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Abstract
Identifying the intersection between digital finance, green finance and social finance is important for promoting sustainable financial, social and environmental development. This paper suggests a link between digital finance, green finance and social finance. Using a simple conceptual model, I show that digital finance offers a smooth, efficient and seamless channel for individuals and corporations to fund social projects that deliver a social dividend, and green projects lead to a sustainable environment. The implication is that digital finance is both an enabler and a channel for efficient green financing and social financing.
INTRODUCTION

This paper analyses the link between digital finance, green finance and social finance. Recently, some proponents of digital finance have argued that the transfer of funds for all types of expenditure should be achieved using digital finance channels and products, while proponents of social finance want funds to be channeled to all activities or projects that deliver a social dividend to members of society.

Proponents of green finance are promoting green finance as a permanent solution for environmental sustainability. They have two major arguments. The first argument is that if policy makers enforce policies that prevent financial institutions and investors from financing firms whose activities or projects harm the environment, then such firms will discontinue harmful activities and projects that harm the environment and pursue activities and projects that protect the environment for the greater good of society. The second argument is one that does not require government policy intervention. Rather, it encourages investors to divest from firms whose activities harm the environment and channel their equity capital to firms whose activities or projects protect the environment in a sustainable way, which acts as a way for investors to show their support for green investing and environmental sustainability.

Various types of funds transfer are performed on a day-to-day basis through digital finance products and channels. But the extent to which green finance and social finance can benefit from the recent proliferation of digital finance have not been explored in the literature. Also, the extent to which digital finance can help to increase or reduce the volume of funding that goes to social projects and green projects – is another question yet to be explored. So far, the finance literature has not examined the link between digital finance, green finance and social finance. This paper attempts to fill these gaps in the literature.

Given the relatively large array of literature on digital finance and the relatively low level of literature on green finance and social finance, it is important to understand the link between digital finance, social finance and green finance because it can offer some insights to synthesize the three literatures into one, and can help us determine whether there are synergistic benefits associated with promoting digital finance, social finance and green finance all at the same time.

This paper argues that digital finance products, proxy by financial innovations such as bank apps, crowd funding apps, online banking and other financial innovations, can act as effective conduits to facilitate the financing of social projects or green projects through voluntary donations or private funding commitments.

This study makes two contributions to the literature. One, this paper contributes to the literature by proposing a simple framework that links digital, green and social finance together for sustainable development. It contributes to the conceptual understanding of financial innovations by developing a framework that links digital finance, social finance and green finance. Two, this study extends the recent literature on green finance by identifying another important factor that encourages investment in green projects. In this paper, based on the conceptual model, I argue that digital finance can be used to channel funds to social projects and green projects, which in turn leads to greater social dividends and environmental sustainability.

The rest of the paper is structured as follows. Section 2 presents the literature review on digital finance, green finance and social finance. Section 3 discuss the conceptual model. Section 4 concludes.

LITERATURE REVIEW

This section reviews the literature on digital finance, social finance and green finance in relation to sustainable development. It begins with the definition of each concept, and then reviews the literature.

DIGITAL FINANCE

Digital finance is defined as ‘financial services delivered through mobile phones, personal computers, the internet or cards linked to a reliable digital payment system’ (Ozili, 2018, p. 330). The goal of digital finance is to contribute to efficient financial intermediation (Motsi-Omoijiaide, 2018; Ozili, 2019), greater financial inclusion (Ozili, 2018; Arabehety et al., 2016), poverty reduction (Wang & He, 2020; Ozili, 2020a), financial stability and sustainable development (Nguyen, 2016; Afzal, 2017).

The benefits of digital finance are enormous. They include: greater financial inclusion, expansion of formal financial services to non-financial sectors, the provision of affordable, convenient and secure banking services to poor individuals in developing countries, increase in gross domestic product (GDP) and greater macroeconomic stability (see Ketterer, 2017; Ozili, 2018; Parada
levels, reduce income disparities in the long run, help that social finance can help decrease unemployment everybody will benefit financially. Rexhepi further suggests to better manage poverty, encourage taking care of the environment, and redirect societal effort towards social innovation. Moore et al (2012) show that significant barriers and disincentives exist within the current mainstream, economic system that limit the channeling of private capital into innovative social projects, products or processes while Myers and Conte (2013) state that a major challenge to social finance is the need to balance social and financial goals and manage this tradeoff effectively.

**Social finance**

Social finance is the deliberate and intentional application of tools, instruments, and strategies to channel capital to activities that deliver a social dividend to society. Social finance can also be viewed as an approach to managing money that combines economic profits with a social dividend. Social finance is a concept used to describe lending to companies and investment into companies who consider themselves social enterprises, charities, co-operatives and non-profit. Social finance is a term used to describe the phenomenon where corporate profits are used for lending or investment in companies who consider themselves social enterprises, and non-profit organisations.

Cornée et al., (2018) show how the social contribution made by financial institutions depends on their funders’ return requirements. They show that funders will sacrifice their financial return to achieve a much higher social return, and that social screening is necessary to attract social funders that will trade their financial benefits for greater social return or outcomes. Cooper et al., (2016) state that investors with varying degree of interest in social return will adjust their portfolio in ways that maximizes both the financial and social return expectations of investors. In relation to poverty, Rexhepi (2016) argue that the best way to deal with poverty is through ‘social finance’ which is designed to help economies create situations where everybody will benefit financially. Rexhepi further suggest that social finance can help decrease unemployment levels, reduce income disparities in the long run, help to better manage poverty, encourage taking care of the environment, and redirect societal effort towards social innovation. Moore et al (2012) show that significant barriers and disincentives exist within the current mainstream, economic system that limit the channeling of private capital into innovative social projects, products or processes while Myers and Conte (2013) state that a major challenge to social finance is the need to balance social and financial goals and manage this tradeoff effectively.

**Green finance**

Green finance is an approach to managing money that combines economic profits with environmental protection. It emphasizes financing or investing in projects that yield economic benefits while promoting a sustainable environment. The motivation for green finance is either financial incentive, or a desire to preserve the planet, or a combination of both (Wang & Zhi, 2016). Green finance has attracted a lot of attention in the recent policy literature while gaining only limited attention in mainstream finance journals (see, Zhang et al., 2019; Ehlers & Packer, 2017; Falcone & Sica, 2019).

Sachs et al. (2019) emphasize the need for greater investment in green project financing, particularly those that provide environmental benefits for sustainable development, and this can be achieved using new financial instruments and new policies such as green bonds, green banks, carbon market instruments, fiscal policy, green central banking, financial technologies and community-based green funds, which are collectively known as green finance. To encourage private investors to participate in green financing, Taghizadeh-Hesary and Yoshino (2019) suggest that green credit guarantee schemes (GCGSs) and some type of tax rebate should be granted to investors that participate in green investment.

A major challenge to green financing is its inability to attract private participation from investors. Investors have little interest in green projects due to the low rate of return on green investments. Sachs et al. (2019) argue that financial institutions show more interest in financing fossil fuel projects than green projects mainly because there are several risks associated with green projects and they offer a low rate of return. The difficulty in attracting private investors green projects has led to calls for the government, and its agencies, to get directly involved in promoting green finance such as the Central Bank and other public investment agencies.
Volz (2017) suggests ways in which governments, through the Central Bank, can influence the investment and credit allocation decisions of financial institutions towards green investments. They suggest that the Central Bank can enforce additional disclosure requirements, climate-related stress testing and differential capital requirements for climate change.

**Conceptual model: Linking digital, social and green finance**

**A Foundation**

In recent years, ‘mainstream finance’ has been overtaken by ‘digital finance’. Digital finance exists through financial innovations such as the use of artificial intelligence in finance, web-based fintech platforms, mobile phone platforms, block chain or distributed ledger technology and the Internet of Things (IoT). Another emerging theme is ‘sustainable finance’ which emphasizes the use of finance for activities that promote sustainability in the environment and society. Intuitively, social and environmental sustainability can be achieved through digital finance. But for this to happen, the three major areas of finance need to be connected: namely, mainstream finance, digital finance and sustainable finance. This proposed connection, as shown in Figure 1, is important because it is the only way by which digital finance can promote investment and funding for green projects and social projects. Although digital finance has its risk and may create new risks and unintended consequences, there is some optimism that the benefits of digital finance will outweigh the associated risks.

