliani-Cohn Hypothesis, Financial Markets, Inflation

Introduction

This paper argues that Fisher equation remains a puzzle for economists since the adjustment of nominal interest rate to changes in inflation without

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significant lags can work only in the world described by rational expectations hypothesis with perfect foresight. Empirical literature proves that the real interest rate is a lot more variable than the nominal interest rate in terms of money (Fisher, 1930; Sarte, 1998). Since Fisher equation exhibits a peculiar behavior, it raises questions about its relevance and it provides motivation for further identification of the reasons for this behavior.

The essence of Fisher equation might be effectively grasped through clear distinction of variables utilized in the original version of equation and the modern conventional version of equation. The former incorporates expected appreciation of money, whereas the latter expect goods appreciation. The devolution of conventional Fisher equation will be subject to more thorough elaboration which will help to identify key flaws that are incompatible with the original Fisher equation and standard rational expectations hypothesis. Paradoxically, conventional Fisher equation in Fisher´s sense seems to be functional for adaptive expectations hypothesis as opposed to the original effect as noted by Rhodes (2008), which suggests the inability of people to adjust promptly the nominal interest rate to change in the price level.

The main goal of this paper is to discuss the relevance of Fisher´s equation. Attention will be paid to Fisher's equation rather than illusory nature of nominal interest rate, which acquires new dimensions under the effect of money illusion, whose potential relevance has been largely dismissed by mainstream economics. However, its potential relevance was brought back to attention with the arrival of behavioral economics and the study of Shafir, Diamond, and Tversky (1997) at individual level and introduced by Fehr and Tyran (2001) at the aggregate level. Growing interest in money illusion was documented by a number of studies in various areas. Potential application of money illusion is discussed in labor markets (Bewley, 1999; Agell & Lundborg, 2003). Growing number of studies demonstrate its relation towards nominal rigidities (Vaona, 2013; Fortin, 2013). In addition, potential effect on consumer behavior was investigated (Hogan, 2013; Blinder, 1995). This is alongside its role in the context of euro introduction (Cannon & Cipriani, 2003; Bittschi & Duppel, 2015; Jureviciene & Markelova, 2016).

The connection of Fisher equation and money illusion is discussed in the context of Modigliani- Cohn hypothesis (1979), which argues that the stock market suffers from money illusion, where people tend to discount real cash flows at nominal discount rates. This also has consequences for pricing of risky stocks relative to safe stocks as suggested by Cohen, Polk, and Vuolteenaho (2005) and Bassak and Yan (2010). It seems that Modigliani-Cohn hypothesis might be partially responsible for the peculiar behavior of Fisher equation with substantial economic implications for the behavior of investors in financial markets.

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The first section of the paper will be used to discuss money illusion as a concept, which accounts for illusory nature of nominal interest rate with substantial economic implications, primarily in financial markets. The second section elaborates more on Fisher equation, which will be put under closer scrutiny, thereby making substantial distinction between the Original and Conventional Fisher´s equation. Lastly, Fisher´s equation, which incorporates money illusion, will be evaluated in the context of Modigliani-Cohn hypothesis followed by economic implications in financial markets.

Fisher's Illusory Nature of Nominal Interest Rate and Fisher Equation

To outline more thoroughly the illusory nature of nominal interest rate, it is worthy to start with illustrative example based on Fisher's book about Money illusion (Fisher, 1928).

Millions of middle-class bondholders were ruined after the World War by the fall of the German mark, the Polish mark, the Russian ruble, and the Austrian crown. An example worth the attention is a lady who was left a legacy of 50000 dollars by her father in 1892. During that time, the dollar was worth the most. The money inherited was put in trust and invested into so-called safe bonds. In 1920, when the dollar was worth the least, the lady visited the trustee together with Professor Fisher. The trustee claimed that there was only a loss of 2000 dollars out of 50000 dollars due to unwise investment made by the lady's father. He argued afterward that the principal had been left intact, apart from this minor loss, reaching a value of 48000 dollars. Fisher however argued that 50000 dollars invested in bonds was the equivalent of about 190000 dollars in 1920. The final amount was not 48000 dollars in real terms because of the depreciation of the dollar. The total loss was almost 75 percent since 48000 does not reflect the buying power of 190000 in 1920. The lady was paid rent of 2500 or 3000 a year, which was her consumption of the principal rather than income. Fisher recommended that the trustee should have adopted different investment strategy to fight against the depreciation of the principal. Thus, the concept of social injustice may be applied again since the debtors-stockholders won what the lady in this example lost.

In other words, "*Inflation has picked the pockets of bondholders and put the value into the stockholders pockets, simply through unstable value of the dollar*" (Fisher, 1928, p.79-80).

Fisher asserts that due to uncertainty in the purchasing power of the dollar, public and private businessmen act like unconscious gamblers. They are running the risk and they will either benefit or loose. Hence, losers who were subject to money illusion blame lucky winners of the lottery who won their neighbors pockets without any intend to defraud. The fault is not that of the winners who are the same unconscious gamblers like the rest of the general

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public. They only played the game which should have been stopped (Chytilova, 2018).

Based on the example above, the illusory nature of nominal interest rate is the center of focus. Fisher claimed that the effects of price level on the economy are as a result of changes in real interest rate, which are given by incomplete perception of changing price level and by wrong price expectations held during the time the loan or nominal contract was signed. He mentions the so-called "peculiar behavior of the interest rate", which is largely responsible for the crises and depressions through price movements (Fisher, 1913, p. 56, cited in Dimand, 1993). Money illusion is again the factor which is responsible for this peculiar behavior (Chytilova, 2018).

Fisher describes the situation of the borrower and debtor, whose relationship should be kept the same during rising prices, as before and after. Not only do lenders require higher interest rates, but borrowers are also capable of paying higher interest rates. This however requires higher nominal interest rate than the stationary prices require. Unfortunately, men tend to consider the dollar as a stable thing regardless that the time and the process of adjustment are really slow and imperfect. This is further strengthened by law and custom, keeping the interest rate down (Fisher, 1913, p. 57-58).

According to Fisher (1913), when prices are rising, "the rate of interest rises but not sufficiently". On the other hand, when prices are falling, "the rate of interest falls but not sufficiently" (Fisher, 1913, pp. 60, 68). The insufficient adjustment of nominal interest rate was attributed to confusion between nominal and real variables.

If there were a better appreciation of the meaning of changes in the price level and an endeavor to balance these changes by adjustment in the rate of interest, the oscillations might be very greatly mitigated. It is the lagging behind the rate of interest which allows the oscillations to reach so great proportions. Marshall says on this point: "The cause of alternating periods of inflation and depression of commercial activity is intimately connected with those variations in the real rate of interest which are caused by changes in purchasing power of money". Fisher (1913, pp.71-72), Marshall (1907, p.594), and Fisher (1896, p.79) gave a fuller quotation of the same passage from the 1895 edition of Marshall's Principles, cited in Dimand (1993).

If the public would correctly perceive and anticipate price changes, it would not affect real interest rate and consequently economic activity. According to Dimand (1993), Fisher did not suppose that borrowers dispose more precise information, only that they perceive an increase in money receipts, inducing them to borrow even more, before they find out that the purchasing power had changed. The same holds for lenders who observe rise in demand for loans and only later realize that the price level has changed (Chytilova, 2018).

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As a result, the famous Fisher equation relating the nominal interest rate to the real interest rate was then, according to him, an imperfect description of the real world. It could only work in the world with "foresight", which is very close to rational expectations, as emphasized by Thaler (1997). Extensive empirical research of Fisher (1930) proved a very slow adjustment of the nominal interest rate to changes in inflation and with very long lags. Thaler (1997) or Dimand (1993) indicate that Fisher was a pioneer in inventing distributed lag econometrics. Thaler (1997) analyzed interest rates in five markets (London, New York, Berlin, Calcutta and Tokyo) and concluded that the real interest rate in terms of commodities is from seven to thirteen times as variable as the nominal interest rate in terms of money. Therefore, this shows the inability of people to adjust promptly the nominal interest rate to changed price level (Chytilova, 2018).

This finding might be closed by poignant statement: "Erratic behavior of real interest is evidently a trick played on the money market by the money illusion," (Fisher, 1930, p.415).

For instance, it is interesting to add that Rutledge (1977) claimed that Fisher did not interpret the lag between inflation and the full adjustment of nominal interest rates in terms of inflation expectations. He neglected Fisher's book, the Money illusion (1928), showing that Fisher believed that real interest rates depend on past inflation during the period of transition. As Dimand (1993) pointed out, this view is consistent with changes in real interest rates due to slow perception and adjustment of inflation expectations (the nominal interest rate lagging behind the inflation) in Fisher's sense (Chytilova, 2018).

Fisher Equation Revisited

Another phenomenon which has not been mentioned yet might serve as the summary of the erratic behavior of Fisher´s effect. It is crucial to emphasize that Fisher´s equation is not represented by a single equation, but it is essential to distinguish between the original Fisher´s equation and conventional Fisher´s equation as noted by Rhodes (2008).

The original Fisher equation which puts emphasis on theory of rational expectations is described by a key phenomenon called expected appreciation of money. It is evident that the reason for inclusion of this variable is clear based on Fisher´s illustrative example on page 3. Expected appreciation of money is defined as the real return of money (Eden, 1976) and is incorporated in the equation through the expectation's operator *E, i.e., expectations over the value of money E (1/P)*. Supposing that the value of goods is P, then the value of one unit of money v is 1/P. Derivation of original Fisher equation is demonstrated with two period present value model shown below, which neglects taxes and risk neutrality for simplicity (Fisher, 1906; Rhodes, 2008).

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A contract in the economy is described by future payment in paper money (dollars). The present value $P_{B,t}$ of the future money benefit (D) sold at discount at time *t* and at nominal interest rate *i* (expressed in fiat money) is expressed as:

$$P_{B,t} = \frac{D_{t+1}}{1+i} P_{B,t} = \frac{D_{t+1}}{1+i} \tag{1}$$

Similar contract is expressed in bushels B for commodity money (for instance wheat). If consumer is supposed to be indifferent between these two contracts, the number of dollars D required in the money contract must be equal to the number of bushels B paid. Expressing these contracts in future value, the real commodity value of future real money payments $D_{t+i} Ev_{t+i} D_{t+i} Ev_{t+i}$ equals to the number of future commodities B_{t+1}. Suppose that *j* is the commodity rate of interest and *v* is the terms of trade between money and commodities, the real present value in a commodity standard of a future fiat money payment is expressed as follows:

$$P_{B,t} v_t = \frac{D_{t+1} Ev_{t+1}}{1+j} P_{B,t} v_t = \frac{D_{t+1} Ev_{t+1}}{1+j} \tag{2}$$

Plugging the price of the asset from (2) to (3) after an adjustment yields:

$$\frac{1+i}{1+j} = \frac{1}{1+a} \frac{1+i}{1+j} = \frac{1}{1+a} \tag{3}$$

After adjustment, this leads to the equation describing the original Fisher effect which expresses a relationship between the nominal interest rate and expected appreciation of money:

$$j = i + a + iaj = i + a + ia \tag{4}$$

where *j* is the ex-ante real return, *i* is nominal interest rate, $a = (Ev_{t+1} - v_t / v_t a = (Ev_{t+1} - v_t / v_t$) *a* is the expected appreciation of money and *ia* is neglected for its small values which results into near one-to-one relationship.

The ex- post real return *j** is present in the Fisher´s identity which is distinct from Fisher original equation:

$$j* = i + a* + ia* \tag{5}$$

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$$a*=(v_{t+1}-v_t/v_t a*=(v_{t+1}-v_t/v_t$$

Where *i* is nominal interest rate,

$$ia*ia*$$

) is the actual appreciation of money, and is neglected for its small values.

In summary, Fisher original equation incorporates the realized ex-ante real return *j*, whereas Fisher identity works with ex-post real return *j**. The question arises about compatibility of Fisher equation and Fisher identity as noted by Rhodes (2008). In a perfect world as described by rational expectations hypothesis with perfect foresight, it holds that ex ante appreciation of money *a* is equal to ex post appreciation *a**. Hence, this implies that the ex-post real return *j** is equal to the ex-ante real return *j*. However, in the world described by uncertainty with imperfect foresight, the ex-post real return *j** differs from the ex-ante real return *j* in general.

In contrast, *conventional Fisher equation* is described as follows (Mankiw, 2007):

$$i=r+\ \pi\ +r\ \pi i=r+\ \pi\ +r\ \pi \tag{6}$$

Where *i* stands for the nominal interest rate, *r* is the ex-ante real interest rate determined by loanable funds market and expected inflation. This is because the nominal interest rate agreed by lender and borrower can adjust only for expected inflation. Expected goods inflation (percent change in E(P)) is defined as EP_{t+1}-P_t/P_t, (Rhodes, 2008).

The value $r\pi$ is negligible and is thereby omitted. This leads us to well-known form:

$$i=r+i=r+\pi^e \tag{7}$$

According to the Conventional Fisher Equation (CFE), the nominal interest rate *i* is a linear function of the ex-ante real interest rate *r* and expected inflation of one-to-one relationship for small values of expected inflation. The conventional Fisher equation is derived from identical framework like the original Fisher equation by incorporating expectations over the value of goods E(P) and expected inflation with respect to the current price level, $\pi=(EP_{t+1}-P_t)/P_t\pi=(EP_{t+1}-P_t)/P_t$ (Rhodes, 2008).

At first sight, it might seem that the conventional Fisher equation might be easily considered as substitute for the original Fisher equation. This is because the original Fisher equation deals with the expected appreciation of money *a*, the commodity real interest rate (ex-ante real return) *j* and nominal interest rate. However, these equations sharply differ in few elements as demonstrated

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by Rhodes (2008) and might be compatible only under special conditions. Some studies such as Hirschleifer (1970) attempted to make a distinction by marking anticipated inflation with the letter "a" to contrast it to Original Fisher equation. First, the interactive terms $r\pi$ and $-ia$ are different and also variables reflecting expected appreciation π and $-a$ are different. Additionally, the reference point which represents the appreciation of money is expressed as the current value of money v_t in Original Fisher equation, whereas in conventional Fisher equation as the future value of money v_{t+1}.The compatibility of two Fisher´s equations might be ensured by the delineation of common ex-post real return equality ($j^*=r^*$) which is the case when inflation expectations are in line with the actual (ex-post) inflation. The compatibility is ensured upon satisfying two conditions:

1. Perfect certainty ensures that the current and future price level is known.
2, A common point of reference regarding the appreciation of money is used.

However, due to uncertainty, expected appreciation of money is not equal to expected deflation $-\pi$ due to Jensen´s inequality. The Original Fisher equation $\left[E\left(\frac{1}{p}\right)\right].\left[E\left(\frac{1}{p}\right)\right].$ was derived by taking expectations over the value of money

The conventional Fisher equation was derived by taking expectations over the $E(P)E(P)$ value of goods in the model above. Jensen´s inequality implies $E\left(\frac{1}{p}\right) \geq \frac{1}{E(P)} E\left(\frac{1}{p}\right) \geq \frac{1}{E(P)}$ that holds for a non-degenerate random variable (P) under uncertainty. This formula stems from the original Jensen´s $A(P)A(P)$ inequality which emphasizes the difference between arithmetic $H(P).H(P) = 1/[A(1/P)$ and harmonic mean $H(P).H(P) = 1/[A(1/P)$ $A(P) \geq H(P) = 1/[A(1/P)]$ and $A(P) \geq H(P) = 1/[A(1/P)]$.

$$A(1/P) \geq 1/A(P)\, A(1/P) \geq 1/A(P)$$

This implies:

Replacing the arithmetic operator by expectation operator yields: $E(1/P) \geq 1/E(P) E(1/P) \geq 1/E(P)$. Here, expectation of P $E(P)\, E(P)$ described by is a weighted average of individual prices with the weights of individual prices being probabilities that sum to one. All in all, for

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a given interest rate, the ex-ante real return is different $j \geq rj \geq r$ (Rhodes, 2008).

Incorporation of conventional Fisher´s equation in analysis of financial markets is a standardized procedure. Nonetheless, it provides a biased estimate of the relationship between nominal and real interest rate in times of uncertainty about future prices despite rational expectations. Once the size of bias is reasonably small (i.e., rational expectations hypothesis holds as already mentioned in Chapter 1), the conventional Fisher equation is good approximation to the original Fisher equation. However, the size of the bias is determined by many factors such as the price level volatility (Sarte, 1998) and long expectations horizons (McCulloch & Kochin, 2000) or individual expectations. As a result, it is highly desirable to avoid inflation-uncertainty bias by writing Fisher´s relationship in terms of the expected value of money E(1/P) as suggested by Fama (1975, 1976) or Rhodes (2008). Inclusion of this component brings us back to the Original Fisher equation. Still, conventional Fisher equation is very popular in research literature despite providing biased estimate as suggested by Rhodes (2008) and Sarte (1998).

Money Illusion and Conventional Fisher Equation

Paradoxically, economists work with conventional Fisher equation, which has its roots in Fisher´s empirical observation of market participants. Thus, its complex psychological behavior significantly affects outcomes through money illusion and imperfect foresight. Such version which would take into account psychological factors has never been formalized mathematically. Modern version of money illusion that has the inability to distinguish between nominal versus real values is well documented by Fehr and Tyran (2001) or Shafir, Diamond, and Tversky (1997). Fisher´s style of money illusion of that time was about the inability to accurately predict the behavior of the nominal interest rate using a backward-looking specification together with proper measurement of money value. As Rhodes (2008) suggests, measurement problems associated with money value are represented by Patinkin´s money illusion (in Fisher´s language if people fail to adjust the yardstick with the changing size of the king´s girdle and measurement problem is not eliminated by pure realization that the yardstick changes) and Jensen´s inequality problem (using an improper yardstick for computation of the actual and expected rate of change in the king´s girth/money value).

Crucial component in transition from original Fisher equation to conventional Fisher equation is expected in appreciation of money, which stands for the rate of change in the value of fiat money expressed in commodities, thereby reflecting the real return on money. Fisher claimed that the direct impact of expected appreciation on nominal interest rates would be

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limited and the effect of commodity price changes would be indirect and lagged due to the presence of money illusion and imperfect foresight. Based on empirical observations, Fisher concluded that expected appreciation shall be replaced by lagged inflation (Rhodes, 2008). Implicit form of conventional Fisher equation incorporates money illusion and proper measurement of expected money value on the basis of distributed lag model of inflation (Fisher, 1930). Here, expected money appreciation is replaced by goods appreciation π.

As a result, Rhodes (2008) suggests that analysis employing backward-looking expectations should be more accurate once using conventional Fisher equation which exhibits features of inflation psychology. It is worthy to note that by the early 70´s, Fisher´s distributed lag model of inflation was considered to be the model based on the adaptive expectations hypothesis. This brings us back to Rutledge (1977) who noted that the interpretation of lag between inflation and nominal interest rate was not based on expected inflation. Despite the fact that modern approach to conventional Fisher equation puts emphasis on forward-looking forecasts of goods prices and it attempts to superimpose the rational expectations hypothesis, it is not compatible with the view of Fisher. If people would be able to measure correctly expected money value and would possess unbiased expectations free of money illusion, there would be no dispute about the proper version of Fisher equation. However, Fisher (1930) empirically proved imperfect adjustment of the nominal interest rate to changes in inflation with substantial lags. He gives an example during the period of 1896 to 1920, when the real rate of interest was wiped out, whereas in 1921 in a period of deflation, the nominal interest rate adjusted incompletely and the real interest rate rose as high as 60%. A period of deflation followed by resulting rise in real interest rate was formulated explicitly by Fisher to affect aggregate production and employment, and thereby strengthening the severity of the Great Depression.

Fisher Equation, Money Illusion, and Modigliani-Cohn Hypothesis

Conventional Fisher equation, which incorporates money illusion, might also substantially affect stock returns in financial markets. The study uses Modigliani and Cohn (1979) famous hypothesis to emphasize this aspect. The issue of money illusion in financial markets is rather topical as confirmed by the studies of Ritter and Warr (2002), Lee (2010), Acker and Duck (2013, a,b), Basu, Markov and Shivakumar (2005), and Chordia and Shivakumar (2005). Also, money illusion in financial markets was also experimentally confirmed by the study of Noussair, Richter, and Tyran (2008) with substantial implications on investor´s behavior. According to this hypothesis, investors are unable to free themselves from certain forms of money illusion and tend to price equities in a way that fails to reflect their real economic value. In

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particular, investors in times of inflation discount real stock cash flows at a rate which parallels the nominal interest rate rather than real interest rate. As a result, stock market prices are undervalued in times of high inflation and overvalued in times of low inflation. Investors partially overlook inflation since the cost of this negligence is small at first. However, still mainstream economists could argue that it is rather controversial to assume the presence of money illusion in the market due to high stakes at stock market which should quickly arbitrage away any signs of money illusion and alternative explanations such as proxy effect are needed.

Cohen, Polk, and Vuelteenaho (2005) consider whether a small number of wealthy and rational arbitrageurs (compared to majority of nominally confused stock investors) might eliminate any potential mispricing induced by money illusion. Basically, any attempt of the investor to correct the mispricing exposes him to the uncertain development on the stock market. Slow correction of mispricing requires long holding periods for arbitrage position. This is along with the fact that the variance of the risk grows linearly with time as the investor is significantly exposed to volatility. As Modigliani and Cohn (1979) emphasize, if a rational investor had bet against money illusion in early 1970s and could correctly assess the extent of the undervaluation of equities, he would suffer from substantial loss for more than a decade. As a result, arbitrage activity is prevented in this sense. In this sense, strategic complementarity in vein of Fehr and Tyran (2001) might intensify undervaluation of stock prices in case of high inflation despite the fact that majority of investors is rational.

Even empirical evidence confirms the possibility that the market tends to exhibit money illusion of Modigliani-Cohn type. Cohen, Polk and Vuelteenaho (2005), Brunnermeier and Julliard (2008), Engsted and Pedersen (2016), and Campbell and Vuelteenaho (2004) confirm a negative relationship between price-dividend ratio and inflation based on backward-looking inflation expectations. It is interesting to note that Modigliani-Cohn hypothesis is limited only to the presence of money illusion in the stock market. However, Bassak and Yan (2010) provide a proof that money illusion seems to be relevant also in bond market. By bringing back the Fisher's relation mentioned in the beginning (Fisher, 1930; Thaler, 1997) stating that nominal interest rate moves one-for-one with expected inflation, it is inconsistent with the aforementioned Modigliani-Cohn negative relationship. In other words, the expected nominal rates of return of assets expressed as a sum of the expected inflation and the ex-ante real return should provide a sufficient hedge against inflation, which implies a positive relationship between stock returns and inflation. Thus, investors are thereby compensated for the loss in purchasing power due to inflation (Gavriilidis & Kgari, 2016). Unfortunately, this is not the case. It has already been mentioned that

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conventional Fisher equation might not represent a good description of reality, which supports again our hypothesis that it is money illusion that is responsible for a rather imperfect working of this conventional equation in reality. Furthermore, it is worthy to note that some studies such as Boudoukh and Richardson (1993) and King and Watson (1997) are consistent with the expected direction of Fisher´s effect in the long run, which suggests that investors will in the longer horizon find out their deception and uncover veil of nominal values. There is a vast amount of other literature on Fisher´s effect which will not be elaborated for the sake of clarity and accuracy of the paper such as Yeh and Chi (2009), Lintner (1975), Gultekin (1983), Schwert (1977), and Svedsater, Gamble and Garling (2007).

Some studies attempt to find alternative explanation for the imperfect working of Fisher equation such as risk premium (Cohn & Lesard, 1980). Risk premium might be a potential factor responsible for negative relationship between capitalization rates and inflation, since inflation affects the value of equity, because it affects the risk premium. Naturally, question arises why profits should be riskier with a steady six percent inflation than with a steady two percent inflation (Modigliani & Cohn, 1979). Moreover, risk premium hypothesis seems to be identical to money illusion hypothesis because changes in inflation change equity values as they also change the risk premium. As a result, the only difference between these two hypotheses is that in the case of money illusion, investors will start to see through the veil of nominal values and inflation will no longer depress market values. In addition, proxy effect might play a negative role in the relationship between inflation and the price of stocks (Brunnermeier & Julliard, 2008). In other words, inflation serves as proxies for some unidentified real macroeconomic variable which drives fundamental stock values. In this particular case, high inflation or high inflation expectations are a bad signal about future economic development. Logically, higher inflation is associated with riskier environment or higher risk aversion, generating a risk premium, which is correlated with inflation. In other words, inflation and or inflation expectations is a proxy for risk aversion (Fama, 1981).

The negative relationship between stock returns and inflation is attributed to the tax effect and high effective corporate tax rate on corporate income (Feldstein, 1980; Cohn & Lesard, 1980). Chen, Lung, and Wang (2009) propose apart from money illusion an alternative hypothesis called the resale hypothesis. They empirically prove that both money illusion and resale hypothesis are relevant explanation in explaining the level of stock mispricing. However, the resale hypothesis appears to have better explanatory power in case of high or volatile price level.

Geske and Roll (1983) tackle the issue of reverse-causality. In their view, the interaction of the fiscal and monetary policy is responsible and

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changes in stock prices once future economic activity is anticipated are highly correlated with government revenues. Once economic activity declines followed by government deficit, monetary policy will try to balance the budget by expanding the monetary base followed by inflation. This leads to a negative relationship between stock returns and inflation.

Cohn and Lessard (1980) control for the risk premium analysis reveals that money illusion clearly dominates not only risk premium factor but also a tax effect. Cohen, Polk, and Vuolteenaho (2005) present advanced tests which detach money illusion from investor´s attitudes towards risk. Findings suggest that expected inflation does not proxy for future output movements or for the higher risk aversion but instead strengthen the relevance of money illusion. In contrast, Schmeling and Schrimpf (2008) consider money illusion and the proxy hypothesis as competing hypotheses rather than joint hypotheses but still achieve similar results compatible with money illusion. Chen, Lung, and Wang (2009) confirm the significance of money illusion and also strong case for resale hypothesis in case of high or volatile price level.

In general, available literature suggests that money illusion is a prevailing phenomenon and overweighs clearly alternative effects.

Modigliani-Cohn hypothesis (1979) suggests that even knowledgeable investors found it surprising that the appropriate capitalization rate may become negative with sufficiently high inflation. If this view is accepted, it cannot be ruled out that apart from investors, lending institutions and business managers are also affected. In turn, the presence of money illusion has significant implications for firm´s behavior and resulting profits. Furthermore, it appears that money illusion is highly probable in case of price level fluctuations, which is in line with the results of Cohn and Lessard (1980) and Cohen, Polk and Vuolteenaho (2005), whereas undervaluation will be noted by investors in case of stable price level.

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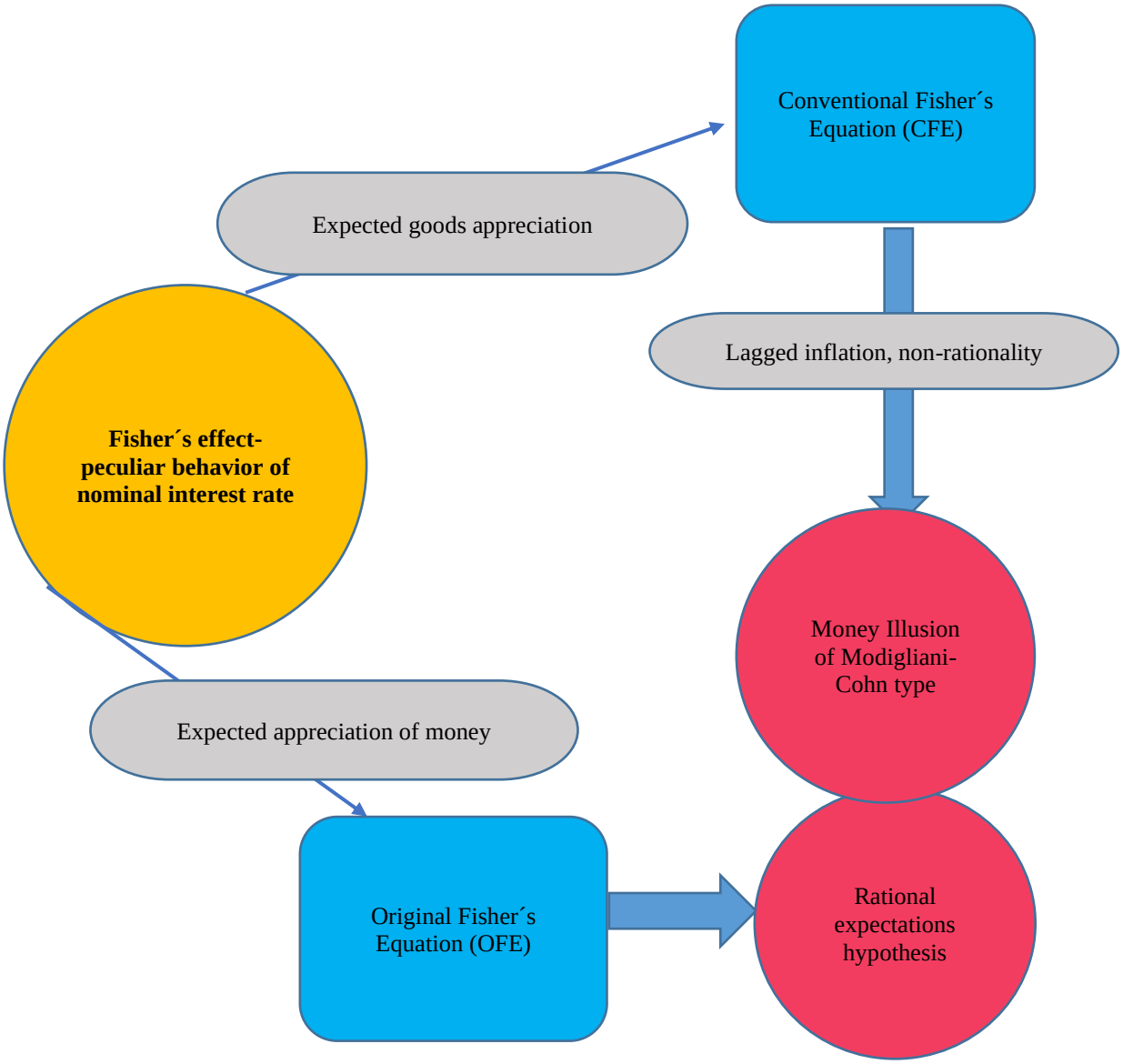

Figure 1. Fisher´s Effect and Modigliani-Cohn Hypothesis
Source: Author´s own contribution, inspired by Rhodes (2008) and Modigliani-Cohn (1979)

Conclusion

The main aim of this paper was to evaluate the relevance of Fisher equation in the context of resurrected concept of money illusion, which is extensively applied in the financial market literature.

