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- Building Effective Marketing Partners
- The Effect of Informal Economy on Human Capital Development
- The Capital Market Matters
- An Approach to Modeling the Probable Consumers Demand of Food Products
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BUILDING EFFECTIVE MARKETING PARTNERS: A TACTICAL TOOL TO ACHIEVE CUSTOMER RETENTION IN THE FACE OF STRONG COMPETITORS

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Abstract

There is a lot of competition and constant shifting of customers in today's business environment. This study, therefore, examined the impact of marketing partners (supplier, distribution, dealer, agencies and customer networking) on customer retention. A descriptive survey research method was used, and data were collected from 356 respondents in the selected deposit money banks. Multiple regression analysis was employed to analyse the formulated hypothesis. The findings showed (R²=0.713, F-test=173.999, p < 0.05), the hypothesis was statistically significant at 5% level of significance, indicating that effective marketing partners demonstrated to be a tactical tool to achieve customer retention. The findings highlight the importance of building and maintaining cordial relationships with marketing partners to enhance customer retention in the banking industry. The study recommended that banks adjust their marketing initiatives and product offers to improve customer retention by being aware of the demands and preferences of their customers.

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1. Introduction

There is much competition and constant shifts in today's business climate. Therefore, many rival businesses are devoting substantial resources to build lasting partnerships to help firms compete in this highly competitive market environment, especially in Nigeria. Top management understands the necessity of building strong customer connections to maintain long-term prosperity and stable core earnings (Kang & Kim, 2017). In order to retain customers, a fundamental issue for marketing management is required (Ogbechi et al., 2018). The Customer Relationship Management (CRM) approach that promotes consumer loyalty, contentment and interest in the brand is known as relationship marketing. Instead of attracting new consumers using marketing and promotion, its purpose is to advertise to current customers. A strong relationship marketing method is founded on customers’ loyalty and long-term interaction with the client base. The benefits to the company include increased word-of-mouth activity, repeat purchases, and customer willingness to offer insightful feedback to the business and its competitors.
Relationship building is based on establishing, nurturing, and keeping relationships with suppliers and customers’ relationships. Hence, the ultimate goal of relationship marketing is to make it easier to figure out and sustain long-term client acquaintances, which necessitates a modification in attention and changes in the marketing strategy system (Gyasi, 2012). Relationship marketing, according to Berry (2002), is a type of marketing that evolved from spreading activation that focuses on customers' loyalty and pleasure rather than trade receivables. It differs from other types of marketing in that it recognises the long-term importance of client connections and goes above invasive branding and marketing advertising messaging to interact with them (Palmatier, 2008). The importance of relationship marketing in guaranteeing a company's performance cannot be overstated. Organisations may stay in the market for the long haul by employing relationship marketing methods that help them build long-term relationships with their consumers (Payne & Frow, 2017). According to the study of Bodey et al. (2017), customers who continue to use a product or service are considered loyal. Customer retention rates are calculated by determining what fraction of a company's initial product offering is still in use from one year to the next (Bodey et al., 2017). According to Han and Hyun (2015), businesses that employ strategies to keep their customers returning are more successful overall. A company's ability to keep its customers around direct results from its commitment to providing them with consistent, high-quality service and the trust, loyalty, and devotion they feel toward the company due to this effort.

The notion of relationship marketing has recently received a relative dearth of attention in Nigeria, particularly in the banking industry. This might be because the notion is slowly making its way to this region of the world. One of the most necessary things organisations utilise to preserve a competitive advantage and ways of brand loyalty is reacting to customers' demands and sustaining consumers' relationship needs, spending habits and behaviours. Customer relationship marketing emphasises the gains of developing long-term acquaintances with customers. Customer relationship marketing strongly emphasises the benefits of forming lifelong relationships with customers. Customer relationship management is creating a robust bond between a customer and a business, which would always result in more spending, involvement, and advocacy on the part of the customer.

Furthermore, creating a successful strategy to acquire a competitive edge is fundamentally a marketing challenge in the organisation that necessitates a relationship marketing strategy and mindset. In today's business climate, standing out among a sea of rivals is difficult for any organisation. In a practical sense, the research identifies an issue with how consumers are treated in Nigeria's banking system. Many studies in the literature (Nunug et al., 2017: Ogbechi et al., 2018 & Trenggana et al., 2022) focused on customer relationship marketing without considering upstream relationships such as agencies and suppliers’ relationships. To this end, this study considered marketing partner variables not captured in the literature and broadened the scope (supplier, distributor, dealers, customer networking/tracking, and agencies) to establish its impacts on customer retention among the selected deposit money banks in Nigeria.

Against these backdrops, this study raised the following research question:

- What is the impact of Marketing partners (suppliers, distributors, dealers, agencies and customers networking) have little impact on customer retention?

2. Literature Review and Hypotheses Development

2.1. Relationship Marketing

Relationship marketing was initially coined in America in the early 1980s, according to Lee Iacocca, as described in Owomoyela (2020). Relationship Marketing is marketing with the conscientious goal of developing and managing long-term and trusting relationships with customers, distribution companies, providers, or other party members in the market structure (Bennett and American Marketing Association, 1995). Some companies may unwittingly advertise based on customer relationships since they know that
building and maintaining these ties is integral to their marketing strategy. Relationship marketing, however, suggests that one is making an effort to retain customers and provide them with effective communication, as well as the use of various marketing strategies such as those, especially in two-way communication between partners and consumers, where technology affords, typically guided by skilled customer purchases and revenue growth assessments.

2.2. Marketing Partners

Advertisers' capacity to build meaningful connections with essential third parties, such as vendors, customers, networks, branding, product, and promotional partnerships, is referred to as partners. Whereas marketing coalitions and crucial contractual relations are less profoundly proven in fundamental business tactics than formalised coalitions or vibrant contractual relations, these stalemates are habitually indispensable to product or service innovation, marketing development, and commercial success (Johnson, 2013). While marketing teams have always dealt with outside organisations, architects, wholesalers, and other vendors, these have often been transactions or controlled partnerships with pre-determined rules, responsibilities, and frameworks. In these relationships, firms continuously collaborate with crucial third parties for collective gain, needing a more customised collaborative relationship and effective working and participatory techniques. Both parties frequently have to adjust components of their marketing strategies to compensate for the alliance.

A partnership marketing approach is necessary when one business may achieve its aims more productively by using the complementary attributes of another firm pursuing a comparable user base. According to Kunitzky (2011), companies are joining more than ever to create commercial value for themselves and their stakeholders through strategic cooperation and partnership marketing. According to Kunitzky (2011), the following are some of the most common marketing partnerships:

- Channel partners, merchandise packaging, and cross-promotions are examples of distribution channels.
- Added value partners – unique offers, promotional partners
- Store-within-store programs – leasing of dedicated physical space to retail partners
- Loyalty marketing programs—participation in a program that fosters cross-promotion and provides discounts.
- Co-marketing entails the development of a new product, service, or special offer in collaboration with another company.
- Affiliate programme partners provide customers with exclusive deals and discounts on subscriptions. Moreover, website affiliates increase website traffic.
- Material marketing programs — dissemination, import, and export of content (in return for free media space)
- Sponsorship programs – brand campaigns and exclusive privileges to special offers and assets
- Licensing programs – access to or sale of brands, material, or other intellectual property for use within the licensor's offerings. Some of these activities may be short-term (for example, co-marketing).

The role of different marketing partners, including suppliers, distributors, dealers, and agents, as well as customer networking, is crucial within the Customer Relationship Management (CRM) concept.

Suppliers: A company's capacity to satisfy customer requests and expectations can impact the timely delivery of high-quality goods or services by suppliers, which can impact customer satisfaction and loyalty. Töllinen, (2018) writes that "the importance of suppliers in CRM cannot be overstated, as the quality and reliability of their inputs directly affect the quality and reliability of the outputs delivered to customers" (p. 231)
Distributors: Distributors are in charge of providing final clients with a company's goods or services. They serve as go-betweens for the business and its clients, and their effectiveness significantly impacts customer loyalty and happiness.

Dealers and Agents: Dealers and agents play a vital role in CRM, especially in industries such as automotive, real estate, and insurance, where intermediaries are involved in the sales and service process. They represent the company to the customers and act as a direct point of contact for sales, support, and service.

Customer networking: Using customer relationships to create new company prospects through recommendations, word-of-mouth advertising, and client testimonials is known as customer networking. It entails creating a network of delighted clients who act as brand ambassadors and spread the word about the business's goods and services (Kotler, & Armstrong, 2018).

2.3. Customer Retention

Customer retention refers to a company's capability to convert one-time consumers into habitual customers and preserve them from shifting to a competitor. According to Ezikiel (2018), customer retention strategies are the processes and exertions that firms use to increase customer loyalty and lifetime value. Customer retention includes customer satisfaction, dedication, dispute settlement, and trust (Kang & Kim, 2017). Customer retention is a sustained association with a good or service (Bodey et al., 2017). Customer retention refers to the proportion of target suppliers deemed engaged at the beginning of each year (Bodey et al., 2017). Customer retention is one of the effective tactics used by the banking industry to build long-term customer relationships and, as a result, prevent customer switching within the banking industry (Han & Hyun, 2015).

Customer retention relates to an industry's or a package's capacity to keep customers for a set amount of time (Qazim, 2009). Customers who use an item or brand regularly revisit, keep buying, or in some other manners do not migrate to another item or brand, or do not use it at all, are said to have high customer retention. Customer defection is something that most selling businesses want to avoid (Yunus, 2011). Customer retention starts with an organisation's initial engagement with a customer and extends throughout the relationship's lifespan, with strong retention strategies considering the whole workflow.

2.4. Knowledge-Based Theory

Penrose (1959) proposed this hypothesis, which others extended (Wernerfelt, 1984; Barney, 1991; Conner, 1991). Understanding the value of knowledge sharing in establishing rapport with clients is particularly relevant to those with a knowledge-based outlook. The knowledge-based approach also offers a fresh perspective on the company, its interaction with each customer, and its possible success results (Alguezaui & Filieri, 2014). The knowledge-based perspective is interested in learning more about knowledge as a resource, especially regarding the role of knowledge sharing in developing customer relationships. The knowledge-based approach also offers a fresh perspective on the company, its relationship with individual customers, and its potential for success.

In Martin-de Castro's (2015) opinion, knowledge is a crucial resource for sustained economic advantage because it promotes creative problem-solving. Knowledge increases the likelihood of desired results because the information is a renewable resource. Additionally, Alguezaui and Filieri (2014) stress the significance of information generation and sharing to competitive performance and claim this is the case. Traditional discussions of the idea have centred on business capacities, product diversification, and the impact these factors have on customer outcomes (Nath et al., 2010). This could be a barrier to theory growth or evolution, much as knowledge-based techniques. However, the theory can be expanded by shifting attention to elements other than those typically addressed by this method. For instance, many studies have concentrated on marketing innovation because of its importance to overall marketing competitiveness (Gupta & Malhotra, 2013). Some research focuses on how businesses may achieve positive outcomes by fostering an innovation.
culture and understanding its link to strategy throughout the innovation process (Terziovski, 2010). Another attribute that is seen as a resource and is linked to competitive edge and product characteristics through the resource-based paradigm is value and rarity (Newbert, 2008). As a result, the knowledge-based approach will direct how organisations use knowledge to create a competitive advantage.

2.5 Empirical Review

Trenggana et al (2022). A study of the relationship between consumer loyalty, relationship marketing, and customer retention was carried out. Data were collected from 100 respondents using a non-probability sampling method. In addition, path analysis was used for data analysis. The results show that loyalty can be influenced by relational marketing directly and indirectly through customer retention.

Ogbechi et al. (2018) examined the impact of customer relationship marketing and loyalty on customer retention. Data were collected from 1200 respondents of the 20 local government areas of Lagos state, Nigeria. Regression and correlation were used to analyse the data collected. The finding revealed a significant and positive impact on customer retention and loyalty concerning customer relationship marketing in the MDBs industry.

Using a case study approach, Nunug et al. (2017) examined how state-owned banks could benefit from holistic marketing strategies to boost their reputations and customer trust. The West Java branch of a state-owned bank served as a case study. Methods of validation and description were employed in the research. The people who worked at the five banks we chose in Indonesia participated in this survey. Twenty-two hundred people filled out the survey. According to the research, the credibility and reputation of banks in West Java can improve through the strategic application of holistic marketing. In addition, it was discovered that trust affects the company’s economic reputation in the eyes of both management and consumers. The results also indicate that trust and general marketing affect how the banking sector is perceived.

Their research shows that Abdallah et al. (2015) examined how the quality of relationships with companies in the Jordanian pharmaceutical business affects customer retention rates. This research focuses on the retail pharmacist who interfaces directly with the pharmaceutical company's supplier. The research design was evaluated by analysing collated responses from questionnaires delivered to 500 retail pharmacies in Amman and Zarqa. Studies have shown that poor communication significantly lowers the quality of relationships. Although there is a positive correlation between supplier capabilities and relationship quality, the most crucial aspect in evaluating relationship quality is relationship marketing. The strategic planning process correlates positively with employees' sense of honesty and trust but does not affect their satisfaction or loyalty. It does, however, have a positive but insignificant effect on their loyalty to the company.

Husnain and Akhtar (2015) wanted to see if better banking ties would help strengthen customer retention and loyalty in Pakistani retail banking; thus, they studied the effect relationship marketing methods had on customer loyalty in that sector. One hundred college students were chosen randomly from those with bank accounts using the convenience sample approach. Specifically, we used multiple regression analysis to examine the connection between four prominent relationship marketing constructs and customer loyalty (trust, commitment, communication, and conflict management). The findings revealed that these factors significantly impact customer loyalty and can serve as a reliable predictor of future developments.

The Benefits of Relationship Marketing for Customer Loyalty: Evidence from a Gas Station in Uasin-Gishu County, Kenya, was the subject of a study by Patrick et al. (2014). Interpretive survey techniques were the backbone of this research. Using both random and systematic sampling, we were able to recruit 354 consumers for the study of the relationship between customer relationship marketing and customer retention. Factor analysis was used to examine potential independent factors, and correlation and multiple regressions was used to examine potential dependent variables in this investigation. The findings supported the study's hypothesis through correlation and regression analysis.
3. Material and Methods

Descriptive survey research was used in this study. The target population for this study consists of 3,273 (https://www.dnb.com & https://www.gtbank.com) existing staff from various branches of Wema Bank PLC and G T Banks in Lagos State. The sample size was selected using Taro Yamane's (1967) formula. Most target respondents (bank workers) have busy schedules, so researchers can only reach them within their convenient time frame using convenient and purposeful sampling approaches. Therefore, the sample size for this study is based on formulae suggested by Taro Yamane (1967).

\[
N = \frac{1}{1+N(e)^2} \times \frac{3273}{1+3273(0.05)^2} = 356
\]

Data were gathered through a questionnaire. Three hundred fifty-six copies of the questionnaire were administered with well-structured questions on five Likert scale (Strongly agree, Agree, Undecided, Disagree and Strongly disagree). The outcome of the data collected was analysed with regression analysis at a significant level of 0.05.

3.1. Model Specification

The model formulated for this study is stated below:

The dependent variable is Customer Retention, while the independent variable is Marketing partners.

Based on the above, the model that expresses the relationship between the two variables is specified as follows:

\[ Y = f(X) \]

The independent Variable (X) = Marketing Partners

The dependent Variable (Y) = Customer Retention (CR)

\[ X = (x_1, x_2, x_3, x_4, x_5), x_1= suppliers, x_2= distributors, x_3= dealers, x_4= agents, x_5= customers networking \]

\[ Y = (y), y = Customer Retention \]

Functional relationships (fn)

\[ Y = f(X) \]

\[ y = f(x_1, x_2, x_3, x_4, x_5) \]

Regression Model

\[ y = \alpha_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \beta_4 x_4 + \beta_5 x_5 + \mu_i \]

Where \( \alpha \) = the constant of the equation

\( \beta_1 \) = the coefficient of variables in the equations;

\( \mu_i \) = the stochastic function that accounts for the errors that may arise in the equation

3.2. Research Instrument

The researcher employed the use of primary data with the use of structured questionnaires. The questionnaires were administered among the existing staff from various branches of Wema Bank PLC and G
T Banks in Lagos State. The questionnaire used for the study was designed using a five-point modified scale structure, with responses to individual items ranging from Strongly Agree (SA) to Strongly Disagree (SD).

**Research Hypotheses:**

The study formulated a null hypothesis viz.: Marketing partners (suppliers, distributors, dealers, agencies and customers networking) do not have significant impact on customer retention.

4. Results and Discussion.

4.1. Hypothesis Testing:

Marketing partners (suppliers, distributors, dealers, agencies and customers networking) have no significant impact on customer retention.

Table 1: Analysis of the Interaction between Marketing Partners (Suppliers, Distributors, Dealers, Agencies, Customers Networking) and Customers Retention

<table>
<thead>
<tr>
<th>Model</th>
<th>R</th>
<th>R Square</th>
<th>Adjusted R Square</th>
<th>Std. Error of the Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>.844a</td>
<td>.713</td>
<td>.709</td>
<td>.736</td>
</tr>
</tbody>
</table>

a. Predictors: (Constant), Marketing partners (suppliers, distributors, dealers, agencies and customer networking/tracking)

b. Dependent Variable: Customers Retention

Source: Authors’ Computation (2022)

Table 1 shows the model summary of the regression analysis of the interaction between marketing partners' variables (suppliers, distributors, dealers, agents, customers networking) and customer retention. The result reveals a positive interaction between the marketing partner's variables and customer retention. The level of the interaction is also statistically significant at the 5% level of significance. The R Square value of 0.713 indicates that marketing partner variables in this study account for 71% of changes in customer retention. The remaining 29% of variability can be attributed to factors captured under the stochastic error term.

Table 2: Regression Analysis Showing Significance of Predictors on the Customer’s Retention

<table>
<thead>
<tr>
<th>Model</th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Regression</td>
<td>470.901</td>
<td>5</td>
<td>94.180</td>
<td>173.999</td>
</tr>
</tbody>
</table>

Residual | 189.444 | 350 | .541 |
Total | 660.346 | 355 |

a. Dependent Variable: Customer Retention

b. Predictors: (Constant), Marketing partners (suppliers, distributors, dealers, agents, customer Networking and tracking)

Table 2 revealed that the overall significance of this model is F (5,355), 173.999, P-value < 0.05. (Sig 0.000). This revealed that a high level of significance exists. The result further revealed that there is strong evidence against the null hypothesis.
Table 3:

<table>
<thead>
<tr>
<th>Model</th>
<th>Unstandardised Coefficients</th>
<th>Standardised Coefficients</th>
<th>t</th>
<th>Sig.</th>
<th>95.0% Confidence Interval for B</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Beta</td>
<td>Std. Error</td>
<td>Beta</td>
<td></td>
<td>Lower Bound</td>
</tr>
<tr>
<td>1</td>
<td>(Constant)</td>
<td>-.160</td>
<td>.299</td>
<td>-.535</td>
<td>.593</td>
</tr>
<tr>
<td></td>
<td>Builds cordial relationships with the distributors</td>
<td>.041</td>
<td>.055</td>
<td>.021</td>
<td>.733</td>
</tr>
<tr>
<td></td>
<td>Maintaining cordial relationships with suppliers</td>
<td>.155</td>
<td>.058</td>
<td>.130</td>
<td>2.690</td>
</tr>
<tr>
<td></td>
<td>Customers' networking and tracking</td>
<td>.462</td>
<td>.054</td>
<td>.420</td>
<td>8.516</td>
</tr>
<tr>
<td></td>
<td>Builds cordial relationships with the dealers</td>
<td>.127</td>
<td>.042</td>
<td>.127</td>
<td>3.046</td>
</tr>
<tr>
<td></td>
<td>Builds cordial relationships with the related agencies</td>
<td>.260</td>
<td>.039</td>
<td>.279</td>
<td>6.680</td>
</tr>
</tbody>
</table>

a. Dependent Variable: Customer Retention

Source: Author’s Computation (2022)

The contribution of the predictors is displayed in Table 3. The model reveals Customers' Networking and tracking with a t-value of 8.516, a p-value < 0.05 contributed 0.462 (46%) to customer retention. Build a cordial relationship with the relevant agencies shown t-value = 6.680, p-value < 0.05 and contributed 0.26 (26%) to customer retention. Maintaining cordial relationships with suppliers showed a beta value of 0.155 (16%), a p-value < 0.05, and a t-value of 2.690. The contribution to the degree of customer retention is statistically significant. Builds cordial relationship with the dealers, beta value = 0.127, p-value < 0.05, and a t-value of 3.046. The result is statistically significant to the level of customer retention. Forms cordial relationships with the distributors showed a beta value of 0.021, a p-value < 0.05, and a t-value of 0.733. The contribution to the degree of customer retention is also statistically significant. Therefore, the study concluded that marketing partners (suppliers, distributors, dealers, agencies, customers networking and tracking) significantly impact customer retention of the selected Deposit Money Banks in Nigeria.