Figure 1: Conceptual framework

![Figure 1: Conceptual framework](source: Author’s elaboration)

**Linking digital, social and green finance**

The conceptual framework for the relationship between digital finance, green finance and social finance is presented in Figure 2. To summarize, the framework shows that social finance and green finance are a component of development finance while digital finance innovations can facilitate the funding of development projects such as green projects and social projects.

Let’s turn now to a more detailed analysis of the relationship between digital finance, social finance and green finance. Corporations, individuals and government now have better alternatives to channel funds for business purposes. Digital finance channels offer an efficient, seamless and suitable alternative for transactions involving business finance, corporate finance, public finance and development finance. Regarding development finance, the framework considers green finance and social finance as a component of development finance because the endgame of green and social financing is to improve development outcomes for the benefit of society and the environment. In a nutshell, the conceptual framework proposes that digital finance acts as an enabler of green finance and social finance.
Future studies can offer additional insights about digital finance, social finance and green finance from the perspective of investors, corporation and individuals. Future studies can assess the differences in expectations and the willingness of various stakeholders to engage and collaborate in green and social financing for the purpose of generating higher return and greater social and environmental dividends.

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CONCLUSION

The paper presented a conceptual framework, and suggests a simple interaction between digital finance and green finance and social finance. These three finance concepts – digital finance, social finance and green finance – are hot topics in the international development community. A clear implication of the proposed conceptual framework is that more research is needed to explore how digital finance innovations affect development outcomes. Such research can help to disentangle some more important research and policy questions.

REFERENCES


The Impact of Dieselgate on the Required Rate of Return on Equity of VW, BMW and Daimler

Romana Čižinská, Pavlína Matějková, Pavel Neset

Abstract

Our paper studies the impacts of the Dieselgate scandal on the required rate of return on equity investments into VW, Daimler, and BMW. The object of investigation is the beta coefficient that determines the risk premium in the Capital Asset Pricing Model (CAPM). Our research takes a deep dive into the developments from the turning point of the scandal (the EPA NOTICE 2015) on September 18, 2015 – when a Notice of Violation of the Clean Air Act was issued to Volkswagen by the EPA – to the end of February 2016. This period also covers FORMAL COMMENCEMENT 2016, when the U.S. Department of Justice first sued Volkswagen on behalf of the EPA. The spillover (contagion) effect of fraudulent practices of VW impacted BMW, Daimler and other companies in the industry that share a similar business model and market segment. Our research of historical market betas has not confirmed the expectation that in the context of the Dieselgate scandal the return required on equity investments into VW, Daimler, and BMW would soar. The Dieselgate scandal proves that the reliability of beta estimates is an inverse function of market volatility. Historical market beta is, therefore, not a good estimate of the required rate of return for the companies in question.

JEL classification: D24, G32, O12
Keywords: historical market beta, CAPM model, signaling theory, contagion effect, Dieselgate

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INTRODUCTION

The German automotive industry has a well-documented history and has long held the dominant position in the vertical global production network. Through ownership control in the integrated peripheries (such as Slovakia, Czech Republic, and Hungary), it promotes and controls the focus on high value-added production (Čižinská & Neset, 2020, Gereffi et al. 2005, Pavlínek & Ženka, 2016). Germany’s dominant position through ownership control in the vertical global production network affects the economic performance of many CEE countries. The automotive industry plays a significant role in economic growth of the EU-27 countries – the share of revenues (turnover) generated by automotive companies to GDP of the EU-27 is around 8 – 9% (see Čižinská & Neset, 2020). The revenues generated by the German automotive industry are the largest in the EU region. The success of the German automotive industry is therefore of strategic importance for the European economy; however, the industry faces unparalleled environmental pressures towards sustainability.

Environmental regulation in connection with the automotive industry has a long tradition. The first automobile emissions standards to control pollution from cars were enacted in 1963 in the United States, soon followed by Japan, Canada, Australia, and several European countries. Over time, the regulations have been tightened and have reached a significant degree of convergence between countries. Currently, companies in the automotive industry face unprecedentedly strict regulation that forces them to undergo a painful and expensive transition towards low or even zero emission mobility.

The biggest German automotive companies are Volkswagen Group (further referred as “VW”), Daimler AG (further referred as “Daimler”) and Bayerische Motoren Werke AG (further referred to as “BMW”), and it was cars produced by VW that launched the intensive crusade against the engine of our prosperity and that significantly increased public awareness of environmental challenges in the automotive sector.

On September 18, 2015, the US Environmental Protection Agency (EPA) issued a Notice of Violation of the Clean Air Act to Volkswagen AG, Audi AG, and Volkswagen Group of America, Inc. (collectively “Volkswagen”) – further referred to as “EPA NOTICE 2015”. According to EPA allegations, Volkswagen sold around a half million diesel motor vehicles (model year 2009 to 2016) equipped with “defeat devices” in the form of computer software designed to cheat on federal emissions tests. Diesel engines in these cars could detect when they were being tested and change the performance accordingly to improve the results. The major excess pollutants at issue were nitrogen oxides (NOx), which pose a serious health concern (United States Environmental Protection Agency, 2020). This resulted in a gigantic industrial scandal called Dieselgate (or Emissiongate).

The formal commencement of the issue occurred on January 4, 2016, when the U.S. Department of Justice first sued Volkswagen on behalf of the EPA (further referred to as “FORMAL COMMENCEMENT 2016”). On June 28, 2016, VW agreed to spend up to $10.033 billion on buybacks and owner compensation and $4.7 billion on programs to offset excess emissions and boost clean-vehicle projects (Shepardson, 2016). On January 11, 2017, VW agreed to plead guilty to three criminal charges in the United States courts and pay a $2.8 billion criminal penalty. In separate civil resolutions of environmental, customs, and financial claims, VW agreed to pay $1.5 billion. Six VW executives and managers were also charged over their role in the emissions cheating (United States Department of Justice, 2017). On June 13, 2018 VW agreed to pay a one-billion-euro fine in Germany, admitting its responsibility for the diesel crisis (Agence France-Presse, 2019). In March of 2020, VW said its diesel cheating scandal had cost it 31.3 billion euros ($34.69 bln) in fines and settlements. The total cost of Dieselgate continues to soar, however, and VW expects the cash outflows to last until 2021 (Reuters Staff, 2020).

Dieselgate was primarily VW’s problem, exclusively affecting this company at the outset. However, it has since morphed into a global issue and may have harmed the German (which means European) automotive industry in general as well as the label “Made in Germany” which had always been viewed as a positive expression, the sign of quality and trust (Aichner et al., 2020; Reuters, 2015). VW rivals Daimler and BMW were quick to say that the accusations against VW did not apply to them (Reuters, 2015). However, Daimler and BMW were later accused of similar manipulation issues. In 2019, for example, Daimler recalled hundreds of thousands of Mercedes-Benz diesel vehicles over diesel emission issues. Subsequently, Daimler was fined 870 million euros by German authorities for breaking diesel emissions regulations (Reuters Staff, 2019). In February 2019, it was announced that BMW would be fined 8.5 million euros for administrative lapses after the German luxury carmaker installed the wrong en-
gine management software in 7,965 vehicles, leading to higher emissions (Reuters, 2019).

In April 2019, the European Union Commission accused BMW, Daimler, and Volkswagen Group of colluding to restrict competition on emission-reducing technology in the period from 2006 to 2014.

The Dieselgate scandal has started a worldwide crusade against diesel cars. In December 2016, the mayors of Paris, Madrid, Athens, and Mexico City announced plans to ban diesel cars and vans from their roads by 2025. In May 2018, Hamburg banned diesel vehicles on two busy streets, the first city in Germany to place any kind of ban on diesel vehicles. In total, more than two dozen cities in Europe have announced plans to ban diesel vehicles over the next decade (E360 DIGEST, 2019).

In 2017, for the first time in recent history, more petrol than diesel passenger cars were sold in Europe, a trend which continued in the subsequent years. In 2019, only 30.5% of all new cars registered in the European Union ran on diesel, compared to 52% in 2015 and 49.2% in 2016 (European Automobile Manufacturers Association ACEA, 2020). The problem with CO₂ emissions relates to a loss of interest in diesel cars. Petrol cars have higher consumption resulting in higher CO₂ emissions, creating a paradox in which the fight against emissions actually causes an increase in emissions. EU regulation 2019/631 (European Commission, 2019) sets an EU fleet-wide target of 95 g CO₂/km for the average emissions of new passenger cars. An excess emissions premium is to be imposed on any manufacturer whose average specific emissions of CO₂ exceed the target. The premium accounts to €95 for each CO₂g/km of excess per vehicle registered (whether for new passenger cars or for new light commercial vehicles).