Firstly, it was discussed that Fisher equation which relates nominal interest rate to the real interest rate is rather an imperfect description of the real world. In particular, the real interest rate is more of a variable than

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nominal interest rate, which is lagging because of the inability of nominally-blinded individuals to adjust nominal interest rate towards changes in price level. This raises questions about the relevance of Fisher equation which might be partially flawed.

As a result, the discussion in the second section was devoted to more thorough analysis of original Fisher equation and modern conventional form of Fisher equation which might not be considered as substitutes but rather competing phenomena. Paradoxically, conventional Fisher equation might provide a biased estimate of the relationship between nominal and real interest rate in times of uncertainty about future prices, and it is incompatible with rational expectations hypothesis. This is due to incorporation of goods inflation instead of expected money appreciation.

Finally, Fisher equation is applied within Modigliani and Cohn hypothesis where investors are unable to free themselves from certain forms of money illusion and tend to price equities in a way that fails to reflect their real economic value. In particular, investors in times of inflation discount real stock cash flows at a rate which parallels the nominal interest rate rather than the real interest rate. Instead of considering real returns, they consider the nominal return on bonds. Investors fail to correct reported accounting profits for the gain of stockholders accruing from depreciation in the real value of nominal corporate liabilities. In particular, the elaboration of money illusion effects in the literature appears to be inconsistent with the expected direction of Fisher's effect, but it is logical due to the illusory nature of nominal interest rate and the prevailing money illusion. Moreover, it shows that conventional form of Fisher equation might be puzzling in financial market and might provide biased estimate of the relationship between nominal and real asset yields in an environment of rational expectations characterized by uncertainty about future prices (Rhodes, 2008; Benniga & Protopapadakis, 1983; Blejer & Eden, 1979). As it has already been mentioned above, the conventional form is valid and close to the original equation only if the size of bias is reasonably small, which is a risky assumption in the real world characterized by imperfections.

This paper also accounted for studies whose results are in line with expected working of Fisher equation and whose findings are not inconsistent with money illusion. The study emphasized that undervaluation of stock prices in case of high inflation might be intensified through the channel of strategic complementarity, despite the fact that majority of investors is rational. However, the existence of money illusion where valuation of an asset by agent is inversely related to the overall level of inflation in the economy is hard to swallow in light of efficient market hypothesis.

As a result, various alternative effects were discussed in line with rational concept which might be responsible for this development in financial

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markets. Proxy affects, where inflation proxies for risk aversion, the resale hypothesis or the tax-effect hypothesis and others. Based on the investigation of available research, it was found that more or less studies successfully isolate these effects and finds the role of money illusion to be non-negligible.

In conclusion, it is worthy to emphasize that the relevance of this topic is undisputable despite the fact that money illusion is presumed to be nonexistent based on rational expectations theory. Instead, this represented a challenge to provide the reader with relevant arguments based on behavioral economics which provides resurrection to Modigliani-Cohn hypothesis and conventional Fisher´s effect described by money illusion.

Additionally, it is extremely difficult if not impossible to gather data which would entail the concept of money illusion in financial markets. Also, many empirical studies, which work with the real data, fail to isolate this effect due to the presence of other effects such as resale hypothesis and tax effect.

As a result, one of the suggestions for our future research is the evaluation of Modigliani-Cohn hypothesis in experimental settings directly in the laboratory. Hence, this would enable us to gather these special data, isolate the effect of money illusion, and thereby provide evidence about the illusory nature of Fisher´s effect in financial markets.

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Effect of Trade Openness on Productivity in Cote d'Ivoire

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Abstract

The implementation of the African Continental Free Trade Zone offers important trade opportunities to African countries, including Côte d'Ivoire. The economic literature has shown that trade openness affects productivity. Therefore, this paper aims tocompare the effect of trade between Côte d'Ivoire and other African countries on productivity and the effect of trade between Côte d'Ivoire and the rest of the world (outside Africa) on productivity. To achieve this objective, the Dynamic Least Squares (DOLS) and Cointegration Canonical Regression (CCR) methods of Park (1992) were used to analyze the relationship between productivity and trade openness in Côte d'Ivoire over the period 1980-2019. We use Total Factor Productivity as measure of productivity in this study. The results show that the effect of trade between Côte d'Ivoire and African countries on productivity differs from the effect of trade between Côte d'Ivoire and the rest of the world (outside Africa) on productivity. Indeed, exports from Côte d'Ivoire to Africa have a positive and significant effect on productivity. while Côte d'Ivoire's imports from Africa have a negative and significant effect. Côte d'Ivoire's imports from the rest of the world (outside Africa) positively and significantly affect productivity. On the other hand, exports from Côte d'Ivoire to the rest of the world (outside Africa) have a negative and significant effect on productivity.

Keywords: Productivity, total factor productivity, innovation, trade openness, AfCFTA

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1. Introduction

Through the elaboration and implementation of National Development Plans, Côte d'Ivoire has demonstrated its ambition to achieve the structural transformation of its economy to support sustainable growth. Productivity gains at both the global and sectoral levels remain an important aspect of the structural transformation of economies. The impact of technological diffusion and innovation on economic growth has been studied in relation to the role of international trade as a channel for the transmission of technological knowledge (Coe and Helpman, 1995; Coe, et al., 1997). Technological diffusion and innovation appear to be important factors that several countries have relied on to achieve their structural transformation.

Export expansion contributes to economic growth by facilitating factor mobilization and capital accumulation in a quantitative sense. It also contributes to promoting productivity growth through the emulation of advanced foreign technology and through competition in foreign markets. In *The East Asian Miracle*, the World Bank (1993) suggested that exports and export promoting policies had been instrumental in East Asia's adoption of frontier technologies, which enhanced the productivity of exporting firms and economies in general, thus accelerating economic growth.

Innovation is at the heart of technical progress and economic growth. Indeed, the creation of new products and production processes are essential elements to achieve technical progress. It is considered a true source of the country's technical progress that improves the overall productivity of the factors of production (labor and capital). According to the Global Innovation Index of the World Intellectual Property Organization (WIPO), Côte d'Ivoire ranks 112th with a score of 21.24. Côte d'Ivoire is among the lower middle-income countries, whose score is below expectations for their level of development (Cornell University et al., 2020).

In addition,many studies focuses on technological change or technological catch-up and on the economic policies that can facilitate such change. A central question for developing countries in such a context has been that of the trade policy to be adopted, a question that is part of the general debate on the possible gains from trade openness. To compensate for low levels of domestic innovation, developing countries resort to imports and foreign direct investment to acquire modern foreign inventions. Opening to the outside world plays an important role in the innovation process of developing countries.

Côte d'Ivoire ratified the agreement establishing the Continental Free Trade Area (AfCFTA) on November 23, 2018. At a time when the entry into force of the AfCFTA is seen as a real opportunity for Africa through the increase of intra Africa trade, it seems interesting to analyze the effects of trade openness on the Ivorian economy. This study answers the following

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question: does trade openness between african countries have the same effect on productivity as trade openness between african countries and the rest of the world ? This study attempts to answer this question for the case of Cote d'Ivoire. The rest of the paper is organized as follows. Section 2 presents the literature review. Section 3 explains the methodology. The section 4 presents the empirical results while section 5 concludes the study.

2. Literature review

Relationship between trade and productivity

In this section, we review the existing literature on trade and productivity. Many studies have been devoted to identifying the role of TFP in growth dynamics to explain the large variation in economic growth across countries. In theory, there is a two-way causal relationship between trade and productivity but advocates of export-led growth generally contend that exports enhance productivity growth (Baldwin ,2003)). Trade openness is an important determinant of economic growth through channels of technology transfer and productivity improvement (Grossman and Helpman (1991), Edwards (1993), etc.,). An increase in international trade promotes the diffusion of new technologies embodied in industrial goods (Barro and Sala-i-Martin, 1997; Baldwin et al, 2005; Almeida and Fernandez, 2008).

Bloom et al. (2016) examine the impact of Chinese import competition on broad measures of technical change—patenting, IT, and TFP—using new panel data across twelve European countries from 1996 to 2007.They find that competition due to Chinese imports increased technical change (around 14% of European technology upgrading 2000–7). Ding et al. (2016) present a similar result for Chinese manufacturing industries, where competition pressure from imports led to rapid technological upgrading that accelerated in firms and industries close to the world frontier. Examining the relationship between openness and productivity in Swiss, Follmi et al. (2018) show that for some branches in the Swiss manufacturing sector, increases in international trade are associated with higher productivity in the long run.

Empirically, Coe and Helpman (1995) are among the first authors to provide empirical evidence of the importance of trade in the international diffusion of technology. In a study of a sample of 22 industrialized and 77 developing countries, they identified a positive relationship between productivity and trade openness. The estimates showed that for the G7 countries , the level of total factor productivity is determined primarily by domestic R&D efforts, while for the smaller countries, international technological externalities embodied in traded goods and services play a much more important role than those of domestic origin, with higher effects for the most trade-open countries. Countries participating in international trade benefit from the research and development of other countries through imports.

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International trade is an important tool in the transmission of technology between countries. Total factor productivity is influenced by domestic research and development activities as well as imported goods.

Dua and Garg (2017) used panel cointegration and group-mean fully modified ordinary least squares estimation to analyse the determinants of labour productivity in developed and developing countries. The study further finds that while both trade openness and foreign direct investment affect productivity of developing economies positively, only trade openness has a positive and significant impact on the productivity of developed economies.
Rodrik (1999) finds similar results to Coe and Helpman's (1995). He highlights the fundamental role of imports in the transmission of technology from developed to developing countries. He suggests that imports can act as positive externalities because they contain know-how and technology not necessarily mastered by developing countries thanks to technology transfers from the North to the South.

Cortes and Jean (2001) note the interdependence of technical progress and trade openness. Indeed, technical progress influences the country's openness by creating international externalities and the qualification of workers. It also influences the transmission of knowledge and technology from one country to another.

Trade openness could be harmful to an economy if it specializes in sectors with dynamic disadvantages in terms of potential productivity growth (Redding (1999), Young (1991) and Lucas (1988). .

To take full advantage of the productivity effects of openness, countries need to have the right human capital. Investment in human capital accumulation in research and development sectors plays an important role in improving productivity (Dahani et al 2020). Theoretical models have also emphasized the role of learning-by-doing (Arrow, 1962 and Alwyn, 1991). Das and Upadhyay (2019) investigated the growth model in 15 Asian countries from the early 1970s to 2014. The empirical indicates significant influence of human capital either directly on output growth or on growth through total factor productivity.

However, Kim et al. (2007) empirical results indicate that exports do not significantly affect TFP growth. Furthermore, their results show a negative relationship between TFP and trade. These results fail to support the export-led growth hypothesis with respect to TFP growth in Korea. Teresiński (2019) finds a similar result. He analyses how the terms of trade (the ratio of export prices to import prices) affect total factor productivity (TFP). He provides empirical macroeconomic evidence for the European Union countries based on the times series SVAR analysis and microeconomic evidence. They find that the terms of trade improvements are associated with a slowdown in the total factor productivity growth. The shift of resources from knowledge

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development towards physical exportable goods has a negative impact on the TFP growth.

Haider et al. (2020) analyze productivity dynamics using a panel of 12 manufacturing industries in 12 industrialized countries for 1990 to 2006. They find no indication for a direct impact of import shares on TFP growth. Nevertheless, the decomposed measures show evidence of a (at least minor) role for technology transfer.

It appears from the literature that studies on the relationship between trade openness and productivity are generally based on the transfer of technology from Northern to Southern countries. Is the mechanism of technology transfer from Northern to Southern countries the same as that of a Southern country to another Southern country?

In view of the almost similar level of development in the majority of sub-Saharan African countries and with the forthcoming implementation of the AfCFTA, this study analyses the effect of the South - South trade on productivity. This study analyzes the effect of trade between Côte d'Ivoire and other African countries on productivity in Côte d'Ivoire. It also examines the effect of trade between Côte d'Ivoire and the rest of the world on productivity in Côte d'Ivoire.

Productivity measures

Productivity is, in general, a measure of output divided by a measure of inputs. Broadly speaking, a distinction is made between unifactor (relating a measure of output to a single factor) and multifactor (relating a measure of output to several factors) productivity measures. In another distinction, productivity measures relate gross output to one or more factors. In these cases output is approximated by value added. Table 1 lists the main productivity measures.

Table 1: Overview of the main productivity measures

Type of output measure	***Type of input measure***			
	Labour	***Capital***	***Capital and labour***	***Capital, labour and intermediate inputs (energy, materials, services)***
Gross output	Labour productivity (based on gross output)	Capital productivity (based on gross output)	Capital-labour MFP (based on gross output)	KLEMS multifactor productivity
Value added	Labour productivity (based on value added)	Capital productivity (based on value added)	Capital-labour MFP (based on value added)	-
	Single factor productivity measures		***Multifactor productivity (MFP) measures***	

Source : OCDE (2001)

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Another measure of productivity refers to Total Factor Productivity. The three essential components for calculating TFP are real GDP per worker, physical capital per worker and human capital per worker. GDP is the measure of output, with capital and labor as inputs. This definition implies that there is no unit for productivity; it derives its meaning from a comparison across countries or over time.

Different approaches have been used to calculate TFP. The first application will be development accounting, following Hall and Jones (1999) and Caselli (2005). The second application will be on growth accounting, as in Jorgenson and Vu (2010). Klenow and Rodriguez-Clare (2005) use real GDP, employment, real physical capital stock, real human capital stock and the share of physical capital in output or the capital elasticity of output. It calculates TFP according to the following formula: $\ln TFP = \ln(Y / L) - \alpha \ln(K / L) - (1- a)\ln(H / L)$.

The Penn World Table (PWT) has developed its approach to calculating TFP. To provide an overview of the differences and similarities between PWT8.0 and existing approaches, Table 2 summarizes the main methods used and compares them to the "standard" approach of Caselli (2005).

Table 2: Input and productivity measurement methods according to PWT8.0 and Caselli (2005)

Area	**PWT8.0**	**Caselli (2005)**
Capital		
- Investment	By asset	Only total
- Depreciation rate	Varies across countries and time	Common across countries and time
PPP	Capital PPP	Investment PPP
Initial capital stock	Based on initial capital/output ratio	Based on steady-state assumption
Capital measure	Stock de capital	Stock de capital
Labor share	Varies across countries and time	Common across countriesand time
Labor input		
Employment	Number of persons engaged	
Human capital	Average years of schooling and assumed rate of return	

Soucre : Inklaar et Timmer (2013)

In this study we analyse productivity at the national level. We use Total Factor Productivity as measure of productivity in this study. The PWT calculation of TFP which takes into account countries specificities is used as productivity measure in this study.

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3. Methodology

3.1. Model specification

The economic literature provides several methods for analyzing the effects of technological diffusion on total factor productivity. The first analytical models proposed by Coe and Helpman (1995) focus on the neoclassical Solow growth model with a Cobb-Douglas production function where returns to scale are constant and technical progress is exogenous in the Hicks sense. $Y=AK^{\alpha}L^{1-\alpha}$ with A representing Total Factor Productivity (TFP), K and L representing capital and labor factors respectively, Y the Gross Domestic Product and α a parameter representing the share of capital in factor remuneration. This function makes it possible to obtain an estimate of TFP using the accounting decomposition of the sources of growth or by econometric regression.

$$\text{TFP} = \frac{Y}{K^{\alpha}L^{1-\alpha}}. \quad (1)$$

The model used by Coe et al (1997) is based on a linear specification that relates total factor productivity to the stock of foreign R&D capital, the degree of openness to trade with industrialized countries, and the level of education. Based on this study, the model used in this work is as follows:

$$\text{logTFP}_t = \alpha_0 + \alpha_1 logH_t + \alpha_2 logEMP_t + \alpha_3 logOUV_t + \varepsilon_t \quad (2)$$

Where :

logTFP_t is the logarithm of total factor productivity at date t ;

logEMP_t is the population employed at date t;

logH_t is the logarithm of human capital at date t. Benhabib and Spiegel (1994) postulate that human capital can directly influence productivity by determining a nation's ability to innovate. The human capital index is calculated from the number of years of schooling and the returns to education (see Human Capital in PWT9);

logOUV_t is the logarithm of trade openness at date t. Imports of machinery and equipment help improve productivity. Trade openness is measured by the share of imports and exports in GDP.

In several studies, trade openness is measured by the sum of exports and imports relative to GDP. Since the transmission channels for the productivity effects of exports differ from those for the productivity effects of imports, the trade openness variable is disaggregated between imports and exports in this study. We test if the effect of trade between Côte d'Ivoire and other African countries on productivity differs from that of trade between Côte d'Ivoire and the rest of the world (outside Africa). The model used to analyze the impact of trade between Côte d'Ivoire and other African countries on productivity is as follows:

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$$\log TFP_t = \alpha_0 + \alpha_1 logH_t + \alpha_2 logEMP_t + \alpha_3 logX\_CI\_AFR_t + \alpha_4 logM\_CI\_AFR_t + \varepsilon_t \quad (3)$$

Where:

$logX\_CI\_AFR_t$ is the logarithm of Côte d'Ivoire's exports to other African countries ;

$logX\_CI\_AFR_t$ represents the logarithm of Côte d'Ivoire's imports from other African countries.

The model used to examine the effect of trade between Côte d'Ivoire and the rest of the world on productivity is:

$$\log TFP_t = \alpha_0 + \alpha_1 logH_t + \alpha_2 logEMP_t + \alpha_3 logX\_CI\_ROW_t + \alpha_4 logM\_CI\_ROW_t + \varepsilon_t \quad (4)$$

$logX\_CI\_ROW_t$ is the logarithm of exports from Côte d'Ivoire to the rest of the world (outside Africa).

$logM\_CI\_ROW_t$ represents the logarithm of imports of Côte d'Ivoire from the rest of the world (outside Africa).

3.2. Data and descriptive statistics

The data used are mainly sourced from the West African Countries Central Bank (BCEAO) database and the Penn World Table (PWT) version 10.0. Data on TFP, human capital (H), and the employed population come from the PWT. Trade data (imports and exports) are from the BCEAO database. The analysis covers the period 1980-2019. Missing data for the import and export variables were calculated using the interpolation method.

Figure 1 shows the trends in Total factor productivity in Côte d'Ivoire. It declined between 1982 and 1994. It began to rise again in 1995 after the devaluation of its currency (XOF). It began to fall in 2005 after the onset of the 2002 political and military crisis. This decline continued until 2011. TFP has been on the rise since 2012. It seems to be sensitive to different shocks (economic and political). Exports and imports (% of GDP) have followed the same trend since 1985. They alternate between increases and decreases. They have followed a downward trend since 2012. Total factor productivity, exports, and imports follow broadly the same trend in their evolution. This suggests a likely link between these variables (figure 1).

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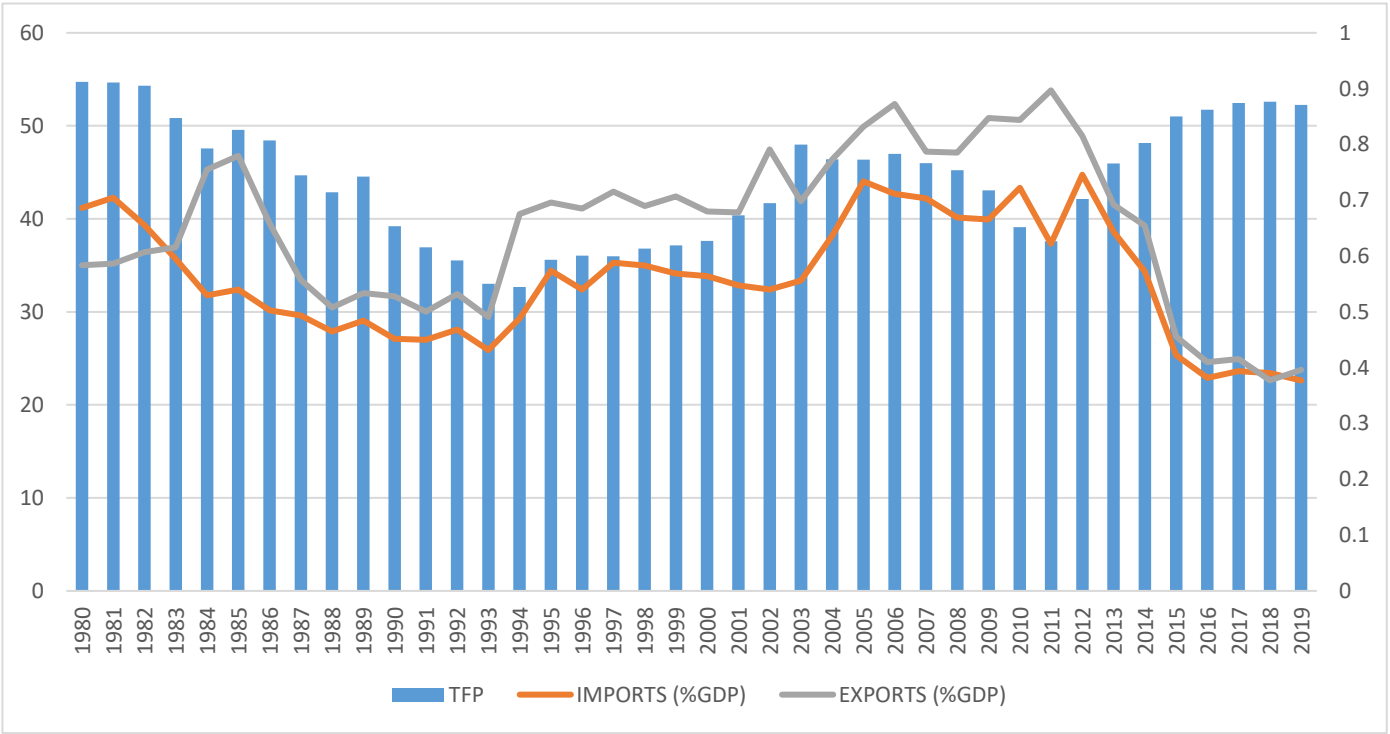
Figure 1: Evolution of Total Factor Productivity (TFP), imports (%GDP) and exports (%GDP) in Côte d'Ivoire



Source: Author's calculations based on PWT and BCEAO data.

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Tables 3 and 4 present the descriptive statistics and the results of the Pearson correlation test, respectively.

Table 3: Descriptive statistics

Variables	Number of observations	Mean	Standard Deviation	Minimum	Maximum
LogTFP	40	-.2283327	.1144331	-.3535398	.0170737
LogH	40	1.40189	.1676758	1.104961	1.695542
logEMP	40	6.683472	.1243419	6.435993	6.875653
logX_CI_AF	40	1.43147	.1427223	1.114929	1.661066
logM_CI_AF	40	1.199691	.398104	.1173582	1.618902
logX_CI_ROW	40	1.852462	.0500223	1.73383	1.939372
logM_CI_ROW	40	1.894574	.0608026	1.766549	1.994272

Source: Author's calculation

3.3. Estimation method

The empirical analysis of the long-run relationship between trade openness and productivity begins with unit root tests. The Augmented Dickey-Fuller and the Kwiatkowski-Phillips-Schmidt-Shin (KPSS) tests were used.

The estimation of a long-term relationship involving cointegrated variables has been the subject of much literature (Montalvo, 1995). Three methods have been proposed to estimate the cointegrating vector: Fully Modified Ordinary Least Squares (FMOLS) (Phillips and Hansen, 1990), Canonical Cointegration Regression (CCR) (Park, 1992), and Dynamic Ordinary Least Squares (DOLS) (Stock and Watson, 1993).

The FMOLS estimator is considered asymptotically unbiased. The FMOLS estimator employs preliminary estimates of the symmetric and one sided long-run covariance matrices of the residuals. The canonical cointegrating regression (Park, 1992) is closely related to FMOLS, but instead employs stationary transformations of the data to obtain least squares estimates to remove the long-run dependence between the cointegrating equation and stochastic regressor innovations.

The CCR transformations asymptotically eliminate the endogeneity caused by the long-run correlation of the cointegrating equation errors and the stochastic regressor innovations, and simultaneously correct for asymptotic bias resulting from the contemporaneous correlation between the regression and stochastic regressor errors (Park, 1992).

Montalvo (1995) finds interesting results and concludes that the CCR estimator shows smaller biases than the OLS and FMOLS estimators while the DOLS estimator consistently performs better than the CCR estimator. On the other hand, the DOLS results are more relevant when there is only one cointegrating relationship (Keho, 2012).

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4. Empirical results

4.1. Results of the unit root and cointegration tests

There are several well-known tests for this purpose based on individual time series. The Augmented Dickey-Fuller and Kwiatkowski-Phillips-Schmidt-Shin (KPSS) unit root tests were used to test the stationarity of the series. The results of both tests indicate that all the variables are stationary at first difference (I(1)). The results of these two stationarity tests are summarized in the table below.

Table 3: Unit root tests results

	Augmented Dickey-Fuller test				**KPSS test**			**Conclusion**
	Level			1st difference	**Level**		1st difference	
	Intercept	Trend and Intercept	None		Intercept	Trend and Intercept		
logTFP	-1.2541 (0.6406)	-2.19690 (0.4773)	0.13560 (0.7195)	-3.797*** (0.0004)	0.327257*** [0.739000]	0.183693*** [0.216000]	0.401002*** [0.739000]	I(1)
logH	0.551362 (0.9864)	-2.64934 (0.2622)	1.487395 (0.9638)	0.041046 (0.6898)	0.781564 [0.73900]	0.127373*** [0.21600]	0.152927*** [0.73900]	I(1)
logEMP	0.438611 (0.9821)	-3.9085** (0.0229)	2.041197 (0.9887)	-0.014148 (0.6716)	0.758740 [0.739000]	0.175320 [0.146000]	0.311580**** [0.739000]	I(1)
LogEXPORT_AF	-2.195532 (0.2111)	-2.73019 (0.2308)	0.002201 (0.6773)	-6.5642*** (0.0000)	0529176 [0.463000]	0.110187** [0.146000]	0.077564** [0.463000]	I(1)
logIMPORT_AF	-2.071946 (0.2566)	-2.0864 (0.5370)	-0.96612 (0.2928)	-6.3055*** (0.0000)	0.253639** [0.463000]	0.174040 [0.146000]	0.286341** [0.463000]	I(1)
logEXPORT_ROW	-2.195532 (0.2111)	-2.73019 (0.2308)	-0.84907 (0.3417)	-6.5642*** (0.0000)	0.567696 [0.463000]	0.085575** [0.146000]	0.084096** [0.463000]	I(1)
logIMPORT_ROW	-2.195532 (0.2111)	-2.73019 (0.2308)	-0.84907 (0.3417)	-6.5642*** (0.0000)	0.155618** [0.463000]	01555441 [0.146000]	0.252786** [0.463000]	I(1)

Probability values for rejection of the null hypothesis are employed at the 5% significance level (**, p-value < 0.05 and***, p-value < 0.01).
Values in ( ) are the p-value (Augmented Dickey-Fuller test) and values in the [ ] are the critical values (KPSS test).
Source: Author's calculation

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The cointegration test was performed to ensure the existence of a long-term relationship between variables. The table below summarizes the results of the cointegration tests. In this study the Johansen cointegration test was used. The results indicate that there are at least two cointegrating relationships for each of the equations. Thus, there is a long-run relationship between the variables.

Table 4: Results of Johansen cointegration test
Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.685644	131.3138	95.75366	0.0000
At most 1 *	0.639731	88.49635	69.81889	0.0008
At most 2 *	0.489194	50.72287	47.85613	0.0262
At most 3	0.323251	25.86755	29.79707	0.1327
At most 4	0.244223	11.42072	15.49471	0.1869
At most 5	0.028252	1.060369	3.841466	0.3031

Trace test indicates 3 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values
Source: Author's calculation

4.2. Results and discussion

The Johansen cointegration test indicates the existence of at least two cointegrating relationships. Dynamique ordinary least squares (DOLS) and Canonical Cointegration Regression (CCR) are used to estimate the long-run relationship. Table 5 reports the results of cointegrating regression analysis using CCR and DOLS.

In order to identify the effect of trade between Côte d'Ivoire and African countries on productivity, we estimated the model by considering exports and imports between these two entities. The results reveal that exports from Côte d'Ivoire to Africa have a positive and statistically significant effect on productivity. Firms tend to learn advanced technologies through exports and must adopt them to compete in the foreign markets. Ivorian firms use the innovations contained in the imported goods from developed countries to produce manufactured goods for African countries. The implementation of the AfCFTA, which offers export opportunities to Côte d'Ivoire, should improve the country's productivity.

On the other hand, imports from Africa to Côte d'Ivoire have a negative and statistically significant effect on productivity. Côte d'Ivoire's imports from other African countries are dominated by raw materials whereas its exports to other African countries are mainly manufactured goods. Imports of Côte d'Ivoire from African countries therefore don't contribute to productivity.