4.2. Discussion of Finding

The finding of this study revealed that marketing partners (suppliers, distributors, dealers, agencies, customer networking and tracking) significantly impact customer retention. Table 1 shows that the model summary of the regression analysis of marketing partners significantly impacts customer retention. Marketing partners account for about 71% of changes in the level of customer retention.

Table 3 also displays the predictor's contribution. Customer networking and tracking enhance the level of customer retention beta= 0.42. Building cordial relationships with the related agencies contributes to a beta value = 0.279, maintaining cordial relationships with suppliers with a beta value of 0.130, a cordial relationship with the dealers with a beta value = of 0.127, relationship with the distributors showing a beta value = 0.021. All these variables were statistically significant at the 5% confidence limit. Therefore, the study rejected the null hypothesis and concluded that the marketing partners significantly impacted customer retention in money
depot banks. This finding supports the conclusion of Ogbechi et al. (2018), that established a positive and significant relationship between customer marketing relationships and customer retention

5. Conclusion and Recommendations

This study demonstrates that marketing partners, including suppliers, distributors, dealers, agencies, and customer networking, significantly influence customer retention in deposit money banks. The findings highlight the importance of building and maintaining cordial relationships with marketing partners to enhance customer retention in the banking industry. This study contributes to the existing literature by providing empirical evidence of the specific variables within marketing partners that impact customer retention. It underscores the need for banks to prioritise their marketing partner relationships to improve customer retention. Based on the findings of this study, several unique recommendations are proposed for banks and marketing managers:

i. In order to improve their customer relationships, banks should fund customer networking and tracking programs. In addition, banks should adjust their marketing initiatives and product offers to improve customer retention by being aware of the demands and preferences of their customers.

ii. Banks should place a higher priority on their relationships with marketing partners like vendors, distributors, dealers, and advertising agencies. Ensuring all parties are happy and dedicated to sustaining a cordial relationship can require planning and implementing relationship-building programs, training programs, and feedback mechanisms.

iii. Banks should think about customised marketing partner strategies that consider each marketing partner's unique requirements and preferences. A one-size-fits-all strategy might not work because different marketing partners have different needs and expectations.

iv. Banks should examine synergies among their marketing partners to add value for the customer. This can entail working with various marketing partners to provide packaged goods or services, combined marketing campaigns, or cross-selling opportunities.

5.1. Research Contribution

By presenting empirical proof of the significant influence of marketing partners (suppliers, distributors, dealers, agencies, and customer networking) on customer retention in deposit money banks, this study adds to the body of knowledge already in existence. In addition, the study highlights the distinct aspects of marketing partners—such as customer networking and tracking and relationships with agencies, suppliers, dealers, and distributors—that support customer retention. This deepens our comprehension of marketing partners' contributions to customer retention in the banking sector.

5.2. Research Implication

The results of this study have several research-related ramifications for theory and practice. By emphasising the significance of marketing partners in the banking setting, the study theoretically adds to the knowledge of marketing relationships and customer retention. According to the research, customer retention can be significantly impacted by developing and keeping social connections with multiple marketing partners. The report offers valuable advice for bank marketing and operational managers on establishing solid connections with marketing partners first. This can assist banks in enhancing customer loyalty, which is essential for corporate success in the cutthroat banking sector.

5.3. Research Limitations and Future Research

Research Limitations: A few restrictions on this study should be considered. First, since the study
primarily looks at deposit money institutions, its conclusions might only apply to some banks or sectors. Second, the study depends on bank employees’ self-reported data, which might be biased toward social desirability. Thirdly, the study only looks at how marketing partners affect customer retention; it ignores other elements like service quality, price, and brand image that may also have an impact. Future studies could overcome these constraints by performing comparison studies across various industries and bank types, utilising diverse data sources, and considering a wider variety of variables that may impact customer retention.

References


THE EFFECT OF INFORMAL ECONOMY ON HUMAN CAPITAL DEVELOPMENT

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Abstract

This study investigated the effect of the informal economy on human capital development and the direction of causality between informal economy and human capital development in Nigeria from 1970 to 2019. The study objectives were achieved by analysing annual time series data sourced from the World Development Indicators and Central Bank of Nigeria using the autoregressive distributed lag estimation technique and the Toda-Yamamoto causality test. Findings from the study showed positive long-run effect of informal economy on human capital development. The result from this study also revealed unidirectional causality flowing from informal economy to human capital development. Consequently, this study concluded that engagement in informal economic activities is beneficial to human capital development in Nigeria. Following these findings, Nigerian policy makers aiming to achieve human capital development should implement comprehensive policies which facilitate the competitiveness and growth of informal economic activities.

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1. Introduction

The importance of quality human capital cannot be overemphasised in a modern world which often demands solutions to different socioeconomic challenges (Ogunade, 2011). Consequently, much of the cross-country differences in socioeconomic development have been attributed to the sophistication of human capital rather than possession of physical, mineral and energy resources (Anyanwu et al., 2015). The fact that human is the only factor of production capable of learning, adapting, innovating, and creating makes human capital the most important factor for socio-economic development (Okebukola, 2014).

According to Djomo and Sikod (2012) human capital is the combination of knowhow, proficiency and capability possessed by individuals through training, experience or innate abilities. Specifically, education is a major aspect of human capital crucial for the expansion of the human capabilities required for socio-economic development. On the one hand, a highly educated population provides an economy with a quality workforce capable of absorbing modern technology and developing capability for self-sustaining growth and development. On the other hand, education improves the well-being of individuals through better access to lucrative employment opportunities. Consequently, individual demand for education is majorly a derived demand for lucrative formal employment opportunities (Todaro & Smith, 2015).
However, a dearth of formal employment opportunities may deprive the underprivileged majority (regardless of their level of human capital development) from earning a living in the formal economy (Todaro & Smith, 2015). Consequently, the excluded segment of the society resorts to informal economic activities for survival (Arandarenko, 2015). Specifically, as at 2018 the informal economy provides 93% of all employment in Nigeria with 95% of women working in the informal sector compared to 90% of men. About 50% of informal workers are independent workers, while 50% of informal workers are employees of small or medium informal enterprises (International Labour Organisation (ILO, 2018). Despite the employment-generation abilities of the informal economy, the likely adverse effect of such a survival strategy on human capital development is a major concern.

According to the Organisation for Economic Co-operation and Development (OECD, 2019), less than 2% of people who operate in informal economies in African countries are with tertiary education. Besides, many studies have confirmed the fact that people with low human capital (education) are more likely to engage in informal economic activities compared to those with high human capital (Gaspereniene et al., 2016).

Consequently, expansion of the informal economy may imply the existence of an army of underprivileged majority with underdeveloped human capital. Such survival strategy may be detrimental to human capital development since the informal economy is often linked to economic activities carried out by individuals by unskilled individuals with little or no formal education (La Porta & Schleifer, 2008). Hence, a large informal economy may discourage the accumulation of human capital and entrepreneurial talent via lack of innovation and productivity (Kelmanson et al., 2019).

According to Katrechka &Dahlberg (2014), the influence of informal economic activities on human capital development may occur via different channels. A growing informal economy undermines the ability of public authorities to perform socio-economic responsibilities (Omodero, 2019). This may occur through the reduction of public tax revenue which adversely affects the availability of funds for public human capital projects (Arandarenko 2015; Nikopour & Habibullah, 2010). Consequently, the less privileged majority who depend wholly on the government for human capital development may be deprived of such opportunity.

Furthermore, increased access to informal economic opportunities (especially for unskilled individuals) may discourage such individuals from developing their human capital (Kolm & Larsen, 2016). Besides, the income insecurity inherent in the informal economy makes it difficult for informal workers to forgo their daily income for activities (formal education and training) that develops their human capital (Jacobs, 2019). Similarly, the fact that human capital development is not a major requirement for access to informal economic opportunities may also be detrimental to human capital development. The fact that individual level of human capital development may not be a requirement for access to informal economic opportunities may be detrimental to human capital development.

The literature on the link between the informal economy and human capital development is made up of studies which conceptualised the informal economy as an outcome of human capital development or vice versa (Kireenko & Nezorova, 2015; Ciutiene et al., 2015; Berniell, 2021; Kolm & Larsen, 2016) Consequently, there is yet no consensus among scholars on the direction of causality between the informal economy and human capital development. Similarly, studies on the effect of shadow economy are yet to reach a consensus on the direction of the effect of shadow economy on human capital development (Kolm & Larsen 2016; Mondal & Sanaul 2017; Bobba et. al, 2021).

Given the aforementioned controversies, further study on the subject matter is required in a developing country like Nigeria, where majority of the population engage in informal economic activities. Consequently, the goal of this study is to investigate the effect of informal economy on human capital development in Nigeria from 1970 to 2019. The rest of this paper is respectively dedicated to review of relevant literature, methodology, discussion of result and policy implication.
2. Literature Review

In spite of the distinct explanations given by modern human development theorists, each agreed that investment in human capital yields return in the form of increased marginal productivity which translates to increased future earnings through increased likelihood of securing lucrative formal employment (Mincer, 1958; Shultz, 1961 & Becker 1962). However, expansion of the informal economy at the expense of the formal economy may jeopardise realization of returns to human capital development. Studies which focus on the link between informal economy and human capital development abound in the literature.

Tumen (2015) studied the influence of the informal economy on the education decisions of youths in 17 South American countries and Turkey using macro and micro data respectively. Findings from his study revealed inverse association between secondary and tertiary education enrolment rates and informal employment opportunities. However, a positive relationship was discovered between rate of student out of lower secondary school and the informal economy. Based on these findings, his study concluded that the availability of informal economic opportunities is discouraging demand for formal education in developing countries.

Ciutiene et al. (2015) examined the interdependency between human capital and the power of the informal economy in Lithuania from 2005 to 2012. Their study revealed a negative and significant inverse impact of attractiveness of human capital on the power of the informal economy. Furthermore, a significant direct effect of the level of education on the magnitude of the informal economy was also discovered. The result from their study also revealed a possible effect of the growth of the informal economy on human capital development through unattractiveness of human capital.

Chen (2015) analysed the relationship between weak protection of property rights and legal enforcement of contracts (legal informality) and human capital development in China. His study revealed that although legal informality contributed to China’s economic growth by minimizing cost of production, informal workers usually detest transitioning to formality due to lack of skills required in such a new regime. Consequently, his study concluded that informality discourages the development of skills required for growth sustenance in a more developed and naturally complicated economy.

Kolm and Larsen (2016) examined the effect of informal economic opportunities on the educational attainment of informal workers with low education using a four-sector equilibrium search and matching model. Findings from their study revealed an indirect association between expansions of informal economic opportunities and the educational attainment of lowly educated informal economy workers. Consequently, their study recommended enforcement of a strict deterrence policy against industries that employ lowly-educated as an encouragement for higher educational attainment of lowly-educated informal workers.

Wahab (2017) studied the effect of informal economic activities on the livelihood of Rovinga refugees in Klang Vally Malaysia using surveys, in-depth interviews and focus group discussions. The result from his study suggested that wages or any form of income earned by Rovinga parents who participate in informal economic activities ensure their ability to support and maintain the educational expenditure of their children in Malaysia. Similarly, Mondal and Sanaul (2017) studied the contribution of urban informal vegetable selling to socio-economic status of vegetable sellers in Dhaka city Bangladesh and found a positive contribution of vegetable selling to continued enrolment in school.

Aghajeri et al. (2019) studied the effect of the informal economy on societal development in the Middle East from 2000 to 2015. The results from their study revealed a significant inverse effect of the informal economy and income inequality on societal development. Increase in government health and education expenditures was also found to have significant direct effects on the level of societal development.

Berniell (2020) evaluated the impact of occupational choice of participants in the informal sector on human capital development. Findings from his study suggested that the effect of participation in the informal economy on human capital development depends on occupational choice of participants. Specifically,
increasing size of the informal economy encourages informal entrepreneurs to complement shortage of physical capital with investment in human capital. However, a large informal economy discourages informal economy employees from investing in human capital.

Ozgur et al. (2021) examined the influence of the informal sector on measures of sustainable development in 160 economies from 1960 to 2016 using ordinary least square estimation. Findings from their study suggested a negative effect of the informal economy on education, education attainment, carbon dioxide emission per capita, life expectancy and access to potable water. Their study also suggested that the discovered empirical relationships are stronger in developing countries.

However, Bobba et al. (2021) opined that using the overall informality rate as the sole determinant of schooling policy may be misleading as strict social contribution policies which eliminate informal jobs increased schooling investments at the expense of workers’ and firms’ welfare. However, benign social contribution policies which increase informality increase welfare and the proportion of people who complete secondary school.

The literature review revealed that several authors have researched different aspects of the relationship between informal economy and various dimensions of human capital development. However, the literature is yet to reach a consensus on the effect of informal economy on human capital development and the direction of causality between the informal economy and human capital development. Consequently, there is need for more up-to-date research with better methods, newer data and more specialised scope.

3. Methodology

3.1 Data Description and Model Specification

This study utilized annual time series data spanning from 1970 to 2019. The data were obtained from the World Development Indicators and Central Bank of Nigeria. The dependent variable, human capital development (HUM) is measured as gross primary school enrolment while the explanatory variable of interest, informal economy (INF) is measured as informal economy (% of GDP). This study controlled for expected life span (LEX) measured as life expectancy at birth (Years); income (INC) measured as per capita income; and foreign direct investment (FDI) measured as direct investment equity. The estimates of the study were derived using Eviews 10 software.

The empirical model for this study stems from the assumption of human capital theory that rational individual invests in human capital development to increase their chances of securing lucrative formal economic opportunities; and the assumption that of the neoclassical perspective that the enormity of the informal economy can be used as a measure of the difficulty of accessing formal economic opportunities. Combining these assumptions, the informal economy is expected to have negative effect on human capital development. Controlling for other variables identified as determinants of human capital development in the literature, the model for this study is stated as:

$$ HUM_t = f (INF_t, LEX_t, INC_t, FDI_t, SPE_t) $$

The implicit model is specified explicitly as:

$$ HUM_t = \alpha_0 + \alpha_1 INF_t + \alpha_2 LEX_t + \alpha_3 INC_t + \alpha_4 FDI_t + \alpha_5 SPE_t + \mu_t $$

A priori expectation: $\alpha_1 < 0$; $\alpha_2, \alpha_3, \alpha_4, \alpha_5 > 0$

3.2 Estimation Technique

The autoregressive distributed lag (ARDL) bounds testing technique was used to estimate of the effect of the informal economy on human capital development in Nigeria. This estimation technique was informed by the result of the Kwiatkowski-Phillips-Schmidt-Shin stationarity test and Augmented Dickey Fuller (ADF)
unit root tests which revealed that the series used in the study are either stationary at level $I(0)$ or first difference $I(1)$. The ARDL estimation technique enables the estimation short-run effects, long-run effects and the speed of adjustment from short-run disequilibrium to long-run equilibrium.

Specifically, the unrestricted ARDL version of equation (2) is specified as:

$$\Delta HUM_t = \beta_0 + \beta_1 \Delta HUM_{t-1} + \beta_2 \Delta HUM_{t-2} + \beta_3 \Delta INF_t + \beta_4 \Delta INF_{t-1} + \beta_5 \Delta INF_{t-2} + \beta_6 \Delta LEX_t + \beta_7 \Delta LEX_{t-1} + \beta_8 \Delta LEX_{t-2} + \beta_9 \Delta LEX_{t-3} + \beta_{10} \Delta INC_t + \beta_{11} \Delta INC_{t-1} + \beta_{12} \Delta INC_{t-2} + \beta_{13} \Delta FDI_t + \beta_{14} \Delta FDI_{t-1} + \beta_{15} \Delta FDI_{t-2} + \beta_{16} \Delta SPE_t + \beta_{17} \Delta SPE_{t-1} + \beta_{18} \Delta SPE_{t-2} + \beta_{19} \Delta SPE_{t-3} + \alpha_1 HUM_{t-1} + \alpha_2 INF_{t-1} + \alpha_3 LEX_{t-1} + \alpha_4 INC_{t-1} + \alpha_5 FDI_{t-1} + \alpha_6 SPE_{t-1} + \mu_t$$

(3)

The restricted version of the unrestricted ARDL model in equation (3) is specified and estimated as:

$$\Delta HUM_t = \beta_0 + \beta_1 \Delta HUM_{t-1} + \beta_2 \Delta HUM_{t-2} + \beta_3 \Delta INF_t + \beta_4 \Delta INF_{t-1} + \beta_5 \Delta INF_{t-2} + \beta_6 \Delta LEX_t + \beta_7 \Delta LEX_{t-1} + \beta_8 \Delta LEX_{t-2} + \beta_9 \Delta LEX_{t-3} + \beta_{10} \Delta INC_t + \beta_{11} \Delta INC_{t-1} + \beta_{12} \Delta INC_{t-2} + \beta_{13} \Delta FDI_t + \beta_{14} \Delta FDI_{t-1} + \beta_{15} \Delta FDI_{t-2} + \beta_{16} \Delta SPE_t + \beta_{17} \Delta SPE_{t-1} + \beta_{18} \Delta SPE_{t-2} + \beta_{19} \Delta SPE_{t-3} + \theta ECT_{t-1} + \mu_t$$

(4)

Where: $\beta_0$ is the intercept, $\beta_1$ - $\beta_{19}$ are short-run coefficients of the explanatory variables; $\alpha_1$ to $\alpha_6$ are long-run coefficients of the explanatory variables. ECT is the error correction term; $\theta$ is the coefficient of the error correction term (expected to be significant and satisfy the inequality $0 \leq \theta \leq 1$); $\mu$ is the error term. Normality, Ramsey regression specification error, Breusch-Pagan-Godfrey heteroscedasticity, cumulative sum, and cumulative sum of squares were conducted to ascertain the validity of the ARDL model estimates.