In the following pages, we study the spillover (contagion) effect of the Dieselgate scandal and its impact on the required rate of return on equity investments into VW, BMW, and Daimler. Our research takes a deep dive into the developments from the turning point of the scandal (called EPA NOTICE 2015) on September 18, 2015—when a Notice of Violation of the Clean Air Act was issued to Volkswagen by EPA—to the end of February 2016. This period also covers FORMAL COMMENCEMENT 2016, when the U.S. Department of Justice first sued Volkswagen on behalf of the EPA. Bouzine and Lueg (2020), who conducted the study of how the Dieselgate scandal affected the stock returns of VW and its industry peers, developed a framework that combines two related theories from the school of information economics: agency theory and signaling theory. They assume these two perspectives as necessary to grasp the financial impact of the scandal itself (agency theory) and of its contagion effect (signaling theory). Agency theory discusses the issues in the relationships between principals (owners) and agents (managers) in business organizations. Since the principal is unable to fully control the actions of the agent, moral hazard arises (see Ross, 1973; Mitnick, 1975). Signaling theory is useful to describe behavior when two parties (agents and principals) hold different information bases. One party, the signaler, must choose whether and how to signal (communicate) the information to the other party (receiver), who must choose how to interpret the signal and how to react to it (see Spence, 1973).

The object of investigation in our paper is the beta coefficient that determines the risk premium in the Capital Asset Pricing Model (CAPM). According to this model, the rate of return that shareholders require for investing in a business (i.e. the cost of equity) equals the sum of the risk-free rate and the premium expected for risk. Risk premium is a product of beta and the current risk premium for an equity market, i.e.:

\[ r_E = r_f + \beta \cdot ERP + OP \]

Where:
- \( r_E \) - is the required rate of return on equity
- \( r_f \) - is the risk-free rate
- \( \beta \) - beta of an asset (equity investment)
- \( ERP \) - equity risk premium, risk premium for average-risk asset
- \( OP \) - are other premiums (e.g. country risk premium and/or liquidity premium)

Average-risk asset is a market portfolio, which (at least in theory) should include all traded assets in the marketplace held in proportion to their market value (Damodaran, 2006, p. 32). The risk-free rate is the rate of riskless assets which have a certain, definite future return. A proxy for risk-free assets are treasury bills or government bonds issued by a country with a high credit rating. Beta is a measure of an asset’s (equity investment) volatility compared to the systematic, non-diversifiable risk of the average-risk asset. It is a degree of change in the asset (equity) return for every 1-unit...
We used daily adjusted closing prices of BMW, Daimler, and VW from the period 2010 - 2019 to calculate the return of the shares in question published by http://finance.yahoo.com. Adjusted close (adjusted closing price) is the closing price of the shares adjusted for applicable splits, new stock offerings, and dividend distributions. We calculated the daily returns according to the following formula:

\[
\text{Stock return at the day } t = \frac{\text{adjusted price}_t}{\text{adjusted price}_{t-1}} - 1
\]

The selected benchmark portfolio of investments into the shares of Daimler, VW, and BMW is Dax Index (GDAXI), the blue-chip stock market index consisting of the 30 major German companies (including VW, Daimler, and BMW). GDAXI is the performance index which measures total return, taking into account not only the capital gains but also the dividends and distributions realized over a period on the portfolio. The data for the period 2010 - 2019 was obtained from http://finance.yahoo.com.

The formula for the calculation of beta is the covariance between the returns of asset \(i\) (i.e. either Daimler or VW or BMW shares’ returns) and the return of the market (\(r_M\) – i.e. GDAXI’s returns) divided by the variance of the market return (GDAXI):

\[
\beta_i = \frac{\text{Cov}(r_i, r_M)}{\text{var}(r_M)}
\]

Where:
- \(\text{Cov}(r_i, r_M)\) - is the covariance between the returns of asset \(i\) (\(r_i\)) and the return of the market (\(r_M\))
- \(\text{var}(r_M)\) - is the variance of the market return (GDAXI)

Since we come out from the market data of individual companies (VW, BMW, Daimler), the results of the quantification using adjusted prices is beta reflecting a given proportion of debt in the capital structure – in other words, our calculations produce levered betas of investments into equity of the companies in question.

The variance is defined as the average of the squared differences from the mean (average value of the variable). The formula for the population covariance is as follows:
Figure 1 depicts the development of adjusted close prices of the assets in question in the period from January 2009 to November 2020. Adjusted close prices of BMW, Daimler, and VW are projected on the left vertical axis. Adjusted prices of GDAXI index are projected on the right vertical axis. GDAXI index is represented by grey area. From Figure 1, it is apparent that EPA NOTICE 2015 had a radically negative impact on the adjusted price of VW. The second biggest slump in the observed time area happened in March 2020 in connection with the COVID-19 pandemic, and it relates to all assets in question – BMW, Daimler, VW and even the GDAXI index. This period, however, is anomalous to our research in this paper. The development in January 2016 does stand out and appears to be fully correlated with the market (GDAXI index).

Below, Table 1 displays the beta coefficient values of the analyzed companies in the years preceding and following the beginning of Dieselgate (EPA NOTICE 2015). According to CAPM, the higher the beta coefficient (ceteris paribus), the higher is the rate of return that shareholders require for investing in a business. Throughout the entire period, it is Daimler that has the highest beta coefficient and therefore also the highest

$\text{Cov}(r_x, r_y) = \frac{\sum_{i=1}^{n}(r_{x,i} - \bar{r}_x)(r_{y,i} - \bar{r}_y)}{n}$

Where:
- $r_{x,i}$ - are the values of the variable $x$ (for example stock returns of VW shares)
- $\bar{r}_x$ - is the mean (average) of the variable $x$
- $r_{y,i}$ - are the values of the variable $y$ (for example returns of GDAXI)
- $\bar{r}_y$ - is the mean (average) of the variable $y$
- $n$ - is the total number of data points (total number of trading days in question)

To uncover and intelligibly describe the relationship between the return of individual assets (Daimler, VW, BMW shares) and the market (GDAXI) in different periods of time, we used the Pearson correlation coefficient calculated according to the following formula:

$\rho_{x,y} = \frac{\text{Cov}(x,y)}{\sigma_x \sigma_y}$

Where:
- $X$ - is the variable $x$
- $Y$ - is the variable $y$
- $\text{Cov}(x,y)$ - is the covariance between the variables $x$ and $y$
- $\Sigma_x$ - is the standard deviation of the $x$-variable
- $\Sigma_y$ - is the standard deviation of the $y$-variable

Standard deviation measures the dispersion of a dataset relative to its mean. It is the square root of variation.

Correlation coefficient is similar to covariance. Both characteristics measure the linear relationships between variables. However, correlation coefficient measures not only the direction but also the strength of the linear relationship using the range from -1 (strong negative relationship) to +1 (strong positive relationship). Values at or close to zero imply weak or no linear relationship.