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Table 5: Results of estimations

	Productivity and trade between Côte d'Ivoire and Africa		**Productivity and trade between Côte d'Ivoire and the ROW (outside Africa)**	
Variables	**DOLS**	**CCR**	**DOLS**	**CCR**
logH	0.989736 [1.343545] (0.1941)	1.516421*** [3.797795] (0.0006)	1.583592*** [2.889118] (0,0091)	1.538954*** [4.636529] (0,0001)
logEMP	-1.218116 [-1.465981] (0.1582)	-2.041748*** [-4.058729] (0.0003)	-1.901803*** [-3.102657] (0,0056)	-2.103933*** [-5.216531] (0,0000)
LogEXPORT_AF	0.202998 [0.803977] (0.4309)	0.237460** [2.072198] (0.0459)		
LogIMPORT_AF	-0.174219** [-2.411967] (0.0256)	-0.207768*** [-6.749102] (0.0000)		
logEXPORT_ROW			-0.977102 [-1.307605] (0.2058)	-1.399156*** [-4.510308] (0,0001)
logIMPORT_ROW			1.108269** [2.545128] (0,0193)	1.485371*** [7.861155] (0,0000)
C	6.288177 [1.380317] (0.1827)	11.20153*** [3.991259] (0.0003)	9.853810** [2.619886] (0,0164)	11.45388*** [4.973367] (0,0000)
R squared	0.943788	0.850877	0.948492	0.878604
Adjusted R squared	0.898818	0.833333	0.907286	0.864322

The numeric values in [ ] are t-statistic and the numeric values in ( ) are p-values. (**, p-value < 0.05 and ***, p-value < 0.01).
Source: Author's calculation

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Estimation of the effect of trade between Côte d'Ivoire and the rest of the world (outside Africa) shows that Côte d'Ivoire's imports from the rest of the world positively affect productivity. This result is consistent with Rodrik (1999) and Coe and Helpman (1995). Imports of capital goods and intermediate goods which cannot be produced domestically enable domestic firms to diversify and specialize, further enhancing their productivity. The imports of Côte d'Ivoire from developed countries support the diffusion of the new technologies in imported industrial goods. This contributes to improving technical progress which in turn increases productivity in Côte d'Ivoire.

In contrast, Côte d'Ivoire's exports to the rest of the world have a negative and statistically significant effect on productivity. This may be explained by the fact that exports from Côte d'Ivoire to countries outside Africa are dominated by raw materials, especially agricultural.

Human capital plays an important role in the diffusion of innovation. The results show that human capital has a positive and statistically significant effect on productivity in Côte d'Ivoire. The know-how of workers is essential for improving productivity. They are led to succeed in their missions by exploiting their knowledge, training and technology. This result is in line with Traoré (2017) who showed that human capital influences the structural transformation of ECOWAS countries.

On the other hand, the number of people in employment has a negative effect on productivity. A World Bank report[1] showed that labor productivity in Côte d'Ivoire is low. In addition, the promotion of labor-intensive activities to reduce unemployment contributes to explain the negative sign.

Conclusion

Côte d'Ivoire has ratified the agreement establishing the African Continental Free Trade Area (AfCFTA). The implementation of this continental free trade zone offers important commercial opportunities to Côte d'Ivoire. The objective of this paper was to analyze the effect of trade openness on productivity in Côte d'Ivoire. The results showed that the effect of trade between Côte d'Ivoire and African countries on productivity differs from the effect of trade between Côte d'Ivoire and the rest of the world (outside Africa) on productivity.

Côte d'Ivoire's exports to Africa have a positive effect on productivity. On the other hand, Côte d'Ivoire's imports from Africa have a negative effect on productivity.

We also find that Côte d'Ivoire's imports from the rest of the world have a positive effect on productivity. On the other hand, exports from Côte

[1] Banque mondiale (2017). *Rapport sur la situation économique en Côte d'Ivoire : Et si l'Emergence était une femme.* volume 5, juillet 2017. Groupe de la Banque Mondiale.

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d'Ivoire to the rest of the world (outside Africa) have a negative effect on productivity. In addition, human capital has a positive effect on productivity.

In light of these results, the implementation of the AfCFTA represents a real opportunity for Côte d'Ivoire to improve productivity. The government must build its productivity improvement strategy by promoting manufacturing exports to African countries and outside Africa. Efforts should also be made to improve the quality of human capital.

Finally, we discuss the limitations of our study, which are primarily associated with data limitations. In particular, due to unavailability of the relevant data on import and export of manufactured goods, we use total imports and exports. These limitations offer significant opportunities for future research on this important topic. Perhaps, future research focuses more specifically on the relationship between productivity and trade at firm level and in different sectors.

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Online Shopping: A Survey on Consumer Buying Behavior in Bangladesh

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Abstract

Consumer attitudes and behavior have shifted dramatically all across the world as a result of the internet. Online shopping has emerged as a result of this trend, and it has had a significant impact on the lives of regular young people. Even though online purchases have been around in Bangladesh for a long time, consumers, particularly senior individuals, are not very interested in doing so. A self-constructed online survey of 150 Bangladeshi respondents was used in this study to try to understand customer behavior regarding online buying. According to the report, the vast majority of customers order online and thus save time and access a wider range of services and products. Males, as well as females, have roughly similar attitudes on online shopping: they prefer home delivery and oppose inadequate return policies. Typically, they gather online shopping information via social media and cash-on-delivery is a popular method of purchasing apparel and accessories. Consumers are particularly concerned about the safety of the payment system, and they are not interested in using credit or debit cards to shop. This study also revealed

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that consumers' favorable experiences with online shopping are uneven.

Keywords: Bangladesh, Customer, Attitudes, Consumer Behavior, Online Shopping

Introduction

In today's hectic world, online buying is the most convenient option. Words, images, and media files are used to explain all products on shopping websites, and for further product information, many internet retailers include links too. So, in their spare time, a buyer can purchase a home product from an online marketplace **(**Rahman, M. T. 2016). There has been a significant shift in client shopping behavior in recent years, owing in part to the present pandemic crisis. Consumers are increasingly comfortable shopping online, even if they prefer to shop at a real store. For modern individuals, online purchasing saves valuable time while also assisting in the maintenance of social distances, which is critical in the current circumstances (Rahman, M. A., Islam, M. A., Esha, B. H., Sultana, N., & Chakravorty, S. (2018). Furthermore, as the notion of e-commerce has grown in popularity in Bangladesh, Bangladeshis are becoming increasingly concerned about the advantages and disadvantages of online buying.

Online purchasing has increased dramatically all over the world because of the diversity of trade and business in the 21st century (Johnson, Gustafsson, Andreassen, Lervik, & Cha, 2001). Globally, approximately an estimated 2.29 trillion USD is generated from e-commerce (John, 2018), with at least 4 trillion USD expected to be reached by 2020 (eMarketer, 2016). In all sorts of e-commerce, including business-to-business, and business-to-consumer (Zuroni & Goh, 2012), a 15% rise in revenue and a 13% increase in orders (eMarketer, 2018) have been achieved. In comparison to the mature market, the Asia Pacific region, which includes the United States, the United Kingdom, Japan, and European countries, is driving the expansion of online shopping. The Asia Pacific region, particularly China, experienced tremendous growth. In 2016, the Asia Pacific area generated almost $1 trillion in online sales, the majority of which came from China, responsible for $899 billion (eMarketer, 2016). According to the e-Commerce Association of Bangladesh (e-CAB), official reports, and industry insiders, online sales rose about 70% in 2020 from the previous year, and market size of the industry stood at nearly $2 billion as of August that year. E-CAB Vice President estimates that valuation of the sector in 2021 might have crossed Tk20,000 crore which is about $2.32 billion. By 2023, the market is predicted to reach a size of $3 billion. (Dhakatribune, 2021).

Consumer behavior toward online purchasing is usually driven by two elements; the elements are trust and perceived advantages (Hoque, Ali, &

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Mahfuz, 2015). As a result, client behavior toward online orders appears to be affected by reputation and expectation of benefits (Al-Debei, Akroush, & Ashouri, 2015; Hajli, 2014). Furthermore, information quality, goods features, distribution, consciousness, way of thinking, customer service, and the consumer's perception of time are all major predictors of online consumer satisfaction (Katawetawaraks & Wang, 2011).

As more individuals can access the world wide web and its benefits, online shopping is becoming more acceptable and favored by a group of customers looking for better product offerings in terms of understanding, accessibility, price, and variety. Online shopping in Bangladesh is becoming more popular because of young people experimenting with new forms of purchasing like in other Asian countries such as India, Pakistan, Srilanka, etc.

Usually, internet stores use different resources to promote all of their products whether the conventional stores are not very much interested in promoting their goods and services. So, sometimes, without intending to buy anything or visit a certain store, passionate consumers start exploring which causes them to feel compelled to make impulsive purchases. However, as a result of their lack of knowledge and evaluation options for selecting the goods, people may have positive or bad repercussions after purchasing. Both internal and external influences impacted this conduct (Tinne, W. S. 2011). Satisfied consumers are more inclined to make repeat purchases if a company provides exceptional customer service. Besides, there is a positive chance of expansion of online commerce in the near future because the availability of the internet that increases rapidly in the rural areas in Bangladesh. On the other hand, our people are usually careful when it comes to purchasing; nevertheless, as a result of technological advancement and a quicker lifestyle, their dependence on shopping online will expand.

Because of the current situation, a growing number of academics are interested in studying consumer behavior in terms of understanding the aspects of online purchasing. As a result, our research focuses on understanding consumer attitudes toward online purchasing, and also their preferences, dislikes, and degrees of satisfaction.

Methods

We designed a study through an online survey, producing a self-constructed questionnaire with the research purpose in mind, to understand the customer behavior of internet buying in Bangladesh. The preceding questions were asked to achieve the study's purpose of identifying customers' clothes purchasing behavior concerning online shopping**:** (Koca, E., & Koc, F. 2016)

1. What are the sources of online shopping information?
2. What are the reasons for choosing online shopping?
3. What are the factors for liking online shopping?

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4. What are the factors for disliking online shopping?
5. What kind of payment method do consumers prefer most?
6. How much is the satisfaction level for Online Shopping?

In this study, data was collected from respondents in Bangladesh using an online survey using a convenient non-probability sampling method. It is one of the most popular sources of data collection. Online surveys are becoming the most frequent approach for academics to conduct studies and gather data in the future, thanks to the availability of effective and readily available online survey technologies. A simple and cost-effective sampling strategy is more popular in IS analysis that receives a greater response rate. (Eze, Manyeki, Yaw, & Har, 2011).

Research Design

In this survey, we directly collected information about online shopping from individual consumer responses through an online based survey and used that as a primary source of data. To collect a quick response from the respondents a google form was created and circulated online via different media such as email, website embedded, social media, etc. As secondary information, supporting information on consumer behavior in e-commerce in Bangladesh has been gathered from various journals and research articles.

Target Population and Sample Size

For an online survey, we sought 180 respondents from diverse age groups, including students, employees, business owners, and homemakers with varying levels of internet buying experience, and 165 participated in the survey resulting in a 92% response rate.

Procedure for Data Investigation

After sifting the 165 responses, 150 useful and legitimate responses were chosen for further investigation. Microsoft Excel was used to analyze the data that had accumulated. Individual customer information was studied and analyzed using standard computer software as well as represented as a bar diagram (Rahman, M. A., Islam, M. A., Esha, B. H., Sultana, N., & Chakravorty, S. 2018).

Formula: 100 (Frequency/Population)

Limitations:

Since the respondents do not have proper knowledge about the e-commerce policies so the online dealers can easily deceive them. Again, sometimes respondents do not feel at ease answering willingly because of the

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lack of interest. So, the finding is associated with certain limitations. The limitations of this study are:

1. Users are bombarded with polls, discounts, and a variety of other online pranks, so respondent cooperation is always an issue.
2. Because internet surveys are done without a mediator or interviewer, data dependability is questionable.
3. Specific segments of the target demographic may be unable to use the internet, resulting in limited access to certain segments of the population.

Results and Discussion

Eleven parameters were taken to analyze and represent survey results using a bar diagram.

Gender

We observed that 64.67 % were men and 35.33 % were women among the respondents.

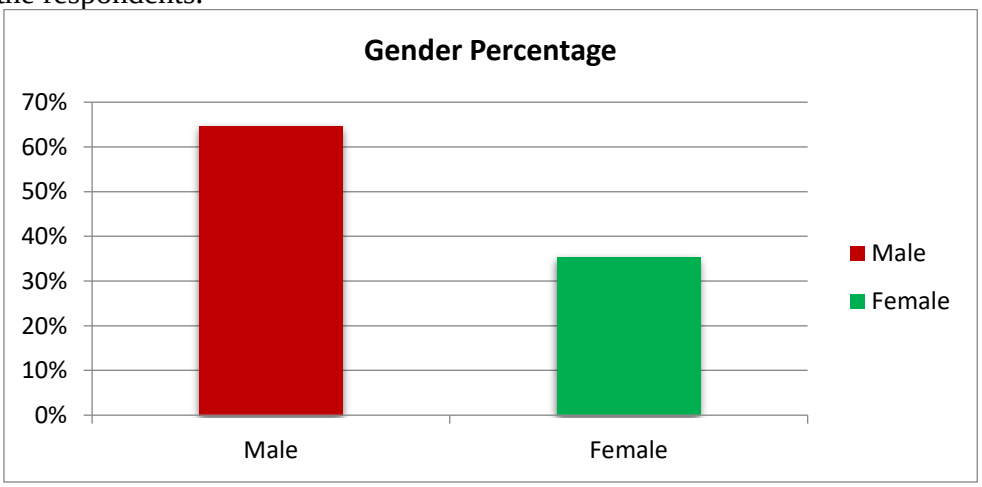

Figure 1: The respondents' gender

Age

The majority of respondents were under the age of 35. 12.67% of respondents were under the age of 19, 37.33% were between the ages of 20 and 24, 23.33% were between the ages of 25 and 29, and 18% were between the ages of 30 and 34, and 8.67% were 35 or older.

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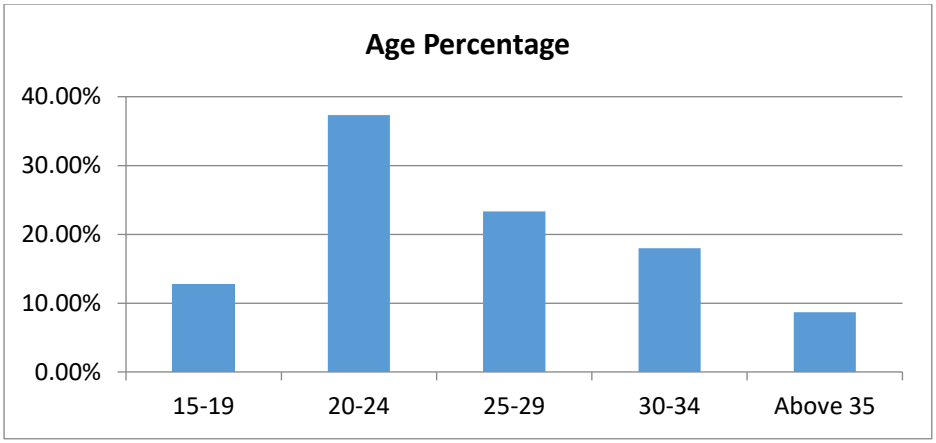

Figure 2: Respondents' age group

Occupation:

According to research, students are more actively engaged in online shopping than in any other occupation. Almost 40.67% of the total respondents were students. 14% of them were homemakers, 34.67% of them were service holders and 10.67% of them were doing business.

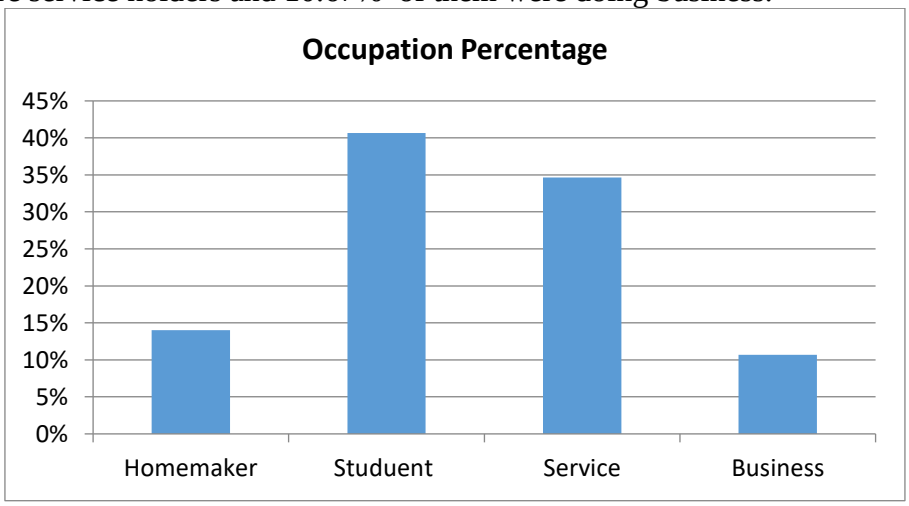

Figure 3: The respondent's occupation

Income range

Almost 50.67 % earn between Tk. 0 and Tk. 15,000 per month, 22.67 % make between Tk. 15,001 and 30,000 per month, 15.33 % earn between Tk. 30,001-45,000 per month, and 11.33 % earn greater than Tk. 45,000 per month.

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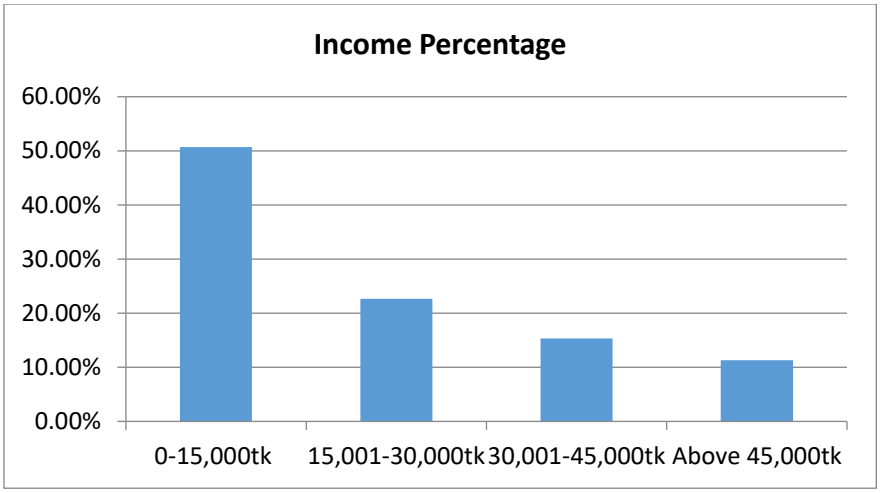

Figure 4: The respondent's income range

Sources of Knowledge on Online Buying

In order to advertise and sell items online, it is important to educate people on online purchases, such as the advantages, limitations, and website addresses linked with it. Social media platforms such as Facebook, Twitter, Linkedin, and Instagram are being used by 52% of those surveyed to learn about online shopping and 16.67 % of them receive information from friends and family. TV advertisements account for 10% of them, whereas websites like Pickaboo, eBay.com, Daraz, and Monarch mart account for 21.33%.

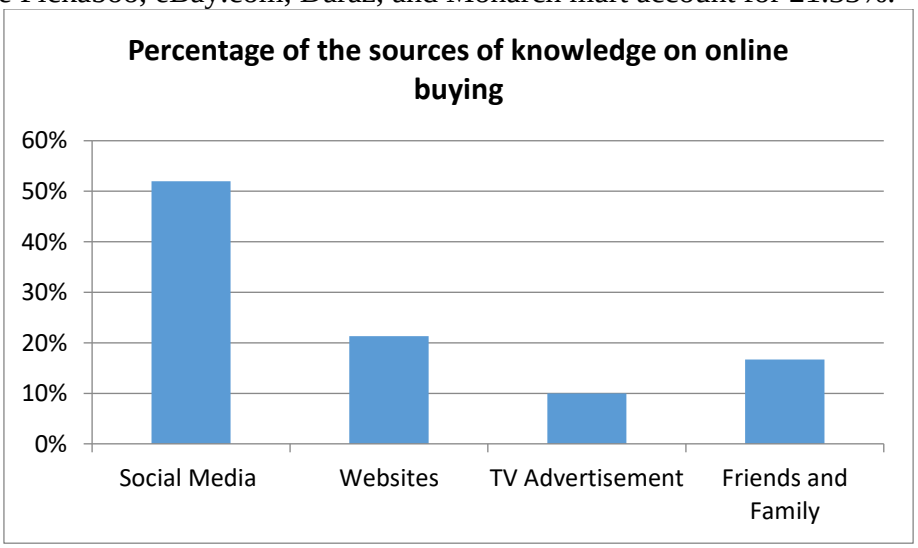

Figure 5: Details of the sources of knowledge on online buying

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Reasons to Shop Online

Online shopping is chosen by 54.67 % of male and female participants since it saves them time, while 27.33 % prefer it because of the variety of products available. Approximately 10% of respondents prefer online purchasing because it makes it easier to compare goods, and 8% favor it since the product is legitimate.

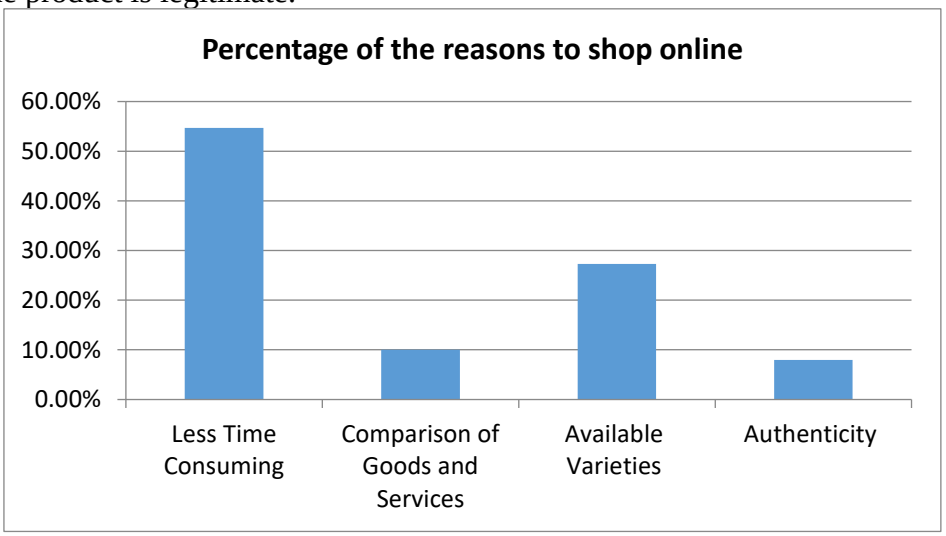

Figure 6: Details of the Reasons to Shop Online

Choices for Goods/Services

When questioned which one of the particular goods and services they desired, 51.33 % chose clothing, while 24.67 % preferred accessories. Electronic gadgets are preferred by 15.33 % of those surveyed, while books are been preferred by 8.67 %.

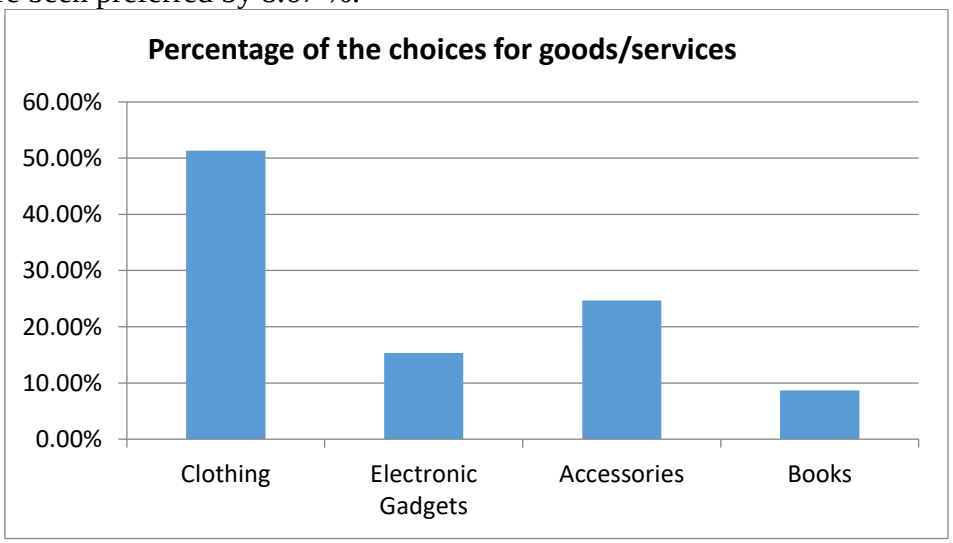

Figure 7: Details of the choices for goods/services

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Reasons to Enjoy Online Shopping

Both male and female participants enjoy the convenience and accessibility of online shopping. They prefer the facilities of home delivery. Because of the evident advantages of home delivery, 40.67 % preferred online purchasing and approximately 12.67 % said it is easier to buy what they want online. Discount offers are appreciated by 20% of respondents while shopping online, while available purchase options and payment channels are preferred by 25.33 %.

Figure 8: Details of the reasons to enjoy online shopping

Reasons for Disliking Online Shopping

The most common complaint about online purchasing is the lack of a positive return policy. Table 9 demonstrates that 36% of respondents detest online shopping because of the bad return policy, while roughly 28% dislike it because of the high cost of products or services. 20% of respondents reject internet shopping's after-sale services, and 16% dislike the unable to touch and feel or try things out.

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Figure 9: Details of the Reasons for Disliking Online Shopping

Payment Method

A consumer's payment method is a critical component in purchasing an online product. When it comes to online buying, the majority of customers prefer the cash-on-delivery method. According to the case study, 81.33% of respondents prefer to pay with cash on delivery, while 11.33% prefer to pay with mobile banking. 5.33% of respondents pay with a credit card, while 2% pay with a debit card.

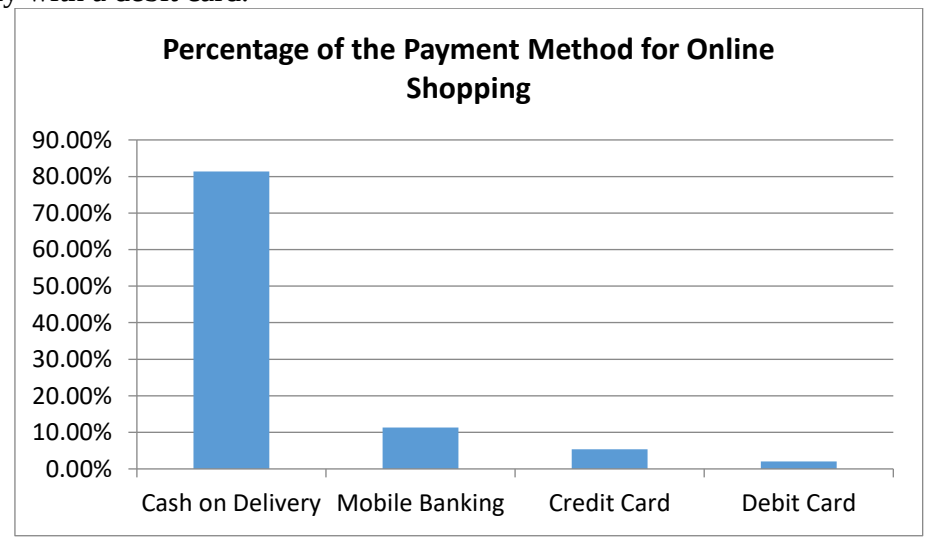

Figure 10: Details of the Payment Method for Online Shopping

Satisfaction level of Online Shopping

Customer satisfaction is critical in online shopping. Customers who are satisfied are more inclined to shop online again. Following data analysis,

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the total online purchasing experience was found satisfied by half of the participants. Just very few online buyers are very happy with the services indicating that there are already issues that prevent consumers from purchasing online regularly. Companies must take steps to move disappointed and indifferent internet buyers into the satisfied or entirely satisfied category. Regular online buyers are satisfied in 52% of cases, whereas 14% are unsatisfied. They are neutral in 27.33% of the cases and only 8% of the total regular internet consumers are extremely satisfied, compared to 1.33% who are really dissatisfied.

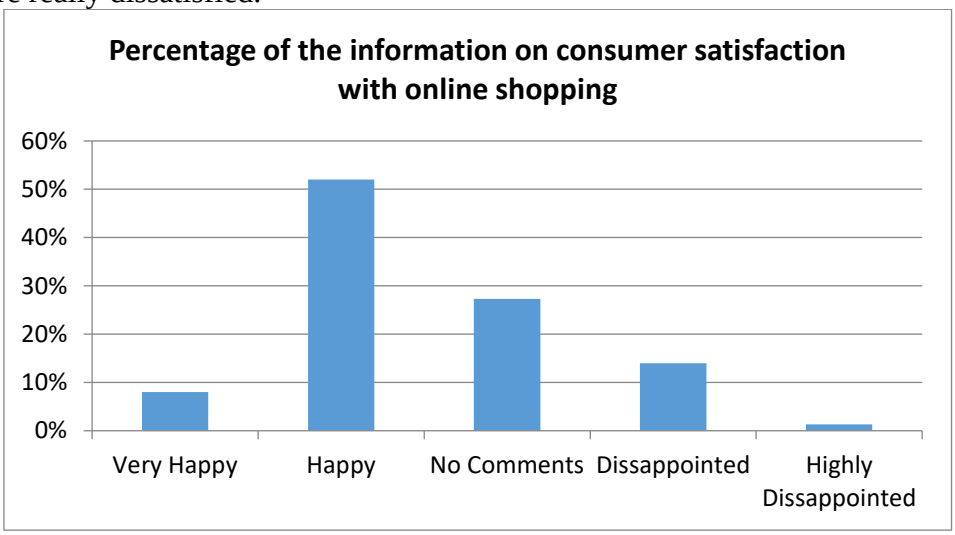

Figure 11: Details of the information on consumer satisfaction with online shopping

Conclusion

The growth of digitalization, online payment methods, and internet access rates in Bangladesh are all driving an increase in online shopping. Unlike in-store shopping, online shopping behavior is affected by elements such as network access, webpage aesthetics (Constantinides, 2004), privacy, customer engagement, level of understanding, and so on. There is room for more study on this site, where the sample size may be raised and the rural population can be included to reflect the overall picture of Bangladeshi customers and their internet purchasing habits (Abir, T., Husain, T., Waliullah, S. S. A., Yazdani, D. M. N., Salahin, K. F., & Rahman, M. A. 2020). Studying these specific online shopping practices could help tech entrepreneurs and politicians in Bangladesh establish appropriate market strategies for online customers.