The Toda-Yamamoto (1995) causality test was used to achieve the second specific objective targeted at determining the direction of causality between informal economy and human capital development. The Toda-Yamamoto causality test is more suitable for this study than the popular Granger (1969) causality test since it does not assume that all the study variables are stationary at level. Specifically, the Toda-Yamamoto causality test is based on the estimation of the augmented VAR model ($k + d_{max}$)

$$HUM_t = \mu_0 + \sum_{i=1}^{k} \alpha_{1t} HUM_{t-i} + \sum_{i=k+1}^{d_{max}} \alpha_{2t} HUM_{t-i} + \sum_{i=1}^{k} \beta_{1t} INF_{t-i} + \sum_{i=k+1}^{d_{max}} \beta_{2t} INF_{t-i} + \varepsilon_{1t}$$

(5)

$$INF_t = \theta_0 + \sum_{i=1}^{k} Y_{1t} INF_{t-i} + \sum_{i=k+1}^{d_{max}} Y_{2t} INF_{t-i} + \sum_{i=1}^{k} \delta_{1t} HUM_{t-i} + \sum_{i=k+1}^{d_{max}} \delta_{2t} HUM_{t-i} + \varepsilon_{2t}$$

(6)

Where: $k$ is the optimal time lag of the VAR model and $d_{max}$ is the maximum order of integration of the variables in the VAR model.

4. Results and Discussion

4.1. Unit Root Test

Table 1 presents the unit root tests results. The comparison of the test statistics and critical values of at least two of the tests at 0.05 significance level revealed that the series are either integrated at level or at first difference. The unit root tests results is consistent with the autoregressive distributive lag technique which assumes that series whose parameters are to be estimated must be stationary at level and first difference.

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### Table 1

<table>
<thead>
<tr>
<th>Variable</th>
<th>ADF</th>
<th>KPSS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>I(d)</td>
<td>Statistic</td>
</tr>
<tr>
<td>HUM</td>
<td>I(0)</td>
<td>-2.937</td>
</tr>
<tr>
<td>INF</td>
<td>I(1)</td>
<td>-8.465</td>
</tr>
<tr>
<td>LEX</td>
<td>I(0)</td>
<td>-4.370</td>
</tr>
<tr>
<td>INC</td>
<td>I(1)</td>
<td>-3.671</td>
</tr>
<tr>
<td>EXP</td>
<td>I(1)</td>
<td>-5.662</td>
</tr>
<tr>
<td>FDI</td>
<td>I(1)</td>
<td>-8.370</td>
</tr>
</tbody>
</table>

Note: Null hypothesis is rejected if absolute value of test statistic greater than critical value (5%)

Source: Authors’ computation, 2023 using Eviews 10.

### 4.2. Bounds Test

The bounds test result is presented in Table 2. The fact that the absolute values of F-statistics and t-Statistic are greater than their respective absolute upper bound values suggests evidence of co-integration among human capital development, informal economy, and the control variables. This result implies that the informal economy and control variables are important policy variables for long-run change in human capital development in Nigeria.

### Table 2

<table>
<thead>
<tr>
<th>H0: No Levels Relationship</th>
</tr>
</thead>
<tbody>
<tr>
<td>F Statistic</td>
</tr>
<tr>
<td>Lower Bound I(0)</td>
</tr>
<tr>
<td>Upper Bound I(1)</td>
</tr>
</tbody>
</table>

Note: Null hypothesis is rejected if the absolute values of test statistic exceed the upper bound.

Source: Authors’ computation, 2023.

### 4.3. Effect of the Informal Economy on Human Capital Development.

The short-run and long-run estimates are presented in Table 3. The p-values of the long-run coefficients of informal economy (0.013 < 0.05); life expectancy (0.000 < 0.05); income (0.000 < 0.05); foreign direct investment (0.031 < 0.05); and government investment in human capital (0.000 < 0.05) are significant at 0.05 level. This implies that all the explanatory variables are long-run determinants of human capital development in Nigeria. Likewise, the probability values of short-run coefficients of one-period lag informal economy (0.002 < 0.05).
### Long-run and Short-run ARDL Model Estimates

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>St. Error</th>
<th>T-Statistic</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>INF</td>
<td>0.494</td>
<td>0.185</td>
<td>2.674</td>
<td>0.013**</td>
</tr>
<tr>
<td>LEX</td>
<td>2.356</td>
<td>0.358</td>
<td>6.573</td>
<td>0.000***</td>
</tr>
<tr>
<td>INC</td>
<td>-2.436</td>
<td>0.334</td>
<td>-7.303</td>
<td>0.000***</td>
</tr>
<tr>
<td>FDI</td>
<td>-0.258</td>
<td>0.113</td>
<td>-2.282</td>
<td>0.031**</td>
</tr>
<tr>
<td>SPE</td>
<td>0.909</td>
<td>0.191</td>
<td>4.746</td>
<td>0.000***</td>
</tr>
</tbody>
</table>

#### Long-Run Estimates

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>St. Error</th>
<th>T-Statistic</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>-0.181</td>
<td>0.025</td>
<td>-7.286</td>
<td>0.000***</td>
</tr>
<tr>
<td>D[HUM(-1)]</td>
<td>0.554</td>
<td>0.090</td>
<td>6.138</td>
<td>0.000***</td>
</tr>
<tr>
<td>D[INF]</td>
<td>0.089</td>
<td>0.046</td>
<td>1.940</td>
<td>0.063</td>
</tr>
<tr>
<td>D[INF(-1)]</td>
<td>-0.191</td>
<td>0.056</td>
<td>-3.393</td>
<td>0.002***</td>
</tr>
<tr>
<td>D[LEX]</td>
<td>-1.851</td>
<td>9.739</td>
<td>-0.190</td>
<td>0.851</td>
</tr>
<tr>
<td>D[LEX(-1)]</td>
<td>19.708</td>
<td>19.510</td>
<td>1.010</td>
<td>0.321</td>
</tr>
<tr>
<td>D[LEX(-2)]</td>
<td>-19.643</td>
<td>10.401</td>
<td>-1.889</td>
<td>0.070</td>
</tr>
<tr>
<td>D[INC]</td>
<td>0.562</td>
<td>0.049</td>
<td>1.253</td>
<td>0.221</td>
</tr>
<tr>
<td>D[INC(-1)]</td>
<td>1.358</td>
<td>0.543</td>
<td>2.501</td>
<td>0.019**</td>
</tr>
<tr>
<td>D[FDI]</td>
<td>0.071</td>
<td>0.059</td>
<td>1.198</td>
<td>0.241</td>
</tr>
<tr>
<td>D[FDI(-1)]</td>
<td>0.234</td>
<td>0.065</td>
<td>3.586</td>
<td>0.001***</td>
</tr>
<tr>
<td>D[SPE]</td>
<td>0.193</td>
<td>0.056</td>
<td>3.435</td>
<td>0.002***</td>
</tr>
<tr>
<td>D[SPE(-1)]</td>
<td>-0.269</td>
<td>0.069</td>
<td>-3.928</td>
<td>0.000***</td>
</tr>
<tr>
<td>D[SPE(-2)]</td>
<td>-0.140</td>
<td>0.055</td>
<td>-2.561</td>
<td>0.016**</td>
</tr>
<tr>
<td>ECT(-1)</td>
<td>-0.588</td>
<td>0.072</td>
<td>-8.177</td>
<td>0.000***</td>
</tr>
<tr>
<td>R SQUARE</td>
<td>0.816</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: ** and *** denotes significance of coefficient at 5% and 1% levels of significant respectively.

Source: Authors’ computation, 2023 using E-views 10.

Specifically, the long-run coefficient of informal economy (0.494) is positive and statistically significant. This implies that a 1 percentage point increase in informal economy will result in about 0.49 percentage point increase in human capital development in the long run. This result agrees with Wahab (2017) disagrees with Carpio (2014); Kolm and Larsen (2016); Ozgur et al., (2021) and partly agrees
with Bobba et al, (2021); Ciutiene et al. (2015); Berneill (2020) and Tumen (2015) which found both positive and negative effect of informal economy on human capital development.

However, the beneficial long-run effect of informal economy on human capital development disagrees with the a priori expectation. The inconsistency of the finding with a priori expectation may be due to the fact that most underprivileged Nigerians fund their human capital development with income earn from informal economic activities. This may also be explained by the desire of informal workers to be eligible for formal economic opportunities whenever socioeconomic conditions are favourable. For instance excluded Nigerian parents usually fund the human capital development of their wards to ensure that they have better chances of securing lucrative formal employment opportunities. By implication this result agrees with studies which concluded that governments of in poor developing democracies are often reluctant to take decisive action on the expansion of informal economic activities for fear of losing political support from the masses (Isayomi & Akintunde, 2021).

Contrary to the positive long-run effect, the findings from this study revealed that short-run coefficient of one period lag of informal economy (-0.191) is negative and statistically significant at 0.05 level. This implies that 1 percentage point increase in informal economy in the current year results in about 0.19 percentage point decrease in human capital development in the subsequent year. This agrees with the a priori expectation that expansion of the informal economy results in socioeconomic conditions which discourage human capital development.

The coefficient of the error correction term (-0.588) is negative and also statistically significant since the absolute value of the t statistic (-8.177) of the error correction term exceeds the upper bound (-4.19) of the t-bounds test associated with the error correction model regression. The negative sign of the coefficient of the error correction term implies that the model is able to adjust from short-run deviations to long-run equilibrium. More specifically, the coefficient of the error correction term of (-0.588) implies that about 59% of the deviations from long-run equilibrium are corrected yearly. Consequently, it takes about 1.7 years (-0.588^-1) to adjust deviation from long-run equilibrium in a particular year.

### 4.4. Post Estimation Diagnostics

Table 4 presents the result of post estimation tests. The probability values of the tests shows that the autoregressive distributed lag model is free from serial correlation, heteroscedasticity, abnormally distributed error and misspecification. Figure 1 presents the result of the cumulative sum of squares (CUSUMSQ) test. The results show that CUSUMSQ plot falls within the 0.05 level of significance lines. This shows that estimated coefficients are stable and can be used for policymaking purposes.

<table>
<thead>
<tr>
<th>Test</th>
<th>Statistic</th>
<th>Value</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Serial Correlation LM</td>
<td>Obs*Rsquared</td>
<td>1.5575</td>
<td>0.4590</td>
</tr>
<tr>
<td>B-P-G Heteroscedasticity</td>
<td>Obs*Rsquared</td>
<td>21.3694</td>
<td>0.3168</td>
</tr>
<tr>
<td>Normality</td>
<td>Jarque-Bera</td>
<td>0.6738</td>
<td>0.7140</td>
</tr>
<tr>
<td>Ramsey RESET Test</td>
<td>F</td>
<td>1.4982</td>
<td>0.2429</td>
</tr>
</tbody>
</table>

Note: The null hypotheses for the post estimation diagnostics are no serial correlation; homoscedasticity; normality and correct specification respectively.

*Source: Authors’ computation, 2023 using E-views 10*
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The result of the Toda-Yamamoto causality test is presented in Table 5. The result revealed a unidirectional causality flowing from the informal economy (INF) to human capital development (HUM). The unidirectional causality from the informal economy to human capital development indicates that the informal economy is a cause and not an effect of human capital development in Nigeria. This finding agrees with extant studies which conceptualize informal economy as a determinant of human capital development (Berniell, 2021; Bobba, Flabbi & Levy 2021; Ozgur et al. 2021) The finding however disagrees with studies that conceptualise human capital development as a determinant of the informal economy (Kireenko & Nezorova, 2015; Čiutienė et al. 2015).

Table 5

<table>
<thead>
<tr>
<th>Maximum Order of Integrations (dmax): 1</th>
<th>Optimal Lag Length (K) : 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Null Hypothesis</td>
<td>Chi Square Statistic</td>
</tr>
<tr>
<td>INF does not granger cause HUM</td>
<td>25.30541</td>
</tr>
<tr>
<td>HUM does not granger cause INF</td>
<td>1.30123</td>
</tr>
</tbody>
</table>

Note: *** denotes rejection of the null hypothesis at 1% level of significance.

Source: Authors’ computation, 2023 using E-views 10

4.5. Causality Test Result

The result of the Toda-Yamamoto causality test is presented in Table 5. The result revealed a unidirectional causality flowing from the informal economy (INF) to human capital development (HUM). The unidirectional causality from the informal economy to human capital development indicates that the informal economy is a cause and not an effect of human capital development in Nigeria. This finding agrees with extant studies which conceptualize informal economy as a determinant of human capital development (Berniell, 2021; Bobba, Flabbi & Levy 2021; Ozgur et al. 2021) The finding however disagrees with studies that conceptualise human capital development as a determinant of the informal economy (Kireenko & Nezorova, 2015; Čiutienė et al. 2015).

5. Conclusion and Policy Implications

This study investigated the effect of the informal economy on human capital development; and the direction of causality between the informal economy and human capital development in Nigeria from 1970 to 2019. The ARDL-bounds test technique and the Toda-Yamamoto causality test were use to achieve the study objectives. Contrary to a priori expectation, this study revealed significant positive effect of the informal economy on human capital development in Nigeria. The result of the study also revealed a uni-directional
The effect of informal economy on human capital development. Both of these findings revealed that the informal economy is in fact beneficial to human capital development in Nigeria.

Findings from this study have several policy implications for Nigeria. Extant policies such as (Universal Basic Education) targeted at human capital development in Nigeria often focus on the supply side of human capital development. Consequently, such policies often fail to maximize the positive influence of informal economy on human capital development. Similarly, existing policies targeted at empowering individuals who engage in informal economic activities have often focused on financial inclusion. However, maximizing the human capital development benefits of the informal economy requires a holistic policy targeted which enhance the competitiveness and growth of informal economic activities.

References

### Appendix A

**ARDL Error Correction Regression**

ARDL Error Correction Regression  
Dependent Variable: D(HUM)

Selected Model: ARDL(2, 2, 3, 2, 2, 3)  
Case 3: Unrestricted Constant and No Trend

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>-0.181185</td>
<td>0.024868</td>
<td>-7.285794</td>
<td>0.0000</td>
</tr>
<tr>
<td>D(HUM(-1))</td>
<td>0.553603</td>
<td>0.090195</td>
<td>6.137857</td>
<td>0.0000</td>
</tr>
<tr>
<td>D(SHA)</td>
<td>0.088710</td>
<td>0.045719</td>
<td>1.940315</td>
<td>0.0629</td>
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<tr>
<td>D(SHA(-1))</td>
<td>-0.191474</td>
<td>0.056429</td>
<td>-3.393201</td>
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<tr>
<td>D(LEX)</td>
<td>-1.850917</td>
<td>9.738757</td>
<td>-0.190057</td>
<td>0.8507</td>
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<tr>
<td>D(LEX(-1))</td>
<td>19.70766</td>
<td>19.51035</td>
<td>1.010113</td>
<td>0.3214</td>
</tr>
<tr>
<td>D(LEX(-2))</td>
<td>-19.64256</td>
<td>10.40100</td>
<td>-1.888527</td>
<td>0.0697</td>
</tr>
<tr>
<td>D(INC)</td>
<td>0.562463</td>
<td>0.449049</td>
<td>1.252563</td>
<td>0.2211</td>
</tr>
<tr>
<td>D(INC(-1))</td>
<td>1.357652</td>
<td>0.542822</td>
<td>2.501099</td>
<td>0.0187</td>
</tr>
<tr>
<td>D(FDI)</td>
<td>0.070897</td>
<td>0.059174</td>
<td>1.198118</td>
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<tr>
<td>D(FDI(-1))</td>
<td>0.233781</td>
<td>0.065185</td>
<td>3.586404</td>
<td>0.0013</td>
</tr>
<tr>
<td>D(EXP)</td>
<td>0.193138</td>
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<td>3.434522</td>
<td>0.0019</td>
</tr>
<tr>
<td>D(EXP(-1))</td>
<td>-0.269469</td>
<td>0.068594</td>
<td>-3.928464</td>
<td>0.0005</td>
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<tr>
<td>D(EXP(-2))</td>
<td>-0.140273</td>
<td>0.054767</td>
<td>-2.561253</td>
<td>0.0163</td>
</tr>
<tr>
<td>CointEq(-1)*</td>
<td>-0.587880</td>
<td>0.071896</td>
<td>-8.176812</td>
<td>0.0000</td>
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</table>

<table>
<thead>
<tr>
<th>Statistic</th>
<th>Value</th>
<th>Description</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>R-squared</td>
<td>0.815641</td>
<td>Mean dependent var</td>
<td>0.010871</td>
</tr>
<tr>
<td>Adjusted R-squared</td>
<td>0.734983</td>
<td>S.D. dependent var</td>
<td>0.078891</td>
</tr>
<tr>
<td>S.E. of regression</td>
<td>0.040613</td>
<td>Akaike info criterion</td>
<td>-3.315587</td>
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<tr>
<td>Sum squared resid</td>
<td>0.052780</td>
<td>Schwarz criterion</td>
<td>-2.725114</td>
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<tr>
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<td>92.91629</td>
<td>Hannan-Quinn criter.</td>
<td>-3.093388</td>
</tr>
<tr>
<td>F-statistic</td>
<td>10.11243</td>
<td>Durbin-Watson stat</td>
<td>2.180239</td>
</tr>
<tr>
<td>Prob(F-statistic)</td>
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<td></td>
</tr>
</tbody>
</table>

* p-value incompatible with t-Bounds distribution.
### Appendix B

#### Levels Equation and Bounds Test

**Levels Equation**  
Case 3: Unrestricted Constant and No Trend

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
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<td>0.494284</td>
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<tr>
<td>LEX</td>
<td>2.355978</td>
<td>0.358438</td>
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<tr>
<td>INC</td>
<td>-2.436149</td>
<td>0.333577</td>
<td>-7.303109</td>
<td>0.0000</td>
</tr>
<tr>
<td>FDI</td>
<td>-0.257831</td>
<td>0.113009</td>
<td>-2.281517</td>
<td>0.0306</td>
</tr>
<tr>
<td>EXP</td>
<td>0.908791</td>
<td>0.191499</td>
<td>4.745658</td>
<td>0.0001</td>
</tr>
</tbody>
</table>

\[
EC = HUM - (0.4943*SHA + 2.3560*LEX -2.4361*INC -0.2578*FDI + 0.9088*EXP)
\]

<table>
<thead>
<tr>
<th>Test Statistic</th>
<th>Value</th>
<th>Signif.</th>
<th>I(0)</th>
<th>I(1)</th>
</tr>
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<tr>
<td>F-statistic</td>
<td>9.402224</td>
<td>10%</td>
<td>2.26</td>
<td>3.35</td>
</tr>
<tr>
<td>K</td>
<td>5</td>
<td>5%</td>
<td>2.62</td>
<td>3.79</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2.5%</td>
<td>2.96</td>
<td>4.18</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1%</td>
<td>3.41</td>
<td>4.68</td>
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<td>Actual Sample Size</td>
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<tr>
<td>Finite Sample:</td>
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<td></td>
<td>10%</td>
<td>2.435</td>
<td>3.6</td>
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</tr>
<tr>
<td></td>
<td>5%</td>
<td>2.9</td>
<td>4.218</td>
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</tr>
<tr>
<td></td>
<td>1%</td>
<td>3.955</td>
<td>5.583</td>
<td></td>
</tr>
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<td>Finite Sample:</td>
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<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>10%</td>
<td>2.458</td>
<td>3.647</td>
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</tr>
<tr>
<td></td>
<td>5%</td>
<td>2.922</td>
<td>4.268</td>
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</tr>
<tr>
<td></td>
<td>1%</td>
<td>4.03</td>
<td>5.598</td>
<td></td>
</tr>
<tr>
<td>Test Statistic</td>
<td>Value</td>
<td>Signif.</td>
<td>I(0)</td>
<td>I(1)</td>
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<td>--------</td>
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<td>------</td>
<td>------</td>
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<tr>
<td>t-statistic</td>
<td>-6.136753</td>
<td>10%</td>
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<td></td>
<td></td>
<td>2.5%</td>
<td>-3.13</td>
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</tr>
<tr>
<td></td>
<td></td>
<td>1%</td>
<td>-3.43</td>
<td>-4.79</td>
</tr>
</tbody>
</table>

Null Hypothesis: No levels relationship
THE CAPITAL MARKET MATTERS - THE EXPERIENCE OF THE GRAND DUCHY

Krasimira NAYDENOVA

Abstract

The Bulgarian capital market is not founding its place in the national economy for more than 30 years, and the market infrastructure is far from world standards, at least as far as the central depository is concerned. The government is a major shareholder in CD (Central Depository) and BSE (Bulgarian Stock Exchange) and is not doing enough for their development and integration. The state is also absent as a factor in the development of securities trading.