To analyze the volatility of shares we use Bollinger Bands, a type of statistical chart consisting of $K$ times and $N$-period standard deviation level above and below a simple $N$-period moving average of the adjusted price (Bollinger, 2001). The bands (level above and below simple $N$-period moving average) widen when volatility increases and vice versa. For $N$ we used the value 20 and for $K$ we used the value 2 (referred to as typical by most of the literature). A 20-day simple moving average of adjusted prices of the share is calculated according to the following formula:

$\text{SMA}(20 \text{ days}) = \frac{\sum_{i=1}^{20} \text{adjusted price}_i}{20}$

Where:
- $t$ - is trading day

Upper Bollinger Band (UBB) is calculated as follows:

$\text{UBB} = \text{SMA}(20 \text{ days}) - 2 * \sigma_{x}$

Where:
- $\sigma_{x}$ - is the standard deviation of the adjusted prices of the share

Lower Bollinger Band (LBB) is calculated according to the following formula:

$LBB = \text{SMA}(20 \text{ days}) - 2 * \sigma_{x}$

Results and Discussion

Figure 1 depicts the development of adjusted close prices of the assets in question in the period from January 2009 to November 2020. Adjusted close prices of BMW, Daimler, and VW are projected on the left vertical axis. Adjusted prices of GDAXI index are projected on the right vertical axis. GDAXI index is represented by grey area. From Figure 1, it is apparent that EPA NOTICE 2015 had a radically negative impact on the adjusted price of VW. The second biggest slump in the observed time area happened in March 2020 in connection with the COVID-19 pandemic, and it relates to all assets in question – BMW, Daimler, VW and even the GDAXI index. This period, however, is anomalous to our research in this paper. The development in January 2016 does stand out and appears to be fully correlated with the market (GDAXI index).
the beta coefficient of VW increased by approximately 18% compared to its value in the period January 2, 2015 to September 17, 2015. A mild increase also happened in the case of Daimler and BMW shares. However, a fundamental change in beta coefficient happened in 2016 in the case of all three companies in question –

rate of return required on equity investments. The beta coefficient of BMW is higher than the beta coefficient of VW — the exception being the year 2011 and the period EPA NOTICE 2015 (September 18, 2015 to December 31, 2015). From Table 1, it is evident that immediately after the turning point (EPA NOTICE 2015) the beta coefficient of VW increased by approximately 18% compared to its value in the period January 2, 2015 to September 17, 2015. A mild increase also happened in the case of Daimler and BMW shares. However, a fundamental change in beta coefficient happened in 2016 in the case of all three companies in question –

Table 1: Beta coefficient of BMW, Daimler and VW from January 2009 to November 2020

<table>
<thead>
<tr>
<th>Year</th>
<th>VW</th>
<th>Daimler</th>
<th>BMW</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year 2009</td>
<td>0.862</td>
<td>1.521</td>
<td>1.185</td>
</tr>
<tr>
<td>Year 2010</td>
<td>1.080</td>
<td>1.373</td>
<td>1.237</td>
</tr>
<tr>
<td>Year 2011</td>
<td>1.265</td>
<td>1.197</td>
<td>1.147</td>
</tr>
<tr>
<td>Year 2012</td>
<td>1.168</td>
<td>1.315</td>
<td>1.260</td>
</tr>
<tr>
<td>Year 2013</td>
<td>1.125</td>
<td>1.282</td>
<td>1.134</td>
</tr>
<tr>
<td>Year 2014</td>
<td>0.958</td>
<td>1.171</td>
<td>1.056</td>
</tr>
<tr>
<td>2.1.2015 - 17.9.2015</td>
<td>1.044</td>
<td>1.168</td>
<td>1.128</td>
</tr>
<tr>
<td>18.9.2015 - 31.12.2015</td>
<td>1.235</td>
<td>1.266</td>
<td>1.197</td>
</tr>
<tr>
<td>Year 2016</td>
<td>0.027</td>
<td>0.147</td>
<td>0.124</td>
</tr>
<tr>
<td>Year 2017</td>
<td>-0.059</td>
<td>0.010</td>
<td>0.080</td>
</tr>
<tr>
<td>Year 2018</td>
<td>-0.114</td>
<td>-0.148</td>
<td>-0.111</td>
</tr>
<tr>
<td>Year 2019</td>
<td>-0.208</td>
<td>-0.062</td>
<td>-0.094</td>
</tr>
<tr>
<td>2.1.2020 - 27.11.2020</td>
<td>0.039</td>
<td>0.244</td>
<td>0.079</td>
</tr>
</tbody>
</table>

Source: Own calculations based on https://finance.yahoo.com/
the values of beta coefficient are unprecedentedly low till the end of the investigated time period.

To measure volatility, we used Bollinger bands. In Figure 2 it is possible to compare the volatility of shares in question and the market (GDAXI index) in the period from September 1, 2015 to February 29, 2016. It is clear that the highest volatility from any asset in question was produced by VW in relation to EPA NOTICE 2015. On the other hand, FORMAL COMMENCEMENT 2016 seemed to have a bigger impact on Daimler and BMW. Also, the study of Bouzzine and Lueg (2020) shows that VW suffered its biggest loss of market share values soon after EPA NOTICE 2015. It seems that the events which followed (VW’s fine in the USA, investigation in Germany and the EU connected with fines and the subsequent crusade against diesels) did not have such a significant impact on the VW shares’ value as in the early stage of the Dieselgate scandal. The cited study works with the hypothesis that markets also assessed the aforementioned negative future aspects and included them in the VW share price at the beginning, i.e. immediately after EPA NOTICE 2015. However, subsequent events had a contagion effect on the supply chain in the automotive industry and on the overall automotive group in Germany (VW, Daimler, BMW).

![Figure 2: Bollinger bands of BMW, Daimler, VW and GDAXI since 01.09.2015 to 29.02.2016](https://finance.yahoo.com/)

Legend: EPA NOTICE 2015 (September 18, 2015) and FORMAL COMMENCEMENT 2016 (January 4, 2016) are marked with vertical red line. 20 days moving average is the bold black line, upper and lower Bollinger bands

Source: Own calculations based on https://finance.yahoo.com/

Table 2 displays the correlation coefficients in the years preceding and following the beginning of Dieselgate (EPA NOTICE 2015). It is apparent that the correlation of VW share returns with the market return (return on GDAXI index) decreased significantly after EPA NOTICE 2015. The returns on Daimler and BMW shares were still strongly correlated with the market. The situation did not change until 2017. From 2017 till the end of the investigated timeframe, the correlation coefficients of the return on VW, BMW, and Daimler shares with the market return (return on GDAXI index) indicate nearly linear independence.
Table 2: Correlation coefficient of the BMW, Daimler, and VW share returns with GDAXI returns from January 2009 to November 2020

<table>
<thead>
<tr>
<th>Period</th>
<th>VW – GDAXI</th>
<th>Daimler - GDAXI</th>
<th>BMW – GDAXI</th>
</tr>
</thead>
<tbody>
<tr>
<td>2009</td>
<td>0.415</td>
<td>0.841</td>
<td>0.714</td>
</tr>
<tr>
<td>2010</td>
<td>0.560</td>
<td>0.784</td>
<td>0.725</td>
</tr>
<tr>
<td>2011</td>
<td>0.824</td>
<td>0.877</td>
<td>0.822</td>
</tr>
<tr>
<td>2012</td>
<td>0.725</td>
<td>0.831</td>
<td>0.807</td>
</tr>
<tr>
<td>2013</td>
<td>0.686</td>
<td>0.765</td>
<td>0.772</td>
</tr>
<tr>
<td>2014</td>
<td>0.763</td>
<td>0.881</td>
<td>0.794</td>
</tr>
<tr>
<td>2.1.2015 - 17.9.2015</td>
<td>0.813</td>
<td>0.927</td>
<td>0.865</td>
</tr>
<tr>
<td>18.9.2015 - 31.12.2015</td>
<td>0.441</td>
<td>0.919</td>
<td>0.906</td>
</tr>
<tr>
<td>2016</td>
<td>0.810</td>
<td>0.876</td>
<td>0.872</td>
</tr>
<tr>
<td>2017</td>
<td>0.314</td>
<td>0.543</td>
<td>0.524</td>
</tr>
<tr>
<td>2018</td>
<td>0.100</td>
<td>0.092</td>
<td>0.010</td>
</tr>
<tr>
<td>2019</td>
<td>-0.075</td>
<td>-0.020</td>
<td>-0.029</td>
</tr>
<tr>
<td>2.1.2020 - 27.11.2020</td>
<td>0.177</td>
<td>0.136</td>
<td>0.244</td>
</tr>
</tbody>
</table>

Source: Own calculations based on https://finance.yahoo.com/

The research of Fernandez and Bermejo (2009), Fernandez (2004) and Suh (2009) has shown that market volatility negatively affects the accuracy of beta estimates – when the market is highly volatile, beta estimates are less reliable – as well as the correlations of individual stock returns with returns on the market. Taking high volatility and low correlation with the market into consideration, it is not possible to take historical market beta of VW as a reliable parameter for the estimation of the required rate of return on equity after EPA NOTICE 2015. VW shares were more volatile than the market (GDAXI index) after EPA NOTICE 2015 and also (although slightly milder) after FORMAL COMMENCEMENT 2016. Since 2017, VW shares lost their correlation with the market (GDAXI index). In the case of BMW and Daimler, historical market beta lost its reliability after FORMAL COMMENCEMENT 2016 when their returns recorded a significant increase in volatility. The development of beta coefficients of VW, BMW, and Daimler in the early stage of the Dieselgate scandal (see Table 1) proves that the reliability of beta estimates is an inverse function of market volatility.