This study found that, like people in other parts of the world, young Bangladeshis under the age of 35 prefer to buy things online since it's less time-consuming and the diversity of goods offered, such as various types of clothing, electrical equipment, home delivery services, and so on. Cash-on-

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delivery is the most preferred payment method among online buyers. When buying products online, they usually estimate the quality of items based on pricing and personal experiences. From Facebook advertisements, the majority of customers learn about goods and services which are then socialized with friends and family. On the other hand, online shoppers are dissatisfied with the lack of privacy and the unfavorable return policy.

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ESJ Social Sciences

Profit Persistence: is There A Conglomerate Effect? The Case of Banking and Insurance in Morocco

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Abstract

This paper analyses profit persistence and its determinants in Morocco's banking and insurance sectors. The solid and increasing interdependencies between both actors are becoming a matter of concern for the regulatory authorities, as they threaten the country's financial stability. Using both static and dynamic hypotheses of the competitive environment model, we study the determinants of profit persistence in eight banks and eight insurance companies for 13 years, using a random-effects panel data model. While previous articles studied banks and insurers separately, we fill the gap in the literature by exploring the profit persistence as a result of their increasing capitalistic interdependence. Our results show a very low-profit persistence level, which signals a competitive financial sector. The main determinants of this profit persistence are diversification, efficiency, size, solvency, risk, and entry barriers. However, we find no evidence of any conglomerate effect, eliminating any synergy premium through cross participation between banks and insurance companies.

Keywords: Profit persistence, Diversified conglomerates, Dynamic hypothesis of the competitive environment, Structure-conduct-performance

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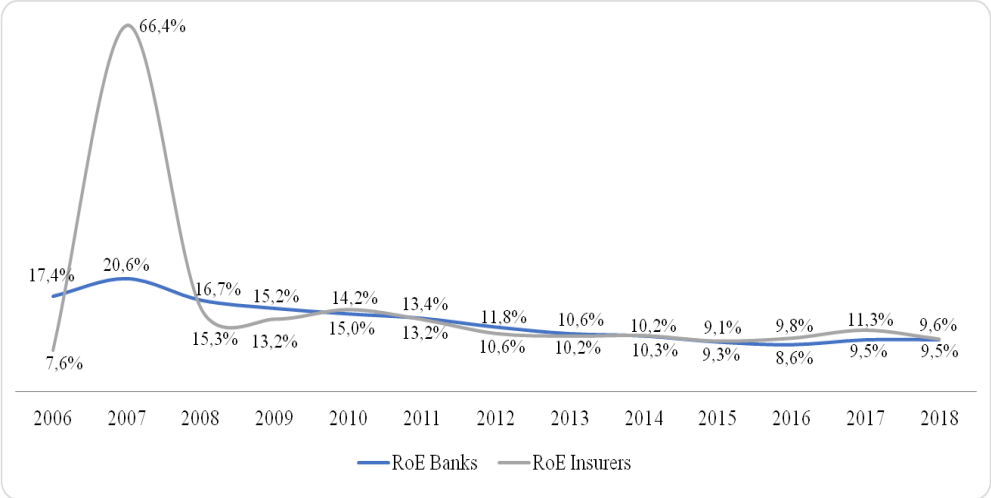
Introduction

Since the financial crisis of 2008, financial stability has become a significant issue for monetary and financial regulators. The growing interconnection between financial institutions is now a crucial risk factor. The fall of Lehman Brothers almost brought in its wake that of Merrill Lynch and the insurer AIG; they were rescued in extremis by the federal state intervention. Henceforth, the risks are no longer isolated within the finance compartment but can be located at the intersection of relations between the various players in the financial market (credit institutions, insurance companies, and investment banks). Thus, the more financial players are integrated into large groups through capital linkages or business partnership agreements, the greater the systemic risk (Kaserer and Klein, 2016).

In Morocco, the big banks control the entire financial sphere of the country. This configuration might represent a significant factor of instability. Banks control 20.4% of assets at market value in the insurance sector and 30.5% of their unrealized capital gains[1]. As the source of a significant portion of the assets and sales of insurance companies, banks in Morocco also control their margins and profitability. Since the 2008 crisis, bank and insurance profitability curves have been almost identical, as shown in the following graph.

Figure 1: Evolution of ROE of the banking and insurance sectors in Morocco



Source: Moroccan Central Bank and Moroccan insurance sector control authority

The interdependence between banks and insurance companies generates an overall systemic risk in the Moroccan financial market; the failure of one of the two parties, caused by their falling profits, will have a chain reaction on the entire economic landscape of the sector. Moreover, a

[1] Source: Annual report of the Moroccan insurance sector – 2017, ACAPS

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prolonged decline in profitability will undoubtedly impact banks' and insurance companies' solvency. Therefore, our central research question can be formulated as follows: **Is there a causal relation between cross-participation between bankers and insurers in Morocco and the persistence of their profits?** According to the OECD, "Conglomerate effects arise when a merger affects competition, but the merging firms' products are not in the same product market, nor are they inputs or outputs of one another.[2]" Our research contributes to the current literature on the topic in two ways. First, we verify the persistence of profit and explain its determinants in banking and insurance in Morocco. To our knowledge, no article has explicitly dealt with this subject. Research in this area has been limited to the study of banking and insurance profitability, not their persistence. The second contribution is to explore the profit persistence resulting from the capitalistic relations between bankers and insurers, where traditional analysis has separated them until now. To our knowledge, no article has tested this hypothesis.

Literature review

In the literature on profit persistence, two main paradigms are usually used. The first is the static competitive environment hypothesis, and the second is the dynamic competitive environment hypothesis.

The static hypothesis of the competitive environment

This theoretical framework assumes that the levels of profit in a sector result from its characteristics and the companies' capacity to avoid competition by erecting different forms of barriers to entry. Intuitively, the more intense the competition in a sector, the more moderate the profitability. Conversely, a sector sheltered from competitive pressure would generate better profits, *Ceteris Paribus* (Carlton and Perloff, 2005).

The restriction to competition can take many forms. It can be endogenous, exogenous, or structural (Makadok, 2011). Some limitations to competition are endogenous and result from implicit or explicit collusion between rivals, such as price-fixing, bid-rigging, market division, and cartels. It can also derive from an exogenous intervention, such as public price control, particularly on essential commodities or barriers to entry through approvals or licenses. Restrictions can also be structural, such as brand loyalty, transfer costs, transport, or cost adaptation for horizontally differentiated products.

Whatever its form is, the restriction to competition affects profits in a sector by artificially increasing output prices or reducing input costs. Thus, in

[2] OECD, “Conglomerate effects of mergers”. Available on: https://www.oecd.org/competition/conglomerate-effects-of-mergers.htm. Accessed, January, 9th 2022

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the absence of market discipline to bring these inputs/outputs back to their competitive norm, these limitations are the primary source of profit formation and persistence.

The central teaching of this paradigm, also known as the "Structure-Conduct-Performance" (SCP) Paradigm, is that profit results from competition dynamics and the industry's structure (Goddard et al., 2011). This assumption allows us to understand better companies' strategies for extracting and maintaining profits (Tamirat, Trujillo-barrera, and Pennings, 2018). Several analytical models have captured these strategies; for instance, the "five forces" model considers barriers to entry and exit, product differentiation, and the number of competitors, suppliers, and customers (Porter, 2008).

The dynamic hypothesis of the competitive environment

The dynamic hypothesis takes the opposite view. It differs from the static one, which takes the impact of the industry structure on the profits persistence as a fundamental postulate, independently of the individual strategies of firms within the industry to extract and maintain profit (Mueller, 1977, 1990). In other words, instead of setting the "industry structure assumptions" independently of the companies' performance and ignoring any difference in profit between the companies inside the industry, the proponents of *the dynamic hypothesis of competitive environment* adopt an adaptive vision of organizational and environmental change. They observe that many companies adapt their strategies and capabilities as competitive environments evolve. They, therefore, focus more on the individual characteristics of firms to explain their performance differentials than on the structure of the industry (Lin, Chen, and Lo, 2014).

This approach is the backbone of the competitive advantage theory, also known as RBV (Resource Based View), the standard in profit persistence analysis today (Tamirat, Trujillo-barrera, and Pennings, 2018). Its central idea is that the extraction and persistence of profit result from the operational strategies of firms and their ability to implement efficient processes for transforming inputs into outputs (Makadok, 2011). Indeed, according to the proponents of this theory, competition eliminates profit through the price mechanism, allowing customers to buy the same products at lower prices. However, companies developing unique advantages can generate and defend gains above the competitive norm, regardless of the industry's structure (Demsetz, 1973). This advantage is obtained and maintained by acquiring scarce, valuable, non-substitutable, and non-imitable resources (Barney, 2001). Resources that preserve a competitive advantage will also generate superior and persisting economic performance over time (Tamirat, Trujillo-barrera, and Pennings, 2018).

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Empirical observation of the persistence of banking profit in developing countries

Many studies tested the validity of both static and dynamic hypotheses by observing banks' profits behavior in emerging countries. Sarpong-kumankoma et al. (2018) study the profit persistence of 21 banks in Ghana, 14 in Tanzania, 27 in Kenya, and 16 in South Africa, from 2006 to 2012. They use a two-step system GMM to estimate their model and utilize a return on average equity as a proxy for profit persistence. They observe that the lagged dependent variable (eROAEt-1) assessing the level of persistence is statistically positive and significant, which validates the hypothesis of bank profit persistence. In their study, the coefficients of industry were as follows:

Table 1: Summary of the coefficients of persistence in 4 sub-Saharan countries

	Kenya	**Ghana**	**Tanzania**	**South-Africa**
Coefficients of persistence	0,214	0,257	0,320	0,445

Source : Sarpong-kumankoma *et al.* (2018)

As for the determinants of this persistence, the authors conclude that economic freedom had a significant and negative impact in Ghana but not in the other countries, suggesting that the solid economic freedom enjoyed by banks in Ghana resulted in greater competition and, therefore, lesser profits persistence. This conclusion is in line with Amidu and Harvey (2015), for whom persistence is reduced by competition in countries with strong institutions. Credit risk has a significant and negative impact on profit persistence in South Africa due to the banks' high exposure to credit activity, exposing them to high-risk loans and, therefore, higher loss probability (Dietrich and Wanzenried, 2011). In contrast, credit risk has a significant and positive effect in Tanzania but not in Ghana or Kenya. Maud and Fernández de Guevara (2004) believe that the positive relationship between credit risk and profit persistence comes from banks making risky loans offset with higher provisions and, therefore, higher-risk premiums.

Efficiency is a fundamental determinant of profit persistence in all countries. Its negative and significant effect suggests that profit persistence could be improved through sound cost management systems, confirming the results of previous studies, which concluded that efficiency rather than concentration could be an important determinant of profitability. Financial sector development is a significant and negative determinant in Kenya and Ghana, but not Tanzania and South Africa. The significantly negative coefficients observed for Kenya and Ghana imply that the development of the banking sector may be associated with increased competition and, therefore, lower profitability. Thus, the financial development level differences may explain the results observed in these countries. Finally, the diversification coefficients are positive but insignificant in all the countries in the sample.

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That might suggest that increased involvement of banks in other activities may increase profitability, but not to the point of explaining the levels of profit persistence in the sampled countries.

Batten and Vo (2019) study the profit persistence of 35 banks in Vietnam between 2006 and 2014 using fixed-effect panel data and a GMM estimator. They use net interest margin (NIM) and the return on average assets (ROAA) are dependent variables. Their analysis shows that, like the banking sector in China (Yong, 2016), profit is not persistent, as indicated by the different coefficients obtained:

Table 2: Profit persistence coefficients in China

	ROAA	**ROAE**	**NIM**
Coefficients of persistence	0,265	0,076	−0,004

Source: Batten and Vo (2019)

As for the determinants, size has a negative and significant impact in most regressions. The solvency level has a positive and significant effect in all regressions. Analysis of banks in Vietnam indicates that those with higher risk tend to benefit from stronger NIMs and lower ROAEs. Efficiency also has a positive and significant impact on NIM. On the other hand, it is linked negatively and significantly to the ROAA. Furthermore, the empirical results of this analysis do not support the SCP hypothesis. Indeed, the concentration coefficients are negative and significant in the regressions where the NIM is the dependent variable.

Pervan, Pelivan, and Arneri (2015) study the persistence of profit of 46 banks in Croatia from 2002 to 2010, using the ROA as a measure of profit. They used the one-step difference GMM and Markov chain to validate their results. This study shows that the persistence of bank profits in Croatia is statistically significant and low. The value of the delayed variable is 0.13, close to zero, indicating a banking sector with intense competition and a high speed of adjustment of profit rates towards the competitive norm. As for the determinants of this persistence, the article confirms the assumption that big banks make high profits. Solvency also has a positive and significant effect on profitability, meaning that banks with high capital ratios are more profitable. The impact of credit risk is negative and significant on profitability, confirming the hypothesis that banks with no effective credit risk management policies achieve low levels of profitability. Diversification has a significant and positive effect on profitability, suggesting that diversified banks make more persistent profits than banks focused on traditional intermediation activity. The article concludes that the concentration ratio is significantly and positively related to persistence at the industry level. This finding confirms the SCP hypothesis that the more concentrated a market is, the higher the banks' profitability. Finally, on the macroeconomic level, GDP growth has a positive

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and significant effect on the profitability of Croatian banks, while inflation affects it negatively.

Data, variables, and model

We analyzed the data of eight banks and eight insurance companies over 13 years between 2006 and 2018. We extract the data from the annual reports of the companies and supervisory authorities' annual reports. Macroeconomic data were extracted from the IMF database. Banks in our sample represent 99% of the banking sector's Net Banking Income[3]. For the insurance sector, we study all general insurance companies.

We use the return on assets ratio (ROA) to evaluate profit persistence, measured as net income ratio to total assets. The ROA measures the ability of executives to generate profit on all the assets. It's the preeminent index for evaluating the profit persistence in the financial sector (Kanga, Murinde and Soumaré, 2020). We select the following explanatory variables:

Size is measured as the natural logarithm of its assets (Jiang, 2018) and refers to assets that the financial institution manages and utilizes to generate revenues for all its stakeholders. The impact of asset size on profit persistence is a priori unknown and diverges according to the underlying studies and the theoretical frameworks the authors use. Large institutions can reduce costs through economies of scale compared to smaller banks (Goddard et al., 2013). For Abel et al. (2018), on the other hand, size negatively influences banks' profitability due to the bureaucracy and cumbersome management specific to large structures.

H_1. The larger the financial institution's size, the higher the profit persistence.

Growth is a materialization of the company's dynamic and competitiveness. This variable is frequently analyzed in the literature (Chronopoulos et al., 2015). The impact of the growth of their assets on the profitability of financial institutions is not established a priori. A financial institution with rapid asset growth can more easily develop and invest in its current operations and create new activities, ultimately fostering its profits (Sinha and Sharma, 2015). On the other hand, rapid asset growth could lead to solvency problems if it does not go hand in hand with rigorous risk management and cost control. Moreover, strong growth acts as a signal associated by investors with superior profits in a market. The latter can attract potential competitors, reducing existing companies' future profits and growth (Cable and Mueller, 2008).

[3] Moroccan Central Bank annual report, 2018

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H_2. Profit persistence is positively related to asset growth.

Several researchers use ***Diversification*** to analyze profit persistence (Sarpong-kumankoma et al., 2018). It refers to an institution's ability to have multiple sources of income in portfolio management and risk reduction logic. For banks, Diversification equals the ratio of non-loan income to assets. For insurance companies, it corresponds to the share of the net investment income to total operating profit. The author (Sarpong-kumankoma et al., 2018) observed a positive relationship between Diversification and profit persistence. For (Yong and Floros, 2012), Diversification increases bank revenues. In addition, banks with more diversified operations can reduce costs through economies of scope. On the other hand, for Yong (2016), strong Diversification decreases the volume of funds allocated to traditional intermediation activities, generating overall declining margins.

H_3. The stronger the Diversification, the weaker the persistence of profit.

Efficiency is the ability to achieve goals at a lower cost, and it is measured as the ratio between expenses and assets (Pervan, Pelivan, and Arneri, 2015; Tan, 2017; Yong, Floros, and Anchor, 2017). Efficiency is widely studied in the literature as the primary determinant of profit persistence in many countries (Goddard et al., 2013). According to several studies, cost control is a crucial variable of profitability in banking and insurance (Goddard et al., 2013; Sarpong-kumankoma et al., 2018). Other researchers have shown a positive relationship between operating costs and profitability (Molyneux and Thornton, 1992).

H_4. The lower the costs, the higher the persistence.

Solvency is the ability of a company to meet its commitments toward its various stakeholders at any moment. It is of particular importance for the financial sector insofar as, being a regulated activity, the size of equity is the best guarantee for the customers. Solvency is equal to the ratio of the equity capital to assets. Several studies have investigated the causal relationship between solvency and profit persistence in the financial sector (Santamaria and Santamaria, 2019). However, the findings lead to ambiguous effects of solvency on profitability. On the one hand, the higher the capital ratio, the lower the profitability, as the establishment would mobilize more equity capital per additional profit, consequently reducing the expected profit (Abel et al., 2018). On the other hand, the larger the capital, the more it reinforces savers' confidence, which leads to a positive relationship between the capital ratio and the persistence of profit (Jaisinghani, Tandon and Batra, 2015).

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H_5. Solvency has a positive effect on profit persistence.

***Risk*.** In financing the various economic agents, a financial institution runs the risk of default on a fraction or all the credit distributed. In this case, the borrower takes an asymmetric risk. If the project succeeds, the lender earns only the capital plus an interest rate, no matter how high the borrower earns the profits. On the other hand, if the investment fails, it loses all or part of its capital (Fontes, Panaretou, and Peasnell, 2018). We calculate credit risk as the ratio of non-performing loans to credits. The literature regularly studies the impact of this variable on bank profitability. The authors agree that high risk reduces profit persistence (Rahman, Yousaf and Tabassum, 2020).

H_6. High risk levels decrease profit persistence.

Liquidity is evaluated in the literature as the ratio between credits and assets or credits over deposits. The more important this ratio, the lower the bank's liquidity, but the higher its revenues from credit activity, concluding a negative relationship between liquidity and profitability (Yong, 2016). Various research studies have shown that liquidity risk deteriorates profitability (Molyneux and Thornton, 1992). If economic theory admits that profitability and risk are positively correlated, high liquidity reduces the risk level and thus profitability (Rahman, Yousaf and Tabassum, 2020). This conclusion is shared by Yong and Floros (2012), who argue that financial institutions with high levels of liquidity are less risky and would exhibit a solid financial structure. Yet, other papers conclude the opposite, claiming that liquidity and profitability would be positively correlated. For example, Bourke (1989), analyzing the profitability of European banks, argues that those with higher levels of liquidity have equally high profitability.

H_7. The higher the liquidity, the lower the persistence of profit.

Cross-participation will be measured by a dummy variable (0= no cross-participation; 1= with cross-participation). Indeed, one of the specificities of the Moroccan financial sector is the strong capitalistic relationships between banks and insurance companies through cross-holdings.

This configuration is not unique to Morocco. Other countries display similar industry structures, such as Japan, where the Japanese *corporate governance system* is based on *keiretsu*, i.e., arrangements of affiliated companies around blocks of cross-shareholdings. Thus, the largest Japanese financial institutions (banks, insurance companies, trading houses, *trust banks*) occupy the positions of key players in these stable blocks of interrelations (Loulmet, 1998).

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H_8. The presence of cross-ownership accentuates profit persistence.

Concentration. To measure this variable in the Moroccan banking and insurance sectors, we used the Herfindahl-Hirschman Index (HHI), in line with previous studies (Doyran, Santamaria and Santamaria, 2019). Four hypotheses explain the impact of concentration on profit persistence. The first is the structure-conduct-performance (SCP) hypothesis, which states that when concentration is high, banks exploit their market power by raising prices to extract profit. The second hypothesis is relative market power (RMP), which states that firms with high market shares (size effect) and differentiated products (differentiation effect) exercise significant market power. The third hypothesis is the '*x-efficiency*' version of the efficient structure hypothesis (ESX). Firms with efficient management and modern production technologies achieve low production costs and consequently high profits. The fourth hypothesis is the '*scale efficiency'* version of the Efficient Structure Hypothesis (ESS), which states that firms that produce on a large scale have low unit costs, which allows them to generate higher unit margins (Goddard *et al.*, 2013). The last two hypotheses challenge the validity of the first two by decoupling performance from concentration.

H_9. The higher the industry concentration, the stronger the persistence.

Barriers to entry. The inclusion of this variable aims to measure the competitive intensity within the banking sector in Morocco. Indeed, the lower the industry barriers, the higher the prices, and the more competition quickly eliminates any abnormal profit. This variable completes the concentration analysis of an industry. Even in a highly concentrated sector, if capital movements are unrestricted, profits converge towards their competitive norm, eliminating any persistence (Gugler and Peev, 2018). We measure this variable as the change in the number of banking actors. We expect a positive impact of this variable as the higher the barriers to entry, the more persistent the profits, *Ceteris Paribus* (Goddard *et al.*, 2011).

H_{10}. Higher barriers to entry increase profit persistence.

Economic growth is the change in GDP at constant prices. The relationship between economic growth and profit persistence is widely analyzed in the literature (Rahman, Yousaf and Tabassum, 2020). The causal relationship suggests a positive impact of economic growth on profit persistence. Indeed, prosperous economic conditions translate into more significant business opportunities for banks and insurers, helping them extract and sustain profit, mainly if economic growth results from credit-expanding monetary policy

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(Twinoburyo and Odhiambo, 2018). Thus, a positive relationship is expected between economic growth and profit persistence. However, the presence of solid opportunities makes the sector more attractive to competition, which in the absence of barriers to entry, could exert downward pressure on margins, and as a result, a negative relationship could exist between GDP growth and profit persistence (Goddard *et al.*, 2011; Yong, 2016).

H_{11}. The greater the economic growth, the stronger the persistence.

Inflation is the variation of the consumer price index (CPI). Inflation impacts both financial institutions' revenues and costs (Abel *et al*, 2018). The study of the impact of rising prices on profitability has been the subject of extensive literature (Rioja and Valev, 2014; Rahman, Yousaf and Tabassum, 2020).

H_{12}. High levels of inflation positively affect profit persistence.

The number of determinants tested in our study is in line with other research that has tried a similar number of explanatory variables (Yong, 2016).

Econometric model

The statistical model used is based on a panel data analysis, in line with previous studies (Obamuyi, 2013; Albulescu Tiberiu, 2015; Salike and Ao, 2018). Indeed, the study data present a two-dimensional aspect combining an observation over time and on the same individuals (banks and insurance companies), and this, on a relatively small sample (08 banks and 08 insurance companies) and over a rather long period (13 years). Furthermore, we used a panel data analysis since conventional linear regression cannot capture unobservable heterogeneity and endogeneity (Gupta and Mahakud, 2020). The profit equation is, therefore, as follows:

$$\pi_{it} = c + \delta\pi_{it-1} + \sum_{k=1}^{K} \beta_k X_{it}^K + \varepsilon_{it}$$

$\pi_{it}\pi_{it}$ is the profit of firm i at time t; i ranging from 1 to 16 and t ranging from 1 to 13. $c\,c$ is a constant value that takes the same value for all firms studied across all periods. $\pi_{it-1}\ \pi_{it-1}$ refers to the profit lag of one period. X_{it} corresponds to the vector of separate explanatory variables, and the $\beta_k\beta_k$ is the vector of constant coefficients to be determined. $\varepsilon_{it}\varepsilon_{it}$ measures the unobservable effect. It is the addition of two effects: $\alpha_i\alpha_i$ which is the unobserved individual effect of the institution (it is incorporated into the

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model to explicitly address the heterogeneity bias across companies) and μ_{ij} μ_{ij} which reflects the interaction of unobserved sources of individual and time variation (Bouzgarrou, Sassi and Rouissi Béjaoui, 2010). $\delta\delta$ traces the speed of adjustment of profit to the competitive norm corresponding to an optimal level of profitability (Doyran, Santamaria and Santamaria, 2019). If 0< δ δ <1, we are in the presence of a sector where profit persistence is observable and shows signs of persistence, depending on its trend. If $\delta\delta$ tends to 0, it corresponds to a high speed of adjustment and a competitive sector. If $\delta\delta$ tends to 1, this would mean a slow pace of adjustment and a low competitive industry with barriers to entry or collusion between operators (Sinha and Sharma, 2015).

Empirical results

Descriptive statistics

Table 3 provides descriptive statistics for the series of data. The average ROA is 1.66%, with substantial disparities among the population, with a standard deviation of 1.11 times the average. The minimum return was -8.58% and the maximum 17.5%, indicating wide disparities in the financial performance of banks and insurance companies. At the microeconomic level, financial institutions in our sample exhibit solid asset growth (8% on average), high-risk levels (19%), and robust liquidity levels (with a liquidity ratio of 101,3% on average). At the industry level, concentration is moderate, and barriers to entry are high, while at the macroeconomic level, inflation is relatively contained, and economic growth is strong (4% on average).

Table 3. Descriptive statistics

Variables	Number of obs.	Mean	Std. Dev.	Dispersion	Min	Max	Range
ROA	217	0,017	0,018	1,113	-0,086	0,175	0,261
Microeconomic indicators							
Growth	217	0,080	0,081	1,009	-0,261	0,491	0,752
Diversification	217	0,027	0,027	0,985	-0,017	0,246	0,264
Efficiency	217	0,036	0,020	0,547	0,015	0,105	0,090
Size	217	20,72	2,526	0,122	16,78	24,46	7,687
Solvency	217	0,118	0,047	0,400	-0,001	0,248	0,248
Risk	217	0,191	0,246	1,290	-0,004	1,025	1,028
Liquidity	217	1,013	0,173	0,171	0,443	1,845	1,403
Industry specific indicators							
Concentration	217	1,479	0,167	0,113	1,237	1,700	0,463
Barriers to entry	217	15,48	3,037	0,196	12,00	19,00	7,000

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Macroeconomic indicators							
Inflation	217	0,016	0,009	0,583	0,004	0,039	0,035
Economic growth	217	0,040	0,015	0,371	0,011	0,076	0,065

Note: The number of observations is the same for all variables, as we worked on a balanced panel. Dispersion is measured as the ratio of the standard deviation to the mean. The range is equal to the difference between the maximum and the minimum.

Multivariate analysis

Table 4 summarizes the results of the regressions, measuring, on the one hand, the profitability of the assets delayed by one period (level of persistence) and providing, on the other hand, the determinants of profitability. The persistence level is highly significant at 5%. It is 0.0702, which is very close to the value found by Abel *et al.* (2018) for banks in Zimbabwe at 0.0048. However, it is far from developing countries' mean of 0.426 (Goddard *et al.*, 2013). This persistence, which tends to be zero for banks and insurance companies in Morocco, is very low and signals a highly competitive financial sector with a high speed of profit adjustment towards the competitive norm. Indeed, even if the Moroccan financial industry is not very open to competition, as evidenced by the stability of the number of institutions, competition among the players is still very strong.

Table 4. Regression results

Variables	**Pooled regression (1)**	**Pooled regression (2)**	**Fixed effects**	**Random effects**
ROA	**0,095****	**0,089****	**0,066***	**0,070***
	(0,039)	(0,039)	(0,040)	(0,038)
Microeconomic indicators				
Growth	0,009	0,009	-0,012	-0,005
	(0,008)	(0,009)	(0,009)	(0,009)
Diversification	**0,559*****	**0,556*****	**0,590*****	**0,576*****
	(0,030)	(0,031)	(0,034)	(0,031)
Efficiency	**-0,150*****	**-0,157*****	**-0,318*****	**-0,230*****
	(0,046)	(0,047)	(0,108)	(0,070)
Size	**-0,004*****	**-0,004*****	-0,003	**-0,005*****
	(0,001)	(0,001)	(0,003)	(0,001)
Solvency	**0,111*****	**0,117*****	0,049	**0,091*****
	(0,019)	(0,021)	(0,035)	(0,028)
Risk	**0,019*****	**0,019*****	**0,016*****	**0,018*****
	(0,004)	(0,004)	(0,006)	(0,005)
Liquidity	-0,002	-0,002	0,008	0,002
	(0,004)	(0,004)	(0,007)	(0,006)
Cross-ownership		0,001	0,008	0,003
		(0,002)	(0,005)	(0,003)

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Industry indicators				
Concentration	-0,004	-0,004	-0,008	-0,007
	(0,009)	(0,009)	(0,009)	(0,008)
Barriers to entry	-0,001	-0,001	-0,003***	-0,002***
	(0,001)	(0,001)	(0,001)	(0,001)
Macroeconomic indicators				
Inflation	0,007	0,010	0,005	0,003
	(0,042)	(0,042)	(0,044)	(0,042)
Economic Growth	-0,032	-0,029	-0,025	-0,029
	(0,053)	(0,053)	(0,055)	(0,050)
Constant	0,089***	0,087***	0,113*	0,126***
	(0,028)	(0,028)	(0,067)	(0,032)
Number of Observations	201	201	201	201
Number of groups	16	16	16	16
LMLM Test				$\chi2(1)$= 3,03 0,041
Hausman Test				$\chi2(14)$= 11,9 0,610
Wald Test				$\chi2(14)$=671 0.000
Sigma_u			0,008	0,005
Sigma_e			0,007	0,007
Rho			0,516	0,270
R-squared	0,800	0,801	0,788	0,787

Note : *; **; *** indicate significance at 10%; 5% and 1% respectively. Standard errors are reported in parentheses. The Hausman test yields a Chi2 probability greater than 0.05, implying that the random-effects model is preferable to the fixed-effects model. The other tests are satisfactory (LM and Wald) at less than 0.05 and the high level of the coefficient of determination indicates a suitably calibrated model. Additional tests (non-reported) conclude to the absence of heteroscedasticity and multicollinearity between the variables.