The example of Luxembourg shows that the capital market can be a driver of the national economy and a factor for growth, which is why it should be recognized. The stated goal of the research also sets the limitations in the present study - it is an overview and uses a comparative analysis of indicators for economic development and trading in financial instruments. The analysis shows that government guidance of capital market development can become a major factor for remarkable growth, and this can be achieved by small economies as well.

Key words: Lyxembourg capital market, Bulgarian capital market, Clearstream, LuxSE, BSE, CD.

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The capital market requires quality state intervention in ensuring the conditions of the investment climate through the legal environment, the level of regulation, confidence and transparency. This is the impact of institutions for the economic behavior in general and for the investment behavior in particular, and is ensured by two main functions – the state institutions determine the rules and the extent to which agents comply with them and lower transaction costs for the commercial contracts (Coase, 1992). In Bulgaria and other smaller economies, especially emerging ones, the state factor is decisive in establishing a quality market infrastructure.

The neglect of the sector by a series of governments in Bulgaria is a fact. They fail to appreciate the possibilities that the capital market, in combination with the technological innovation industry, can open to the national economy. In this sense, the example of small economies, which are deliberately directed along the path of pre-emptive development of the financial sector, is important not only for Bulgaria. Luxembourg, the smallest country in the EU (European Union), can offer such an experience.

The purpose of the present study is to present the experience of Luxembourg as far as the capital market sector is concerned, as well as to show a brief comparison of the market infrastructure of Bulgaria and Luxembourg, in the limited space of a review scientific article. The goal is to expose that the capital market can be a driver of the national economy and a factor for growth, which is why it should be recognized. The overview assumes a limited toolkit - macro data for the two economies and a comparative analysis of the changes in the two jurisdictions, with relevant reflections on the national economy. A historical review of events relevant to capital markets infrastructure in both countries is also used. The cited sources in most cases present up-to-date market information and information about the important units in the investment process in both countries.

2. Luxembourg today

The Grand Duchy of Luxembourg has a population of just over 600,000 people and an area of less than 3,000 square kilometers. The “elf” of the European Union, however, impresses with the value of GDP per capita - among the highest in the world and in first place among the countries of the community.

In the early 1980s, GDP per capita data ranks Luxembourg after Switzerland and not so far from Germany and the US, but even then the country performs twice as well as the EU average. Forty-two years later, Luxembourg long overtakes Switzerland, and the indicator’s value is almost twice higher than the US’s and even higher than that of Germany. Compared to the EU average, Luxembourg performs exactly 3.48 times better (data in table 1).

<table>
<thead>
<tr>
<th></th>
<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Bulgaria</td>
<td>2 239</td>
<td>2 367</td>
<td>1 621</td>
<td>3 900</td>
<td>6 853</td>
<td>7 075</td>
<td>10 130</td>
<td>12 221</td>
</tr>
<tr>
<td>Switzerland</td>
<td>19 410</td>
<td>39 575</td>
<td>38 865</td>
<td>56 243</td>
<td>76 531</td>
<td>83 806</td>
<td>85 656</td>
<td>91 992</td>
</tr>
<tr>
<td>Germany</td>
<td>12 138</td>
<td>22 304</td>
<td>23 695</td>
<td>34 520</td>
<td>41 572</td>
<td>41 103</td>
<td>46 773</td>
<td>51 204</td>
</tr>
<tr>
<td>European Union</td>
<td>8 101</td>
<td>15 461</td>
<td>16 948</td>
<td>27 344</td>
<td>32 970</td>
<td>30 485</td>
<td>34 330</td>
<td>38 411</td>
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<tr>
<td>Liechtenstein</td>
<td>21 386</td>
<td>49 417</td>
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<td>105 462</td>
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<td>133 590</td>
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<td>48 651</td>
<td>56 763</td>
<td>63 531</td>
<td>70 249</td>
</tr>
</tbody>
</table>

Source: WorldBank / authors’ compilation, 2023
The Luxembourg government has a simple explanation for the results. According to the administration, two major transformations take place in the national economy - at the end of the 19th century and at the end of the 70s of the 20th century. Initially basing the business on agriculture and handicrafts shifts to industry and by the middle of the 20th century the country is already the largest producer of steel in the world, and the sector contributes to economic development over a long period of time. In the 70s of the 20th century, the first world crisis in the steel industry becomes a fact and sets a requirement for the second transformation. The government takes serious action to initiate economic diversification by developing a fiscal environment of advantages that will soon make Luxembourg one of the most important financial centers in the world. Just in that moment Luxembourg overtakes Switzerland.

The financial industry occupies a major place in the economy today, and the financial sector forms 25% of the country's GDP (luxembourg.public.lu, Reference 21). The prospects are entirely international – this sector is an operational hub for many international financial institutions. They prefer precisely this jurisdiction as a center of their cross-border services in the field of private banking, corporate banking, take advantage of the opportunities for administration of funds, portfolios and deposits, for the management of assets, including wealth. For many of the sector's clients, Luxembourg is the main financial gateway cause of the direct access to the unique European financial market.

The capital market is important for any economy and plays a key role in economic growth by efficiently allocating capital to projects with high added value, generating jobs, providing public services, creating infrastructure and/or driving innovation. However, this industry also represents an alternative to the focus of national planning, while opening development opportunities for multiple sectors. Finance as a science is interdisciplinary, and practicing finance or investing in financial instruments today is impossible without the technological achievements of the IT sector. For this reason, the financial sector is not the unilateral choice of Luxembourg governments. At the beginning of the 80s, the governers clearly recognize the capital market as a potential engine for the innovation sector due to the needs of post-trade services, international and interbank payments, the complex supervision in the system and the growing regulatory requirements. The opportunities for the trading process provided by the new information technologies are perceived. The capital market requires serious investment in infrastructure, which has long been fully in the field of technological and informational innovation. This is recognized, and the conditions are created. Today, Luxembourg is chosen as a European hub by leading companies in the field of e-commerce and electronic payments. Mobile payments and e-money, RegTech solutions, Big Data analytics, DLT technologies, identity and security innovations, automated investment services and alternative finance resources, are working industries now.

Due to all of the above, the country's economy today is one of the most dynamic in Europe and one of the most open in the world. Luxembourg is regularly featured in the world rankings for competitiveness, digitization and innovation, and this is no accident. One of the government initiatives that put innovation as the basis of the national economy is the creation of the House of Startups – a unique place for new companies that develop revolutionary ideas. It is not just a place that gathers business incubators, but also provides direct access to investors. Luxembourg also has a special FinTech platform - House of Financial Technology - The LHoFT. It is charged with building and promoting the development of the country's thriving FinTech ecosystem and brings together financial institutions, innovative companies, research, scientific and public authorities and aims to manage the development of products for the specific needs of the financial industry. The platform works in collaboration with the Financial Markets Association and the Luxembourg Banker’s Association, as well as numerous local and international companies, working groups and initiatives. Capital market specialists help the sector with financing, not only in the initial stages of start-ups (luxembourg.public.lu, Reference 22).

Naturally, the financial industry requires collaboration with additional specialists in the field of management, banking, insurance, tax law and legal consulting. Thus, the circle of achieving a high gross product is closed and the fruits of the smart planning and governance of Luxembourg's national economy are already available for 40 years. At the same time, the trend is constant and positive.
Today the results of the relocation of the national economy undertaken years ago are
(www.luxembourgforfinance.com, Reference 23):

− 5.5 trillion euros invested through Luxembourg-domiciled investment funds;
− the country is now the host for 57% of cross-border investments through investment funds from
80 countries;
− 76% of the best fund management companies choose Luxembourg as their home - the destination
ranks first in Europe and second in the world as the choice of investment funds;
− Luxembourg Stock Exchange hosts over 39 000 listed securities in over 60 currencies of more
than 2 500 issuers from more than 100 countries;
− Luxembourg is home to institutions offering depository and other post-trade services; assets
under management in securities and currencies are worth over 8 trillion euros; Clearstream is the
world's leading depository;
− the country is defined as the first center for Islamic finance in the EU and the fourth in the world.

3. Legal Forms of investment business - an important regulatory factor of success

Among the tools that have made Luxembourg one of the world's financial centers, the legal forms for
investment business occupy an important place. Fund Toolbox (www.luxembourgforfinance.com, Reference
24) or the options, the legal formulations that local legislation gives to attract management fund firms through
investments in securities, are:

− UCITS – undertakings for collective investment in transferable securities - regulated funds for
retail and institutional clients; it is a global product with maximum investment protection and a
serious global brand in collective investment, but preceded by a smart government decision
before that - Luxembourg is the first country to implement the collective investment directive in
its national legislation back in 1988; the share of such funds located in Luxembourg among
European funds is 35% or €4.6 trillion in assets under management (AuM);
− SIF – specialized investment fund - it is a flexible and efficient investment tool with multiple
investment objectives;
− SIKAR – venture capital investment company; a special design for private risky capital with a
focus on venture capital investments;
− UCI – collective investment undertakings - flexible, highly regulated pool investment fund;
− RAIF – reserved alternative fund - offers instant investing, indirectly regulated through an
alternative investment manager.

Alternative funds are represented by venture capital funds, hedge funds and real estate investment funds,
and Luxembourg is a preferred location for them as well. The business environment in the financial sector, as
well as the available market infrastructure, suggest a number of acquisition facilities in the field of equity and
real estate transactions, including cross-border transactions. Back-office infrastructure is available,
outsourcing solutions are also offered, with cost management options. Regulated alternative investment funds
today manage assets worth €962 billion and are an important part of the infrastructure of the financial market.

Luxembourg is today a leader in the global distribution of fund management services, but part of this
achievement is due to the express introduction of European regulations in this area. Opportunities are being
exploited and this plays a major role in opening up markets and providing European clients – retail and
institutional – with access to international investment. Investment funds managed by Luxembourg raise capital
from 80 countries, with a main focus on Europe, Asia, Latin America and the Middle East. Leaders in fund
management choose the country as a hub, and it offers them international expertise and the necessary set of
financial infrastructure. Part of the important infrastructure is regulation and Luxembourg offers an innovative
regulator and a relaxed regulatory environment. Taxation is appropriate and the management fee is not subject
to VAT (www.luxembourgforfinance.com, Reference 25).
The two types of investment funds operating in Luxembourg (Undertaking of Collective Investment in Transferrable Securities (UCITS) and Alternative Investment Funds (AIFs)) take advantage of the opportunity to attract investors and savers from all EU and EEA (European Economic Area) countries. They are created on the basis of two different European directives and offer investor protection to retail and professional investors respectively.

Investing in real estate, debt investing companies, hedge funds, private companies and venture capital are subject to AIFs, respectively not allowed for UCITS. Alternative funds (AIFs) are of several different types:

- Regulated Investment Funds – regulated - subject to immediate supervision by the Commission de Surveillance du Secteur Financier of Luxembourg;
- Unregulated Investment Funds – no prior permission to raise capital is required from the Commission.

Several factors need to be taken into account when deciding to set up an investment fund in Luxembourg:

- target investor base and fund size; investment strategy, type and origin of the assets to be invested in; marketing and distribution strategy;
- regulatory environment and compliance requirements; initial costs of establishment and subsequent costs of maintaining the activity and regulatory fees;
- time required to fill the minimum investment capital and build the fund management structures; choice between regulated and unregulated structures;
- selection of risk diversification strategies; choice of fund structure – standalone / umbrella;
- level of flexibility in fund management and corporate structure; potential tax benefits;
- rendering account for the financial industry ecosystem in the relevant jurisdiction.

There are specifics for non-residents considering investment business in Luxembourg. Entities with headquarters outside the EU and EEA must register the activity in a relevant country of the community, under the domestic legal norms. This means that the activity will be subject to EU regulations. An alternative is the decision to "get a passport" for the business. In this option, the investment scheme is subject to supervision. Another alternative is to delegate the investment activity to a licensed entity from the community, while the fund owner retains part of the risk management strategy. Similarly, the investments of Luxembourg registered funds in foreign territory, for example Asia, are subject to supervision by the corresponding supervisory institutions there (https://www.luxembourgforfinance.com, Reference 23).

The costs of registering an investment scheme are:

- notarial documents – between 2,000 and 5,000 euros; initial registration costs – between 4,000 and 8,000 euros;
- legal costs – between 40,000 and 60,000 euros;
- annual supervisory fees – between 4,000 and 8,000 euros;
- portfolio management fees – 0.05% to 2% of net asset value, on an annual basis; management costs – from 0.03% to 0.12%;
- depository fees – from 0.05% to 0.1% of net assets; administration fees – from 0.1% to 0.3% of net asset value (www.luxembourgforfinance.com, Reference 25).
The Capital Market Matters – The Experience of the Grand Duchy

Table 2

<table>
<thead>
<tr>
<th>Country</th>
<th>Foreign investments, % of GDP, 2020</th>
<th>Portfolio investments, million USD, 2020</th>
<th>Stock market capitalization, % of GDP, 2020</th>
<th>Stock market capitalization, billion USD, 2020</th>
<th>Stock market return, %, 2021</th>
<th>Assets investment funds, % of GDP, 2020</th>
<th>GDP, growth, %, 2021</th>
</tr>
</thead>
<tbody>
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<td>139.42</td>
<td>301158.00</td>
<td>70.30</td>
<td>51.57</td>
<td>42.20</td>
<td>8330.59</td>
<td>6.89</td>
</tr>
<tr>
<td>Bulgaria</td>
<td>5.19</td>
<td>-166.07</td>
<td>25.34</td>
<td>17.71</td>
<td>18.54</td>
<td>1.48</td>
<td>4.18</td>
</tr>
<tr>
<td>USA</td>
<td>0.71</td>
<td>687416.02</td>
<td>194.89</td>
<td>40719.66</td>
<td>32.65</td>
<td>140.16</td>
<td>5.67</td>
</tr>
<tr>
<td>Germany</td>
<td>3.71</td>
<td>-15466.66</td>
<td>59.38</td>
<td>2284.11</td>
<td>23.68</td>
<td>74.96</td>
<td>2.89</td>
</tr>
</tbody>
</table>

Source: [www.theglobaleconomy.com](http://www.theglobaleconomy.com)

The impact of the asset management industry for the national economy is decidedly sound (table 2). Attracting foreign assets to the domestic market is clearly Luxembourg's trademark and this has a strong positive impact on both gross product and returns on securities investments as measured by stock index growth.

4. Luxembourg Stock Exchange – an important unit in the financial chain and an innovative market factor

Luxembourg has a fully equipped market infrastructure regarding securities transactions and a unique international expertise, this makes the country perfect location for companies of all sizes seeking financing for European or international projects. The government targets and leverages this and LuxSE becomes a world leader in raising debt capital, a key hub for securitization and structured finance instruments, and a recognized platform for notable public offerings.

Luxembourg Stock Exchange (LuxSE) ([www.bourse.lu](http://www.bourse.lu), Reference 26) has a long history as a pioneer in the capital markets. It is established in 1928, and during the first two decades of its activity it is focused on European issuers – they list securities denominated in the respective European currencies. The opening to global markets is in 1953 with the first dollar bonds issued by the World Bank, this institution remains the leader in new issuances to this day. In 1962, the first investment fund is listed - France's Finance Union's Investment Fund. The first ever Euro bonds go to market in 1963. In 1981, following the introduction of the European Currency Unit (ECU) two years earlier, the first ECU-denominated bond issue of SOFTE starts trading. 1990 is the time of the listing of the first global depositary notes, in this case issued by Samsung. In 1991, the exchange introduces an electronic trading system and this system allows in 1996 to launch the multi-fixing market. Subsequently, in 2002, it becomes the venue for the first listing and trading of sukuk (Sharia compliant bond), the first listing of green bonds in 2007, and in 2011 dim sum bond (bonds based on Chinese debt). In 2016, there are already 100 green bond issues traded there, and the Luxembourg Green Exchange becomes a reality. Today, the capitalization of this market exceeds $175 billion and represents half of all green bonds listed anywhere.

In 2005, the exchange launches the Euro MTF multilateral trading system. In 2007, LuxSE and Euronext jointly introduce cross-membership, and this allows trades to be generated also through the Euronext UTP platform. 2019 is the time of the launch of LuxXPrime – the bond universe. The platform is specialized for private small clients’ investments. The Luxembourg Green Exchange (LGX) is the latest spectacular financial innovation. The trading platform for sustainable, green and social securities allows the market to contribute to the development of the global taxonomy and undoubtedly strengthens the position of the local capital market as a financial leader in the world.

LuxSE is a leader in the listing of foreign securities and can undoubtedly be defined as a leader in the development of world markets for the last 50 years. The institution itself defines as an important factor for its development the stable and consistent policy for easy and quick access of foreign issuers, brokers and
investors. Euronext's trading platform certainly contributes to the results, transactions are on two markets – RM (regulated market) and Euro MTF. The completion of transactions through Clearstream and Euroclear provides access to foreign investors and investment intermediaries. The trading mechanism of the system is based on the Central Order Book standard for electronic platforms. Trading rules allow for three types of security prices – transactional, indicative and valuation.

Undoubtedly, a fundamental role for the stable trading process plays the rules requirement for market maker quotations. The trading system has an algorithm for real-time tracking of outstanding orders, and this increases their visibility for market makers and other participants. The system, called NEOSS, allows increasing market liquidity for outstanding orders. The mechanism applies to all listed issues. The benefits of NEOSS are monitoring of outstanding orders, increased liquidity, competition at the level of market makers and other liquidity providers, improved market prices, systematic equilibrium of buyer and seller prices.

High market liquidity is one of the most important requirements for a functioning and attractive capital market. Supply and demand, represented by client orders, are one side of the solution, but all global markets work to increase market liquidity through their own mechanisms. Market makers and other liquidity providers are an important part of the market infrastructure and Luxembourg Stock Exchange assures the process. In the first place, investment companies carrying out algorithmic trading are involved, followed by market makers. All of them are required to become party to an agreement to provide liquidity. Their obligation is to quote in both directions in comparable volume to market requirements and competitive prices, on their behalf, at least during half of the exchange session, for a period of one calendar month (www.bourse.lu, Reference 27).

In a market stress situation, liquidity providers operate with doubled spread requirements and halved liabilities. Market stress is defined as a situation where a financial instrument suffers short-term severe changes in traded quantities or prices. Extraordinary market circumstances are also defined: extreme volatility in one or more market positions; war, industrial trouble, civil unrest or cyber attacks; unusual market conditions; trading process technology issues, investment risk management issues, or inability to hedge short sales in extreme volumes. In cases of extraordinary circumstances, the quoting obligations of liquidity providers are terminated.

LuxSE’s active trading members are brokers from seven different countries and three institutions providing liquidity. Online brokers from five different countries offer services, cross-membership is an option for free access to Euronext members and vice versa. Free market data on trading and listed issues are available to participants. The onboarding process is simple, there are no membership or order entry fees, and trading commissions are low (www.bourse.lu, Reference 27).