Immediately after FORMAL COMMENCEMENT 2016, the spillover (contagion) effect of Dieselgate impacted BMW and Daimler. Share market data indicates that markets reacted to the Dieselgate scandal with some time delay and absorbed subsequent events that this scandal produced in the USA and then in Europe as well. Similar to the study by Bouzine and Lueg (2020), we can work with the agency theory (principal – agent theory) leading to moral hazard and subsequently to the fraudulent practices of VW. However, from the perspective of our study, the application of signaling theory is more relevant. It is a demonstration of signaling theory that the unlawful actions of a key player in the automotive industry has, with a certain time delay, some considerable effects on the financial indicators of other automotive companies. It appears that, in this respect, the financial market behaves efficiently (see efficient market hypothesis by Fama, 1970) and important negative news on one entity is evaluated in all relevant aspects of horizontal and vertical structure of the whole industry. The Dieselgate scandal is a classic example of contagion effect that is observable even in other industries (moral hazard and its subsequent impact on the world financial markets in the years 2007 to 2009 is another demonstrative example of how contagion effect and signaling behavior have strong impacts on the other companies in the industry including the entities that are acting ethically).

It is apparent that EPA NOTICE 2015 had a devastating effect on VW shares. As soon as the markets absorbed and processed the initial information of the Dieselgate scandal, they sent a signal (according to signaling theory) that the problems with diesel engines will not be an isolated issue but will constitute a much weightier problem, mainly in the context of other legislative arrangements regarding the environment that are gaining importance in the beginning of the 21st century. Surprisingly, it shows (Bouzine & Lueg, 2020) that
contagion effect has bigger impact on Daimler than on BMW. This is mainly because Daimler operates (similarly to VW) also in the segment of vans that, to a large extent, use diesel engines. Contagion effect has, therefore, a bigger impact on other companies in the industry that share a similar business model and market segment. Financial markets evaluate this situation rationally as a danger with subsequent impact into the financial indicators.

Conclusion

On September 18, 2015, EPA NOTICE 2015 significantly increased insecurity regarding the future development of the value creation of VW, Daimler, and BMW. The Dieselgate scandal had (or more precisely will have until at least 2021) a strongly negative impact on the free cash flow to equity investors of VW. Environmental issues also affected companies such as Daimler and BMW. Therefore, it makes economic sense to expect that in the context of this development the return required on equity investments would soar. However, our research of historical market betas has not confirmed this expectation. Beta coefficient that is a constituent of the required rate of return in the CAPM model had recorded only short term and moderate increases (from September 2015 to December 2015) in the case of all three companies. Afterwards, the beta coefficient recorded an unprecedented decrease almost to zero – i.e. almost on the level of a risk-free asset. We discovered that this finding connects to the increase of volatility and the decrease of correlation with the market (GDAXI index). The reliability of beta estimates based on historical data is an inverse function of market volatility. Historical market beta does not seem to be a good estimate of the required rate of return of VW, Daimler, and BMW. However, our research is still ongoing, and we received promising preliminary results from the adjustments and extension of the basic statistical model applied in this paper.

References


Acknowledgement

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DO FISCAL TRANSFERS FOSTER REGIONAL ECONOMIC GROWTH?

NAFTALY MOSE

Abstract

Fiscal transfer development across the world today has been in part driven by assertions of a supposed ‘economic dividend’ linked with the devolved financial spending. There is, however, little empirical evidence to validate these assertions in Kenya. It is against this background that this study was carried out to estimate the end product of fiscal transfer on regional economic growth in Kenya using a secondary panel data set. Using the ARDL estimation technique the long-run and error correction estimates of the model were generated. The findings revealed that increased fiscal transfer in recurrent budgets accelerates regional growth, hence confirming the Keynesian hypothesis. Conversely, fiscal transfer in capital expenditure was insignificant. This study recommends the need for policymakers to put in place policies and strategies that will improve budget allocation and execution in capital budgets so as to improve physical infrastructure and thus boost private productivity and consequently regional income growth.

JEL classification: E62, O23, H54, G51

Keywords: regional economic growth, fiscal transfers, capital, recurrent, Kenya

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**INTRODUCTION**

The federalized fiscal transfer trend in Sub-Saharan nations is reinforced by the Bretton Woods twins, which consider fiscal transfer a key pillar of regional growth and poverty eradication strategy (World Bank, 2016). But attention to fiscal transfer has been mainly inspired by increasing demand for more autonomy from some areas of the state, as well as fair and equitable distribution of national wealth (Yemek, 2005). The objective of the fiscal transfer program in Canada is to minimize financial resource concentration at the center (Ezcurra & Rodríguez-Pose, 2010). With fiscal transfer trends in Africa, rural areas are currently receiving more attention than the urban ones (Omolo, 2010). The mechanisms through which components of fiscal transfer may impact regional income growth is through the channel of direct effect on economic activities through improving the country’s capital stock and indirectly by improving the marginal productivity of privately supplied factors of production (Gisore, 2017).

Even with the devolved fiscal transfer growth, Kenya’s economic growth has been lower than yearly estimated targets, widening income disparities and increasing the poverty rate over the years. Fluctuating economic growth adversely affects income expansion and income equality (GoK, 2019). This advances the reservation on whether fiscal transfer is an effective fiscal policy tool for achieving regional growth. And if so, how can it be used to address macroeconomic problems in Kenyan counties.

**ECONOMETRIC MODEL SPECIFICATION**

Building on previous studies (Ram, 1986), a simple growth equation model (1) is formulated.

\[
\ln Y_{i,t} = \beta \ln X_{i,t-1} + y \ln G_{i,t-1} + \mu_i + v_t + \varepsilon_{i,t}
\]

Where:
- \(\ln Y_{i,t}\) - the dependent variable - Regional economic growth
- \(\ln X_{i,t-1}\) - set of explanatory variables apart from components of fiscal transfer
- \(\ln G_{i,t-1}\) - the fiscal transfer variables
- \(\beta\) and \(\gamma\) - are parameters to be estimated
- \(\mu_i\) - county fixed effects
- \(v_t\) - time fixed effects
- \(\varepsilon_{i,t}\) - the error term

and the subscripts \(i\) and \(t\) represent county and time period respectively.

Most of the preceding empirical studies on the relationship between fiscal transfers and growth have, however, focused on the national government levels other than the lower tier government (Akai & Sakata, 2002). These studies do not consider the emerging significance of sub-national government in planning and influencing regional economic activities.

**RESEARCH METHODOLOGY**

This study applied quantitative research design so as to analyse the effect of fiscal transfer on regional growth in Kenyan counties. The selected research design is appropriate to the study as it capture the trends of fiscal transfer and its effects on regional growth in Kenya. It allows for a broader study, involving a greater number of variables, and enhancing the generalization of the findings. This was carried out in the period 2013 - 2017 using annual series secondary data for 47 counties and panel ARDL/PMG technique, resulting in 235 county-year observations. Panel data technique permitted control for unobserved county government heterogeneity.
Measurement of variables and sources of data

Regional Economic Growth

As established in the growth literature (Mose et al., 2019), this study used the growth of GCP per capita as a function of fiscal transfer and the control variables. It is an indicative measure of a county’s standard of living and is derived by dividing Gross County Product (GCP) by its total population (World Bank, 2016). The real GCP per capita growth variable data was obtained from the Gross County Product report.

Fiscal Transfer Components

According to Keynesian theory, capital spending can improve positively economic growth by adding productivity into the population (Keynes, 1936; Romer, 2001). But recurrent fiscal transfers are expected to give a negative result, since most recurrent are for consumption purposes. Consumption expenditure is ineffective on the grounds of the crowding-out phenomenon (Mitchell, 2005). The fiscal transfer variables were obtained from County Budget Implementation Review Reports.