As for the determinants of this persistence, ***Diversification*** has a positive impact. It is a solid explanatory factor of banks' and insurance companies' profitability in Morocco. Indeed, for banks, the continuous decrease in the central bank interest rates in the wake of an expansive monetary policy has reduced the profits from credit activity, forcing them to seek other sources of profit. For insurers, profit comes more from asset management activity than risk coverage. Therefore, the more assets they have, the more they generate investment margins when financial markets are bullish, and they suffer heavy losses when they turn bearish. This relationship is

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consistent with that identified by Yong and Floros (2012) on banks in China and by Sarpong- kumankoma *et al*. (2018) on banks in Sub-Saharan Africa.

Size also has a very significant adverse effect on profit persistence. Indeed, size acts as a factor favoring economies of scale for banks and as a lever for additional revenues for insurance companies. In the case of Morocco, the relationship is negative, indicating the presence of diseconomies of scale and organizational inefficiency that are consubstantial with the bureaucratic tendencies of large structures. This phenomenon was observed by Abel *et al. (*2018), who concluded that size leads to decreasing marginal returns due to an increase in organizational rigidity resulting from an expansion in size, while Barros, Ferreira and Williams (2007) explained this negative relationship by the information asymmetry problems faced by big players.

Solvency also has a very significant positive effect on profitability. Indeed, the greater the size of equity, the more latitude the institution has to engage in risky but profitable activities. For Batten and Vo (2019), even though equity negatively affects ROAE in the long run, correctly endowed banks perform better. On the other hand, the greater the capital, the more it enhances savers' confidence (Jaisinghani, Tandon and Batra, 2015), while institutions with low creditworthiness must bear higher costs which translates into lower profitability (Chronopoulos *et al.*, 2015).

Efficiency has a negative and significant effect on profit persistence. Cost control is a factor favoring the performance of financial institutions in Morocco. This finding validates the efficient structure hypothesis, which states that firms with the ability to produce at lower costs than the competition are likely to generate and maintain profit (Berger, 1995). It is consistent with the result of the study of Pervan, Pelivan, and Arneri (2015), who concluded that efficiency was a significant variable for the 46 Croatian banks and that of Goddard *et al.* (2013) for 4787 European banks that they studied between 1992 and 2007.

Risk positively and significantly affects the profit persistence of financial operators in Morocco. That is quite rare, as the risk is generally negatively correlated with profitability (Abel *et al.*, 2018). But the Moroccan case, while unusual, is not unique. Indeed, Sarpong-kumankoma *et al.* (2018) observed the same pattern in banks in Tanzania, which Maudos and Fernández de Guevara (2004) explain by the fact that institutions that make risky loans compensate for them with higher provisions and, therefore, higher risk premiums.

Among the external variables, only barriers to entry show a significant but negative relationship with profitability. In other words, the higher the barriers to access, the lower the profitability. While contradicting the static hypothesis of the competitive environment (Goddard et al., 2011), this finding highlights the intense competition between incumbent players, which drives

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them into rate wars that ultimately reduce their profitability, hence the low levels of persistence observed in this study.

In contrast, the most important finding of this paper is the following. Although the impact of cross-ownership on profit persistence in Moroccan banking and insurance is positive, it is not significant in any of the regressions we conducted. This has an important implication: the synergy expected from cross-participation by a bank or insurance company in Morocco did not materialize in value creation. It confirms the problem of the poor financial performance of diversified conglomerates (Laeven and Levine, 2007). Cross-holding did increase insurers' revenues via the cross-selling channel, as noted by Chiang (2019) in the case of bancassurance in the U.SU.S. That was also the case in Morocco, where cross-holding between banks and insurance companies has favored the development of bancassurance activity (CCSRS, 2018). However, it is clear from the results of this study that the growth in sales has not translated into sustained profitability, which remains very low in Morocco and depends on factors other than the synergy effect expected from cross-holdings.

This conclusion is of definite managerial significance and should be considered by managers of financial institutions in Morocco before paying important premiums for synergies, which may never materialize.

Conclusion

The 2008 crisis has put banks and insurance companies under intense scrutiny. On the one hand, many scholars point to their responsibility in the outbreak of the crisis. On the other hand, their financial health, measured by the profit rate, has been strongly affected. In Morocco, they have not escaped this rule, especially since, in addition to the continued decline in their profitability, the level of their cross-shareholdings raises fears of systemic risk. And for a good reason, the persistence of bank profits is the subject of growing interest within the research community.

Studies in this direction mobilize two theoretical frameworks. The first is the static hypothesis of the competitive environment, which explains the persistence of profit by the specific characteristics of a sector and the protection from external competition that it manages to put in place. The second is the dynamic hypothesis of the competitive environment. While recognizing the importance of sectorial characteristics in explaining profitability, this hypothesis focuses on the strategies deployed by firms to extract and maintain their profit. It better explains the differences in profitability observed within the same sector.

In this paper, we analyze the ROA of 8 banks and 8 insurance companies from 2006 to 2018, using a random-effects panel model. In addition to the usual determinants from the literature review, our main

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contribution to the literature consists of utilizing the cross-ownership variable as an additional profitability factor. The results show that the level of persistence in Morocco is very low at 0.07, which means that than only 7% of one year's profits persist into the following year, implying a relatively competitive financial sector. As for the determinants, diversification, solvency, barriers to entry, size, and risk significantly explain the profitability of banks and insurance companies. The first two variables have a positive impact on profitability, while the last three have the opposite effect.

Finally, we find no conglomerate effect on profit persistence in banking and insurance in Morocco. Indeed, although the relationship between cross-ownership and profitability is positive, it is not significant. This indicates the absence of a synergy effect on profitability and that belonging to a diversified group does not increase the profitability of a bank or insurance company in Morocco, a lesson that managers should consider when negotiating the acquisition price of cross-holdings.

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Household Heads Characteristics and Access to Water in Kenya

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Abstract

Kenya has taken numerous steps in ensuring universal access to water among all households by 2030. However, the country may not achieve this by 2030 due to challenges related to the implementation of objectives including inadequate data on the indicators to allow for better policy formulation. The study aimed at finding out the effect of household head characteristics on access to water. The study employed multinomial logistic regression modeling using 2015/2016 Kenya Integrated Household Budget Survey data. Arising from the study findings, an increase in the income of the household head led to an increase in the household's access to clean water. Education levels (primary, secondary, and tertiary) of household heads compared to no education increased the probability of household heads selecting clean water sources. Being employed as well as being male increased the probability of accessing clean water. Further, residing in a rural area by a household head reduced the probability of using clean water compared to residing in an urban area. Based on the findings, the study suggests that there is a need to develop a policy around the key and significant household head characteristics to improve access to clean water in Kenya.

Keywords: Household Head characteristics, clean water, multinomial logistic regression, Kenya

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Introduction

Water forms the traditional list of basic human needs. It is directly related to people's well-being as well as prosperity. As such, it is part of the global 17 sustainable development goals (SDGs) developed by the UN member states in 2015 as a basis for poverty eradication, fair, healthier, and prosperous generations. SDG 6 is related to access to clean water. In addition, water also forms the basis for the African Union's priority aspiration of a prosperous Africa (African Union Commission, 2015). Access to clean water at an affordable rate is, therefore, important and should be a right of everyone given their necessity and the global aspirations as espoused in the SDGs and regional aspirations as espoused by the African Union Commission (AUC). According to Abubakar (2019), most of Africa's challenges and opportunities fall around among others water scarcity. Abdu, et al., (2016) assert that access to cleaner water leads to agricultural development, improved health, and improved education among other things. Agricultural development in turn leads to food security and employment opportunities among others. Improved health means reduced mortality rates, reduced disease burden, and better brain development among others while improved education in turn means better societal development (Orayo, 2020).

The study is anchored on both the utility maximization theory developed by Alfred Marshall in 1890 as well as the random utility theory developed by McFadden in 1974. The former theory is based on how a rational individual would make consumption decisions**.** The theory looks at how individuals spend their income on a set of goods or services based on their preferences and budget constraints. The theory assumes *maximization of utility* and individuals will always make purchase decisions that give them the greatest benefit. The theory concludes that individual consumers will always go for the combination of goods and services that maximizes their satisfaction given their income as well as the prices of the goods and services.

The latter theory which is the random utility theory is based on the maximization of utility and states that individual choice is based on the alternative with the highest utility. The utility derived from an alternative depends on the attributes of the alternative and the observed and unobserved attributes of the individual making the decision. The theory assumes that people are *excessively rational* and have an irrational passion for dispassionate rationality. The theory concludes that individuals would choose alternatives if the utility derived from them is greater than that derived from any other alternatives. Further, an individual would go for other alternatives if the utility derived from these alternatives are less or equal to the utility derived from other alternatives. The random utility theory informs the current study as the household head is treated as a rational decision-making unit and the household head can go for water sources that maximize their utility. The household

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head's ability and the economic environment also contribute to the household head's choices on clean water. The household's ability in our case was based on household head characteristics like age, education level, sex, employment status, area of residence, and the household characteristics like household size. In Kenya, access to a safe, adequate, and reliable water supply is one of the central socio-economic development indicators (Government of Kenya, 2017). It is a fundamental right that every citizen should enjoy without any limitation. Lack of access to improved drinking water and time-intensive pursuit of water collection often prevents women from taking up income-generating activities and girls from going to school (Mwihaki, 2018). Access to clean water will therefore turn this round as it fosters faster economic growth in the country. In addition, safe water for domestic use also means a reduction in water-related diseases like diarrhea and therefore a healthier nation. Owing to the importance of water, the African Union's goal is that all households should have access to adequate clean water and sanitation facilities by 2025. All rural homes should meet the standards for habitation as contained in the African Union housing policy by 2040 (Africa Union Commission, 2014).

According to the Development Initiative report (2018), Kenya is faced with several constraints to the provision of 100 percent universal access to safe water and sanitation by 2030. The constraints include a resource gap of around KES 1.2 trillion, over-reliance on donor contributions, high poverty incidence, fragmented policy frameworks, inadequate data for planning and budgeting, water pollution, and increasing population growth characterized by increased demand for water as well as climate change. The country also records significant inequalities in water access from an improved source that needs to be addressed so that all counties are at par. For instance, water access from an improved source increased between 2009 and 2015/2016 at the national level but rural areas are still left behind. At the national level, an increase from 56.1 percent in 2009 to 72.6 percent in 2015/16 was recorded. According to the report, 86.7 percent of urban households have access compared to 61.8 percent of rural households. However, 50 percent of households do not have access to water from an improved source between 2009 and 2015/2016 from over 10 rural counties exposing them to water-borne diseases among other challenges. There is however a significant inequality in access to water from an improved source. For instance, Taita Taveta, Embu, and Kisumu are doing well at over 80 percent while less than 30 percent have access in West Pokot, Wajir, and Marsabit among other counties in Kenya.

Household heads are an integral part of economic development since they are crucial decision-making units in society on access to clean water. The author explains the role of household heads concerning access to clean water. Understanding how household head attributes affect the access to clean water

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is key in policy formulation for promotion, on of these crucial aspects of development. In addition, the significance of household heads access to clean water is underscored as an alternative or complement to government provision. This is more so important considering the handicaps faced by the government in the provision of clean water. Decision making by household heads and local authorities about basic infrastructure provision is seen as a contributing factor to the amount of time associated with these domestic labor tasks. Liao, Chen, Tang and Wu (2019) acknowledges that household head is the decision-maker of household affairs and as such there exists a relationship between their characteristics and the access to clean water or choice of energy in the household.

Kenya has taken numerous steps in ensuring that all households have universal access to water by 2030. However, the country may not achieve this goal by 2030 due to the challenges related to the implementation of the objectives including inadequate data on the indicators to allow for better policy formulation (Koolwal & Van de Walle, 2013). This therefore calls for alternative channels of achieving universal access to clean water in Kenya by 2030. This study is an effort towards this strand of thinking since it seeks to establish how the household through the household head can contribute to access to clean water. Specifically, the study explores which household head characteristics should be promoted to improve access to clean water. Previous studies on household heads characteristics and attainment of access to clean water focused on the households' demand for housing in Kenya (Kithinji, 2015), the socioeconomic determinants of households' access to safe drinking water as well as factors influencing urban-rural inequality in access to safe drinking water in Nigeria by Abdu, et al., (2016) and the roles and attitudes of urbanites towards urban water insecurity by Asibey, Dosu and Yeboah (2019) in New Juaben Municipality, Ghana. None of these studies established how household head characteristics influence access to clean water in Kenya. The study sought to answer the following question: what is the effect of household head characteristic on access to clean water sources?

Methods

To achieve the study objective, secondary data was obtained from the 2015/2016 Kenya Integrated Household Budget Survey (KNBS, 2015). Being the household budget survey, this set of cross-sectional data in Kenya was collected over twelve months and disaggregated data by county and at a national level. The survey collected data on a range of socio-economic indicators including household characteristics, housing conditions, education, and general health characteristics among others, and presented the findings at national, county, rural, and urban levels. In the identification and selection of study variables, the survey question asked the respondents to identify their

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main water source out of eight mutually exclusive alternatives that were further categorized into 4 mutually exclusive water sources.

Horowitz et al., (2014) highlight that the random utility model aims at modeling the choices of rational consumers among sets of n alternatives. The choice alternatives are labeled $1, \dots, n$. The model assumes that a consumer's preference among the alternatives can be described by a utility function from a vector $U_1, U_2, \dots U_n$ that is associated with the n possible alternatives. The random utility for the item i is therefore given by U_i. The theory stems from the maximization of utility and stastatesat the individual choice is based on the alternative with the highest utility. The utility derived from an alternative depends on the attributes of the alternative as well as both the observed and unobserved attributes of the individual making the decision.

Precisely, it U_1 is the utility for choosing an alternative1, U_2 for choosing 2 and U_n for choosing alternative n, then an individual's choice y over n alternatives will be given by;

$y_i = \{1\ if\ U_1 > U_n\ 0\ if\ U_1 \leq U_n$ ……..……..1

Equation 1 implies that individuals would choose alternative 1 if the utility derived from this choice is greater than that derived from all other alternatives and will go for other alternatives if utility derived from these alternatives are less or equal to utility derived from other alternatives. The n possible outcomes of choice y will therefore be given by;

$y = 1,2, \dots, n$……....……2

Borrowing from the concept of Horowitz et al.,(2014), the random utility function will be given by;

$U_1 = W'\beta_1 + Z_1'\alpha_1 + \varepsilon_1\ U_n = W'\beta_n + Z_n'\alpha_n + \varepsilon_n$ ……3

Where W' is a vector of characteristics of the individual consumer while $Z'$is a vector of the attributes of the choices the individual has to make. The random utility model gives the probability with which each alternative will be chosen so that;

$0 \leq P\{y = i\} \leq 1$ and $\sum_{i=1}^{n} \quad P\{y = i\} = 1$……....……..…4

The marginal effects shall be derived using the values of the estimated coefficients which are the odds ratio. The odds ratio will be given by;

$log\ log\left(\frac{p_{ij}}{p_{ik}}\right) = X_i'\left(\beta_j - \beta_k\right) = X_i'\beta_j$ if $k = 0$…….....5

The probability that respondent selects alternative i can be assumed to be described by multinomial logit model so that;

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$$P\{y=i\} = \frac{exp\{X_i'\beta\}}{1+exp\{X_2'\beta\}+\cdots+exp\{X_n'\beta\}} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 6$$

In developing empirical model, a theoretical framework was extended with the help of empirical literature to achieve the study objective. Based on the reviewed empirical literature, the economic environment as defined by the prices and consumer's income are extended when the specific consumer is considered. In our case, the consumer is the household head and therefore, the economic environments are his attributes such as sex, age, education level, and employment status according to the empirical literature. The characteristics of the household headed by this consumer include the household size and the residence of the household (that is urban, rural, or peri-urban).

Since the commodities considered are three, the addition of the attributes of the choices the individual has to make to the characteristics of the household head and the household itself yields three different extensions. The determinants of the choice the household head makes on the water source for domestic include the household head characteristics, household characteristics, and the frequency of fetching water by the household.
Therefore, equation 5 becomes;

$$log\ log\left(\frac{p_{ij}}{p_{ik}}\right) = \beta_0 + \beta_1 income\ levels + \beta_2\ Age + \beta_3 Education + \beta_4 Sex + \beta_5 Employemnet\ status + \beta_6 Household\ size + \beta_7 Area\ of\ residence + \beta_8 Frequecy\ of\ fetching\ water + \varepsilon_i \ldots\ldots\ldots\ldots\ldots\ldots 7$$

Where: ε_i Is the error term
Here the four possible mutually exclusive outcomes of choice on water source y_i are given by;

$$y_i = \{1\ if\ Surface\ water\ 2\ if\ spring\ water\ 3\ if\ borehole\ water\ 4\ if\ piped\ water$$

In operationalization definition, the KIHBS 2015/2016 defined surface water as water from rivers, stream, pond dam, among others, whereas spring water was defined by protected and unprotected spring water as well as rainwater collection, borehole water, as defined by borehole and both protected and unprotected dug well water and finally piped water was defined by piped water into dwelling, into the plot and public tap. The model as shown in equation 7 was estimated via the maximum likelihood estimation (MLE) technique. According to Orayo (2014), MLE has higher efficiency and produces better numerical stability. The study employed MLE to get more robust parameter estimates for household characteristics and access to clean

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water. As informed by the empirical literature, several variables influence access to clean water. The variables used are summarized in table 1.

Table 1: Variables, definitions, and measurements

Category	Variables	Description	Measurement
Household head characteristics	Sex	The sex of household head	Dummy variable = {1 if a male 0 otherwise
	Age	The number of years of a household head	Positive integers
	Education level	The level of education of the household head	Categorical variable= {1 if primary, 2 if Secondary, and 3 if tertiary}
	Area of residence	The place/area the specific household resides	Dummy variable= {1 if rural,0 otherwise}
	Employment status	The employment status of the household head	Dummy variable = {1 if employed 0 otherwise}
	Income levels	Proxied by the type of dwelling the household live in	Dummy variable = {1 if permanent, 0 otherwise}
Household Characteristics	Household size	The total number of household members living in each household	Continuous variable measured as members living in the household
Attribute specific to water	Frequency of fetching water	The number of times the household went to fetch water	Count variable (positive integers)
Attribute specific to housing	House rent	Amount of rent paid for the house	Continuous variable measured in KES

Source: KIHBS 2015/2016 and Own conceptualization

To achieve the objective, STATA version 14.0 software was used whereas data was analyzed using multinomial logit regression model. This is because the dependent variable had multiple responses. The study determined the log odds of the independent variables as well as the marginal effects of the same variables. Following Orayo (2020), the resulting coefficients were not interpreted but the marginal effects were interpreted.

Results

Table 2 presents the mean values of the dependent variables. The mean, was employed to explain the nature of the distribution of data for the various variables.

Table 2: Descriptive statistics of dependent variables

Dependent Variable		No of observations	Unit of measure (Dummy that sets to:)	Frequency (%)
Water Source	Surface water	20,698	1 if Surface water	23
	Spring water		2 if Spring water	15
	Borehole		3 if Borehole water	26
	Piped		4 if Piped water	36

Source: Own calculation

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The summary statistics presented in Table 2 shows the frequency for the various factor variables used as dependent variables. According to Table 4.1, 36 percent of the household heads were using piped water, 26 percent used borehole water, and 23 percent used surface water while 15 percent used spring water. Since piped water is considered the cleanest, majority of household heads were using clean water. This tallies with the national assertion that about 50% people in Kenya have access to clean water (Government of Kenya, 2017).

Table 3: Descriptive statistics of independent variables

Independent Variable		**Observations**	**Unit of Measurement**	**Mean/ Frequency (%)**	**Standard deviation**	**Minimum**	**Maximum**
Age		21146	Years	43.6	14.7	18	80
Education	No education	17165	1 if No education 2 if Primary 3 if Secondary 4 if Tertiary	0.4			
	Primary			54.4			
	Secondary			30.1			
	Tertiary			15.1			
Sex (Male=1)		21773		66			
Employment Status		21756		36			
Household size		21773		4.3	2.5	1	28
Residence (Rural=1)		21773		60			
Water Frequency		19863	Per Month	2.2	1.6	0	40
Rent		13939	Per Month	2,605.50	5,571.90	300	150,000

Source: Own calculations

The summary statistics presented in Table 3 shows the mean and frequencies for the various variables used as independent variables. On the other hand, the mean for water frequency and rent are interpreted as the average monthly unit of measure for the various variables while mean for age and household size is the average age for household head and average household size respectively.

From summary statistics, the average age of household head is 44 years old while the minimum age is 18 years and maximum age is 80 years. This means that the surveyed population was still within the productive years and can head a household. The results show that, 54.4 percent of the household heads attended up to primary level of education, 30.1 percent up to secondary level of education while 15.1 percent attended up to tertiary level of education. 0.4 percent of the household heads had no education. This implied that majority of household heads in Kenya have basic literacy skills of reading and writing.

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The results in Table 3 indicated that 66 percent of the household heads were male. This implied that Kenya is still a patriarchal country. The study observed that 36 percent of the respondents were employed. This means that majority of the household heads are either out of the labor force or are unemployed. Also, the results, illustrate that the average household size is four persons. The household with smallest number of persons had one person while maximum had 28 persons. This implied that majority of households in Kenya have declined relative to the sizes in the 1960's (United Nations, 2017).

Table 3 further shows that 60 percent of the household heads reside in the rural areas. This implied that majority of households are rural dwellers while on average 40 percent reside in the urban. This was expected as rural area is vast compared to urban areas in Kenya (Government of Kenya, 2017). In addition, the findings indicate that on average a typical household will fetch water twice a month. However, there are other households who would fetch water as high as 40 times a month, while others as low as once in a month. This underscores that there is inequity in access to clean water in Kenya. The results show that on average, a household head will pay a monthly rent of Kshs. 2,605.50. The household head who incurs the minimum rent would pay Kshs. 300 per month, while the one incurring the highest expense pays Kshs. 150,000 per month. This implies that the choices of housing in Kenya are markedly varied.

Table 4: The effect of household head characteristics on access to clean water

		Coefficients		
Variable	**Surface Water**	**Spring water**	**Borehole water**	**Piped water**
Income levels		-0.226***	0.130**	1.010***
		(0.059)	(0.052)	(0.053)
Age		0.018	0.011	0.011
		(0.013)	(0.012)	(0.012)
Age squared		-0.000	-0.000	-0.000
		(0.000)	(0.000)	(0.000)
Primary education		0.839*	-0.028	0.494
		(0.440)	(0.313)	(0.387)
Secondary education		1.158***	0.318	0.972**
		(0.442)	(0.316)	(0.389)
Tertiary education		1.585***	0.658**	1.149***
		(0.450)	(0.325)	(0.396)
Sex (Male=1)		-0.061	0.065	0.124**
		(0.060)	(0.055)	(0.056)
Employment status (Employed=1)		0.187***	0.187***	0.397***
		(0.059)	(0.053)	(0.054)
Household Size		-0.038***	-0.033***	-0.167***
		(0.012)	(0.011)	(0.012)

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Residence (Rural=1)	-0.052	-0.471***	-1.249***
	(0.065)	(0.056)	(0.055)
Water frequency	-0.006	-0.030*	0.096***
	(0.019)	(0.017)	(0.016)
Constant	-1.535***	0.254	-0.003
	(0.514)	(0.394)	(0.454)
Post Estimation diagnostics			
Number of observations	14,370		
LR Chi2 (36)	3157.26***		
log likelihood	-17972.003		
Pseudo R^2	0.0807		
Prob >chi^2 =		0.0000	
Independent of Irrelevant Assumption (Statistic) $chi^2(21) = (b-B)'[(V_b - V_B)^{-1}](b-B)$ (V_b-V_B is not positive definite)	93.10		
Key			
Standard errors in parentheses Where *** p<0.01, ** p<0.05, * p<0.1			

Source: Own calculations

Table 4 shows that the model had a likelihood ratio test with a Chi square test statistic of 3157.26 with 36 degrees of freedom and a corresponding P-value of 0.000. This means that the calculated Chi square statistic is greater than the tabulated at one percent level of significance. Therefore, at one percent level of significance the coefficients of the respective variables are jointly significant in explaining variations in the choice of water source by household heads. The Pseudo R square is 0.0807 implying that the variables jointly explain 8.07 percent of the variations in household head choice of water source. According to Hoffman and Duncan (1988) this coefficient of determination is adequate for a multinomial choice variable. Therefore, the findings in table 4 can be used to estimate the marginal effects (ME) of the respective variables as shown in table 5. For diagnostic test, the chi square under Hausman test for independence of irrelevant alternatives was 93.10 which mean that the estimated multinomial logit model met the asymptotic assumptions of the test as chi-square was greater than zero and is valid under the Independence of Irrelevant Alternatives (IIA) assumption (Fry & Harris,1998). Therefore, the characteristics of surface water choice alternative by household head do not impact relative probabilities of choosing borehole water, spring water or piped water.

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Table 5: The effect of household head characteristics on access to clean water marginal effects

Variable	Surface Water	Spring water	Borehole water	Piped water
Income levels	-.0574***	-.0879***	-.0488***	.1941***
	(0.0072)	(0.0067)	(0.0080)	(0.0079)
Age	-.0021	0.0015	.0003	.0003
	(0.0016)	(0.0015)	(0.0017)	(0.0017)
Age Squared	.00002	0.7759	-0.3772	-.0000
	(0.000)	(0.000)	(0.000)	(0.000)
Primary	-.0631	.0803**	-.0792	.0620
	(-0.0563)	(0.0346)	(0.0606)	(0.0554)
Secondary	-.1251**	.0857**	-.0675	.1069*
	(0.0565)	(0.0350)	(0.0609)	(0.0557)
Tertiary	-.1664**	.1204**	-.0409	.0869
	(0.0571)	(0.0363)	(-0.0617)	(0.563)
Sex (Male)	-.0079	-.0178 **	.0057	.0199**
	(0.0076)	(-0.0073)	(0.0083)	(0.0079)
Employment	-.0415***	-.0014	-.0060	0490***
Status(employed)	(-0.0072)	(0.0069)	(-0.0079)	(0.0077)
Household size	.0130***	.0039**	.0090***	-.0258***
	(0.0015)	(0.0014)	(0.0017)	(-0.0017)
Residence (Rural)	.1047***	.0784***	.0208**	-.2039***
	(0.0073)	(0.0068)	(0.0082)	(0.0083)
Water frequency	-.0031	-.0037*	-.0133***	.0201***
	(0.0023)	(0.0022)	(0.0027)	(0.0023)

Key
Standard errors in parentheses
Where *** p<0.01, ** p<0.05, * p<0.1

Source: Own calculation

Discussions

Table 5 shows that an increase in income reduces the probability of a household head selecting surface water, spring water and borehole water by 5.74, 8.79 and 4.88 percentage points respectively while at the same time increases the probability of the household head selecting clean water (piped water) by 19.41 percentage points. This means that increase in income of the household head increases the chances of household using clean water. The study finding aligns with how a rational individual faced with alternative choices and limited income would go for decisions that give them maximum utility in the theory of the consumer. The study findings further agree with that of Asibey et al., (2019) that studied the roles and attitudes of urbanites towards urban water insecurity in Ghana and revealed that individual's income played a significant role in determining the preferred coping strategy to water shortages with poor households going for cheaper and unsafe alternatives to water sources.

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Table 4 shows that the coefficient of age on spring water regression is 0.018 and that on borehole and piped water regression as both 0.011, with a corresponding P-value greater than 0.1 across all water sources. Table 4 further shows that the marginal effects of age on surface water, spring water, borehole water and piped water is -0.0021, 0.0015, 0.003 and 0.003 respectively. The P-value is however greater than 0.1 across all water sources. This means that the calculated Z statistic is less than the tabulated Z statistic at five percent level of significance. This means that the null hypothesis for this coefficient is not different from zero and is not rejected at five percent level of significant. Age is therefore not statistically significant across all water sources and as such the age of the household head does not influence the choice of water sources. Based on the random utility theory for utility maximization, age can be considered among the observed and unobserved attributes of individual making rational decisions for attainment of the highest utility. However, the study finding differs with this notion as age does not influence choice of water source. The study further differs with that of Abdu et al., (2016) on socioeconomic determinants of households' access to safe drinking water in Nigeria that established that age among other variables, have positive effects on likelihood of accessing safe drinking water as well as being responsible for urban-rural inequality in access to safe drinking water. The fact that age of the household head does not influence the choice of the water sources implies that government efforts to improve access to clean water should not target a particular age group rather it should focus on the society as a whole.

Table 4 shows that the coefficient of age squared on all water sources is -0.0000 with a corresponding P-value greater than 0.1 across all water sources. Table 5 further shows that the marginal effects of age squared on surface water, spring water, borehole water and piped water is 0.0002, 0.7759, -0.3772 and -0.000 respectively. The P-value is however greater than 0.1 across all water sources. This means that the calculated Z statistic is less than the tabulated Z statistic at five percent level of significance. This means that the null hypothesis for this coefficient is not different from zero and is not rejected at five percent level of significance (Orayo, 2020). Age squared is therefore not statistically significant across all water sources. Also, age of the household head has non-linear effect on household's head choice of water sources.

Table 4 shows that the coefficient of primary education of the household head is 0.839 with a corresponding P-value greater than 0.1 for the spring water regression. This means that the calculated Z statistic is greater than the tabulated Z statistic at 10 percent level of significance for spring water regression. This implies that the null hypothesis that the coefficient is not different from zero is rejected at 10 percent level of significance. However,

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Table 4 shows that the coefficient of primary education in the borehole and piped water regression have P-values greater than 0.1. This means that the calculated Z statistic is less than the tabulated Z statistic at five percent level of significance for both borehole and piped water regression implying that the null hypothesis for these coefficients are not different from zero and is not rejected at five percent level of significance. Since the household head having primary education is weakly significant its marginal effect in Table 5 were interpreted. The results show that the marginal effects are 0.0803. This implies that an increase in the level of education of the household head from increases the probability of household head selecting spring water by 8 percentage points.