Luxembourg Stock Exchange is a gateway for international investors and offers integrated access to listing, trading and information services. The focus is the listing of international debt securities. The market infrastructure assures high levels of transparency and stability in the capital market for five decades.

The exchange’s statistics as of the end of 2021 are:

- listed issues – 37 839; issuers – 1 937 from 98 countries, in 71 currencies;
- total value of 7.4 trillion euros of issued bonds.

The "green" exchange of Luxembourg complements the enviable market statistics - LGX has its own results: 2 613 issues, up almost 200% from 2020; 222 issuers from 47 countries, in 50 currencies; value of listed bonds – 640 billion euros (www.bourse.lu, Reference 28).

5. Clearstream - a remarkable competitive advantage

The problems of market structure and design, price discovery, transaction costs, information and its disclosure, the behavior of investors and market makers, refer to market microstructure (O'Hara, 1999). It is represented by the institutions facilitating the trading of assets and the rules of trading (market infrastructure), as well as by the institutions trading and offering assets for investment. In this sense, besides the regulated market, another extremely important unit is the depository institution.

Post-trading services have made a special contribution to Luxembourg's place in the financial industry.
All aspects of depository services, collateral management and securities administration are covered by clearing, settlement, asset servicing and custody systems. The main provider of these services is Clearstream - a leading global depository. Three more post-trading service providers assure access to the ECB – their combined activities include issuance, settlement and custody services, as well as maintaining the needed processes for investment funds and global notes issues. The business of these companies is worth more than 8 trillion euros in assets. Clearstream offers direct and secure access to multiple money and capital markets around the world. Over the years and the development of the global financial trading network, a constant new demand for inclusion to new markets and instruments is generated by the participants, accordingly the custody service provider network follows the trend (clearstream.com, Reference 9).

Clearstream Banking S.A., Luxembourg (CBL) is originally established as “Cedel” (Centrale de Livraison de Valeurs Mobilières) in September 1970. 66 of the world’s largest financial institutions participate, and the goal is to minimize risk in the settlement of securities transactions in different markets and by different participants. The reason is the growing Eurobond market. From January 1, 1995, a new corporate holding structure is introduced under the name Cedel International S.A. and a banking subsidiary Cedel Bank is founded (later under the name Cedelbank). In early 2000, Cedel International, together with its subsidiaries, merge with Deutsche Börse Clearing, itself a subsidiary of Deutsche Börse AG, and form Clearstream International S.A. Ownership is equally divided between Cedel International S.A. and Deutsche Börse AG. In July 2002, Deutsche Börse AG acquires Cedel International S.A. and on June 30, 2004 the institution begins operating under the name Clearstream International S.A. After a number of legal changes, the institution today operates as Clearstream Banking S.A. (CBL) and is a joint-stock company wholly owned by Clearstream Holding AG, in the Deutsche Börse AG Group. CBL is today an International Central Depository (ICSD), operating through its headquarters in Luxembourg and through its regional offices, thus ensuring the trading process to its customers. Subsidiaries are available to provide the process in distant markets – Australia, Japan, Singapore and London. Offices in Dubai, Hong Kong, New York and Tokyo are available also (clearstream.com, Reference 9).

CBL develops and maintains the post-trade infrastructure of the Eurobond market and over 50 local foreign securities markets. Services include securities issuance, settlement and custody services, services for investment funds and global financing companies. High financial requirements for customers are maintained through an obligation for reasonable risk management in the supply of securities and money, in the execution of transactions and in the holding of customer assets.

CSSF (Commission de Surveillance du Secteur Financier) is the competent regulator of the company’s activities. As a monetary financial institution (MFI) offering banking services, the depository is also regulated by the Banque Centrale du Luxembourg (BcL), which ensures systematic stability of payments as part of its responsibilities to the European System of Central Banks.

ClearstreamXact is the system developed by the institution for communication, orders and reports with clients (clearstream.com, Reference 8). Vestima is the system used by investment funds and companies. Customer and Access Acceptance Policy is the document governing the access of customers and issuers to the depository system. In order to ensure customer access to a wide range of markets and financial products and services, CBL develops an extensive network of suppliers and together they maintain a Service Network. CBL also creates an interface for institutions external to the depository, so that clients can settle transactions with parties whose accounts are in other depository institutions and settlement systems. Information and reporting systems are part of this network. The infrastructure connecting customers, markets and depository institutions consists of:

- CBL as service unit and liaison with all parties;
- customers; stock brokers;
- connection with markets; other depositories; other settlement systems;
- financing banks; correspondent banks;
- regulatory institutions;
- information systems, portals and agencies.
In CBL's custodial system, securities transactions requiring coupon payments, repurchases, physical delivery and cash, etc. are generally conducted through a depository or agent that is a member of the CBL network infrastructure.

The different types of agents and custodians used in the CBL network are:

- domestic depositories / agents - local entities - through them, deliveries are made for transactions on markets outside of Luxembourg;
- specialized depositories – for deliveries not in non-available form; also for Eurobonds and other Euro-instruments;
- common depositories – internationally traded securities, usually issued in the form of a Global Note (global depository note); notes can be exchanged for certificates or remain in non-available form until maturity; the common depositories represent CBL and Euroclear Bank in providing safe custody for securities transactions issued as Classical Global Note (CGN);
- common safekeepers – agents approved by CBL and Euroclear Bank – maintain a register of payments when issuing international debt;
- common service providers – for servicing assets on international markets issued in NGN (New Global Note) form;
- transfer agents – for servicing investment fund transactions.

The service network ensures its activity through three types of connections with the respective markets:

- direct connection with a central depository – the depository of the network is also the central depository of the relevant market;
- direct connection through an agent – CBL account in the relevant depository, but managed by an agent;
- indirect link – the depository acts as an intermediary between CBL and the respective clearing system or depository (clearstream.com, Reference 8).

The infrastructure allows the offering of a full range of basic clearing and settlement services: delivery versus payment; delivery free of payment; back-to-back processing; lending securities system; administration of papers traded on multiple markets (multi-market securities); pre-matching; allegation; administration of general meetings of shareholders and bondholders. As far as settlement is concerned, CBL enables the procedures to be carried out also in cases where the transactions require special deliveries, for example outside the depository's system. Standard domestic settlement procedures are for trades between two CBL accounts – in these cases any instrument maintained as an issue in CBL, regardless of which market it is traded on. Bridge transactions are allowed for clients of Euroclear Bank. The issue subject to the transaction should have been accepted in both systems. Foreign trades are with participants outside of CBL's clients and allow for physical delivery of securities traded on a domestic or international market (clearstream.com, Reference 8).

Custodial and depository services, as well as settlement algorithms, require an extremely high level of risk management and liquidity checks. A Bridge Agreement is signed between CBL and Euroclear, containing the principles of risk management. These principles allow limiting mutual exposures and eliminating systemic risk, which is a requirement of the applicable standards in the financial industry, namely the CSDR requirements, the ECB-CESR standards for clearing and settlement systems in the EU and the CPSS IOSCO principles for the infrastructure of financial markets (clearstream.com, Reference 8).

An important part of the liquidity, symmetry and efficiency of the capital market is provided by the capabilities of the market infrastructure to carry out short sales (Endo, Ghon Rhee (2006)). CBL does this through The Automated Securities Lending and Borrowing Program (ASL). Securities loans are guaranteed, concentration limits are introduced. The system is flexible and enables owners to decide which issues, how much of them and in which currencies to make available for lending. Approval of loans to borrowers is done automatically or on a case-by-case basis. The loan period is not fixed. Intraday lending is also available, which allows for the equalization of discrepancies in the terms of delivery in different markets (clearstream.com, Reference 8).
6. Bulgarian Experience

The comparison between Bulgaria and Luxembourg, as far as the capital market is concerned, is unfortunately adequate only in terms of registration and supervision costs: the Bularian FSC (Financial Supervision Commission) fee for licensing a capital management company is over 3 000 euros, about 4 000 euros for an investment intermediary; the annual supervision tax is within 2 500 euros. The values are fully comparable to those of the Luxembourg supervisory authority, with completely incomparable capital market qualities in the two countries. The law on collective investment schemes is in place in Bulgaria since 2011, although such companies are licensed since 2000 under a different law. The first alternative investment fund is authorized to operate in 2019. Exchange-traded funds receive formal regulation at the end of 2013. At the same time, alternative investment funds are authorized. The number of collective investment schemes, investment funds and alternative funds registered in Bulgaria at the end of 2021 is 144, managed by 30 management companies. The assets under management of the Bulgarian collective investment companies at the same time are worth BGN 3 153.7 million (www.fsc.bg, Reference 12). The number of licensed investment trusts is 57, of which 9 invest in receivables, the others in real estates. There are 59 investment intermediaries, of which 20 are banks. The clients’ securities at the investment intermediaries are worth a little over BGN 8 billion, it is logical that the assets of the pension funds and the capital management companies are exactly on client accounts at the intermediaries.

The Bulgarian Central Depository is established on August 13, 1996. Its activity is based on a statute book, which is mandatory for investment intermediaries and issuers (www.csd-bg.bg, Reference 7). The central depository maintains the securities register by organizing and managing a registration system for dematerialized financial instruments, securities accounts system, registration and administration of issues and securities, distribution of dividends, interest and other payments, managing an information system for corporate actions on listed issues, blocking and unblocking of securities, servicing margin purchases and margin accounts ensuring margin trading. The central depository organizes and governs a clearing and settlement system, registers and ensures the completion of transactions, maintains accounts and makes payments concerning transactions, registers repo and reverse repo transactions, manages a settlement guarantee fund and centralized lending information system (pool). The Central Depository of Bulgaria also performs the functions of a national numbering agency for assigning and maintaining a register of ISIN (International Securities Identification Number) securities issue codes, builds relationships with foreign depository institutions for the needs of double and cross-listing and cross-border settlement.

The current regulations of the depository allow three types of membership for investment intermediaries - clearing, direct and non-clearing. Clearing and direct members perform operations in the clearing and settlement system as direct participants, and non-clearing members only through a clearing member (www.csd-bg.bg, Reference 7).

The depository carries out all necessary procedures for registration of new issues, registration of shares against rights and convertible bonds, initial offers, initial sales and repurchases for mutual funds, investment companies and alternative funds.

Cash settlement provision requires members to declare bank accounts with direct debit consent, including accounts for settlement of margin purchases and short sales. For the purposes of concluding transactions in euro, members declare cash accounts with consent for direct debit opened in a bank from the Trans-European Automated System for Gross Settlement of Express Transfers in Real Time. The settlement is based on the principle of "delivery versus payment" (DVP) or DFP - delivery free of payment.

The Bulgarian central depository goes through different stages, according the development of the national capital market. After Bulgaria's accession to the EU, the integration of the national capital market determines the steps that the institutions of the market infrastructure must take. Thus, the end of 2009 leads to the adoption of a strategy for the development of the depository and it implies integration into the European markets and establishing connections with other depository institutions, and introduction of the SWIFT standard for communication. In June 2010, an account is opened in Clearstream Banking Luxembourg, and it is expected...
that this will facilitate the access of Bulgarian investors to foreign markets. Unfortunately, this is still not enough to facilitate the access of foreign investors to the Bulgarian market. At that time, the private sector had long taken the necessary steps and Eurobank EFG Bulgaria is already an active agent of CBL for Bulgaria, and in 2010 Unicredit Bulbank ensures the joint work of the Polish stock market through Krajowy Depozyt Papierów Wartościowych S.A. Before that, as early as 2008, the Bulgarian depository established a relationship with RoClear and is its member, and the possibilities for double listing of papers are also being worked on. 2012 leads to a membership agreement with Depozitarul Central Romania and OeKV Austria. In 2013, new types of membership, forms for settlement of pending transactions, guarantee fund, automated collateral processing and SWIFT transactions required by international partners and contributing to attracting foreign investors were introduced. Despite ongoing efforts, by the end of 2014, Bulgaria had not yet signed the framework agreement governing the rights and obligations of depositories in the Eurosystem. 2016 marks the launch of the new information system. In 2017, Target 2 Securities - European technical and technological requirements for the servicing of transactions by depositories - are on the agenda. At that time, Bulgaria does not declare its intention to join the settlement platform. Negotiations are also starting with the Greek depository Athex Group, with which there is a need to connect due to securing transactions in the See Link system (csd-bg.bg, Reference 5).

2018 brings to the Bulgarian capital market the new system developed by CD EPOS - an electronic platform for holding general meetings. At the same time, the Bulgarian Stock Exchange (BSE) started work on its BG International project for trading foreign shares on its floor, and CD's link with Clearstream mediates the completion of the transactions. The connection with the Greek depository is not yet implemented. In 2019, the link with the Hungarian depository KELER is already a fact. In 2021, the need for investments in the depository's systems leads to a decision by the shareholders to increase the capital to BGN 1 400 000 by issuing 4 000 new shares with a face value of BGN 100 and an issue price of BGN 570. A common initiative with Bulgarian National Bank (BNB) to join T2S due to the plan to introduce the euro starts (annual reports, www.csd-bg.bg, Reference 5).

At the beginning of 2023, the Bulgarian depository is still not able to secure the national capital market to a sufficient extent. Initiatives for development and technological adequacy with the requirements of financial transactions in the 21st century remain a weak point, and this is probably also due to state ownership. Shareholders in the capital of CD are the Ministry of Finance with 43.70%, BSE – 6.21%, banks operating in Bulgaria with a total share of 37.01% and other institutions with 13.08%. By comparison, the capital of Luxembourg's depository institution is wholly owned by the Deutsche Borse Gruppe.

### Table 3

<table>
<thead>
<tr>
<th>Year</th>
<th>Transferred securities, number</th>
</tr>
</thead>
<tbody>
<tr>
<td>2008</td>
<td>650 403 771</td>
</tr>
<tr>
<td>2009</td>
<td>612 531 163</td>
</tr>
<tr>
<td>2010</td>
<td>349 197 817</td>
</tr>
<tr>
<td>2011</td>
<td>629 009 302</td>
</tr>
<tr>
<td>2012</td>
<td>421 771 137</td>
</tr>
<tr>
<td>2013</td>
<td>858 704 143</td>
</tr>
<tr>
<td>2014</td>
<td>782 745 850</td>
</tr>
<tr>
<td>2015</td>
<td>186 938 993</td>
</tr>
<tr>
<td>2016</td>
<td>182 445 009</td>
</tr>
</tbody>
</table>
The problems in integrating the national market with the single European market and the world capital market are clearly reflected in the volume of activity. Table 3 presents figures according to which transactions in Bulgaria are still far from what they were in 2009.

The beginning of 2023 does not look any different, but there is a national plan for the introduction of the euro, and because of this, numerous measures and activities related to changes in the payment and settlement systems are being implemented in Bulgaria. This implies the integration of the depository institution to the TARGET2-Securities (T2S) settlement platform. This platform plays a key role in the implementation of the single securities market in Europe and in general for the integration of the financial markets in the European Union. The convenient access to custodial services and settlement systems is critical for the attractiveness of the national market. The connections with established global depository institutions are important because they provide access to the national market of foreign investors, as well as access to foreign capital for domestic companies.

Bulgarian Stock Exchange (BSE) is the next important unit forming the market infrastructure of the Bulgarian capital market. In fact, this institution began its existence twice. The first is at the beginning of the 20th century, in 1907 – well before the Luxembourg Stock Exchange. Then 21 companies were traded before the Great Depression and the number reached 30 before closing in 1947 (www.bse-sofia.bg, Reference 29). The second start is possible in 1991, after the adoption of the Trade Act - the first registration of the institution dates from 11/8/1991. Initially, the securities market and the first companies to offer shares to investors arose spontaneously, without special legislation. The hyperinflation of 1996-1997 puts an end to the romantic beginning. The restart is with state intervention, through a change in the legal framework, according to which all companies subject to mass privatization become public. Regulated securities trading becomes a fact in 1995, after the adoption of the first special law.

Today, BSE organizes two markets - the BSE main market and the BASE alternative market, supports a multilateral trading system and the Beam growth market since 2018. From 2021, the BSE International project is launched, enabling market participants to directly invest in foreign securities. This is a fact through TradeGate, as the institution is a party to BSE International transactions and a market maker for all BSE International issues. The actual transfer of the instruments takes place at Clearstream Banking S.A. Luxembourg, between accounts owned by Central Depository and TradeGate.

The thirty-two-year new history of BSE today reports:
- registered issues on BEAM 7, on BSE International – 191; both segments launch in 2021;
- registered premium segment issues, BSE market – 7; unchanged compared to the previous year;
- registered issues of the Standard segment, BSE market – 65 – by 1 more than the previous year;
- registered issues on the BASE market – 132, 4 fewer than in 2021;
- registered investment trusts on the BSE market – 17, with 1 more than the previous year;
- investment trusts issues on the BASE market – 36, 5 less than a year ago;
- members – 45, minus one for the last year.
- bond issues 82, plus 10 compared to 2021 (bse-sofia.bg, Reference 3).

<table>
<thead>
<tr>
<th>Year</th>
<th>Transactions</th>
</tr>
</thead>
<tbody>
<tr>
<td>2017</td>
<td>383 790 321</td>
</tr>
<tr>
<td>2018</td>
<td>271 108 350</td>
</tr>
<tr>
<td>2019</td>
<td>174 598 333</td>
</tr>
<tr>
<td>2020</td>
<td>309 311 999</td>
</tr>
<tr>
<td>2021</td>
<td>372 425 281</td>
</tr>
</tbody>
</table>

Source: annual reports, www.csd-bg.bg
Market participants were not always such a modest number. In 2009, the maximum number of members (investment intermediaries with the right to trade) was registered, namely 86. The same applies to registered issues - in 2008 they were 557 and are decreasing since then. The market capitalization at the end of 2020 is BGN 28,354.51 million and represents 23.91% of GDP. The data at the end of 2021 is BGN 30,781.29 million, which is 23.96% of GDP.

The improvement in capitalization indicators is not the only good result of the last year. Table 4 shows a significant increase in traded securities in terms of turnover and number of transactions.

**Table 4**

<table>
<thead>
<tr>
<th>Bulgarian Stock Exchange, Turnover Data</th>
<th>2019</th>
<th>2020</th>
<th>2021</th>
</tr>
</thead>
<tbody>
<tr>
<td>Turnover million BGN</td>
<td>334</td>
<td>398</td>
<td>819</td>
</tr>
<tr>
<td>Traded shares without trusts, million BGN</td>
<td>269</td>
<td>265</td>
<td>498</td>
</tr>
<tr>
<td>Traded trusts’ shares, million BGN</td>
<td>33</td>
<td>80</td>
<td>99</td>
</tr>
<tr>
<td>Traded bonds, million BGN</td>
<td>21</td>
<td>44</td>
<td>169</td>
</tr>
<tr>
<td>Number of transactions in thousands</td>
<td>44</td>
<td>61</td>
<td>87</td>
</tr>
</tbody>
</table>

Source: [www.bse-sofia.bg](http://www.bse-sofia.bg), Reference 3.

The Bulgarian Stock Exchange is far from the standards of Luxembourg in the trading of sustainable bonds, but on March 31, 2021, the first and only think-tank for sustainable finance and energy - Green Finance & Energy - is officially launched in Bulgaria. The Green Center is created on the initiative of BSE and the Bulgarian Independent Energy Exchange and is implemented in partnership with the Ministry of Finance, the Ministry of Energy, the Financial Supervision Commission and the Fund of Funds ([www.bse-sofia.bg](http://www.bse-sofia.bg), Reference 3).