Control Variables

Absorption rate of fiscal transfers denotes the share of the actual regional spending out of the targeted budgeted spending. If the budget absorption rate is lower there will be deterioration of the economy (Claudia & Goyeau, 2013). Panel data for this variable was obtained from annual County Budget Implementation Review reports. Non-devolved fund transfers were measured as the share of national government spending (less county government expenditure), which is a better indicator of national government activity on counties (Ezcurra & Rodríguez-Pose, 2010). Keynesian macroeconomic theory posits that non-devolved expenditure can accelerate growth through growing purchasing power of the citizens (Keynes, 1936; Romer, 2001). The data for this variable was obtained from National Budget Implementation Review reports.

The overall school enrolment rate at a specific level of schooling is often used to measure human capital development in the economic literature because the quality of the data on schooling level is usually better (Mo, 2001). Data for the variable was collected from annual Statistical Abstracts. As previous economic literature has suggested, economic growth depends highly on energy inputs (Wen-Cheng, 2016). Following studies by Aslan (2014) and Wen-Cheng (2016), electricity demand in Kilowatts by region was used as a proxy. Data was retrieved from the Kenya Power Distribution Master Plan reports.

Crime rate is factored in the panel growth regression analysis since it is one of the main elements that influence household, firm and government location decisions. Total Crimes reported to the police service by region was used as a proxy, following the Detotto and Pulina (2009) study. The panel data used in the study was retrieved from Economic Survey reports. Corruption perceptions index is negative in relation to economic growth (Hanousek & Kochanova, 2015). The secondary data was obtained from Ethics and Anti-Corruption Commission (EACC) reports.

Panel data analysis techniques

The unit root test was employed in order to check for the presence of the non-stationary in the regression model in order to reduce chances of spurious findings. The Harris–Tzavalis (HT) unit root test is specified as follows:

$$\Delta X_{i,t} = \alpha_i + \beta_i X_{i,t-1} + \sum_{j=1}^{k} y_{i,j} \Delta X_{i,t-j} + \epsilon_{i,t}$$

Where $\Delta$ is first difference operator, $X_{i,t}$ is dependent variable, $\epsilon_{i,t}$ is the white-noise disturbance with a variance $\sigma^2$ of $i$, ..., $N$ indexes sample (region) and 1, ..., $T$ indexes year.

Basically, the Autoregressive Distributed Lag (ARDL)/Pooled Mean Group Estimation (PMG) technique involved the following steps. First, it involves testing of the long-run relation among the variables under consideration by the use of the F-statistic. Second step is to check if the variables have a long-run relationship; this study applied the Kao co integration test. When co integrating is confirmed, the long-run equilibrium and short-run dynamic adjustments of the ARDL are attained. At this stage of analysis, diagnostic test statistics of the selected ARDL framework is examined from a short-run adjustment process. The diagnostic examination is significant to ensure the regression model is free from standard econometric problems. The error correction framework of the series can be represented as follows:
\[ \Delta \ln X_t = \sum_{i=0}^{k} \beta \Delta \ln X_{t-i} + \sum_{i=0}^{k} \gamma \Delta \ln G_{t-i} + \gamma E C M_{t-i} + \epsilon_{t} \]

In this model, \( y_t \) is the impact multiplier or short-run dynamic effect that measures the immediate impact that a change in \( G_t \) will have on change in \( Y_t \). On the other hand, \( ECM_{t-1} \) is the adjustment effect and shows how much of the disequilibrium is being corrected, that is, the extent to which any disequilibrium in the previous period effects any adjustment. The error-correction model (ECM) estimated will capture both the short-run and long-run adjustment equilibrium mechanism.

**Discussion of results**

**Panel unit root results**

A Panel Harris–Tzavalis (HT) unit root test was conducted in this study at level and at first difference and result reported in Table 1.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Statistic</th>
<th>Z</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \ln y )</td>
<td>0.5352</td>
<td>0.495</td>
<td>0.6896</td>
</tr>
<tr>
<td>( \ln \text{cg} )</td>
<td>0.1754</td>
<td>-4.6* ***</td>
<td>0.0000</td>
</tr>
<tr>
<td>( \ln \text{rg} )</td>
<td>0.1627</td>
<td>-4.8* ***</td>
<td>0.0000</td>
</tr>
<tr>
<td>( \ln \text{ng} )</td>
<td>0.4469</td>
<td>-0.747</td>
<td>0.2276</td>
</tr>
<tr>
<td>( \Delta \ln \text{ng} )</td>
<td>-0.094</td>
<td>-5.9* ***</td>
<td>0.0000</td>
</tr>
<tr>
<td>( \ln \text{ag} )</td>
<td>0.1697</td>
<td>-4.7* ***</td>
<td>0.0000</td>
</tr>
<tr>
<td>( \ln \text{cr} )</td>
<td>-0.3738</td>
<td>-12.3* ***</td>
<td>0.0000</td>
</tr>
<tr>
<td>( \ln \text{ec} )</td>
<td>0.1999</td>
<td>-4.2* ***</td>
<td>0.0000</td>
</tr>
<tr>
<td>( \ln \text{hc} )</td>
<td>0.6827</td>
<td>-2.570</td>
<td>0.9949</td>
</tr>
<tr>
<td>( \Delta \ln \text{hc} )</td>
<td>-0.458</td>
<td>-10.2* ***</td>
<td>0.0000</td>
</tr>
<tr>
<td>( \ln \text{tc} )</td>
<td>0.2110</td>
<td>-4.1* ***</td>
<td>0.0000</td>
</tr>
</tbody>
</table>

Notes: The null hypothesis is that the series is non-stationary, or the series has a unit root. Indicates *** 1% significance level and ** 5% significance level.

Source: Own elaboration

The results in Table 1 indicate that all the target variables are stationary at their level except per capita GCP, human capital and non-devolved expenditure at 5 per cent level of significance. Thus, the null hypothesis of non-stationary for all cannot be rejected and hence the panel series contains a unit root. But they become stationary after the first difference implying that the variables are integrated of order one, I(1).

**Panel co-integration result**

In the case of Kao residual co-integration test, from the result in Table 2, all the statistics are statistically significant at 5 per cent level, confirming the presence of a long-run relationship between the target variables.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Statistic</th>
<th>t- statistic</th>
<th>P- Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADF</td>
<td>-3.064099***</td>
<td>0.0011</td>
<td></td>
</tr>
<tr>
<td>Residual Variance</td>
<td>0.000419</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HAC variance</td>
<td>0.000306</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Notes: The null hypothesis is that No co-integration, indicates *** 1% significance level, ** 5% significance level and * 10% significance level.

Source: Own elaboration
Long-run analysis regression results

Table 3 presents the long-run regression results.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Standard error</th>
<th>t-Statistics</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>ln rg</td>
<td>0.199515***</td>
<td>0.070196</td>
<td>2.842272</td>
<td>0.0049</td>
</tr>
<tr>
<td>ln cg</td>
<td>0.071553</td>
<td>0.092460</td>
<td>0.773876</td>
<td>0.4399</td>
</tr>
<tr>
<td>ln ag</td>
<td>0.443697**</td>
<td>0.188628</td>
<td>2.352237</td>
<td>0.0196</td>
</tr>
<tr>
<td>ln ng</td>
<td>0.381221***</td>
<td>0.053286</td>
<td>7.154250</td>
<td>0.0000</td>
</tr>
<tr>
<td>ln ec</td>
<td>0.184176***</td>
<td>0.044249</td>
<td>4.162305</td>
<td>0.0000</td>
</tr>
<tr>
<td>ln tc</td>
<td>-0.161680**</td>
<td>0.071938</td>
<td>-2.247493</td>
<td>0.0256</td>
</tr>
<tr>
<td>ln hc</td>
<td>0.168296*</td>
<td>0.088961</td>
<td>1.891799</td>
<td>0.0598</td>
</tr>
<tr>
<td>ln cr</td>
<td>0.300932***</td>
<td>0.064302</td>
<td>4.679937</td>
<td>0.0000</td>
</tr>
<tr>
<td>Cons</td>
<td>0.312010</td>
<td>0.464699</td>
<td>0.671424</td>
<td>0.5028</td>
</tr>
</tbody>
</table>

LM Test: F(4,212) = 0.990024, Prob > F = 0.4139
Breusch-Pagan Test: F(16,215) = 13.14***, Prob > F = 0.0000
Pesaran CD (z) = -1.38348, Pr = 0.1665
Ramsey-Reset Test: F(1,215) = 0.291460, Pr = 0.5898
Goodness of Fit Test: F statistics = 83.59***, P-value(F) = 0.0000

Notes: *** indicates significant at 1 per cent, ** indicates significant at 5 per cent, * indicates significant at 10 per cent.