Table 4 shows that the coefficient of secondary education of the household head is 1.158 with a corresponding P-value less than 0.1 for the spring water regression. This means that the calculated Z statistic is less than the tabulated Z statistic at 1 percent level of significance for spring water regression. Table 5 further shows that the coefficients of secondary education of household head is 0.972 with a corresponding P-value less than 0.1 for the piped water regression. This means that the calculated Z statistic is less than the tabulated Z statistic at 5 percent level of significance for piped water regression. This implies that the null hypothesis that the coefficient is not different from zero is not rejected at 1 percent level of significance and at 5 percent significance level on spring water and piped water respectively. However, Table 4 shows that the coefficient of secondary education in the borehole water regression have P-values greater than 0.1. This means that the calculated Z statistic is less than the tabulated Z statistic at five percent level of significance for borehole water regression implying that the null hypothesis for these coefficients is not different from zero and is not rejected at five percent level of significance. Since the household head having secondary education is significant in spring water and piped water regression, its marginal effect in Table 5 were interpreted. The results show that the marginal effects are -0.1251, 0.0857 and 0.1069. This implies that an increase in the level of education of the household head from no education to secondary school education reduces the probability of household head selecting spring water by 12.51 percent. A similar effect however increases the probability of household head selecting borehole water and piped water by 8.57 percent and 10.69 percent respectively.

Table 4 shows that the coefficient of tertiary education of the household head is 1.585 and 1.149 with a corresponding P-value less than 0.1 for the spring water and piped water regressions. This means that the calculated Z statistic is less than the tabulated Z statistic at 1 percent level of significance for spring and piped water regressions. This implies that the null hypothesis that the coefficient is not different from zero is not rejected at 1

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percent level of significance. Table 4 further shows that the coefficient of tertiary educa,tion of the household head is 0.658 with a corresponding P-value less than 0.1 for the borehole water. This means that the calculated Z statistic is less than the tabulated Z statistic at 5 percent level of significance for borehole water regression. This implies that the null hypothesis of the coefficient is not different from zero and is not rejected at 5 percent level of significance. Since the household head having tertiary education is strongly significant, its marginal effect in Table 5 was interpreted. Table 5 shows that the marginal effects are -0.1664 and 0.1204 on surface and spring water. This implies that an increase in the level of education of the household head from no education to tertiary education reduces the probability of household head selecting surface water by 16.64 percent while this advancement in education increases the likelihood of household head using spring water by 12.04 percent.

From the foregoing discussion, primary education increases the probability of a household head selecting spring water, secondary education reduces the chances of a household head selecting surface water while at the same time encourages the household head to select spring and piped water. Tertiary education on the other hand reduces the probability of a household head selecting surface water and enhances the probability of a household head selecting spring water. This means that as the education of the household head increases from no education to primary education through tertiary education, their probability of selecting a clean water source increase. This finding is like that of Abdu et al., (2016) on socioeconomic determinants of households' access to safe drinking water in Nigeria that established that education level among other variables is responsible for urban-rural inequality in access to safe drinking water. The findings as well concluded similarly to a study of Abubakar (2019) who also established education as a key factor influencing housed access to drinking water in Nigeria. The finding confirms the theoretical underpinning that rational decision-making units presented with different choices will go for the alternative that gives them the highest utility with education considered among the observed and unobserved attributes of the decision maker in the random utility theory. The implication is that education is a tool that policy makers and the government can use to influence household heads to select clean water sources.

Table 4 shows that the coefficient of sex on spring and borehole water regressions is -0.061 and 0.065 respectively with a corresponding P-value greater than 0.1. This means that the calculated Z statistic is less than the tabulated Z statistic at five percent level of significance, implying that the null hypothesis for this coefficient is not different from zero and is not rejected at five percent level of significant. Table 4 however shows that the coefficient of sex on piped water regression is 0.124 with a corresponding P-value less than

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0.1. This means that the calculated Z statistic is greater than the tabulated Z statistic at five percent level of significance, implying that the null hypothesis for this coefficient is different from zero and is rejected at five percent level of significance. Table 5 further shows that the marginal effects of sex on surface water and borehole water is -0.0079 and 0.0057 respectively with P-value greater than 0.1. However, the marginal effects of sex on spring water and piped water are -0.1078 and 0.0199 respectively with P-value less than 0.1. According to the study findings therefore, being male reduces the probability of household head to use spring water by 0.79 percent while being male increases the probability of using piped water by 1.99 percent. The study considers sex as part of the observed attributes of rational decision-making unit under the random utility theory for utility maximization The study findings is similar to that of Abdu et al., (2016) on socioeconomic determinants of households' access to safe drinking water in Nigeria that established that gender among other variables, have positive effects on likelihood of accessing safe drinking water. This implies that sex is a tool that policy makers and the government can use in the efforts to provide clean water.

Table 4 shows that the coefficient of employment status on spring water, borehole water and piped water is 0.187 and 0.397 respectively with the corresponding P-values less than 0.1 across all water sources. This means that the calculated Z statistic is greater than the tabulated Z statistic at one percent level of significance. This means that the null hypothesis for this coefficient is different from zero and is rejected at one percent level of significance. Table 5 further shows that the marginal effects of employment status on surface water and piped water is -0.0415 and 0.0490 respectively. This study finding shows that being employed reduced the likelihood of using surface water by 4.15 percent and increased the likelihood of using piped water by 4.90 percent. The fact that a change from being unemployed to being employed increases the probability of a household head selecting piped (clean) water sources implies that labor market outcomes are important for the access of clean water. Those with employment, and therefore, employment incomes are more likely to select clean water sources unlike those without. This study agrees with that of Asibey et al., (2019) on roles and attitudes of urbanites towards urban water insecurity in Ghana that established that poor household goes for cheaper and unsafe alternatives to water sources. Therefore, efforts by the government and other stakeholders geared towards increasing employment rates in the Kenyan labour market are important tool of increasing access to clean water.

Table 4 shows that the coefficient of residence on spring water regression is -0.052 with a corresponding P value greater than 0.1. This means that the calculated Z statistic is less than the tabulated Z statistic at one percent

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level of significance. This means that the null hypothesis for this coefficient is not different from zero and is not rejected at one percent level of significance. The coefficient of residence on borehole and piped water regressions is -0.471 and -1.249 respectively with P-value less than 0.1. This means that the calculated Z statistic is greater than the tabulated Z statistic at one percent level of significance. This means that the null hypothesis for this coefficient is different from zero and is rejected at one percent level of significance. Table 5 further shows that being in the rural increases the probability of household head using surface water, spring water and borehole water by 10.47 percent, 7.84 percent, and 2.08 percent respectively. Being in the rural however reduces the probability of using piped water by 20.39 percent. This study finding is in line with the findings of Abdu et al., (2016) that established rural-urban inequality in access to safe drinking water is associated with that household head attributes. This implies that if a household head migrates from an urban setup to a rural set up their probability of selecting clean water sources reduces. Efforts to address inequality in the access of water between rural and urban areas should therefore be enhanced.

Conclusion

The study sought to establish the effect of the household head characteristics on access to clean water. It was established that when a household head moves from being unemployed to being employed, his or her probability of selecting clean water sources increases. Therefore, the study concludes that labor market outcomes are important in determining access to clean water. Specifically, finding a job increases the probability of a household head selecting clean water sources. Considering income levels, the study concludes that, an income source is important in determining access to clean water. Specifically, engagement in any income generating activity by household head increases their probability of accessing clean water. Age was found not to influence choice of clean water. The study therefore concludes that government effort in provision of clean water should not target any specific age group.

Additionally, the study established that all education levels (primary, secondary and tertiary) compared to no education increased the probability of household head accessing clean water. The study concludes that education is crucial for access to clean water in Kenya as the higher the education level, the more the household head have access to clean water. In addition, sex significantly increased choice of clean water sources. Therefore, the study concludes that male headed households have access to clean water sources relative to female headed ones. Finally, the study established that when a household head moved from the urban to the rural, their probability of accessing clean water source increased. The study therefore concludes that

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area of residence of household head means inequality of access to clean water in Kenya.

Based on the study findings, the following recommendations are made.

First, arising from the conclusion that favorable labor market outcomes increase the probability of a household head selecting clean water sources, the study recommends that employment opportunities should be expanded in the country. This could be achieved in the short-term through an expansionary monetary or fiscal policy such as *'Kazi Mtaani'*. In the medium to the long term this could be achieved through sustained expansion of the economy that creates employment opportunities in the private sector and the public sector. The expanding economy should be complemented by relevant training such that the increased labor market opportunities find a workforce that is ready to take up the opportunities.

Secondly, from the conclusion that the higher the education of household head from primary through tertiary, the higher the chances of them accessing clean water, the study recommends investment in the education sector by the government in the country. This could be achieved by the government providing free primary and secondary education in the country as well as making colleges more affordable for citizens so that a majority of the citizens have access to education. The free education initiatives should be accompanied by the government designing a curriculum that integrates the training on the use of clean water in schools (primary, secondary, and higher education institutions).

In addition, from the conclusion that being male increases the chances of household heads accessing clean water, the study recommends social welfare programs and reduced inequalities in the country. This could be achieved by the government through the relevant ministries and county governments working hand in hand to enhance the existing social programs like women empowerment programs to promote access and use of clean water as envisaged in Kenya's vision 2030. Finally, from the conclusion that as household head moving from the urban to the rural, their probability of accessing clean water source reduces, the study recommends for equity in distribution of resources across the country. This can be achieved through devolution of resources by the government in Kenya.

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Evaluation de l'Etat de la Gestion des Excrétas dans la Ville de Bukavu en République Démocratique du Congo : Cas de la Commune de Kadutu

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Résumé

Cette étude a pour objet d'évaluer la problématique de la mauvaise gestion des excrétas et ses risques environnementaux dans la Ville de Bukavu, précisément en Commune de Kadutu. L'objectif de cette étude est d'évaluer les causes de la mauvaise gestion des excrétas de la municipalité Kadutu et de proposer des recommandations pour une gestion saine des excrétas La méthodologie utilisée porte sur trois techniques sur le terrain : l'observation directe, l'analyse documentaire et les enquêtes (focus groupe et interview semi-structurés). L'étude a abouti aux résultats selon lesquels la faible implication des autorités étatiques, les constructions anarchiques, la non-implication des agents d'assainissement, l'incivisme de la population constituent les causes de la mauvaise gestion des excrétas dans la Commune de Kadutu. La majorité des habitations construites le long de la rivière « *Kahuwa* » n'a pas des fosses septiques, leurs toilettes se vident directement dans cette rivière. Cela a comme conséquences, des odeurs répugnantes dans tous les coins de ladite municipalité. Ces effets sont visibles peuvent engendrer des conséquences néfastes sur la santé de la population et sur l'environnement.

Mots-clés : Gestion des excrétas, impact environnemental, Ville de Bukavu, RDC

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Evaluation of the State of Excreta Management in the City of Bukavu in the Democratic Republic of Congo: Case of the Commune of Kadutu

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Abstract

This study focuses on assessing the problem of poor excreta management and its environmental risks in the City of Bukavu, specifically in Kadutu Commune. The objective of this study is to assess the causes of poor excreta management in the municipality of Kadutu and to propose recommendations for sound excreta management. The methodology used is based on three field techniques, namely: direct observation, documentary analysis, and surveys (focus group and semi-structured interviews). The study concluded that the poor involvement of state authorities, anarchic construction, the non-involvement of sanitation agents, and the incivism of the population are the causes of poor excreta management in the Commune of Kadutu. The majority of the houses built along the river "*Kahuwa*" do not have septic tanks and their toilets are emptied directly into this river. This results in

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disgusting odors in every corner of the said municipality. These effects are visible and can have negative consequences on the health of the population and the environment.

Keywords: Excreta management, environmental impact, city of Bukavu, DRC

Introduction

Le rapport de l'Organisation Mondiale de la Santé (OMS, 2021) en 2020, renseigne que 54 % de la population mondiale (soit 4.2 milliards de personnes) avait accès à des services d'assainissement gérés de manière sûre. Le même rapport de l'OMS (2021) illustre que plus de 1,7 milliard de personnes ne disposent toujours pas de services d'assainissement de base, tels que des toilettes privées ou des latrines.

Parmi elles, 494 millions défèquent encore à l'air libre, par exemple dans les caniveaux, derrière des buissons ou dans des plans d'eau. Cet assainissement insuffisant est associé à la transmission des maladies diarrhéiques, telles que le choléra, et la dysenterie, ainsi que d'autres maladies comme la fièvre typhoïde, l'infestation par des vers intestinaux (helminthiases) et la poliomyélite.

La proclamation de l'Organisation Mondiale de la Santé (OMS, 2020) sur l'utilisation sans risque des eaux usées, des excrétas et des eaux ménagères certifie que l'assainissement de mauvaise qualité exacerbe les problèmes de retard de croissance et contribue à la propagation de la résistance aux antimicrobiens.

En outre, ce même rapport de l'OMS (2020), démontre qu'un assainissement de mauvaise qualité porte atteinte au bien-être humain et au développement social et économique compte tenu de ses effets en termes d'anxiété, de la réduction des possibilités éducatives et la défécation à l'air libre entretient le cercle vicieux de la maladie et de la pauvreté. Les pays où cette pratique est la plus répandue atteignent aussi les niveaux les plus élevés pour ce qui est de la mortalité des enfants de moins de 5 ans, de la malnutrition, de la pauvreté, avec des fortes disparités dans la répartition des richesses.

Dans la région subsaharienne et dans la plupart des villes africaines, les technologies de collecte de traitement et de recyclage des ordures ménagères et des excrétas restent rudimentaires (Koanda, 2006 ; Dah, 2013). Les programmes spécifiques publics centrés sur la gestion des ordures sont quasiment absents (PNUE, 2008). Ces grandes villes africaines comme celles des mégapoles, les métropoles et autres agglomérations de la République Démocratique du Congo (RDC), sont plus confrontées à un réel problème de gestion des excrétas du fait de la croissance démographique exponentielle qui rend de moins en moins durables les pratiques de défécation à l'air libre, alors

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que, ces excréments doivent être considérés comme des matières dangereuses qu'il convient de manipuler avec précaution (Zerbo, 2011 ; Negrin, 2017). Par définition, les écrêtas sont des substances rejetées hors de l'organisme, consistant principalement en déchets de la nutrition et du métabolisme (fèces, urines, sueur, matière sébacée, gaz carbonique, etc., PNUE, 2008).

L'évacuation inappropriée des excrétas humains infectés conduit, d'une part, à la contamination du sol, des sources d'approvisionnement en eau potable ; et d'autre part, elle risque de constituer un foyer de prolifération et de propagation d'infections de la part de certaines espèces de mouches ; et d'attirer ainsi d'autres insectes, les rongeurs, la vermine susceptibles de créer un gêne intolérable. A cause de cette situation, des millions de personnes meurent, et la plupart sont des enfants de moins de cinq ans (UNICEF, 2009).

Selon Koffi (2010), la mauvaise gestion des excrétas et la consommation d'une eau souillée sont les principales causes des maladies hydriques en Afrique. Ces eaux, majoritairement des puits et quelquefois de surfaces, sont souillées par des déchets ruisselés lors des précipitations et des inondations.

Cette réalité n'échappe pas à notre pays la RDC, car cette situation constitue un des facteurs aggravants de la dégradation de l'environnement dans la ville. Et cette question est de la première importance pour les autorités locales qui sont conscientes de l'importance de cet enjeu. De plus, la prise de conscience effective par les acteurs locaux de leur rôle à jouer dans le développement économique et social de la ville, fait en sorte que cette situation se situe dans le cadre de développement.

D'après Zondo et *al*. (1992), toutes les grandes agglomérations de la RDC ont en général de la peine à s'offrir un service de proximité approprié. Le secteur de l'assainissement n'en est pas épargné, car il est dominé par des ouvrages d'assainissements autonomes ; principales sources des pollutions diffuses, difficilement maîtrisables. On y observe plusieurs comportements à risque liés à la mauvaise gestion des excrétas, certaines latrines creusées sont moins profondes, mal construites et très mal entretenues par les habitants. Elles sont souvent confondues aux poubelles suite aux ordures ménagères qui y sont régulièrement jetées (Mashukano, 2012).

Dans la ville de Bukavu, l'insalubrité est notoire et surtout dans la Commune de Kadutu où les déchets des ménages, des différents marchés et les excrétas trainent dans tous les caniveaux et débordent lors des pluies torrentielles. En outre, toutes les maisons longeant le long des rivières et cours d'eaux n'ont pas des fosses septiques, leurs toilettes se vident directement dans lesdites rivières et cours d'eaux. Dans les quartiers Nkafu et Cimpunda (**Figure 1**), plusieurs cas des maladies graves résultent de l'eau stagnante des toilettes entrainant des odeurs nauséabondes dans les coins et recoins de la Commune.

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A cet effet : (i) Quelles sont les causes de la mauvaise gestion des excrétas dans la Commune de Kadutu ? (ii) Quelles sont les conséquences environnementales de cette mauvaise gestion des excrétas ? C'est dans ce cadre que cette étude a pour objet d'évaluer la problématique de la mauvaise gestion des excrétas et ses risques environnementaux dans la ville de Bukavu, précisément en Commune de Kadutu.

De façon spécifique, il s'agira d'identifier les causes de la mauvaise gestion des excrétas dans la Commune de Kadutu ; d'établir les différents modes de gestion des excrétas par la population ; d'identifier les conséquences environnementales et sanitaires liées à la mauvaise gestion des excrétas à Kadutu et de formuler des recommandations pouvant amener la population de Kadutu à la gestion saine des excrétas.

Methodologie

Milieu d'étude

La municipalité de Kadutu se trouve dans la ville de Bukavu, Chef-lieu de la Province du Sud-Kivu. Elle est située à 2°33 1' et 2° 28 3°n Sud et les méridiens 28°48 4' 28°53,6' Est. La ville est séparée du Rwanda par le Lac Kivu et la Rivière Ruzizi. Cette agglomération de Kadutu se trouve sur les flancs de la colline, son altitude est entre 1640 et 1800 m entre une latitude de 2°28' au sud et 28°53' de longitude Est.

Elle a une superficie de 1.010 km^2 et sa population est hétérogène, estimée d'environ 594 349 personnes, soit une densité d'environ 58 846 habitats/Km^2. Elle est limitée au Nord par la rivière Wesha, au Sud par la rivière Kahuhwa, à l'Ouest par la rivière Wesha, au Nord-Est par le Lac Kivu et à l'Est par la rivière Kahuhwa qui la sépare de la commune d'Ibanda.

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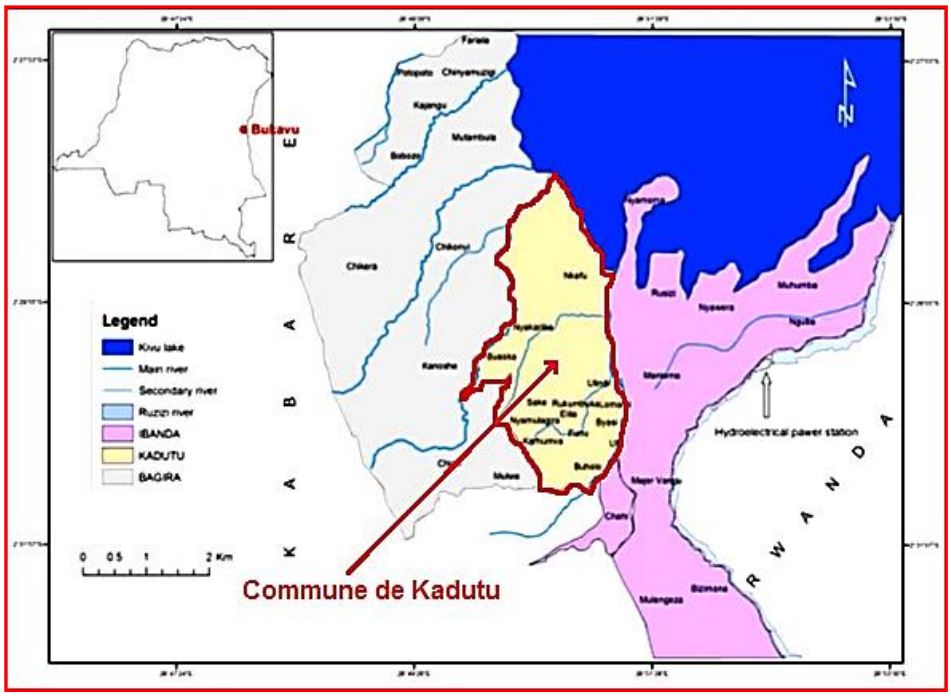

Figure 1. Carte de la ville de Bukavu (crayonné en rouge : Commune de Kadutu. Source : Commune de Kadutu).

En tant qu'entité décentralisée, elle est composée des sept quartiers (Cimpunda, Nyamugo, Mosala, Kasali, Nkafu, Kajangu et Kalere). Cette augmentation de la population pendant les dernières années s'explique par l'exode rural, sa proximité et le taux de natalité élevé suite à la population trop jeune sans travail.

Méthode et techniques

La méthode descriptive nous a permis d'observer et de décrire le comportement de nos enquêtés sur l'assainissement de leurs toilettes et la gestion des excrétas afin de réaliser une analyse systématique de toutes les informations et données récoltées, notamment à partir de :

- un questionnaire ciblant un échantillon de la population (106 par quartier suivant la formule d'Alain Bouchard (2010) ;
- 14 Focus groupes (soit 2 focus groups par quartier réunissant à la fois les femmes, les hommes et les jeunes avec des données qualitatives) ;
- des entretiens semi-structurés avec les représentants des entités étatiques ;
- la technique d'observation nous permet d'expliquer les constats de dégradation environnementale.

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Pour déterminer la taille de notre échantillon, nous avons utilisé le tableau de Bouchard (2010), selon lequel pour une population infinie allant jusqu'à 1.000.000 d'individus, l'on fait correspondre un échantillon de 96 sujets avec une marge d'erreur de 10.

$$NC = \frac{n \times N}{n + N} = \frac{96 \times 59268}{96 + 59268} = 95{,}5 \text{ soit } 96 \text{ personnes}.$$

***NC** : Taille de l'échantillon corrigé, **N** = la taille de la population-mère (taille de l'univers) & **n** = la taille de l'échantillon pour une population infinie ou Taille de l'échantillon pour l'univers fini*

Par cette formule de Bouchard (2010), une marge d'erreur de 10% doit être prise en charge pour déterminer l'échantillon, lors de notre enquête dans la commune de Kadutu. Nous nous sommes entretenus avec 742 personnes soit 106 personnes par quartier.

Nous avons analysé les données qualitatives des questionnaires et des entretiens semi-structurés avec le programme SPSS version 16.0. Ce programme nous a servi à réaliser l'encodage de l'ensemble des données recueillies sur le terrain. Il s'est révélé très indispensable lors de l'analyse des données en l'occurrence la production des moyennes, les tableaux de fréquence et ceux de contingences.

Nous avions aussi effectué une Analyse en Composantes Principales (ACP) (Guerrien, 2003) des données quantitatives par le logiciel *Canoco 5* pour chercher à comprendre les principales causes de l'état des lieux de la gestion des excrétas et son impact environnemental dans la Commune de Kadutu en tenant compte de données multidimensionnelles constituées des variables quantitatives.

Resultats

Caractéristiques sociodémographiques des personnes enquêtées

Les résultats des caractéristiques sociodémographiques des personnes enquêtées sont présentés dans les deux histogrammes ci-dessous (**Figures 2A & 2B**). Il ressort du premier histogramme des caractéristiques sociodémographiques que de la variable genre ; 371 enquêtés (soit 50 %) sont du genre féminin et 371 (soit 50 % sont) sont du genre masculin.

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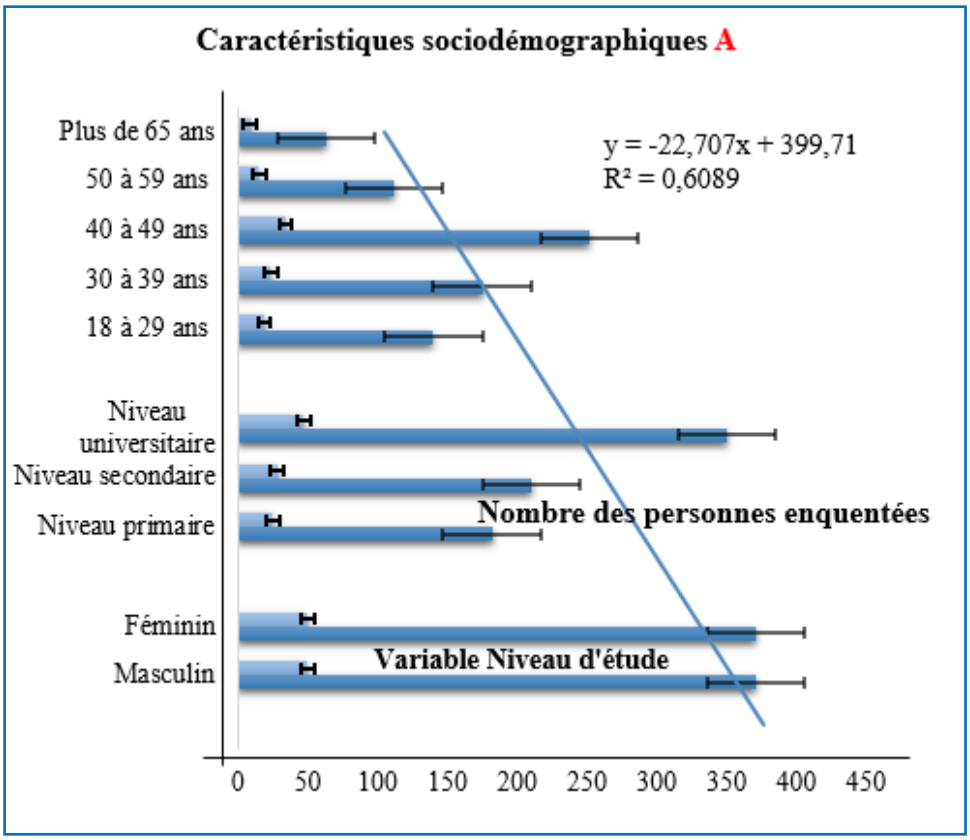

Figure 2A. Histogrammes des caractéristiques sociodémographiques

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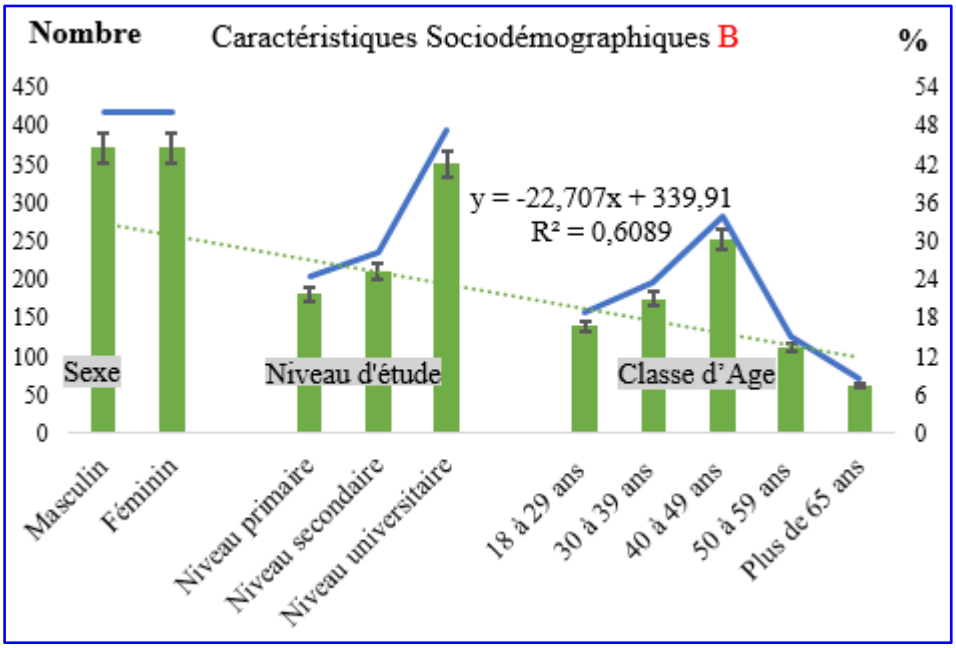

Figure 2B. Histogrammes des caractéristiques sociodémographiques

Selon la variable niveau d'études, 350 (soit 47.2 %) des personnes enquêtées dans la Commune de Kadutu ont le niveau d'études universitaires suivi de 210 (soit 28.3%) avec le niveau secondaire et seulement 182 personnes (soit 25.5%) ont le niveau primaire. Nous avons enquêté beaucoup de personnes du niveau universitaire parce qu'elles connaissent la nature de la gestion des déchets et ont une connaissance sur la gestion durable de l'environnement et la prévention des maladies.

Suivant la variable âge de la population, la tranche variant entre 40 et 49 ans ; 252 individus (soit 33.9 %) ont été beaucoup interviewés suivis de la tranche d'âge variant entre 30 et 39 ans ; 175 (soit 23.5 %). Ces deux tranches d'âge ([40-49], [30-39]) ont été plus considérées du fait que lors de nos enquêtes préliminaires, ces classes étaient considérées comme les plus informées et ayant beaucoup plus de connaissance en la matière environnementale.

L'équation de l'indice de la qualité de régression (R^2) ou coefficient de détermination linéaire de la variance expliquée est importante (> 0.5). Ceci montre l'inégalité des interviews malgré l'équilibre observé.