While LuxSE is an important unit in the chain of global financial markets, this is completely unapplicable to the Bulgarian regulated market. Lagging behind world consolidation trends is a fact, but an important step forward is made in 2014 with the SEE LINK initiative. It starts as a project of the stock exchanges of Bulgaria, Macedonia and Croatia and aims to create a regional infrastructure through which investors can trade securities of public companies from the three markets. Later Serbia, Bosnja and Herzegovina, and Slovenia join also. The idea is based on the integration of the markets without the need for a merger or other type of corporate acquisition of the exchange operators. This is a regional infrastructure for trading the securities listed on the three exchanges, as well as technical integration of the local markets. The system enables brokers (originating brokers) to transmit for execution the orders of their clients for transactions with securities on any of the other markets for which they are not residents through executing brokers (they also carry out clearing and settlement and guarantee activities on site). Since April 2016, the system calculates 2 own indices. As of early 2023, the underlying index is at 181.65 versus 99.96 at platform launch. SEE LINK is not a solution to the problems of BSE, but it is a way to increase the number of investors for the Bulgarian public companies. It is a de facto consolidation of a regional principle, with a number of opportunities for both issuers and investors and investment intermediaries ([www.see-link.net](http://www.see-link.net), Reference 4).

The last few years have been successful for the development of the Bulgarian regulated market. The new management is making significant progress, and an important part of it is the BEAM market, providing financing for non-public companies. From June 24, 2021, companies from the BeamUp Lab program Endurosat and Software Group are also presented to global investors from the Deutsche Borse Venture
Network (DBVN1) platform, and this is the debut of Bulgarian companies in Digital Investor Talks - the format of the platform that meets growing companies and investors.

Among the weaknesses of the national market is the underdeveloped trading of derivatives. This is reported by the management of the exchange, and from the end of 2021, the institution focuses its work on the development of this segment, including the formation of a clearing institution to ensure payments and the continuity of the process.

BSE and CD remain outside the global consolidation processes and this is a problem. The merging large international institutions of the market infrastructure become an even stronger competitor to the small national emerging market, and it remains completely invisible to foreign investors, correspondingly unattractive to listing for national companies. The Bulgarian government rejects all proposals by influential European market operators for merger or acquisition submitted during the period 2006 - 2008. Additionally in 2010 the Ministry of Finance acquires in a non-market way, through a capital increase provided, the majority share of the capital of the market operator and converts the market infrastructure to a completely state-owned. The possibilities for consolidation, at this stage, are ceased.

The foreign interest in order to acquire the Bulgarian Stock Exchange is no longer a fact, probably due to the presence of a majority shareholder like the Ministry of Finance (50.05%). The privatization procedure of the stock exchange in a package with the Central Depository is terminated on February 25, 2013.

7. In summary - the government's "market infrastructure" problem

Capital market transactions require institutions, rules, technologies, material base and market participants competent to initiate and mediate deals. All these conditions are provided by the financial infrastructure, and the market infrastructure is part of it. It includes a narrower number of institutions responsible for transactions with financial instruments. One part of these institutions, namely private individuals (investors, intermediaries and issuers) react to investment conditions, but are not responsible for their formation. The exchange operator and the depository institution are the main factors in both the level of transaction costs and the available investment and financing options. Another factor of such importance are the regulations and supervisory process and that is the level of transparency and confidence or lack of confidence and over-regulation. This is also the reason why the Luxembourg government promotes its market through the attitude of the regulatory authority towards the supervised persons. All mentioned above (regulations and supervision, capabilities of the depository institution and the commercial exchange system), in Bulgaria are responsibility of the government.

Whatever the quality of the conditions for the investment process offered by the Bulgarian institutions, there are differences in the market infrastructure between the many different national markets in the EU, united in words in the concept of "single European market". Trading, clearing and settlement platforms remain inefficiently connected, while through the trading platforms the investment process is accessible to anyone, professional or non-participant. Each investor is required to access multiple specific, non-integrated systems that have their own technical requirements and market practices (settlement periods, rules for corporate events and new issues) and operate under unequal tax and legal regimes, despite the common European regulatory requirements. In this sense, insufficient integration is a barrier and causes additional risks and costs for investors, operating in more than one national market. Additional costs due to fragmentation represent a serious limitation both in number of the transactions as well as for the business of the institutions of the market infrastructure (Schmiedel, 1

1 DBVN is a platform to support growing companies from Germany and Europe, created by Deutsche Borse. At the moment, it unites more than 200 companies and nearly 460 investors from all over the world, with more than 152 financing rounds for more than 4.9 billion euros.

2 For comparison, shareholders in LuxSE are: 25.35% - Banque et Caisse d'Epargne de l'Etat; 21.20% - Grand Duchy of Luxembourg, 10.54% - Tradhold SA, 10% - BIL Banque International, 32.91% - institutions and private individuals.
Schönenberger 2005). A market in financial instruments is fully integrated if all market participants with similar relevant characteristics operate under the same rules, can use the same markets, services and instruments and are treated in the same way (Baele et al. 2004). This is not yet a fact for investors on the Bulgarian capital market. Apart from the problems at the EU level, the Bulgarian back-office process remains outside the single market, despite the available partial connections. This not only restricts domestic investors, it mostly does not attract foreign ones, which disrupts access to capital for national public companies.

State ownership in Bulgaria's two main infrastructure institutions (BSE and CD) can be called a problem, since their development does not meet the requirements of investors in at least two directions - taking advantage of the integration process and opportunities provided to issuers and investors. Stock trading in recent decades is developing in the conditions of integration and consolidation. The market operators join a set of national markets, offer listed companies a wide horizon, an increased access to capital is a logical effect. This also applies to the depository institution. The lack of integration is a problem not only for investment intermediaries, but it also deprives Bulgarian issuers of access to capital. At the same time, their competitors from Europe and the USA choose between sources of financing that are unavailable in terms and prices for us.

The Bulgarian capital market for the moment cannot be compared with Luxembourg in terms of investment opportunities, financing opportunities and innovation opportunities, and this is a problem of the market infrastructure. Outside of it, the investment climate is essential for the capital market. Bulgaria is part of the European Union, but not a member of the Eurozone. The use of a currency other than the euro is one of the problems facing both foreign investors on our capital market and Bulgarian investors opening positions on the European markets. Conversion costs are a fact, and currency and political risk are calculated by investors without taking into account the fixed exchange rate and ERM II membership. This is also a government omission.

There are other serious problems. Such are the ownership concentration, the asymmetric investment process due to the underdeveloped systems for short sales and the existing repo opportunities, over-regulation, lack of confidence and transparency, low market liquidity. The ownership concentration prevents the adequate and complex intervention of the market makers, accordingly the stock exchange rules cannot impose adequate requirements. The asymmetric process allows bubbles and deeper crashes and does not help to increase efficiency. The declining numbers of investment intermediaries and listed issues are not just statistics, they are a sign of a serious consequence of the over-regulation of the local stock market, namely a bilateral restriction of access (North, Wallis, Weingast (2006)). In it, investors suffer a reduced supply of financial services due to the withdrawal of issuers and financial institutions, and issuers leave the market due to high listing requirements and accordingly suffer reduced access to external capital. All these conditions are created by governments.

Untangling the puzzle is not easy, but Luxembourg's experience shows that the government is a factor and recognizing the capital market as a path to development enables national growth. The modern financial industry is complex, requiring not only a modern regulations and serious investments, but also interdisciplinary capacity. Finance today is beyond technological innovation only as infrastructure, the two industries are developing powerfully and influencing each other. Beyond that, the investment business requires an environment transparency and confidence, and that is certainly the government's task.

References


AN APPROACH TO MODELING THE PROBABLE CONSUMERS DEMAND OF FOOD PRODUCTS USING PEARSON DISTRIBUTION SYSTEM AND JOHNSON DISTRIBUTION SYSTEM

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Abstract

To meet the random consumers demand the distributors maintain inventory. For optimal inventory control under random demand it is necessary to know the cumulative distribution function (CDF). The practical determination of CDF is related with a number of difficulties. This paper proposes a way to construct a probability distribution function of demand. Data on weekly sales of over 400 types of food products over a period of five years in a small distribution company were analyzed. The ARIMA model was used for primary analysis of the consumption data. Random variables are modeled using Pearson Distribution System and Johnson Distribution System and can be used to determine inventory management strategies.

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1. Introduction

The goods delivery activity links production and consumption and has an important role in economic life. It contributes to the satisfaction of needs in a suitable and convenient for economic agents way. Companies that produce large quantities of a given product do not have the ability to deliver to every consumer. In such cases, the services of distributors are used, and they play the role of intermediaries between the producer and the aggregate consumer. Goods distribution involves the engagement of human resources, transport costs, costs of temporary storage of goods, etc.

According to APICS Dictionary, cited by Ross (2015) distribution is defined as “the activities associated with the movement of material, usually finished goods or service parts, from the manufacturer to the customer. These activities encompass the functions of transportation, warehousing, inventory control, material handling, order administration, site and location analysis, industrial packaging, data processing, and the communications network necessary for effective management. It includes all activities related to physical distribution, as well as the return of goods to the manufacturer. In many cases, this movement is made through one or more levels of field warehouses.”
Economic activities are regulated by laws and enactments. Some legal definitions can be derived from these sources:

"Food distribution" is any stage of the distribution of food, such as storage, transportation, trade, import and export of food (§1, item 6 of the Additional Provisions of the Food Act, promulgated SG No. 52/09.06.2002).

Producer means an individual or legal entity who, by occupation, produces finished goods, raw materials and components used to produce other goods, or who presents himself as a producer by placing his name, trademark or other distinguishing mark on the goods. A producer is also any person who, by occupation, imports goods in the territory of the European Union for the purpose of sale, rental or leasing, or uses any other form of distribution of goods in the territory of the Union (Article 130, Paragraph 3 of the Consumer Protection Act, promulgated SG No. 99/09.12.2005).

According to aforementioned a food producer is the individual farmer, the agricultural processing enterprise, the bakery, etc. The one who prepares food for home consumption is not a producer.

A distributor or trader is any person, other than a manufacturer, who puts goods into circulation. The distributor participates in the process of selling goods, and his activity does not affect the safety characteristics of the goods (art. 77, para. 2 and art. 130, para. 4 of the Consumer Protection Act, promulgated SG No. 99/09.12.2005).

"Consumer" means the final user of a food product who will not use the food as part of any economic operation or activity related to the food product (§1, item 7 of the Additional Provisions of Ordinance No. 1 of January 9, 2008 on the requirements for trade in eggs, title amended SG No. 94/29.10.2013). Consumers are, for example, the individuals and the households.

In this paper, "distributor" will be understood mainly as a wholesaler. The distributor operates incoming and outcoming material flows. Both types of flows connect the distributor with a large number of partners. This leads to probabilistic consumption.

The aim of this paper is to present an approach to modeling random consumption (a modelling approach to random consumption) using some known probability distribution systems. To achieve it, the following main tasks have been formulated:

1) Creation of probabilistic models of the consumption of different types of food products over time.
2) Assessment of the adequacy of the created models.
3) Assessment of the possibility of using the obtained models in solving the "newsvendor problem".

The object of research is a small food distribution company in the city of Varna. On the basis of real sales data over a period of several years, the consumption of various types of goods was analyzed and conclusions were drawn about the nature of the demand.

In this paper the random variable distribution is obtained using the ARIMA model and Pearson distribution System and Johnson Distribution System.

2. Literature review

According some researchers around half the price paid for a product is adsorbed by the distribution outlay (Dent, 2008). For food products, which are essential goods, the losses from deterioration of quality or from spoilage should be additionally added. Some foods (esp. fresh fruits or vegetables) lose their weight by natural evaporation. Producers, customers and intermediaries participate in distribution activities.

The basic structures for goods distribution systems are shown in Fig. 1:
Fig. 1. Typical distribution structures

Source: (Dent, 2008)

The connections between producers, distributors and consumers are implemented through supply chains. There are different definitions of "supply chain", which do not differ significantly, but complement and extend each other (Blagoeva & Kehayova, 2008).

There are different delivery scenarios (Gruchmann, et al., 2019). The simplest of them is the direct link between producer and consumer (business-to-consumer, b2c). Its application in the field of distribution of food products is possible in the form of farmers' markets, small bakeries, home delivery, etc., i.e. mainly local foods are consumed. In the second and third scenarios, intermediaries are involved between the producer and the consumer, i.e. a business-to-business (b2b) connection is included. These intermediaries can be at several levels: wholesalers (distributors) or retailers (supermarkets, shops, etc.). The presented scenarios may not be in this "pure" form. In many cases, the producer may have a relationship with distributors, retailers, and consumers at the same time.

The processing and distribution of goods are decomposed into separate activities (Christopher, 2011). Many of these add costs but do not add value to the product for the consumer. For example, moving the product from one shelf to another and returning it to the same one or storing it for a long time obviously does not increase its value to the consumer, but is associated with costs. Value addition occurs when a utility is created for which the customer (wholesaler, retailer or consumer) is willing to pay. Such activities, for example, are transportation from the producer to the wholesaler, from the wholesaler to the retailer and from the store warehouse to the shelf. They require costs, but those costs increase the value of the product. Every activity takes time, and ultimately, that time can create value, or it can only increase costs. Time that does not create value can be eliminated or at least reduced without reducing utility for the customer. In Fig. 2 an example diagram of how some activities increase value or only costs is shown.
It can be seen (Fig. 2) that the non-value-added costs are mainly related to the storage of the materials and the finished products. Therefore, rational inventory management is essential to reduce costs.

According to cited researchers an example diagram of incoming and outgoing material flows can be presented (Fig. 3).

The main material flows that should be considered are: 1) from the producers to the distributor; 2) from other distributors to the distributor; 3) from the distributor to the wholesalers. These material flows can be planned with a higher degree of determinism, based on advance requests.

However, there are also material flows that are highly uncertain. It is possible the demand for a product to increase. Retailers will then request an urgent additional delivery (flow 4) that is not pre-planned. In this case, in order to satisfy its customers, the distributor will have to keep additional stocks or request emergency
deliveries (flow 5 and 6) from the producers or from other distributors. It is possible that he himself fulfills urgent requests from other distributors who have fallen into a similar situation. The distributor may sell to consumers whose behavior cannot be predicted (flow 8).

If the distributor limits its activity to managing flows 1-3 only, detailed planning is possible. Then the right kind of products will be delivered at the exact moment of emergence of the need and in the right quantity. This is the ideology of Toyota Motor Co's just-in-time strategy (Ohno, 1988). It implies giving up the creation of material stocks. In this way, losses can be reduced to the possible minimum. The existence of flows 4÷8 does not allow the application of such an approach. In order to compensate the non-deterministic demand and possible delays in supply, it is necessary to maintain stock acting as a buffer (Shenoy & Rosas, 2018). This allows to improve the quality of customer service, whose needs may arise by chance.

One of the main problems is determining the quantity of this stock. On the one hand, it must be large enough to ensure full satisfaction of customer needs. On the other hand, non-deterministic demand may be such that the stock will not be used.

A classic model for inventory control under non-deterministic demand is the Newsboy Model (Axsäter, 2015), also known as the "Newsvendor Problem". Despite being known for a long time, it is current and a number of extensions and applications are being developed on its basis (Choi, 2012).

To apply the model, it is necessary that the consumption cumulative distribution function is known. This is usually difficult to implement. (Nikolaev & Milkova, 2022).

Determining the cumulative distribution function means making a probabilistic forecast of consumption. In many cases consumption is assumed to be some of the known theoretical distributions or a mixture of them. In his monograph, Axsäter assumes that the compound Poisson, compound geometric, compound logarithmic, normal, and gamma distributions are appropriate (Axsäter, 2015). Some researchers report that, in many cases, empirical data does not fit normal distribution (Salnani, 2012). A possible explanation is that one of the conditions for application of the Central Limit Theorem is the independence of the summed random variables. There is also an independence condition for the compound Poisson distribution. But in many cases the behavior of an individual consumer depends on the behavior of others. Then the resulting random variable is a complex function of other random variables.

One approach to determine such a random variable is to observe consumer demand history. Aggregate consumers behavior is assumed to possess a certain inertia. In the field of nutrition, relatively long-lasting traditions have been built up in individual regional consumer groups. It is necessary to determine the length of the observed period (month, week, day) and to determine how far back information will be collected.

The length of the period depends on the nature of the product. If, for example, chilled meat is traded, stocks should be created with a one-day turnover estimate. Stock planning for foods with longer shelf life can be weekly. Stocking up is not appropriate for a longer period (a month) even with conserved food, because financial resources are blocked and storage costs increase.

It is generally considered that the longer consumption is observed, the better. Some researchers recommend 12 to 36 months of follow-up (Thomopoulou, 2015).

Observations distant in time may be related to user behavior that is no longer relevant. For example, the Covid-19 crisis had an impact on consumer behavior (Kurshumov & Radev, 2022), (Dhakal, Acharya, & Wang, 2022) and on the food trade in general (Stefanova, 2022). Consumption in the Varna region was significantly reduced due to the collapse in the number of tourists. It must be concluded that the processing of data distant in the past does not lead to an improvement in the forecast.

Methods of obtaining the distribution law of random variables are proposed by Pearson and Johnson (Pearson, 1895, 1916), (Johnson, Kotz, & Balakrishnan, 1994), (Lahecne, 2013).

The ARIMA model (Box, Jenkins, Reinsel, & Ljung, 2016) is used for collection of statistical data. This model is used by Stoyanov (2022) to forecast retail sales of food products in the Republic of Bulgaria. However he examines the sales in monetary terms within the national economy. In this paper the sales of the quantity of
goods within one company are examined. The goal is not so much to forecast the consumption as to determine the distribution of the random variable, characterizing residuals.

3. Methodology

According to the Newsboy Model consumption is assumed to be a random variable with a known probability distribution function \( F_X(x) \). Losses resulting from unsatisfied demand per product unit \( C_U \) and losses resulting from excess per product unit \( C_O \) are known, too. If the stock quantity is \( S \), the cost function has the form

\[
Z(S) = C_O \int_0^S (x - S) dF_X(x) + C_U \int_0^S (S - x) dF_X(x)
\]

Let the stock quantity, at which the distributor’s costs are the smallest be denoted by \( S^* \). \( S^* \) satisfies the equation:

\[
F_X(S^*) = \frac{C_U}{C_U + C_O}
\]

In cases where the random variable is discrete and the cumulative distribution function is step-like, \( S^* \) is equal to the first admissible value of the random variable for which

\[
F_X(S^*) \geq \frac{C_U}{C_U + C_O}
\]

\( C_U \) and \( C_O \) can be determined through expert evaluation. \( C_U \) depends on the distributor's strategy. If, when the stock is depleted, customer requests are not fulfilled, the amount of losses will be the difference between the purchase and sale price. If requests are satisfied by additional deliveries, costs will be determined by the cost of the additional delivery. \( C_O \) depends on the nature of the product. If it is spoilage resistance, the costs include mainly the storage costs. In the case of perishable products, the partial or full depreciation of the goods is possible.

The quantitative parameters of each system are modeled with appropriate variables. In probabilistic systems, the variables are random. Random variables can be discrete, absolutely continuous, mixed. The general way to specify the manifold of random variables is the cumulative distribution function (Dimitrov & Yanev, 1990) defined in the form

\[
F_X(x) = P(X < x), \quad \text{or}
\]

\[
F_X(x) = P(X \leq x)
\]

In nondeterminism, consumer demand is a random variable. Stock quantity is also a random variable. Such stock is created and consumed over a period of time (for example, a week). The creation is one-time, at the beginning of the period.