Source: Own elaboration

The regression result revealed that the effect of recurrent fiscal transfer on regional growth is positive and significant in the long-run. Specifically, a 1 percentage point increase in recurrent spending would cause an increase in real GCP per capita by 0.2 percentage point in counties. This is attributed to the ability of recurrent transfers to improve the purchasing power and productivity of the population in the regional economy. County recurrent budget on health and education services, for example, has the likelihood of inspiring and growing workers’ productivity and thus regional growth in long-run (Kweka & Morrissey, 2000; Gisore et al., 2014). The result is consistent with other studies (Kweka & Morrissey, 2000; Gebreegziabher, 2018) on positive effect. In contrast, Mutile (2014), Hammed (2016), Maingi (2017) found a negative relationship. Implying an increase in recurrent spending is likely to cut growth rate given that in order to fund them, higher taxes must be introduced which will discourage private investment and growth.

From the results in Table 3, the effect of capital transfers on regional growth was insignificant. Most of physical infrastructure investments are generally long-run initiatives for growth. If insufficient budget is allocated to the county public infrastructure, it will be a waste of resources, and therefore will have insignificant influence on expansion in the long-run (Hammed, 2016). The above finding is consistent with the results of other studies like, Muguro (2017), which point to an insignificant relationship in Kenya. In contrast, other studies, Wahab (2011) and Gebreegziabher (2018), established that a positive relationship exists in the long-run. This type of public spending could be associated with the productive spending that Barro and Sala-i (2003) identified to be an extra factor to the growth production function.

Regarding the control variables, the estimated coefficient of absorption rate of fiscal transfer is positive and statistically significant in the long-run at 5 per...
cent level. This demonstrates that economic growth is often tied to public expenditure, that is, failure to spend county budgeted money directly affects the rate at which the economy expands in the long-run. The effect of non-devolved expenditure on GCP per capita is positive and significant, implying that the efficiency and effectiveness of national spending exceeded the adverse effect of higher taxes and transfer payment to fund budget and thus accelerating growth. Table 3 shows that the coefficient of human capital is positive and significant. Improved human capital leads to increase in productivity and further inducing of regional growth. Any expansion in electricity demand is estimated to stimulate the agriculture process and industrial activities at local level as an additional input in the production function. Corruption was significant and positive at 5 per cent level of significance. Prior studies postulate that corruption has a beneficial effect on economic expansion through reducing barriers from bureaucracy and lack of transparency of the judicial system and, hence, increases the efficiency of an economy by removing obstacles to private sector investment and increasing growth. The results of the panel regression analysis support the hypothesis that crime rate has a negative effect on growth. The effects of crime on private businesses can involve diverting resources to crime prevention measures and otherwise discouraging private investment and thus slowing growth (Cardenas, 2007).

**Short-run regression results**

Consistent with the long-run results, the estimated short-run panel regression findings revealed similar conclusions, as presented in Table 4.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Standard error</th>
<th>t-Statistics</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Δln rg</td>
<td>0.040953***</td>
<td>0.015780</td>
<td>2.595308</td>
<td>0.0102</td>
</tr>
<tr>
<td>Δln cg</td>
<td>0.000490</td>
<td>0.009827</td>
<td>0.049851</td>
<td>0.9603</td>
</tr>
<tr>
<td>Δln ag</td>
<td>0.116742**</td>
<td>0.049062</td>
<td>2.379463</td>
<td>0.0183</td>
</tr>
<tr>
<td>Δln ng</td>
<td>0.116576***</td>
<td>0.033189</td>
<td>3.512520</td>
<td>0.0006</td>
</tr>
<tr>
<td>Δln cr</td>
<td>-0.029637***</td>
<td>0.010583</td>
<td>-2.800470</td>
<td>0.0056</td>
</tr>
<tr>
<td>Δln hc</td>
<td>0.112542***</td>
<td>0.024184</td>
<td>4.653604</td>
<td>0.0000</td>
</tr>
<tr>
<td>Δln ec</td>
<td>0.187711***</td>
<td>0.013471</td>
<td>13.93495</td>
<td>0.0000</td>
</tr>
<tr>
<td>Δln tc</td>
<td>-0.256716***</td>
<td>0.027281</td>
<td>-9.410220</td>
<td>0.0000</td>
</tr>
<tr>
<td>Δln y</td>
<td>0.117091*</td>
<td>0.068099</td>
<td>1.719430</td>
<td>0.0873</td>
</tr>
<tr>
<td>ect-1</td>
<td>-0.244890***</td>
<td>0.027968</td>
<td>-8.756001</td>
<td>0.0000</td>
</tr>
<tr>
<td>Cons</td>
<td>0.312010***</td>
<td>0.051681</td>
<td>6.037182</td>
<td>0.0000</td>
</tr>
</tbody>
</table>

**LM Test**

\[ F(2,213) = 0.76965 \]  \[ \text{Prob} > F = 0.4645 \]

**Breusch - Pagan Test**

\[ F(17,214) = 10.04*** \]  \[ \text{Prob} > F = 0.0000 \]

**Pesaran CD**

\[ z = -1.12439 \]  \[ Pr = 0.2608 \]

**Ramsey-Reset Test**

\[ F(1,214) = 0.662835 \]  \[ Pr = 0.4165 \]

**Goodness of Fit Test**

\[ F_{\text{statistics}} = 29.89*** \]  \[ P-value(F) = 0.0000 \]

\[ R^2 = 0.675147 \]  \[ \text{Adjusted } R^2 = 0.664995 \]

Notes: *** indicates significant at 1 per cent, ** indicates significant at 5 per cent, * indicates significant at 10 per cent.

**Source:** Own elaboration
In the short-run recurrent expenditure is positive and significant at 5% level of significance. This finding can be attributed to increased purchasing power of the population in the short-term. The result of this study is in agreement with the findings obtained by scholars like Ag’enor (2007) and Gebreegziabher (2018). Contrasting studies by Mutie (2014) and Maingi (2017) concluded that negative relations exist. The impact of capital expenditure on growth is insignificant in the short-run. Capital budget is usually seen as expenditure creating future benefits, as there could be some intervals between when it is incurred and when it takes effect on the economy. They are more discretionary and are made of new programs that are yet to reach their stage of completion (Ag’enor, 2007). The above findings agree with the results of Muguro (2017) and Oguso (2017). However, this finding contrasts other studies, Maingi (2017) and Gebreegziabher (2018) found that positive relationships exist in the short-run.

From the result in Table 4, budget absorption rate is positive and significant at 5 per cent. Economic growth is often tied to budget execution, failure to spend budgeted money directly affects the rate at which the economy expands in the short-term. Impact of non-devolved expenditure on regional income was positive and significant. Non-devolved expenditures increase population purchasing power for public goods and services, which in turn permits suppliers to grow use of their productive capacities by engaging new labour and capital, and thus expanding supply in the economy (Romer, 2001; Mose, 2021). An increase in electricity power use is estimated to cause economic growth and its shortage may cause a slowdown in the development process. The coefficient of human capital is positive and significant at the 5 per cent level in the short-run. According to macroeconomic thought, development of human capital increases labour force productivity. Corruption is negative and significant. Corruption incidence can result in resource misallocation when decisions on how public funds will be invested, or which private sector businesses are to be approved, are made by a corrupt county government authority (Choe et al., 2013). County Crime rate is negative and significant. Crime increase imposes large costs to private and public sectors which have a negative impact on private investment and growth.

ECT<sub>1,1</sub> is quite low, -0. at 25, implying that equilibrium slowly converges to long-run equilibrium in counties. From the result, cross-sectional dependence and autocorrelation were not a problem in this study. However, heteroscedasticity was a problem but the study used robust standard error to correct it. Also, the adjusted R<sup>2</sup> was 0.67 implying that 67 percent of the variations of the dependent variable are explained by the explanatory variables in the model. This indicated that the overall goodness of fit was satisfactory.