Modes de gestion des excrétas et les latrines

Sur terrain, les observations faites montrent que les excrétas posent des graves problèmes de santé publique lorsque des moyens adéquats ne sont pas mis en œuvre pour leur évacuation. Si l'insalubrité d'une manière générale est

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néfaste à l'être humain dans sa maison, les eaux usées et les excrétas sont particulièrement dangereux pour la santé de l'homme. Les opinions des enquêtés sur les modes de gestion des excrétas et les latrines se trouvent dans le **Tableau 1.**

Suivant le type des maisons, 39.6 % des enquêtés logent les maisons en planches ou les maisons en terre. Par contre, seulement 23.6 % des ménages enquêtés logent dans les maisons en brique. Suivant les types des fosses septiques, 336 enquêtés (soit 45.3 %) utilisent des fosses septiques arables non couvertes, tandis que 266 enquêtés (soit 35.8 %) sont sans fosse septique, leurs toilettes déversent directement les excrétas dans les rivières « *Kahuwa* & *Dubwi*, **Figure 3** » et seulement 140 enquêtés (soit 18.9%) utilisent les toilettes avec fosses septiques bien aménagées et de haut standing (niveaux élevés). Ceci montre que la majorité des habitants de la Commune est dans des maisons de bas standing (niveaux bas).

Du point de vu présence des latrines, 518 enquêtés (soit 69.8 %) des ménages ont des toilettes dans leurs parcelles tandis que 224 (soit 30.2 %) n'en ont pas, et, par conséquent, utilisent les toilettes des voisins. Sur 742 personnes enquêtées, 434 personnes enquêtées (soit 58.5 %) affirment qu'elles ont l'habitude de vider leurs latrines une fois remplies contre 308 autres personnes (soit 41.5 %) qui ne vident jamais leurs latrines. Celles-ci, déversent directement leurs excrétas de manière inappropriée dans la rivière.

Cette réalité se présente avec des latrines en fosses septiques arables qui, une fois remplies, on passe à l'enfouissement en les couvrant de terre (constat fait sur l'avenue Bugabo 1 et 2, Camp TV, Inga, Garunva, Funu, etc.). Ces latrines moins profondes sont parfois mal construites et mal entretenues.

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Tableau 1. *Opinion des enquêtés sur les modes de gestion des excrétas et les latrines*

Modes de gestion des excrétas	Nombre	Pourcentage
Type des maisons		
Maison en terre	126	17.0
Maison en semi durable	147	19.8
Maison en planche	294	39.6
Maison en brique	175	23.6
Total	**742**	**100.0**
Présence des latrines		
Absence des latrines/toilettes	224	30.2
Présence des latrines/toilettes	518	69.8
Total	**742**	**100.0**
Fosses septiques		
Ménages sans fosses septiques	266	35.8
Ménages utilisent des fosses septiques	336	45.3
Utilisation des toilettes avec fosses septiques	140	18.9
Total	**742**	**100.0**
Habitude de vide la latrine		
Je vide régulièrement la latrine	434	58.5
Je ne vide pas ma latrine	308	41.5
Total	**742**	**100.0**

Sources : nos enquêtes

Figure 3.A. Versement des excrétas (solide et liquide) le long de la rivière 'Dubwi' dans le quartier Cimpunda, commune de Kadutu et B. Excréta humains (liquide et solide) en l'air libre respectivement dans les quartiers Cimpunda et Kalere (Photos Akonkwa Mushagalusa

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Causes liées à la mauvaise gestion des excrétas et son impact sur l'environnement

L'assainissement comprend l'évacuation et le traitement des eaux et des solides usagés. Ces matières incluent les eaux de pluie, de drainage, de lavage, les eaux usées et/ou provenant des toilettes, les excréments, et les déchets solides ; ces derniers ont différentes origines (domestique, agricole, industrielle, médicale, …). Dans le **Tableau** 2, nous montrons les opinions des enquêtés sur la connaissance de l'impact de la mauvaise gestion des excrétas et son impact sur la qualité de l'environnement dans la Commune de Kadutu.

Tableau 2. *Opinions de la population communale sur la mauvaise gestion des excrétas et opinions de la population sur son impact sur l'environnement*

Mauvaise gestion des excrétas et impact	Nb. cit.	Fréq.
Causes		
Incivisme	182	24.5
Construction anarchique	161	21.7
Non implication des agents d'assainissement	154	20.8
Non implication des autorités locales	140	18.9
Sans réponses	105	14.2
Total	742	100
Conséquences		
Présence des matières fécales à l'air libre dans l'environnement	192	25.9
Prolifération des maladies	250	33.7
Prolifération des insectes et vecteurs des maladies	161	21.7
Présence des odeurs nauséabondes	62	8.4
Dégradation de l'environnement physique	77	10.3
Total	742	100

Sources : nos enquêtes

Les résultats obtenus du **Tableau 2** renseignent que 182 enquêtés (soit 24.5 %) de notre échantillon affirment que l'incivisme de la population est la cause principale de la mauvaise gestion des excrétas dans leur Commune ; suivis de 161 personnes enquêtées (soit 21.7 %) de l'effectif qui soutiennent la construction anarchique parmi les causes majeures de la mauvaise gestion des excrétas dans la commune de Kadutu.

La non-implication des agents d'assainissement (assainissement de la Commune et de la Mairie à titre illustratif) est soutenue par 154 personnes enquêtées (soit 20.8 %). 140 de nos enquêtés, (soit 18.9%) parlent de non-implication des autorités locales. Notons que 105 personnes (soit 14.2 %) n'ont pas voulu donner leur avis sur les causes de la mauvaise gestion des excrétas. Selon eux, l'Etat ne s'occupes pas de l'entretien de leur quartier et la majorité d'entre eux, leurs tuyaux d'évacuation des excrétas se dirigent directement dans les rivières

En ce qui concerne les conséquences liées à la mauvaise gestion des excrétas, nous avons abouti aux résultats selon lesquels, 250 (soit 33.7 %) des

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personne enquêtées admettent la prolifération des maladies. Ceci est confirmé par la **Figure 4** et démontre que les excrétas constituent donc un foyer où certaines espèces de mouches prolifèrent et propagent l'infection en attirant les animaux domestiques, les rongeurs, la vermine créant ainsi une gêne intolérable. De même, le rejet anarchique des eaux de lessive, des douches et des cuisines se constituent en gîtes larvaires des mouches et des moustiques vecteurs des maladies qui affectent la population. Le disfonctionnement des ouvrages d'assainissement pose un problème sanitaire et environnemental.

Figure 4. A gauche, centre d'épuration de la Commune de Kadutu dans le quartier Nyamugo sur les deux photos ; en partie supérieure droite, vidage des excrétas (solide et liquide) le long de la rivière Kahuwa dans le quartier Nkafu et en partie inférieure droite, Mauvaise gestion des installations sanitaires dans la commune de Kadutu, quartier Nyamugo (Photos Akonkwa Mushagalusa Alain).

Opinions des enquêtés sur les obstacles rencontrés dans la gestion** des excrétas **et les principaux acteurs à la base de la mauvaise gestion des excrétas

Sur terrain, les observations faites indiquent que les obstacles sur la gestion des excrétas et l'insalubrité d'une manière générale, les eaux usées et excrétas sont particulièrement dangereux pour la santé de l'homme et son environnement.

Le **Tableau** 3, nous renseigne que 343 personnes (soit 46.2 %) affirment que la principale menace est celle de la présence des autorités municipales corrompues (Chefs d'avenues et des cellules). La menace relative à la construction anarchique est soutenue par 187 enquêtées (soit 25.2 %) ; 72

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enquêtés, (soit 9.7 %) évoquent le désintéressement de la population sur la question environnementale ; 140 autres enquêtés (soit 18.9 %) soutiennent la menace liée à la faible éducation environnementale de la population. En lisant le même **Tableau** 3, la responsabilité de la dégradation de l'environnement incombe aux autorités politico-administratives. Cette affirmation a été donnée par la majorité des personnes enquêtées dans ladite Commune, 532 enquêtés (soit 71.7 %) contre 210 enquêtées (soit 28.3 %) orientent cette responsabilité vers la population.

Tableau 3. *Opinions des enquêtés sur les obstacles rencontrés dans la gestion de l'environnement et les acteurs à la base de la mauvaise gestion*

Variables	Fréquences	Pourcentages
Obstacles à la bonne gestion des excrétas		
Corruption des autorités cadastrales (lors de la vente des parcelles)	343	46.2
Désintéressement de la population sur la question environnementale	72	9.7
Faible éducation environnemental de la population	140	18.9
Construction anarchique (manque de canalisation)	187	25.2
Total	742	100
Acteurs à la base de la mauvaise gestion des excrétas		
Population locale	210	28.3
Autorités politico-administratives	532	71.7
Total	742	100

Source : nos enquêtes

Relation entre la gestion des excrétas et l'impact l'environnemental

Pour mieux comprendre la relation qui existe entre la gestion des excrétas et l'impact environnemental dans la Commune de Kadutu, nous avons effectué une analyse indirecte basée sur l'Analyses Composantes Principales (ACP). Les relations obtenues se distribuent selon l'effet des différentes responsabilités de chacun (**Figure 5**).

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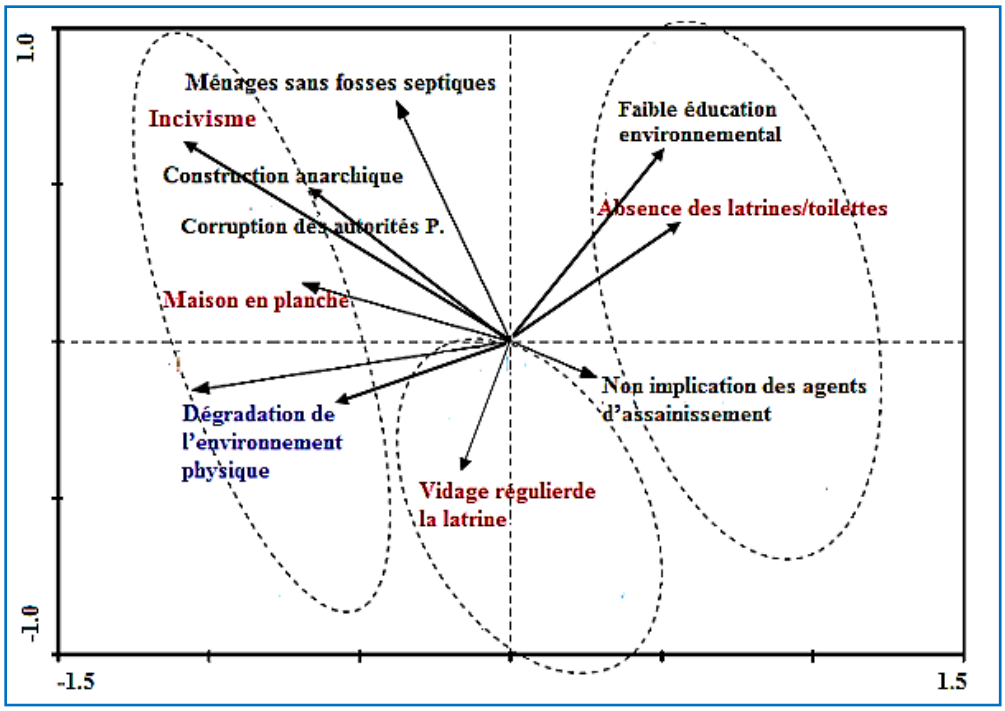

Figure 5. Analyse canonique des correspondances réalisée sur les variables liées à l'état des lieux de la gestion des excrétas et son impact environnemental

Le premier axe (horizontal) expliquerait les conséquences majeures. Dans la partie positive de l'axe, on considère les évènements suivants : l'incivisme de la population, les constructions anarchiques, les ménages sans latrines. Le deuxième axe (vertical) est plus corrélé à l'effet du comportement de la population comme faible éducation environnementale, absence de latrine dans une parcelle.

Discussion

Mauvaise gestion des excrétas

La meilleure protection possible de la santé publique et de faire un usage optimal de ressources importantes. Les opinions des enquêtés sur les modes de gestion des excrétas et les latrines, nous renseignent que 39.6 % des enquêtés logent dans les maisons en planches ou en terres et leurs toilettes déversent directement les excrétas dans les rivières. Suivant les types des fosses septiques, 45.3 % des ménages utilisent des fosses septiques arables non couvertes, tandis que 35.8 % sont sans fosses septiques. Selon les types des latrines, 69.8 % des ménages ont des toilettes dans leurs parcelles tandis que 30.2 % n'en ont pas et utilisent par conséquent les toilettes des voisins. Pour l'habitude de vider les latrines par les ménages, 58.5 % affirment qu'elles ont l'habitude de vider leurs latrines une fois remplies tandis que 41.5 % n'ont

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pas cette habitude ; leurs toilettes se déversent directement dans la rivière et d'une manière désordonnée.

L'Organisation mondiale de la Santé (OMS, 2012), dans son ouvrage intitulé ; Utilisation sans risque des eaux usées, des excrétas et des eaux ménagères, Volume III, conseille les habitants de la ville, où l'espace est plus rare, de faire vider périodiquement la fosse septique car les excrétas qu'elle contient renferment de nombreux germes pathogènes présents et que le coût de la fosse et de sa superstructure y est généralement plus élevé. Il faut éviter de réaliser une vidange manuelle.

Ces résultats sont confirmés par Lina (2016), en disant que Kadutu est la Commune où vivent principalement les ménages de basse classe (88.5 %) suivie de ceux de la moyenne classe (11.5 %). Zondo et Mashukano (2012), soulignent que la gestion des excrétas est un sujet alarmant dans presque tous les pays du tiers monde et surtout dans les villes à bas standing. Ainsi donc, l'homme a toujours été à la base de la mauvaise gestion des excrétas oubliant que l'environnement est une affaire de tous (Zondo & Mashukano, 2012 ; Tshitenge, 2013 ; Negrin, 2017).

Pour cela, le cadre de Stockholm est une approche intégrée qui combine évaluation et gestion des risques pour lutter contre les maladies liées à l'eau. Il constitue un cadre harmonisé pour la mise au point des recommandations et des normes relatives à la santé traitant des dangers microbiens liés à l'eau et à l'assainissement. Ce cadre prévoit une évaluation des risques sanitaires préalables à la définition des objectifs liés à la santé et à la mise au point des valeurs éducatives, l'élaboration des stratégies de base pour limiter ces risques et l'évaluation de l'impact de ces stratégies combinées sur la santé publique

Gestion des excrétas

OMS (2008a) et PNUD (2008), articulent que la gestion des excrétas doit se faire d'une manière accélérée du fait qu'elle désigne des substances dégagées par l'organisme dans la nature qui sont à la base de la prolifération des maladies (choléra, dysenterie bacillaire et amibienne, verminoses, fièvre typhoïde, …) et suscitent la circulation des mouches vectrices de nombreuses maladies, la croissance des cafards, des rats, etc. Pour ce faire, des contrôles de routine efficaces et contraignants doivent être réalisés dans tous les pays afin d'assurer une évacuation saine et un traitement salubre des excrétas.

Ces affirmations confirment nos résultats obtenus qui renseignent que 33.7 % des personnes enquêtées admettent que la mauvaise gestion des fosses est à la base de la prolifération des maladies. Elles constituent un foyer où certaines espèces de mouches prolifèrent et propagent l'infection en attirant les animaux domestiques, les rongeurs, la vermine créant ainsi une gêne intolérable. De même, le rejet anarchique des eaux des lessives, des douches

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et des cuisines se constituent en gîtes larvaires des mouches et des moustiques, vecteurs des maladies qui affectent la population.

Zondo et *al*. (1992), attestent que dans les villes congolaises, la gestion des excrétas est devenue un défi majeur car elles sont confrontées à des fortes croissances démographiques, à un manque d'infrastructures appropriées ainsi qu'au manque des moyens techniques et financiers. Cependant, Zondo et Mashukano (2012), soutiennent qu'actuellement, toutes les municipalités de la RDC ont de plus en plus de la peine à offrir un service de proximité approprié. On y observe plusieurs comportements à risque liés à la mauvaise gestion des excrétas tels que : certaines latrines creusées sont moins profondes, mal construites et très mal entretenues par les habitants. Elles sont souvent confondues aux poubelles suite aux ordures ménagères qui y sont régulièrement jetées. Ces résultats se réfèrent à ceux trouvés par Kadesirwe (2018), qui affirme que chaque culture correspond à une personnalité de base, c'est-à-dire une configuration psychosociologique (l'âge, le sexe, le niveau de connaissance, la famille et le travail) particulière se manifestant par un certain style de vie à dépenser à partir duquel les individus réalisent leur variance individuelle.

Les conséquences environnementales de la mauvaise gestion des excrétas

Baba-Moussa (1994), Koffi (2010) et Zerbo (2011) démontrent que, la mauvaise gestion des excrétas à l'air libre affecte aussi la nappe phréatique. La consommation d'une eau souillée (l'eau de puits, les eaux de surface souillées lors des précipitations et des inondations) est la principale cause des maladies hydriques de la population en Afrique. Cette réalité n'échappe pas à la RDC, l'exemple typique est la Commune de kadutu. Dans la Commune de Kadutu, les agents d'assainissement ne sont plus actifs dans le suivi de l'état de l'environnement physique.

La population a opté pour un comportement nocif à l'égard de l'environnement via le déversement incontrôlé des excrétas pendant la pluie. C'est ce qui justifierait la pratique de non vidange des latrines. Comme la Commune est à dominante bas standing, ceci explique l'emploi des latrines à canon dont les tuyaux d'évacuation des excréments sont directement orientés vers les rivières ou caniveaux.

Plusieurs auteurs (Kayeye et *al*., 2012; Lina, 2016), confirment que l'assainissement de la ville de Bukavu est faible, le niveau d'accès à l'eau potable est aussi faible ; ainsi, les émissaires domestiques constituent le cadre de premier choix adopté par les habitants pour le rejet de leurs déchets. Selon Lina (2016), la rivière « *Kahuwa* » est la plus polluée des rivières de Bukavu car elle fait l'objet d'importantes pollutions engendrées par les activités domestiques, et constituent des égouts à ciel ouvert.

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Dans le domaine de la santé de l'environnement, les données microbiennes sont utilisables pour indiquer la présence éventuelle de dangers dans l'environnement par une analyse microbienne et un processus important dans l'apport des données destinées à l'évaluation des risques. Des informations spécifiques au site sur les types et les nombres d'agents pathogènes présents dans les excrétas ou les eaux usées, dans les bassins alimentés par ces rejets et dans les poissons et les produits qu'ils fournissent sont utilisables pour quantifier les risques.

D'après Lina (2016), les excrétas et les eaux usées non traités renferment divers organismes excrétés, y compris des agents pathogènes, dont les types et les nombres dépendent des niveaux de fond des maladies dans la population. Il montre que les flux des pollutions microbiologiques et les coliformes fécaux sont plus élevés dans cette rivière avec onze sortes des taxons de parasites qu'il a identifiés (*Entamoeba coli, Giardia lamblia, Entamoeba histolytica, Ascaris, Ankylostoma, Strongyloide., Trichiura, Hymenolepis nana, Hymenolepis diminuta, Taenia saginata et Schistosoma mansoni)*. Ces parasites sont à la base des plusieurs maladies telles que la dysenterie, le Cholera, la fièvre typhoïde …. et tant d'autres.

De nos investigations sur terrain, nous sommes arrivés aux résultats selon lesquels 25.2 % des enquêtés affirment que la principale conséquence liée à la mauvaise gestion des excrétas dans cette commune, est la présence des matières fécales à l'air libre presque dans le ¾ des quartiers enquêtés. Cette mauvaise gestion est déconseillée par OMS (2012a).

Pour l'organisme, l'exposition à des fèces non traitées comporte des risques, en raison de la présence potentielle des germes pathogènes en fortes quantités, dont les concentrations dépendent de la prévalence de ces organismes dans une population donnée. Ces agents pathogènes sont notamment des bactéries, des virus, des protozoaires parasitiques ou des helminthes. Ils peuvent provoquer diverses maladies infectieuses, touchant en grande majorité le système gastro-intestinal (Albonico, 1995 ; OMS, 2012a).

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Valorisation eaux usées et des excrétas : contextes socio-économiques

Les conditions socio-économiques des populations peuvent être perçues au travers d'un certain nombre de facteurs des biens pour un développement sanitaire et mental. Le traitement et la valorisation des eaux usées ainsi que des excrétas revêtent une importance grandissante quoique inégale selon les contextes socio-économiques et la situation physique des agglomérations considérées (OMS, 2012b).

Ce traitement des eaux usées et des excrétas à des degrés variables peut réduire notablement les concentrations de certains contaminants (des agents pathogènes provenant des excréta et de certains produits chimiques, par exemple) et ainsi le risque de transmission des maladies (OMS, 2012a). Les villes des pays en développement sont confrontées aux coûts très élevés des infrastructures de traitement et de valorisation des eaux usées, des excrétas et de leur maintenance, rapportés à la faiblesse de leurs ressources et de celles de leurs administrés, ainsi qu'à un manque des connaissances des solutions et de leurs avantages comparatifs.

Aujourd'hui dans d'autres pays, le souci de traitement et de valorisation des eaux usées et des excrétas connaît un regain d'intérêt, dans le but d'améliorer l'environnement sanitaire, et, dans une perspective gestionnaire, pour soulager l'économie globale de la filière de traitement, en diminuant son coût, voire en couvrant une partie des frais afférents à son exploitation. Diverses formes de réutilisation des affluents sont possibles suivant les filières de traitement (irrigation agricole, réutilisation à des fins récréatives et municipales, recharge des nappes, aquaculture, épandage, etc.), mais requièrent une qualité d'eau en rapport avec un usage donné (von Sperling et *al.*, 2004).

Malheureusement, le dépotoir Commune de Kadutu se trouvant dans le quartier Nyamugo est dans un état de détérioration terrible (**Figure 6**). Aucun traitement ne se fait et au contraire, au lieu d'être un centre d'épuration, il devient un centre de prolifération des déchets dans cette municipalité.

Des recherches menées à Phnom Penh au Cambodge indiquent qu'il peut exister une association entre l'exposition à des eaux usées et des problèmes de peau tels que des dermatites de contact (eczéma) (Van der Hoek et *al.*, 2005). Pour ce qui concerne le traitement des eaux usées et des excrétas, il peut être nécessaire d'envisager les conséquences des coûts économiques sur l'évaluation qui nécessite le calcul des coûts et des bénéfices marginaux du projet ;il convient également de réaliser une analyse économique des composants du système.

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Figure 6. Station d'épuration ou fosse septique centrale du quartier Nyamugo (Commune de Kadutu, ville de Bukavu)

Par exemple, les planificateurs (les gouvernants, société civile,..) doivent analyser les différentes options pour chaque composant du système de traitement et d'utilisation des eaux usées et des excrétas y compris les options en matière de transport et cela posent des problèmes dans la ville d'une manière générale.

Conclusion

Dans cette étude, nous avions évalué les causes de la mauvaise gestion des excrétas ; déterminé les différents modes de gestion des excrétas par la population de la Commune de Kadutu ; identifié les conséquences environnementales et sanitaires liées à la mauvaise gestion des excrétas. Des résultats obtenus par rapport aux conséquences ; nous avons constaté que les excrétas entrainent la prolifération des maladies, la dégradation de l'environnement physique et la présence des odeurs nauséabondes dans plusieurs coins de la commune, la destruction de l'environnement physique, etc.

En somme, nous avons proposé quelques stratégies en termes des voies d'amélioration de la gestion des excrétas. Ainsi, la prévalence des agents pathogènes liés aux excrétas dans une population humaine donne la mesure de leur présence dans l'environnement. Les facteurs-clés à prendre en compte à ce stade de l'évaluation des dangers sont les suivants :

- prévalence et incidence de la maladie (corrigées, si possible, pour tenir compte de la sous-déclaration) ;
- pourcentage de sujets infectés déclarant la maladie (morbidité, variable selon les organismes) ;
- densité d'excrétion (variable selon les organismes) ;
- durée d'excrétion et prévalence des porteurs asymptomatiques (variable selon les organismes) ;

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- voie d'excrétion (fèces ou urines).
- l'évaluation économique d'un projet d'utilisation des eaux usées/des excrétas pour déterminer son rapport coût/efficacité et s'il vaut la peine d'être mis en œuvre

Les approches proposées dans ces manuscrits doivent être adaptées aux circonstances socioculturelles, environnementales et économiques locales, mais elles doivent viser à l'amélioration progressive de la santé publique. La priorité doit être donnée aux interventions qui répondent aux plus fortes menaces sur le plan local ou familial. A mesure que des ressources et des données deviennent disponibles, on pourra introduire des mesures de protection sanitaire supplémentaires.

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Public Policies and Sustainability of Industrial Growth in Pakistan

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Abstract

The paper evaluates the effectiveness of public policies on the growth and development of the industries sector of Pakistan. Based on the supporting arguments, it historically reviews the performance of the industrial sector during the last seven decades (from 1951 to 2020), pointing out the flaws in the formulation and implementation of public policies. The components of the industrial structure are required to identify the major obstacles hampering the growth and sustainability of this sector. The components like; industrial power supply, credit facility, technical and vocational education to industrial workers, flexible taxation system, and basic infrastructure facilities are given emphasis here and are thought to be of more importance in the rapid industrial progress in the country. Likewise, the security issue and law and order situation is also of greater importance in giving protection to physical as well as human resources in the overall industrial structure. The paper also suggests

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coherent sustainable policy recommendations as a way forward for the sustainable industrial growth of Pakistan in the larger public interest.

Keywords: Industries, Growth, Sustainability, Policies, Gross Domestic Product (GDP)

1. Introduction

The recent agenda of Sustainable Development Goals (SDGs) is to end poverty, fight inequality and injustice, and tackle climate change by 2030. These goals could not be achieved without sustainable growth of the industrial as well as the agricultural sector of the economy. The income differentials between higher income and low-income countries are in most of the cases related to the corresponding differences in the output of these two sectors is in turn related to the differences in living standards, freedom of choice, and effective public service delivery of the countries. The political economy of public policies plays an important role in increasing per capita income through an increase in output of agricultural and industrial sectors for the purposes to achieve the growth targets in these sectors of the country's economy. Economists and scholars recognize the significance of the role of political economy as being a tool for the improvement of production, distribution, and consumption. While different groups of experts in the economy adhere to their own theories on how the economy should be developed, the political economy is a complex field that covers a broad range of political interests. In simple terms, political economy refers to the advice given by economists to the government on either general economic policies or on certain specific proposals created by politicians (CFI Institute, 2015- 2020).

The political economy assesses which policies will provide the most beneficial results. It also relates to the capability of the economy to achieve the desired results and focuses on three major areas: The first one is the economy which is the most important indicator of development and it defines the mechanism that allocates scarce resources among competing stakeholders. The second is to increase in total and per capita gross national product with an increase in purchasing power parity and average annual real growth rate, and The third important is to increase in agricultural and investment share in the gross domestic product, reducing the rate of inflation debt, poverty and healthy performance of current account balance are healthy indicators of a developed economy. The economic development indicators divide the entire world into three groups; developed, developing, and less developed or low-income countries or in more simple terminology first world, second world, and third world economies. One thing which is common with all economies of the world is that the sector-wise structure of an economy is based on the three sectors. The first important primary sector of an economy is agriculture (includes

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hunting, forestry, fishing, and life stock). The important point to mention here is that agriculture's contribution is comparably higher in backward and developing economies than in the developed world. That is why; third world economies are also called traditional economies or agricultural countries. The second is Industries including mining and quarrying (including oil production) manufacturing, electricity, gas, water, and construction. And third is Services which include wholesale; retail trade; restaurants, hotels, transports, storage; communications, financing, insurance, real estate, business services, community, social and personal services. The industrial growth and economic development of the country have a strong correlation and key role in developing countries to initiate and increase the welfare of the citizens through the production of quality goods and services for domestic consumption and export abroad for prospering society and economy by adopting the strategy of inclusive industrial growth.

The Industrial Revolution in Britain, and then in other European countries in the 16th century challenged the feudal status queue in the entire world. Industrial growth was also played a significant role in human civilization and current globalization with a fast pack of communications technology from nook to the corner and horizontal to vertical in the entire world by industrial growth and development. This paper is written in this context to evaluate the industrial growth of Pakistan's economy in-depth with respect to the role of political economy in industrial policy and industrial growth sustainability. This study investigates the role of the political economy of public policies in dealing with the agenda, of industrial growth and highlights the existing direction of public spending. It contributes to the economy of Pakistan to set the direction of essential public initiatives that will bring industries on track of sustainability at large in the long run. The study is restricted to analysis present performance of the industries in the economy of Pakistan, with the main causes of the slow pace of unstable industrial growth and to develop robust strategic policy document for effective resource tapping for improvement in the sector.

2. Scope of the Study: This study will evaluate the existing structure of public policy to deal with industrial policies served to grow. The public sector institutional complexity and its policy flaws in process of implementation and implications on governance are discussed in detail. This research also reviews the direction of the political economy on the agenda of industrial growth and development in reference to the experience and achievement during the last **70 years** from 1951to 2020.

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3. Objectives of the Study: The study has three objectives;

i. A strategic review of public policy, economy, and Pakistan's industrial growth nexus.
ii. To evaluate the direction of public policies to achieve the agenda of sustainable industrial growth in Pakistan.
iii. To review the existing situation and how the political economy can deal in the future to boost industrial growth.

4. Research Questions: The study will be guided by the following questions:

i. What is the present status of Pakistan's industrial growth Profile in terms of its share in the economy?
ii. To what extents have political and economic managers used effective institutions tools, good governess for export lead growth?
iii. How we can remove the major obstacles in the industrial growth of Pakistan and reach the destinations of sustainable industries in the greater public interest.

5. Methodology and Data: Descriptive analysis is one of the important methods of research and relies on secondary data such as reviewing available literature or qualitative approaches like informal discussions and more formal approaches to specific group studies. This study integrated both the quantitative and qualitative data to analyze the time-series analysis of national accounts. Pakistan National Accounts' data is taken from an economic survey of Pakistan's yearly publications. Evidence from the Economic Survey of Pakistan is used to analyze through statistical tools and techniques to produce the best results for researchers, policymakers, and students of social sciences. The data is analyzed by the latest powerful business intelligence (BI) software tool which is unique for valid results in times series data evaluation for future planning and policy formulations in the public interest. The study is conducted in mix method to make it result-oriented. The policy implications are based on the result of the quantitative and qualitative analysis conducted by the authors in an explanatory method of the research mostly used in social sciences subjects.