Given the above, the following algorithm can be used to accumulate statistical data used to determine the probability distribution function of the individual product.

1) The length of the period for creating stock and its realization is determined.
2) Data are collected on the realization of a given product for a number of past periods. The data is in the form of time series:

\[
Y_1, Y_2, \ldots, Y_t, \ldots, Y_n.
\]

3) The number of periods \( m \) involved in forecasting the consumption in period \( t \) is determined.
4) A forecast function is chosen

\[
\hat{Y}_t = f(Y_{t-1}, Y_{t-2}, \ldots, Y_{t-m}).
\]
and a forecast is determined for every $t = m + 1, m + 2, \ldots, n$.

5) The residuals of forecast are calculated

$$e_t = Y_t - \hat{Y}_t, \quad t = m + 1, m + 2, \ldots, n$$

(8)

6) Based on the residuals (8), the distribution of the random variable $X_e$ is obtained.

Now the random variable of the consumption for each period can be determined

$$X_t = \hat{Y}_t + X_e, \quad t = m + 1, m + 2, \ldots, n$$

(9)

After determining the distribution function, formulas (1) ÷ (3) can be used.

In this study, the ARIMA model is chosen as a forecast function.

Some distribution systems can be used to determine the distribution function, for example the systems proposed by Karl Pearson and Norman L. Johnson.

The Pearson Distribution System (Pearson Curves) was developed at the end of the 19th century by Karl Pearson and initially included five types of distributions. Subsequently, the family of distributions was expanded to 12 types. Some of the Pearson curves are the well-known absolutely continuous distributions (beta distribution, gamma distribution, normal distribution, etc.).

The family of Johnson distributions is based on transformations bringing the family curves to a normal distribution.

Both families of curves represent absolutely continuous distributions. Food stock quantities can be integers or multiples of integer (depending on the units per package). Approximation of discrete distributions by continuous ones is associated with inaccuracies. For some of the widely known discrete distributions, sufficiently accurate approximation methods have been developed (Johnson, Kemp, & Katz, 2005). Observed empirical data may differ from known distributions. In such a case, further verification with an appropriate statistical test for the adequacy of the chosen modeling curve is required.

The choice of a modeling curve can be done in several ways. One of them is the method of moments. Pearson proposed to evaluate the mathematical expectation, variance, skewness and kurtosis of the empirical data, based on these estimates to choose the appropriate type of curve and to determine its parameters. In non-normal distributions, this method leads to inaccuracies (Ord, 1972). More accurate results are given by the methods of maximum likelihood or ordered statistics, which, however, are algorithmically more difficult. With the development of modern software and hardware this problem is easily solved.

4. Results

The weekly sales were observed for the period 2017-2021. Over the years, the company worked with 1000-1500 corporate clients and with individuals, whose number was not reported. The total number of items sold is 2068. The crisis caused by the Covid-19 pandemic took place within the research period.

The demand of large part of the items is accidental, i.e. there are many periods during which the demand is zero. Items for which consumption was reported in more than half of the weeks over the five observed years were examined. Their number is 403 in total.

The consumption of each product by week is represented by time series of 261 items. For all weeks numbered 51, 52, ..., 261, forecasts are made with the ARIMA models, taking into account previous consecutive observations of length 5, 10, 20, 30, 40 and 50 weeks. The R language for statistical computing and graphics with the additional package Forecast was used. The models were built with the auto.arima function, and the forecasts for one period ahead – with the forecast function (Hyndman, et al., 2023).

For all models generated by time series of the same length (5, 10, 20, 30, 40 and 50), the residuals of the forecast from the actual reported values were calculated. Sets of residuals are obtained. Every set can be denoted by $R_{A,N}$, i.e. set of residuals for a product $A$, obtained by time series of length $N$. 

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Every $R_{A,N}$ was tested with the Shapiro–Wilk test (with the Royston extension) under the null hypothesis that the population has a normal distribution and significance level $\alpha = 0.05$. The results are shown in Table 1.

### RESULTS

from assessing the normality of residuals of observed data from the forecasting ones

*(Shapiro-Wilk test, significance level $\alpha = 0.05$)*

<table>
<thead>
<tr>
<th>$R_{A,N}$</th>
<th>$R_{A,5}$</th>
<th>$R_{A,10}$</th>
<th>$R_{A,20}$</th>
<th>$R_{A,30}$</th>
<th>$R_{A,40}$</th>
<th>$R_{A,50}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tested products</td>
<td>403</td>
<td>403</td>
<td>403</td>
<td>403</td>
<td>403</td>
<td>403</td>
</tr>
<tr>
<td>There is no reason to reject null hypothesis</td>
<td>28</td>
<td>34</td>
<td>27</td>
<td>36</td>
<td>32</td>
<td>32</td>
</tr>
<tr>
<td>There is a reason to reject null hypothesis</td>
<td>375</td>
<td>369</td>
<td>376</td>
<td>367</td>
<td>371</td>
<td>371</td>
</tr>
</tbody>
</table>

*Source: Author’s compilation, 2022*

It can be seen that, as a general rule the residuals are not normally distributed. For modeling distributions of residuals from forecasts, it is appropriate to use families of distributions. Such modeling was carried out using the following methods:

- With the Pearson Distributions System with the method of moments (PM).
- With the Pearson Distributions System with the maximum likelihood estimation (PML).
- With the Johnson Distributions System with ordered statistics (JOS).

Modeling was performed with the PearsonDS and SuppDists packages in the R language (Becker & Klößner, 2022), (Wheeler, 2022).

For each $R_{A,N}$, an attempt was made to fit models of the types PM, PML, and JOS. It is noted that for some of them this cannot be fulfilled. Successfully created models were checked for goodness-of-fit with observed empirical data. The Kolmogorov-Smirnov test was used with the null hypothesis that the given residuals have the same distribution as a created model with significance level $\alpha = 0.05$.

The data on the results of the creation and verification of the models are shown in Table 2. The total result is not a sum, but union of the results for the individual models and time series lengths.

### RESULTS

of assessment of model adequacy (existing a model, goodness-of-fit using Kolmogorov-Smirnov test, significance level $\alpha = 0.05$)

<table>
<thead>
<tr>
<th>$R_{A,N}$</th>
<th>$R_{A,5}$</th>
<th>$R_{A,10}$</th>
<th>$R_{A,20}$</th>
<th>$R_{A,30}$</th>
<th>$R_{A,40}$</th>
<th>$R_{A,50}$</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tested products</td>
<td>403</td>
<td>403</td>
<td>403</td>
<td>403</td>
<td>403</td>
<td>403</td>
<td>403</td>
</tr>
<tr>
<td>PM model</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Non existing model</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>
There is a reason to reject null hypothesis for some of the products, only one of the theoretical models passed the goodness-of-fit test. Table 3 provides data for such models.

### Table 3

**NUMBER OF PRODUCTS**

for which only one of the theoretical models pass goodness-of-fit test for $R_{A,N}$

<table>
<thead>
<tr>
<th>Type of model</th>
<th>$R_{A,5}$</th>
<th>$R_{A,10}$</th>
<th>$R_{A,20}$</th>
<th>$R_{A,30}$</th>
<th>$R_{A,40}$</th>
<th>$R_{A,50}$</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>PM model</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>PML model</td>
<td>12</td>
<td>18</td>
<td>15</td>
<td>15</td>
<td>11</td>
<td>8</td>
<td>4</td>
</tr>
<tr>
<td>JOS model</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>0</td>
<td>4</td>
</tr>
</tbody>
</table>

Source: Author’s compilation, 2022

One approximative criterion for assessment of the quality of different models is the value of the D-statistic of the Kolmogorov-Smirnov test. It can be considered that as its value is lower, as the model is better. Table 4 shows the number of best models for each group $R_{A,N}$, distributed by type.
There are isolated cases when two different modelling methods lead to distribution models for a given\textit{R}_{A,N}, where the D-statistic is minimal and the same.

Probabilistic models of consumer demand can be created for all products considered. In most cases (about 80%), the Kolmogorov-Smirnov test shows that the models are adequate. The models of type PML have the best goodness-of-fit. In second place in terms of adequacy are models of type JOS.

### 5. Conclusion

The obtained results give reason to apply the following algorithm. A PML type probabilistic model is constructed and checked for adequacy. If the model satisfies the requirements, it can be used. If the model does not meet the requirements, a JOS type model should be tried. If it also does not satisfy the requirements, a PM type model may be used. If none of the models is adequate, the one for which the D-statistic has a minimum value can be used. In the latter case, it is assumed that the risk of forecast error is great.

Modeling the demand cumulative distribution function of the product enables creation of an inventory management strategy. The newsboy model is one of them. Another possible strategy is, for example, planning and maintaining such quantity of stocks that customers' needs will be fully satisfied with a probability no less than a predetermined one. Such strategy corresponds to the marketing concept, according to which the satisfaction of the customer's needs is placed at the center (Kotler & Armstrong, 2016).

### References


DEMAND AND COMPETITION IN THE RETAIL MARKET OF DIESEL FUEL IN BULGARIA

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JEL: L1

Abstract

The purpose of the article is to evaluate the parameters of demand for diesel fuel by households in Bulgaria, the structure of the retail fuel market and the effectiveness of competition. Based on statistical data, the parameters of the demand function for diesel fuel by households were estimated and the price and income elasticity was determined. Models of market behaviour are applied and theoretical values of equilibrium quantities and prices are estimated. The hypotheses of cartel existence, revenue maximization, competitive market with low market concentration and perfect competition are tested.

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1. Introduction

The increase in fuel prices is being received painfully and with understandable concern by consumers in the EU and especially in Bulgaria, mainly due to the relatively low household incomes. Periodic protests have been calmed by declarations and promises by governments and the initiation of investigations by prosecutors and regulatory institutions. Promises of revelations of cartel agreements between gas station chains and the imposition of penalties have not been realized for more than a decade. The Commission on Protection of Competition (CPC 2017) did not find violations during the inspections of gas station chains and gave contradictory recommendations in its decisions.

The present article aims, based on the Industrial Economy paradigm, to test the hypothesis of the presence of non-competitive behaviour in fuel pricing in the retail market and to offer an adequate explanation of the market situation. A reasonable assumption of a cartel can be made at market prices and sales profitability that are equal to or close to the theoretical levels of monopoly prices and corresponding values of the Lerner index under monopoly. To determine these theoretical values, it is necessary to estimate the demand function, the price elasticity of demand, and the value of the marginal costs of gas stations.

Aggregated annual data on household consumption, average fuel prices and average cash income per household from national statistics were used to estimate the demand function. Data were used on the diesel fuel consumption per 100 households, diesel fuel prices and household incomes for 2012-2021. A linear multiple regression model was used to estimate the demand, the parameters of which were estimated using the method of least squares. The regression model describes the dependence of consumed fuel quantities on households' average prices and monetary incomes.
2. Literature review

On the problems of retail fuel prices, there are numerous publications by researchers from different countries, which are directed in several directions. Chalakova-Todorova (2019) examines the factors of retail fuel pricing related to supply chains, the characteristics of market participants, as well as the influence of EU and Bulgarian legislation. In the publication, direct and indirect factors are highlighted, along with the main price-forming factors, the main competitors behaviour and the demand's price elasticity are indicated. Balke (1998), Clerides (2010) and other authors comment on the relationship between US retail motor fuel prices and oil prices. The analysis emphasizes the propagation of price shocks and the symmetry of the change in retail prices when crude oil prices increase and decrease. The authors point out that the source of asymmetry is the sellers' market power and consumers' costs of price research.

A. Todorov (2019) analyzes the regional market structure and price levels of the fuel market in Bulgaria. A negative correlation was found, albeit weak, between the number of gas stations and the average prices of all types of motor fuels in the individual administrative regions of the country.

Based on several studies of fuel markets in the United States, Great Britain and Canada, Druzic (2018) et al. rate the price elasticity of demand as very low, especially in the short run at -0.26 and in the long run at -0.58. The median income elasticity has a positive value of 0.57. Taghvae (2014), Alves (2003) and Lin (2013) find low price and income elasticities of fuel demand in Iran, Brazil and China.

Nowakowski and Karasiewicz (2016) find a positive relationship between market concentration and fuel retail margins in 24 European Union countries, and this trend is particularly strong in the presence of multinational and vertically integrated companies.

3. Theoretical model

The degree of competition in the diesel fuel market can be determined by comparing the theoretical values of equilibrium prices under different market structures and firm behaviour with actual market prices. Theoretical price values are calculated using the demand function, the assumed market structure and the behaviour of firms. The quantity demanded of diesel fuel is a function of the market price and household income, and the parameter values can be determined by the method of least squares. Hypotheses about market structure and firm behaviour are profit-maximizing cartels, revenue-maximizing cartels, profit maximization in low-concentration markets and perfectly competitive markets.

The effectiveness of competition is assessed by the Lerner index (Elzinga, K., and Mills, D., 2011), and its relationship with the price elasticity of demand and market concentration is explained by Carlton and Perloff (1990).

**Monopoly market**

The monopolist produces and supplies the entire market quantity (Q) by trying to supply the quantity at which it will maximize profit. The monopolist's profit is the difference between revenue, variable and fixed costs and can be represented by the following formula familiar from the microeconomic theory of the firm.

$$\pi = P \cdot Q - c \cdot Q - FC \rightarrow \text{max}$$

It is assumed that the monopolist seeks to maximize profit by restricting supply until the revenue from the final product equals the marginal cost of its production. The optimal quantity for the monopolist can be determined by the quantity at which the first partial derivative of the profit function equals zero:

$$\frac{\partial \pi}{\partial Q} = \frac{\partial P \cdot Q}{\partial Q} + P - c = 0$$

After converting the above equation, we get:

$$-\frac{\partial P \cdot Q}{\partial Q} \cdot \frac{1}{P} = \frac{P - c}{P}$$
The expression on the left is the reciprocal of the price elasticity of demand:

\[- \frac{1}{e} = \frac{P - c}{P}\]

The expression on the right-hand side is the Lerner index, the value of which, according to the equation, is inversely proportional to the price elasticity of demand. On the other hand, the Lerner index is a ratio between the profit (margin) from the sale of a unit of product and the revenue from that sale, or profitability of sales. The equation shows that the monopolist's sales profitability is objectively limited by the price elasticity of demand. From the same equation, it follows that high profitability is possible only in markets with low price elasticity, where consumption shrinks to a lesser extent than the increase in the market price. The low price elasticity is explained by several characteristics of the product and market demand, but mostly by the degree of necessity and urgency of the consumption of the goods, the presence of high market barriers and the lack of close substitute products. Conversely, under perfectly elastic demand (e=∞) the profitability of sales is zero and the minimal increase in price will cause demand for the firm's products to disappear. Theoretically, perfect price elasticity of demand is one of the characteristics of markets with perfect competition, with a homogeneous product, free entry, perfect information, and a large number of sellers and buyers. It can be assumed that the presence of low price elasticity of demand for diesel fuel is a prerequisite for large margins and profitability in an alleged monopolist or cartel.

**Market with n number of firms:**

There are n-number of equal-sized firms in the market that sell equal quantities of a product (Q/n). The profit function for one of the firms can be represented as follows:

\[\pi = P \cdot \frac{Q}{n} - c \cdot \frac{Q}{n} = FC \rightarrow \text{max}\]

\[MR - c = 0\]

Marginal revenues take the following form:

\[MR = \frac{\partial P \cdot Q}{\partial Q} \cdot \frac{1}{n} + P\]

Marginal revenue is substituted into the profit maximization equation:

\[\frac{\partial P \cdot Q}{\partial Q} \cdot \frac{1}{n} + P - c = 0\]

Market power is determined by the price elasticity of demand and the number of firms. Market power increases as the price elasticity of demand decreases and as the number of firms decreases. If firms offer equal quantities, then a firm's market share can be represented as s=1/n.

\[- \frac{1}{e} \cdot s = \frac{P - c}{P}\]

According to the above expression, the profitability of sales (market power) of one of the firms operating in the market is inversely proportional to the price elasticity of demand and directly proportional to the market share. A high market share is the second necessary prerequisite for obtaining monopoly profits.

The industry or market profitability of sales (Lerner index) can be calculated as the weighted average profitability of the sales of the firms operating in the market using their market shares as weights.

\[\text{the } - \frac{1}{e} \cdot \sum s^2 = \frac{P - c}{P}\]

The sum of the squares of the market shares is the market concentration index (Hirschman and Hirschman):  

\[\sum s^2 = \frac{P - c}{P}\]

The market power of firms in a market is determined by the product of the reciprocal of the price elasticity of demand and the market concentration index. The value of the market concentration index HHI can be
calculated as the sum of the squares of the market shares defined as a ratio (0-1) or as a percentage (0-100%). In the first case, the value of the index varies from 0 to 1, and in the second from 0 to 10,000.

In the parasite analysis methodology, the CPC (2009) provides guidance on the relationship between HHI values, the degree of market concentration and market competitiveness. With index values up to 1000 (0.1), the market has low concentration and is defined as competitive. For values between 1000 and 2000 (0.1 – 0.2), the level of concentration is medium and the market is relatively competitive and for values above 2000 (0.2) the concentration is high and the market is weakly competitive. For a market to fall into the first group, the market must have more than 10 companies of the same size, in the second group between 5 and 10 companies, and in the third – less than 5 companies of the same size.

The market power that a firm can exercise is the result of the demand conditions determined by price elasticity, the market structure determined by the firm's market share and the firm's behaviour (profit maximization, market capitalization, revenue maximization).

**A Model of fuel demand and price elasticity**

The fuel demand function is represented by a linear multi-regression model. The dependent variable is the amount in litres of fuel consumed per 100 households. The independent variables are the average annual fuel prices in BGN and the annual income of 100 households.

By definition, demand is a function of product price, prices of substitute goods, and consumer income.

\[ Q_d = f(P, P_i, Y) \]

To the extent that automotive fuels, and diesel in particular, have no close substitutes, demand can be assumed to be a function of fuel prices and household income.

\[ Q_d = a \cdot P + b \cdot Y + \varepsilon \]

Where:
- \( Q_d \) – the amount of demand in litres of diesel fuel per 100 households;
- \( P \) – the price of diesel fuel in BGN per litre;
- \( Y \) – annual monetary income of 100 households in BGN.

The model parameters were estimated using the method of least squares. In the given form of the demand function, the partial derivative of demand with price is equal to the regression coefficient (a).

\[ \frac{\partial Q}{\partial P} = a \]

The value of the price elasticity of demand can be calculated as the product of the regression coefficient and the relationship between price and quantity. The linear demand function is characterized by variable price elasticity, and due to the negative relationship between price and quantity, as price increases, the \( P/Q \) ratio increases, and along with this, the price elasticity of demand increases.

\[ e = a \cdot \frac{P}{Q} \]

From the demand function, the price function (inverse demand function) can be derived.

\[ P = \frac{Q}{a} - \frac{b}{a} \cdot Y \]

**Profit maximization, cartel**

We assume that the hypothesized cartel tries to maximize profit by supplying to the market the quantity at which revenue from the last unit of product sold equals marginal cost. A monopolist's revenue is defined as the product of quantity and price:

\[ TR = P \cdot Q = \frac{Q^2}{a} - \frac{b}{a} \cdot Y \cdot Q \]

Profit can be represented as the difference between income and expenses:
\[ \pi = TR - TC \]

\[ \pi = \frac{Q^2}{a} - \frac{b}{a} \cdot Y \cdot Q - c \cdot Q - FC \]

The quantity at which the monopolist maximizes profit is:

\[ Q_m = \frac{a \cdot c + b \cdot Y}{2} \]

and the monopoly price will be:

\[ P_m = \frac{c}{2} - \frac{b \cdot Y}{2a} = 1/2 \cdot (c - \frac{b \cdot Y}{a}) \]

The behaviour of firms (supply) under perfect competition

In perfectly competitive markets, firms make no economic profit and the price is equal to the marginal cost. With a linear demand function and constant marginal cost, the market equilibrium under perfect competition will be established at twice the monopoly quantities.

\[ Q_c = a \cdot c + b \cdot Y \]

Profit maximization in an n-firm market

Supply in a market with n number of firms can be derived from the Cournot model, in which firms try to maximize profits by accepting competitors' supply permanently. The result of such behaviour is a partition of the market without the need for negotiation, and the market quantity is determined by the number of firms. In this market model, n-firms that independently maximize profits will produce \( n/(n+1) \) of the equilibrium quantity under perfect competition (Carlton, D., Perloff, J., 1990, p.267). So, for example, a monopolist offers \( \frac{1}{2} \) of the competitive quantity, a duopoly offers \( \frac{2}{3} \), three firms \( \frac{3}{4} \), and so on.

\[ Q_n = \frac{n}{n + 1} \cdot Q_c \]

If we assume that firms offer the same quantities and in the above formula we replace n with 1/HHI, then the supply at the corresponding degree of market concentration will be:

\[ Q_{HHI} = \frac{1}{HHI + 1} \cdot Q_c \]

The above formula makes it possible to estimate the market supply according to the degree of market concentration defined by the CPC methodology. With a low degree of concentration and competitive markets (HHI<1000/0.1), the market quantity under independent profit maximization will be no less than 90.9% of the quantity under perfect competition. In relatively competitive markets with a medium degree of concentration (1000<HHI<2000) the market quantity will be between 83.3% and 90.9% of competitive markets and in weakly competitive markets with high concentration (HHI>2000), the market quantity will be between 50% and 83.3% of the competitive amount.

Revenue maximization, cartel

Revenue maximization is an alternative strategy by which firms attempt to maximize market share. Baumol's model underlies many studies of oligopoly behaviour (Amihud and Jacob, 1979). To follow such a strategy, firms try to increase the quantities sold until the price of the final product drops to zero. Firms will make profits if the average cost of quantities sold exceeds marginal cost or losses at prices below cost. The implementation of the strategy in the second case depends on the ability of the trader to absorb the potential losses for a certain period.

\[ \frac{\partial TR}{\partial Q} = \frac{2 \cdot Q}{a} - \frac{b}{a \cdot Y} = 0 \]

\[ Q = \frac{b}{2 \cdot Y} \]
According to the above formula, the revenue-maximizing supply is determined only by the parameters of the demand function and will be equal to half the demand at a market price equal to zero.

Statistics and results

Table 1 presents statistics on annual diesel fuel consumption in litres, cash income per 100 households and the average price of diesel fuel per litre for the period 2012-2021.

<table>
<thead>
<tr>
<th>Year</th>
<th>Diesel fuel litres</th>
<th>Price</th>
<th>Cash income</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012</td>
<td>2577.9</td>
<td>2.62</td>
<td>1003700</td>
</tr>
<tr>
<td>2013</td>
<td>3337.8</td>
<td>2.61</td>
<td>1122400</td>
</tr>
<tr>
<td>2014</td>
<td>3860.9</td>
<td>2.51</td>
<td>1148900</td>
</tr>
<tr>
<td>2015</td>
<td>5398.1</td>
<td>2.20</td>
<td>1172300</td>
</tr>
<tr>
<td>2016</td>
<td>6630.1</td>
<td>1.92</td>
<td>1196600</td>
</tr>
<tr>
<td>2017</td>
<td>7269.4</td>
<td>2.02</td>
<td>1269700</td>
</tr>
<tr>
<td>2018</td>
<td>8459</td>
<td>2.17</td>
<td>1328600</td>
</tr>
<tr>
<td>2019</td>
<td>9146.8</td>
<td>2.22</td>
<td>1422500</td>
</tr>
<tr>
<td>2020</td>
<td>8844.1</td>
<td>1.96</td>
<td>1497700</td>
</tr>
<tr>
<td>2021</td>
<td>8864.3</td>
<td>2.15</td>
<td>1601500</td>
</tr>
</tbody>
</table>

The annual consumption per 100 households during the period 2012-2021 ranges from 2577.9 to 9146.8 litres with the highest value in 2019 and lower consumption in the following two years due to the covid 19 pandemic. The average annual consumption for the period is 6438.8 litres, with a standard deviation of 2367.7.

Diesel fuel prices range between BGN 1.92 and BGN 2.62/l, with the highest values recorded in the first three years of the research period. The average price is BGN 2.238/l, and the standard deviation is 0.245.

The cash income of 100 households increased from BGN 1,003,700 to BGN 1,601,500 with an average value of BGN 1,276,390 and a standard deviation of BGN 176,159.

Table 2

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Diesel fuel</th>
<th>Price</th>
<th>Cash income</th>
</tr>
</thead>
<tbody>
<tr>
<td>Min</td>
<td>2577.9</td>
<td>1.92</td>
<td>1003700</td>
</tr>
<tr>
<td>Max</td>
<td>9146.8</td>
<td>2.62</td>
<td>1601500</td>
</tr>
<tr>
<td>Average</td>
<td>6438.84</td>
<td>2.238</td>
<td>1276390</td>
</tr>
<tr>
<td>St. dev.</td>
<td>2367.7</td>
<td>0.245</td>
<td>176159</td>
</tr>
</tbody>
</table>

Source:own calculations
Estimation of demand and price elasticity

Fuel demand was estimated using a linear two-factor regression model. The dependent variable is the amount of diesel fuel consumed per 100 households in litres, the independent variables are the average annual fuel prices in BGN and the average annual income of 100 households.

\[ Q_d = a \cdot P + b \cdot Y \]

Where:
- \( Q_d \) – the amount of demand in litres of diesel fuel per 100 households;
- \( P \) – the price of diesel fuel in BGN per litre;
- \( Y \) – annual monetary income of 100 households in BGN.

The model parameters were estimated using the method of least squares.

### Table 3

<table>
<thead>
<tr>
<th>Regression Statistics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Multiple R</td>
</tr>
<tr>
<td>R Square</td>
</tr>
<tr>
<td>Adjusted R Square</td>
</tr>
<tr>
<td>Standard Error</td>
</tr>
<tr>
<td>Observations</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Coefficients</th>
<th>Standard Error</th>
<th>t Stat</th>
<th>P-value</th>
<th>Lower 95%</th>
<th>Upper 95%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Price</td>
<td>-2894.54</td>
<td>520.9514</td>
<td>-5.55626</td>
<td>0.000537</td>
<td>-4095.86</td>
</tr>
<tr>
<td>Cash income</td>
<td>0.010112</td>
<td>0.00091</td>
<td>11.1092</td>
<td>3.85E-06</td>
<td>0.008013</td>
</tr>
</tbody>
</table>

Source: own calculations

The regression model (Table 3) explains over 86% of the variation in diesel consumption. Regression coefficients are statistically significant at the 95% confidence interval.

According to the results of the regression analysis, an increase in the price of diesel fuel by BGN 1 is expected to reduce the consumption of 100 households by 2,894 liters. The price elasticity of demand can be calculated by multiplying the regression coefficient by the price and dividing it by the quantity consumed in the corresponding year.

\[ Qd = -2894.54 \cdot P + 0.010112 \cdot Y \]

At the same time, the demand function changes as household income (\( Y \)) increases. The regression dependence shows that other things being equal, the demand for fuels will increase by approximately one litre for every one hundred BGN increase in the annual monetary income.
The demand function estimated as a dependence between price and quantity at a fixed household income for 2021 has the following form:

\[ Q_d = 16194.4 - 2894.5 \cdot P \]

The price elasticity of demand is defined as the partial derivative of demand with respect to price (the regression coefficient) multiplied by the relationship between market price and quantity:

\[ e = -2894.5 \cdot \frac{P}{Q} \]

The linear form of the demand function implies a variable price elasticity, the value of which increases with an increase in price and a corresponding decrease in the quantity demanded, due to an increase in the P/Q ratio, which is also seen in the following table. Based on the parameters of the regression model, at the level of household income in 2021, the values of demand and price elasticity were calculated for fuel prices in the range of BGN 1.50 to BGN 4.50 per litre.

**Table 4**

<table>
<thead>
<tr>
<th>Price</th>
<th>Demand</th>
<th>Price elasticity</th>
<th>Price</th>
<th>Demand</th>
<th>Price elasticity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.50</td>
<td>11853</td>
<td>-0.366</td>
<td>3.10</td>
<td>7221</td>
<td>-1.243</td>
</tr>
<tr>
<td>1.60</td>
<td>11563</td>
<td>-0.401</td>
<td>3.20</td>
<td>6932</td>
<td>-1.336</td>
</tr>
<tr>
<td>1.70</td>
<td>11274</td>
<td>-0.436</td>
<td>3.30</td>
<td>6642</td>
<td>-1.438</td>
</tr>
<tr>
<td>1.80</td>
<td>10984</td>
<td>-0.474</td>
<td>3.40</td>
<td>6353</td>
<td>-1.549</td>
</tr>
<tr>
<td>1.90</td>
<td>10695</td>
<td>-0.514</td>
<td>3.50</td>
<td>6064</td>
<td>-1.671</td>
</tr>
<tr>
<td>2.00</td>
<td>10405</td>
<td>-0.556</td>
<td>3.60</td>
<td>5774</td>
<td>-1.805</td>
</tr>
<tr>
<td>2.10</td>
<td>10116</td>
<td>-0.601</td>
<td>3.70</td>
<td>5485</td>
<td>-1.953</td>
</tr>
</tbody>
</table>
With an average price of diesel fuel for 2021 of BGN 2.15 and fixed cash income of households as of 2021, the demand function is:

\[
Q_d = 16194.4 - 2894.5 \cdot P = 9971
\]

The value of the price elasticity of demand at the given price and quantity is -0.62.

\[
e = -2894.5 \cdot \frac{2.15}{9971} = -0.62
\]

Inelastic demand can be explained by the lack of substitutes for diesel fuel. The calculated data in table 4 show that the demand has unit elasticity at a diesel fuel price of about BGN 2.80 per litre and is inelastic at lower prices.

**Behaviour of companies**

The market behaviour of firms can be judged on the basis of the level of current market prices compared to theoretical price levels when following different strategies by firms. The hypotheses that can be tested are about:

- maximizing profits by forming a cartel;
- maximizing revenue by forming a cartel;
- independent (uncoordinated) maximization of individual profits;
- acceptance of the market price (market with perfect competition).

**Market Structure and Market Behaviour in 2022**

*Cartel, profit maximization*

The existence of monopoly power and its use by the would-be monopolist or cartel can be tested by comparing market prices and quantities with monopoly prices. Since the quantities for the current (2022) year are not known, a comparison can be made between current prices and the prices at which the monopolist (cartel) would maximize profits. The monopoly price can be calculated from the inverse demand function at the cartel's profit-maximizing quantity.

The price function (inverse demand function) can be derived from the demand function:

\[
Q = 16195 - 2895 \cdot P
\]

\[
P = 5.59 - 0.345 \cdot Qk
\]

Where: Qk is the quantity in thousands of litres.

By 2022 the monetary income of a family for the last four quarters is BGN 18,386, therefore the demand function would change to:
To maximize profit, the monopolist supplies a quantity at which marginal revenue (MRm) equals marginal cost. Marginal revenue is the partial derivative of the demand function with respect to quantity, and the monopolist's revenue function is obtained by multiplying the market price by the sales quantity:

\[ TRm = P \cdot Q = 6.42 \cdot Qk - 0.345 \cdot Qk^2 \]

The wholesale price of diesel fuel, which as of the date of the study was BGN 2.94 per litre, was taken as the value of the marginal costs.

\[ MRm = 6.42 - 2 \cdot 0.345 \cdot Qk = c = 2.94 \]

![Figure 2. Market equilibrium under cartel, competitive market, perfect competition 2022.](image)

Solving the above equation determines the quantity at which the potential cartel will maximize profits, which in this particular case is at a quantity of 5,043 litres per year per 100 households. With this monopoly quantity, the market price should reach BGN 4.68 per litre.

\[ Q_{km} = \frac{6.42 - 2.94}{2 \cdot 0.345} = 5,043 \]

\[ Pm = 6.42 - 0.345 \cdot 5,043 = 4.68 BGN/l. \]

Profit maximization is illustrated by point M in Figure 2.

Learner index value is 0.372.

**Cartel, revenue maximization**

A possible cartel would maximize revenue (point TR in Fig.2) when it sells (offers) the last product where the increase in revenue (marginal revenue) will be equal to 0.

\[ MRm = 6.42 - 2 \cdot 0.345 \cdot Qk = 0 \]

\[ Qk = \frac{6.42}{2 \cdot 0.345} = 9,304 \text{ л.} \]
With this quantity, the equilibrium market price will be BGN 3.21/l: 
\[ P(\text{maxTR}) = 6,42 - 0,345 \cdot 9,304 = 3,21 \text{ лв.} \]
In a perfectly competitive market (point C in Fig. 2), the market price will be equal to the marginal cost (BGN 2.94), and the market quantity will be twice the monopoly quantity.
\[ P = 6,42 - 0,345 \cdot 2,94 \\
Q_k^c = \frac{6,42 - 2,94}{0,345} = 10,09 \text{ litre} \]
The return on sales for such market behaviour is 0.092.

A competitive market with a low level of concentration

A study by A Todorov (2019) defines the retail fuel market in Bulgaria as a market with a low and medium degree of concentration according to the criteria of the methodology of the Commission for the Protection of Competition. The calculated Hirschmann and Hirschman index for regions in Bulgaria ranges from 509 for the Stara Zagora region to 1456 for the Vidin region, with a mean of 814, a median of 792, and a standard deviation of 254.

The market quantity that traders would offer in a competitive market with concentration HHI=0.814 (point 814 in fig.2) is 9.33 thousand litres. per 100 households:
\[ Q_{\text{HHI}} = \frac{1}{0,0814 + 1} \cdot 10,09 = 9,33 \]
The equilibrium price for this quantity is BGN 3.20:
\[ P(\text{HHI}=0.814) = 6,42 - 0,345 \cdot 9,33 = 3,20 \text{ BGN} \]
This price is just over 2% higher than the average market price for 2022 \(^1\). The price elasticity of demand is -0.996 and the value of Learner’s index is 0.082, which indicates a low degree of market power.

Figure 3 illustrates the relationship between price, revenue and profits of an alleged cartel, determined based on the consumption of 100 households. At an average market price for 2022 of BGN 3.14, the behaviour of an alleged cartel is more revenue-maximizing than retailer profit-maximizing.

\(^1\) Data at www.fuelo.bg
The data from the analysis of the various hypotheses for the competitive behaviour of retailers in the diesel fuel market before 2022 are summarized in Table 5:

Table 5

<table>
<thead>
<tr>
<th>Hypotheses</th>
<th>Equilibrium price</th>
<th>% of the average price</th>
<th>Learner Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cartel</td>
<td>4.68</td>
<td>149%</td>
<td>0.372</td>
</tr>
<tr>
<td>Maximize revenue</td>
<td>3.21</td>
<td>102.3%</td>
<td>0.092</td>
</tr>
<tr>
<td>A competitive market with low concentration</td>
<td>3.20</td>
<td>102%</td>
<td>0.082</td>
</tr>
<tr>
<td>Perfectly competitive</td>
<td>2.94</td>
<td>94%</td>
<td>0</td>
</tr>
<tr>
<td>Average market price *</td>
<td>3.14</td>
<td>100%</td>
<td>0.064</td>
</tr>
</tbody>
</table>

Source: Own calculations, fuelo.bg

Closest to the 2022 average market prices are the equilibrium prices of the low-concentration competitive market models (+2%) and cartel revenue maximization (+2.3%), followed by the perfectly competitive market (-6%). The most distant in terms of prices is the assumption of a cartel (+49%), making it also the least likely.

The presence or absence of monopoly power and monopolistic practices in diesel retail, apart from price levels, can also be assessed by the value of the Lerner index, which is 0.064 at current market prices and theoretical values 0.082 at a competitive market, 0.092 under revenue maximization and 0.372 under a cartel.

Market structure and behaviour of companies in 2021.
In the test for a competitive market in 2021, both the equilibrium prices in the various market behaviour
models can be compared with the averages for the year and the equilibrium quantities with those reported by the statistics.

Table 6

Hypotheses for market structure and company behaviour 2021.

<table>
<thead>
<tr>
<th>Market Structure and behaviour hypothesis</th>
<th>Quantity thousand l.</th>
<th>% of the actual quantity</th>
<th>Equilibrium price</th>
<th>% of the average price</th>
<th>Learner Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cartel</td>
<td>5,172</td>
<td>58%</td>
<td>3.81</td>
<td>177%</td>
<td>0.470</td>
</tr>
<tr>
<td>Maximize revenue</td>
<td>8,097</td>
<td>91%</td>
<td>2.80</td>
<td>130%</td>
<td>0.279</td>
</tr>
<tr>
<td>Competitive market</td>
<td>9,566</td>
<td>108%</td>
<td>2.29</td>
<td>107%</td>
<td>0.118</td>
</tr>
<tr>
<td>Perfect competition</td>
<td>10,345</td>
<td>117%</td>
<td>2.02</td>
<td>94%</td>
<td>0</td>
</tr>
<tr>
<td>Statistics *</td>
<td>8,864</td>
<td>100%</td>
<td>2.15</td>
<td>100%</td>
<td>0.06</td>
</tr>
</tbody>
</table>

Source: own calculations and NSI

Table 6 shows the results for the equilibrium quantities and prices for the investigated variants of market behaviour. The values are compared with statistical data on quantities and market prices published by NSI. In terms of equilibrium quantity, the closest to the actual data are the competitive market model (+8%) and revenue maximization (-9%). The remaining assumptions are respectively +17% for a perfectly competitive market and -42% for a cartel.

Regarding the equilibrium price, the closest to the average price reported by NSI are the assumptions for a perfectly competitive market (-6%) and a competitive market (+7%). The other two guesses are at +30% for revenue maximization and +77% for cartel, respectively.

The theoretical value of the Learner index in a competitive market is closest to the calculated value in the 2021 statistics.

The analyzes made and comparisons between the theoretical value of the prices at the actual concentration levels with the current market prices, confirm the conclusions of the economic models that the retail market prices of diesel fuel are most likely the result of independent actions of traders to maximize individual profits in the conditions in a competitive (HHI=814) market and not by entering into prohibited agreements (cartel) to extract monopolistically high profits. A possible revenue-maximizing cartel would achieve the same prices as a competitive, profit-maximizing market, so it is unlikely.

Anomalies in retail prices may possibly result from market structures or non-competitive behaviour of companies involved in fuel distribution, production or crude oil markets.

Conclusion

Based on information from national statistics, a two-factor regression model was applied, in which statistically significant parameters of the demand for diesel fuel by households were estimated as a function of the price of monetary income. The price elasticity of demand and the values of the equilibrium quantities and prices have been determined under the hypotheses of 1. a profit-maximizing cartel; 2. a revenue-maximizing cartel; 3. independent behaviour of traders in a competitive market with a low degree of market concentration; 4 perfectly competitive market. The conclusions drawn regarding the market structure and behaviour of retailers in the household diesel fuel market are substantiated by comparing the theoretical values of equilibrium prices, quantities of fuels consumed and the Learner index under different models of market structure and behaviour with the statistical data of quantities and prices for 2021. and average prices for 2022.
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