Review of Literature: Industrial policy is academically defined as a variety of economic policy tools, ranging from innovation to trade and foreign direct investment for the economic growth of the country. Another definition is the government policy intervention that attempts to alter the structure of production toward sectors that are expected to offer better prospects for economic growth. The industrial policy itself is based on two fundamental elements one production in some sectors is more desirable than in others, and the second government should make an active effort in nudging the production

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structure. "A frequent misunderstanding is that industrial policy does not refer only to supporting industry i.e. manufacturing, but rather it can refer to any sector, including favoring a shift to services, for growth than would occur in the absence of such intervention" (Saggi) "A successful industrial policy should induce entry and encourage young enterprises to grow, which in turn can lead to increased competitiveness and productivity growth". (MHAMMEDI).

Globally all countries engage in different forms of industrial policy for the betterment of the future and try their best but the majority could not get success in implementation because every policy has some pros and cons means some advantages and adverse impacts. we have an example of such successful industrial policies of the USA, China, Japan, Taiwan, and South Korea to deliver technologies invocations and its export growth. (Ricardo, 30 December 2006)conclude that some "traded goods are associated with higher productivity levels than others and that countries that latch on to higher productivity goods will perform better in terms of economic growth over the medium and long term period". It has been shown that governments have always taken a proactive role in the economy at the dawn of industrial revolutions, to ensure their national competitive edge. (Becker) The urgent need to accelerate, and make a national success of, the green and digital transition in the industrial sector are leading to widespread calls for greater government involvement in the economy, including by means of an active industrial policy as the need of the hour (Alessio Terzi).

This is a real fact that COVID-19 has emerged as one of the biggest challenges to the global and domestic economy, and jolted economic activities from top to bottom and from horizontal to vertical. The situation is more challenging for the industrial sector due to two reasons: First, many industries' jobs are on-site and cannot be carried out remotely, and second, the slowdown in the industrial activities due to high trade & production linkages with the hardest-hit countries. Therefore governments all over envisaged the situation well in time and should adopt the best industrial policy measures i.e., earlier resumption of businesses, relief to export-oriented industries, and construction & industrial packages. Further, well-coordinated fiscal and monetary policies for sustainable industrial growth is the need of the hour to face the challenges of 21st-century industrial digitalization and at the lowest cost quality productions for changing's consumption pattern and export boom as a post-pandemic industrial strategy in the greater public interest.

6. Pakistan Industrial Map: Historically before the partition of sub-contents modern industries were established during the British regime Lahore and Karachi was the hub of the business and now has become one of the leading industrial states of the country and dominated industries were textiles.

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Now day Glass, leather, sports, garments banking, and petroleum and gas industries played a key role in industrial growth in Pakistan. Its nature and pattern can be understood in detail with help of an industrial map of the country. The map in figure-1 below shows the regional significance of the industrial production as below upper region mostly based is on agricultural forestry and tourism industries, Lahore and Islamabad are its telecommunication and finance including services, agric value addition industries' and petrol and rock. Sindh and Baluchistan the southern region are sufficient with petrol and gas reservoirs and also agriculture-based food and cotton plus horticulture productions. The country is categorized as a semi-industrialized state. Pakistan's economy has grown tremendously since its independence in 1947. Punjab and Karachi regions constitute the major share of the economic growth of the country. The first decade of the 21st century has experienced wide-ranging economic reforms, particularly in the manufacturing and financial services sector, leading to improvement in the country's economic outlook. Some other popular industries are construction materials, minerals, paper products, food processing, and beverages.

Pakistan's manufacturing sector provides employment to at least 20% of the country's labour force. Some major manufacturing industries include cotton textile and apparel manufacturing, carpets, rugs, rice, chemicals, sports goods, and leather goods. Historically, Pakistan's textile industry and clothing sector has always been a major contributor to the foreign exchange earner and is still the 2nd largest supplier of cotton yarn. The fertilizer and Cement industry is two of the most prominent and energetic organizations having operations and interactions with agriculture growth and growth of the construction industry of the country. Further details are provided in the industrial map in **figure 01 below.**

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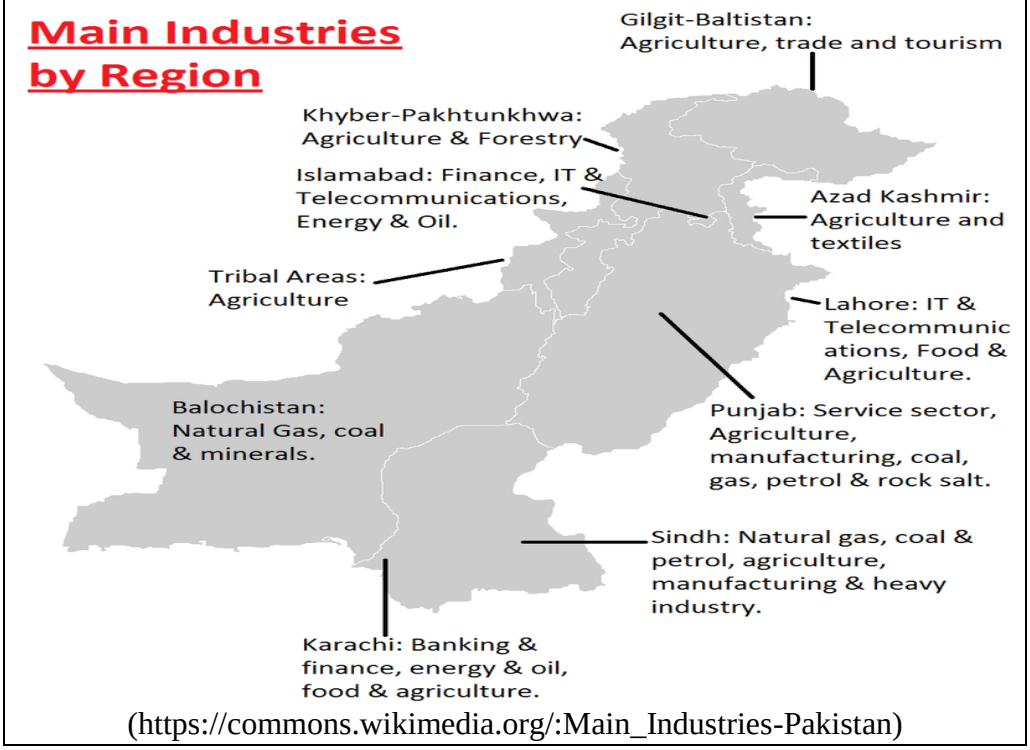
Figure-01



(https://commons.wikimedia.org/:Main_Industries-Pakistan)

(wikimedia.org)

7. Discussion and Results:

I. Industrial Policies and Growth Performance in Pakistan (1951-1971): The Pakistan Industrial Sector is the second largest sector of the economy accounting for not below 20% of the GDP. This sector is comprised of the large, medium, and small-scale/cottage industries. At the time of independence in 1947, its contribution was less than 2% percent to the GDP. The hub of industrial growth was Karachi and Lahore division in the west part of Pakistan. The decades of 1950, 1960, and early 1970 were highly favorable for industrial growth but unfortunately, the war with India in 1965 and 1971, the separation of East Pakistan in late 1971, and the Nationalization of industries in 1974 hampered the process of industrial growth at large.

The historical record growth was observed from 1960 to 1970 during president Muhammad Ayoub Khan's regime (1958-1968), which had a keen interest and focus on revolutionary industrial policies and he has credited the establishment of the Pakistan Industrial Development Corporation (PIDC) in the country. The highest growth occurred in 1953-54 in the mid-fifties and then after at the end of Ayuob's regime as 9 to 10 % in GDP, 11 to 15% in the agriculture sector, and 11 to 14 % in the manufacturing and commodity-

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producing sector of the industries are measured in mid-fifties to end of the sixties in the national economy details as shown in figure -02 for a further review of two decades of national accounts data of Pakistan. Figure-02 elaborates on year-wise contributions in detail.

II. **Impact of Nationalizations on Industrial growth (1972-1977)**: The 06 years government tenure of the Pakistan people's Party government from 1972 to July 1977 under the leadership of its founder Zulfiqar Ali Bhutto mostly focused on state enterprises in the country and his nationalization policies adversely affected the industrial growth and its sustainability. But on the other hand, he was credited with developing the basic infrastructure of the country which was essential for industrial growth and development. He has also established technical and vocational institutions having a positive role to play in the long run with the establishment of Pakistan steel mills and several other types of cement and sugar industries in the country under the public sector domain. But it's the real fact that managing industries are not a true business of the bureaucracy so, their credibility and performance were not exemplary in that period, despite he has launched many reforms in the field of agriculture, industries, and restructuring of the services sector and to move forward in the legal front and constitutionals base of the country in the greater public interest. As a result, his national policies had an adverse impact on the sustainable industrial growth of the country.

III. **The Martial law government of Military leader General Zia ul-Haq (1977-1988):** The policy of Military Governments was very soft with industrialists and supported them in all the ways to stabilize the industrial growth again. He has personal relationships with industrial elites and gave them out-of-way perks. He has also developed a new industrial class in his own fever to continue his illegal rule and set aside the labour laws and prohibited labour unions activities for at least one decade but his tenure was stable growth of industries in the county despite that, he has credited for the basic changes brought by the Bhutto the government in irrigation agriculture education and rural development including agro-based industries in far-flung areas. After the death of a military ruler in 1988, the second government of the Pakistan people's Party **(1988-1990)** formed the industrial policy but did not properly implement it. The industrial class challenged the government and toppled it with quite a support of an industrial group led by Mr. Nawaz Sharif in 1990. Figure 02 elaborates on the output in 20 years of the early period from 1951 to 1971.

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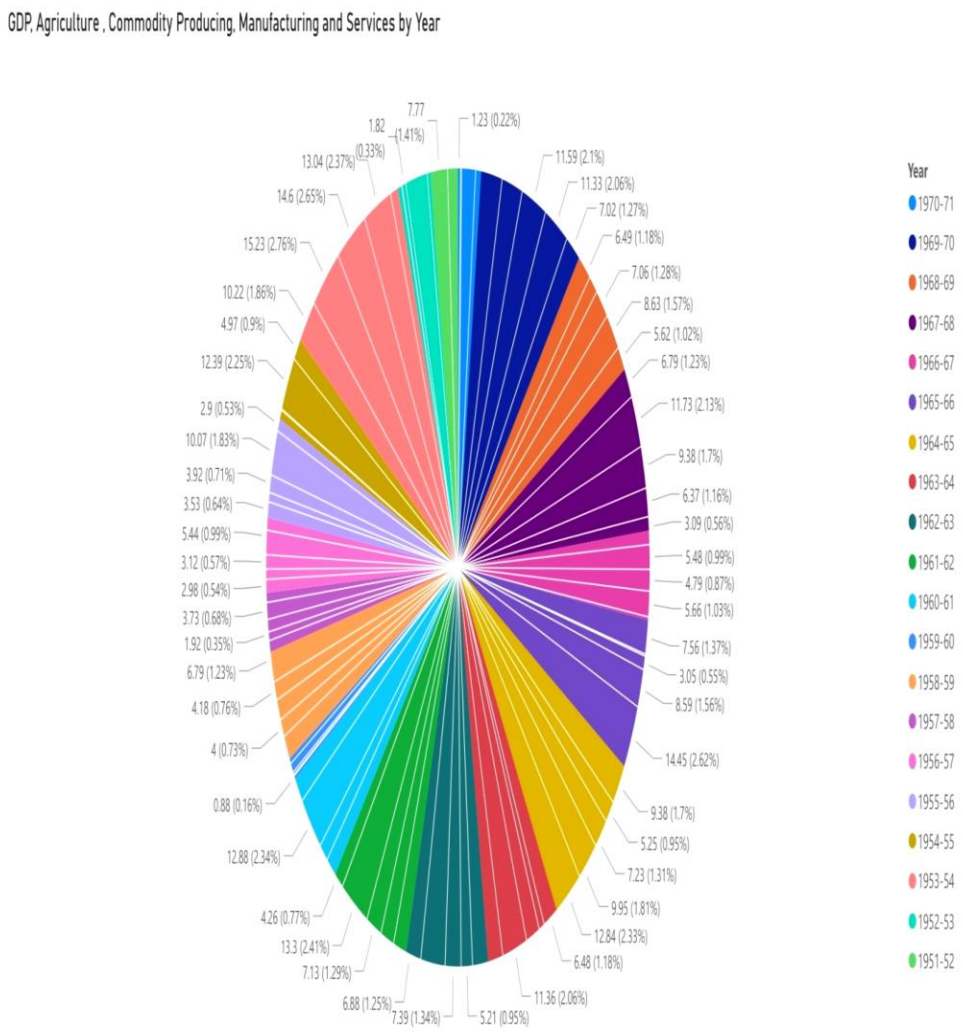
Figure-02



(1951-1971)

IV. The Industrial Growth Policy and Sustainability (1989-2000): The tug of war was started between two elite group one group of feudal under the leadership of the Pakistan People's party with help of the industrial labour class and another was Industrial group under the umbrella of the Pakistan Muslim League headed by Mian Mohammed Nawaz Sharif from 1991 to 1993 and from 1997 to 1999. The Political instability again harms the industrial

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growth from 1989 to 1999 till the end of the second millennium and the nuclear exercise conducted in May 1998 by the industrial group the government again derailed the growth path of country's industrial production because of sanctions on the economy for a long time. The establishments take over again in October 1999 to overcome some unavoidable circumstances in the country. The lowest growth of the manufacturing sector is measured in the decade of 1990 to 2000 as reflected in **figure 03 below** of national accounts growth as 0.53 in 1974 and -0.07 in 1997, in the commodity sector. The **figure-03** contributes year's wise performance of national accounts data and mostly focused on 30 years of industrial output in the economy in detail from 1971-72 to 1999-2000.

The twenty-year period from **1980 to 2000** also brought changes in the automobile sub-sector of the industries and supported growth indicators a lot. The producing and selling of self-powered vehicles, passenger cars, trucks, farm equipment, and other commercial vehicles are familiar as automotive engineering has emerged as an important sub-sectors of the industrial economy. It is a major force of large scale manufacturing sub-sector of the industries and an important contributor in growth; contributing at least US$ 01 to 03 billion to the national economy and engaging over 200,000.00 people indirect employment in the country. Now a day sugar industries are also the largest industry in Pakistan after the Textile Industry. At present, there are 106 sugar mills are operating in Pakistan. At the time of independence in 1947, there were only two sugar factories in Pakistan. The export of sports items and surgery equipment also contributes at large to the national economy but the overall growth rate of Pakistan's industrial sector of the economy is still stabilized. It contributes constantly 19% to 20% to GDP and is a major source of tax revenues of the country but not promoted by the vested interests commonly known by the red tapes. These red tapes are mostly known as slow and manual proceedings/ functions of policy institutions, and other relevant stakeholders which are traditional and cultural factors of rural and illiteracy society social taboos, including feudal powers holders, not technical managers and several other factors that determine industrial growth. Law and order situation in the country and religious extremists and despite the fact young energetic youth resources are available on cheap rate but mostly or unskilled or semi-skilled.

The manufacturing sector is the backbone of Pakistan's economy and constitutes the second largest sub-sector of the industries to offer the growth but its contributions are also steady but declines from 13.01% in 1981-1982 to 1.5% in 1999-2000 as placed in last on **figure 03 below** and insist the researcher to work on the root cause of the declining trends in the sector. The commodity sub-sector was also at its peak in 1980-1981 at 15.09 % and in the last year of 1999, it's at only 3.02%. This is alarming satiations for the

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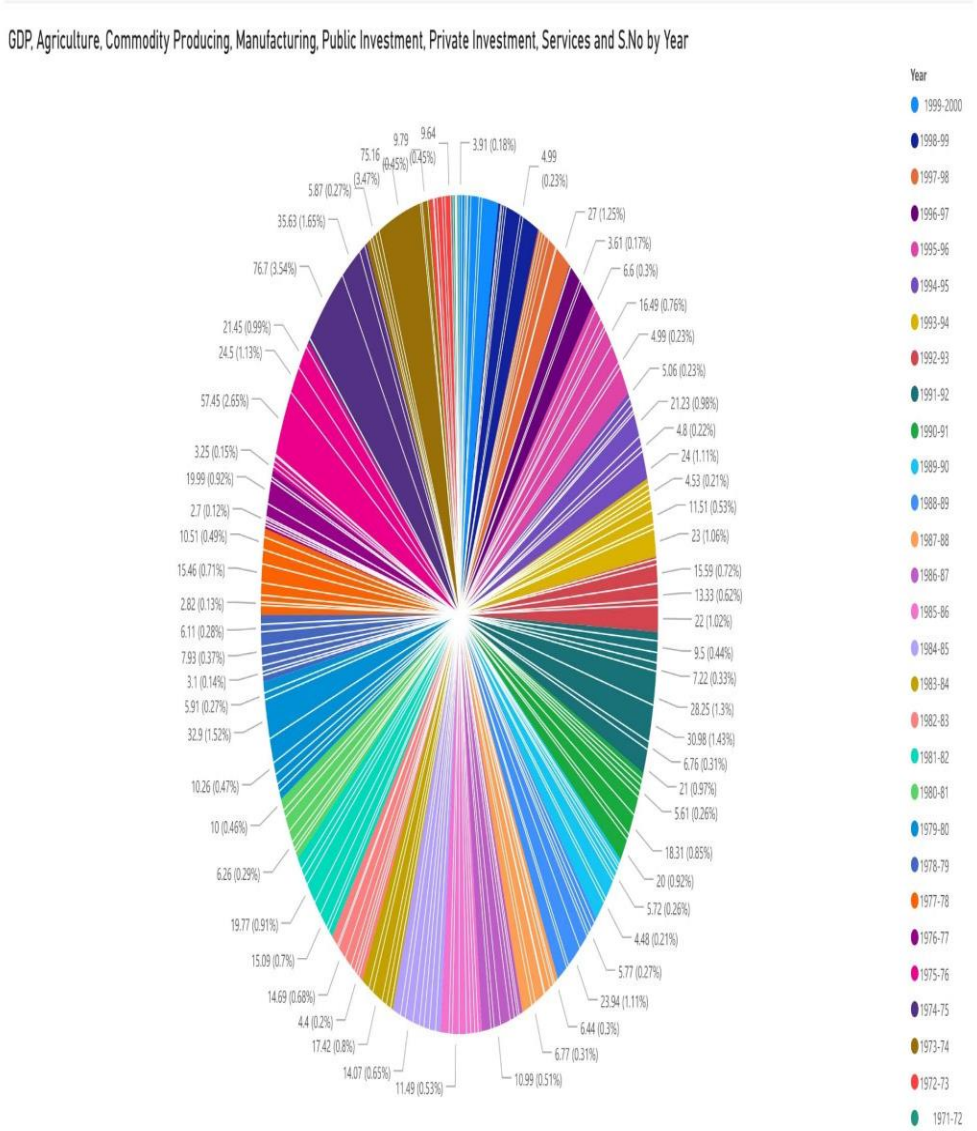
economy of 223 million people of Pakistan and their prosperous future in the long run.

Figure-03



(1971- 2000)

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V. Industrial Policies and Growth Sustainability in 21st Century (2001-2020): The 9/11 tragedy was held in America in the year 2001 and the country went into the war against terror which still continues but its volume is very low for the past few years this war has an irreparable loss to Pakistan's economy particularly industrial growth. It has been analyzed that the first decade of the new millennium shows a dismal picture of the country's economy and again insists the policymakers boost the industrial growth and get rid of manic terrorism, corruption, poor infrastructure facilities, and energy crisis as soon as possible. According to the Economic Survey of Pakistan 2019-2020, the last two years show the dismal pictures impacted by the COVID-19 as the growth of manufacturing and commodities in minus growth of -5.06 and -01 in last year mentioned in **table 01** below.

The data examined below in **figure 04,** indicate that the industrial sector grew slowed in the outgoing years of the new millennium from 2001 to 2020. Figure-04, sum up the two decades' performance of the growth in Pakistan which is mostly unstable. It has been observed that the large-scale manufacturing which has a share of at least 80% within manufacturing and 10% in overall gross domestic product-GDP, according to data of (ESP) is not performing well in the last few years. Small-scale manufacturing accounts for 02% of gross domestic product-GDP and at least 10% within manufacturing is also not impacted widely in the last 02 decades of the 21st century.

The other components of the manufacturing sector include slaughtering and construction which have also had a significant share in the gross domestic product-GDP of the country and overall growth of the economy is performed on average except for poultry farming industries and real estate sectors contributions due to rapid population and migrations towards urban centers. The construction sector is displaying robust activities due to housing demands in urban centers that are under the pressure of migrations toward cities.

The construction sector witnessed the growth of 9% in the economy and delivered its best because of the infrastructural development activities which lead to an increase in the demand for steel, cement, bricks, and allied products within the country and also abroad. After evaluation of nearly two decades of data on the industrial growth of Pakistan, only improvements were found in the middle period of the first decade which means the year from 2005 to 2008.

The industrial economy was put on the road to revival again in 2004 - 2005, and the highest industrial growth was observed as an increase of 16.03% in manufacturing only. Similarly, the poor results were seen in the years 2009-10 when it got a steady decline of -1.9%.

Pakistan Industrial Sector Growth recovered from the losses in 2010-2011 and achieves a record recovery of more than 4% industrial growth. This

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increase was because of technocrat's efforts to revise the policy in larger public interest with support policy of price by the people's government and bummer crop of cotton sugar cane and wheat but the major role was textile production of the country to stimulate the growth of the industrial sector in the country economy.

VI. Results: On the basis of available data of almost 70 years, we can sum-up the discussions that it did not bring significant improvement in the sector mostly its contribution was found not only stagnant in its nature but lagging behind in the terms of real achievement as estimated in the development agenda of industrial growth and economic development of the country to boom the export goods and to reduce the rate of poverty and unemployment of the skilled labour and to put the country on the sustainable industrial growth path in the 21st century. It is also important to mention that China Pakistan Economic Corridor (CPEC) is also a part and parcel of the Pakistan economy but its contribution to the economy and industrial growth was not reported as a game-changer. The questions need a more detailed discussion on the (CPEC) impacts on the industrial growth of Pakistan particularly and the economy of the country at large.

Table-01. Industrial Growth Sustainability Performance in last 03 years

Year	GDP	Agriculture	Manufacturing	Commodity	Services	Total Investment	Public Investment	Private Investment
2017-18	5.5	4	5.4	4.3	6.3	16.4	25.4	13.7
2018-19	1.9	0.6	-0.7	-0.9	3.8	-1.3	-21.6	7.1
2019-20	-0.4	2.7	-5.6	-0.1	-0.6	8.4	13.2	6.5

(2017- 2020)

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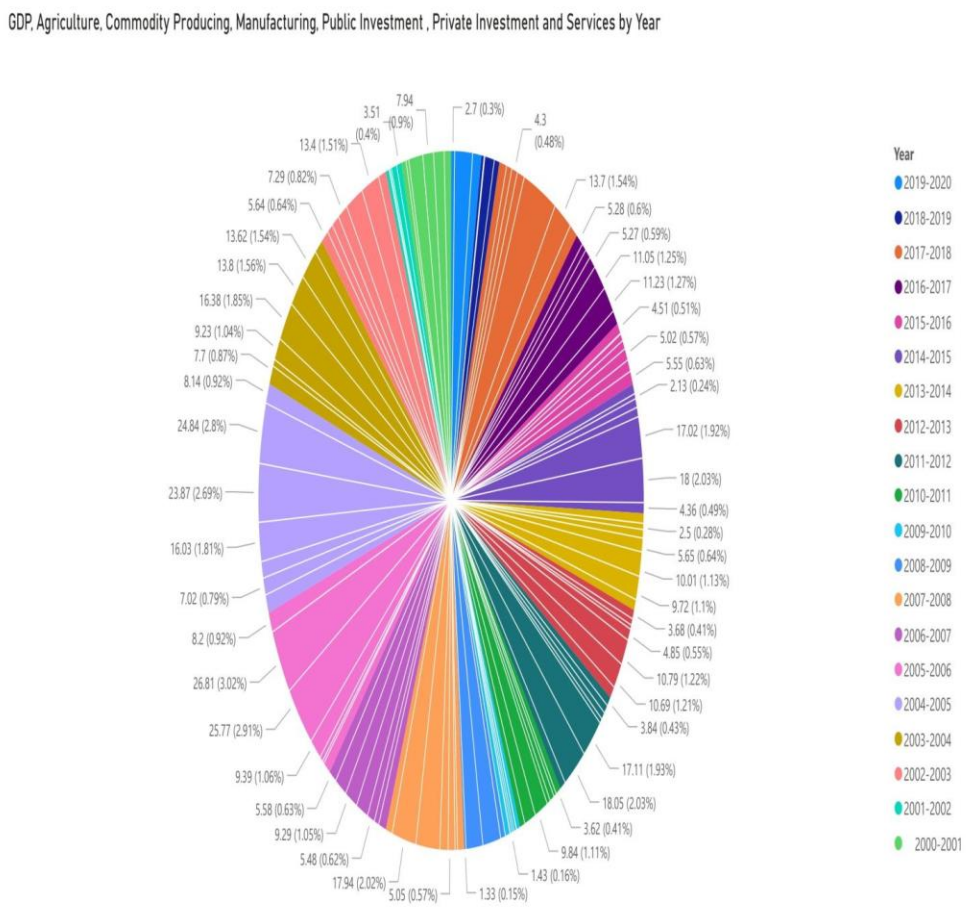
Figure-04



(2000,2001-2019, 2020)

Conclusion

The study concludes that this is the basic fact that there is a limited market for capital goods due to the environment of the country with reference to low savings and low investment so, only industries producing consumer goods are performed well. The poor and improper links among academic institutions and industries created a huge gap in productive industrial research for the economy. The energy crisis is on rising in Pakistan mostly industries

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are suffering from power supply available thinly and also expensive prices with unnecessary taxations are also included, so this situation serves as a major obstacle to the industrial growth**.** The great tragedy of 9/11 held in America and the manic of religious terrorism in the country and these religious and ethical feuds create a law and order situation that slowed the industrial growth and development process of the economy. Pakistan, as the country is still in grip of feudal cultures majority of its people, are residing in the rural areas and are illiterate living with the false notion and time-barred thinking so it impacted industrial growth at large. The historical trend indicates that in the early years of Pakistan industrial policy was developed by seasoned bureaucrats /policymakers. The political instability harms the growth of industries at large. The others factor which affect industrial growth are as follows; poor monetary policy and financial discipline and its consistency and continuity for industrial development impact inversely. The issues /flaws in public policies towards domestic demand, poor macroeconomic environment, and less allocation of funds for industrial research are major obstacles/challenges which directly affect the industrial development of Pakistan.

Pakistan's Sustainable Industrial Growth Policy Implications:

The industrial sector can be promoted by increasing the production of capital goods in the country by the utilization of natural and human resources of the county by redesigning long-term and sustainable public policies. Saving and investment in the country are thinly proportioned in the context of gross domestic product-GDP growth and the consumption pattern is traditional in the country. Most income of the country is consumed by the nations on social, cultural, and traditional taboos which are unproductive. The investment should be increased to develop the industrial sector of the country for more products in the greater national interest. It is concluded that if we are interested to promote the industrial sector, there should be technical know-how and skillful labour investment to convert the huge flow of young populations into the skilled labour force at large.

The tax policies are mostly inflexible and difficult for common to understand in-depth and pay easily and the tax concession means tax-free zones are also needed to increase the investment in new industries for sustainable industrial growth. In time the supply of raw materials from abroad and within the country is necessary for the improvement of industrial sector performance. Improved infrastructure is a necessary tool for the industrial development of Pakistan. Financial institutions should provide credit facilities to the industrial sector under flexible terms and conditions.

There should be an expansion of markets, at domestic and foreign levels, for industrial goods. Foreign direct investment should be encouraged;

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more incentives should be given to investors. Political stability is compulsory for the development of the industrial sector.

A high degree of technical education is required to produce a skilled, technical, and efficient workforce for future challenges in the industrial sector in presence of China Pakistan Economic Corridor-(CPEC) interventions. The problem of load-shedding and irregular supply of electricity should be removed. Commercial policy and self-reliance policy should be adopted to remove industrial backwardness. The study suggests that the state should play a significant role in introducing sustainable policy instruments to boost sustainable industrial growth in the country. The economic manager should focus to increase the volume of exportable goods and decreasing the ratio of imports in the larger national interest to promote local industries.

There is a dire need to strengthen the industrial institutions of the country to bring greater economic change, through the industrial revolution particularly agro-based industries in far-flung areas, and provide a good governance structure that can effectively manage the political economy of public policy and industrial economic growth stability as in the dynamic world of the global competitions in every field of technology and economy.

Pakistan is now a country of 226 million people but most of them are unskilled and illiterate which affects the industrial growth of the country. The low income and traditional consumption pattern lead to low savings and it leads to the lowest investment in the country so growth is also affected by growth. Poor infrastructure of the country affects and impacts the industrial growth of the region, and poor ways of communication are an obstacle to the production, marketing, and export of the produce.

The supporting and allied institutions like **the** National Development Finance Corporation, **(**NDFC), Regional Development Finance Corporations-(RDFC), and Industrial Development Bank of Pakistan-(IDBP) are closed due to corruption and mismanagement some years ago. There is a dire need to establish a new entity to provide easy credit to industries now for their sustainability in industrial growth and development.

It is also suggested that Pakistan's industrial sector policymakers adopt the self-sufficiency theory as adopted by King Bumble of Thailand and avoid fully relying on the miracle of the China Pakistan Economic Corridor (CPEC) in the near future. It can be predicated on the available/used data of the economic survey of Pakistan that the industrial growth and development in Pakistan will be slower in the next few years in comparison with other emerging economies if necessary, measures are not taken within due course of time.

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