**Conclusion**

This study set out to estimate empirically the long-run and short-run effects of fiscal transfer on regional economic growth in Kenya, 2013-2017. In order to achieve the specific objectives, this study disaggregated the fiscal transfer variable further into recurrent and capital spending. This study used panel econometric techniques such as testing for panel unit root test using Harris and Tzavalis test so as to avoid the problem of spurious outcomes that arise due to non-stationary data. Using the Kao testing approach to co-integration the study estimated the long-run static relationship and short-run dynamic relationship of the model. The findings of this study established that there exists a co-integration relationship among the real GCP per capita and the regressors in the model. Panel diagnostic tests were applied to ensure the estimates are free from standard econometric problems. The coefficients of the effect of these were shown to differ in magnitude, sign and direction. However, the overall fit of the regression models suggests that the target variables explain significant amount of fluctuation of economic growth in Kenyan counties. The first objective of this study was to estimate the long-run and short-run effects of recurrent expenditure on growth in counties. The finding revealed that the effect of recurrent transfers is positive for economic growth. However, on the second objective, there was no evidence of impact of capital transfers on GCP growth. The overall result revealed that fiscal transfers have been a key driver of regional economic growth.

Since capital spending has no influence on economic growth in counties this study thus recommends that regional government should allocate more funds to public infrastructure development and human capital activities. Since capital expenditure is insignificant, there is a need for the county authorities to reduce recurrent transfers so as to free resources which can be used for development purposes. The mechanisms of the effect of devolved expenditure on economic growth can be traced in two levels: In the short-run the county authorities target economic boom through following Keynesian policies, but they should be careful that the share of recurrent expenditure is not above
the optimal level since it will disadvantage the capital budget. In such a situation, any increase above optimal level will reduce GCP growth. In the long-run, county authorities will favour a policy of government intervention for rapid economic expansion. But it should be noted such a policy may or may not impede county economic growth. The implication is that the process of growth in counties will depend on both components of fiscal transfers and unique economic features of the specific county.

The study has some limitations. One limitation is that regression analysis does not factor-in all the determinants that influence regional economic growth. Another limitation of the study is the small sample size.

For future research, macroeconomic analysis should be extended to include the source of fiscal transfers (tax revenue, intergovernmental transfer, grants, public debt and budget deficit) used to finance public expenditure, which need to be identified and taken into account in the analysis. For this reason, some extra macroeconomic factors should be included as control variables during panel estimation, and there is a need to extend the sample size.

References


Abstract

The thesis deals with usury and illegal lenders both on the domestic scene and abroad. The usury itself is defined by its characteristics, by adjudication and by historical connotations. The historical definition begins in Mesopotamia and ancient Rome, basically since the emergence of money. The aim of the paper is a comprehensive overview of usury, which from the legal perspective is not precisely defined as a term and the thesis tries to find such a definition with the help of case law and interpretation. The characteristics of usury that are described in the thesis are distress, the presence of a weaker party, mental weakness, and a gross disparity of performance. The thesis also describes the history of loan sharks and usury in the United States, where violence plays a considerable part in the issue. The paper also deals with the social background of usury and illegal lenders in the United Kingdom and outlines possible solutions to eradicate these phenomena in financially disadvantaged communities. In the end the thesis attempts to find unifying characteristics of usury across history and said countries.

JEL classification: G53, K15, P37

Keywords: usury, adjudication, lending, interest rates, history, criminal offense, financial literacy

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**INTRODUCTION**

Views of the usury concept differ widely. The aim of this thesis is to define the problems connected to the civil view of usury, which concerns not only the considerations of the gross disparity of performance construct, but in the final result also the invalidity of an usury agreement in itself. The Consumer Protection Act defines the weaker party of an agreement and also unfair commercial practices which involve deceptive or aggressive commercial practices which are often tied closely to usury. Usury used to be a synonym for high interest. Nowadays the term usury agreement is used. But not even today should the term “usury” be used for the whole contract and part of the literature does not even use it for the payment provision itself (i.e. concerning interest), but considers usury to be only a definition and characteristics of an exaggerated, disproportionate and therefore prohibited payment for the performance provided (Zimmermann, 1979).

The basis of the term “usury” is therefore an excess of a certain allowed level of payment for performance, which is provided by one contract party to the other and the payment promised in return for such a performance is disproportionate. Usury is a typical concretization and expression of the principle laid down in the Law No. 89/2012 Civil Code Coll. (Civil Code, 2020), § 3 sec. 2 letter c); the protection of the weaker party and is nothing other than abuse of such a party or of a subjective weakness of the other contract party beyond a permitted level.

**SUBJECT AND METHODOLOGY**

The aim of the submitted contribution is a comprehensive overview of usury, which from the legal perspective is not precisely defined and this thesis, using case law and interpretation tries to find such a definition. It uses the method of terms description, which are closely linked to the issue of usury. Distress, the presence of a weaker party, mental weakness and gross disparity of performance are amongst such terms. The second method used is an analysis of the state of things in the past and in the present. Based on this analysis it forms a recommendation on how to avoid usury in the future. In the end it forms a synthesis, from which common traits of usury in individual countries derive.

**HISTORY**

Usury or in Czech “lichva” (from the Latin usuria, from the gothic German leihwan meaning “to lend” or German leihen of the same meaning) is in general an obligation disproportionate to the profit gained by such an obligation. The most frequent example are loans with high or even exorbitant interest, even 100% per day. However, the term “usury” had a different meaning in ancient history – usury was used for “any interest earning for money lent”.

Lending money for a fee appeared shortly after the emergence of money already in the ancient lands of Mesopotamia, Egypt, Greece and Rome. Since the early medieval ages, this practice met certain limitations coming from different religions. According to the Christian church, interest was a fee for time which belongs to God, thus making it non-negotiable. Another reason was an opinion that lending money in itself does not create any new value. Until this day the Czech language uses the word “unchristian” for an unduly high interest and Islam has forbidden the lending of money for interest up through the present days. In medieval times usury was forbidden for Christians but at the same time allowed for Jews, as one of a very few activities they could perform. Christians viewed it as one of the greatest sins, many of the church councils condemned usury as reprehensible. At the same time, the core of legitimacy of usury in ancient times, as Hayes (2017) points out, was not the interest for lending money, but the payment of compensation for any expenses arising from an otherwise unpaid loan.

In the Lands of the Czech Crown usury was permitted for Christians from the year 1484 by Vladislaus II of Hungary. In the beginning of the 16th century the interest rate was between 10 – 35 %. In 1545 it was also legalized in England by King Henry VIII. There were frequent attempts throughout history to limit interest rates, which could have come from a sovereign’s effort to provide some relief to (or to ingratiate himself with) his subjects or from more practical reasons in the form of limiting his own or governmental debt expenditure (Otto, 1900).

In Austria, the Usury Imperial Patent was in effect since 1751 which was very strict in its provisions. It was abolished in 1787 by the Emperor Joseph II which meant that usury was no longer punishable by death. It caused huge unrest in the country and lawsuits for massive usury abuse, leading to the reinstatement of the abolished Imperial Patent in the year 1803. A loan was considered to be usurious when the interest rate exceeded 5 – 6 %. This Patent was valid until 1866, when this interest rate limit was increased. In 1868 a new law entered into effect, which abolished all the previous usury and interest provisions, thus allowing usury providers to act (Vlček, 1879). Usury in the early modern
age of Germany was a politically charged concept, which contained a lot of illegal practices (Suter, 2017).

In China it was believed that usury is a remnant of times prior to 1948 and nowadays the people of China are confronted with the existence of private financial institutions, which provide predatory loans (loan sharks). Whereas the majority consider usury to be ethically loathsome, the evidence proves that private financial institutions have become a very important source of loans to support economic activity in China as Cheng (2018) points out.

The 1964 Civil Code contained a provision, namely § 49, on agreement on the conclusion under “strikingly disadvantageous conditions” which entitled a contracting party to withdraw from the agreement if concluded in distress and under strikingly unfavorable conditions. The essential difference between these two principles is the fact that if a party concluded an agreement in accordance with the 1964 Civil Code under pressure and under strikingly disadvantageous conditions, they were entitled to withdraw from such an agreement. Absolute invalidity of a usury agreement with reference to § 49 of the 1964 Civil Code was derived from situations where the actions of the beneficiary reached the intensity of § 3 section 1 of the 1964 Civil Code, meaning it was also the exercise of right at variance with good morals.

If an agreement did not reach such intensity, but its conditions were unfavorable or disadvantageous for one of the parties, such party was entitled to withdraw from it. It was also due to this reason that the use of § 49 of the 1964 Civil Code was not very efficient. In accordance with § 1796 of the New Civil Code an agreement is invalid due to usury if one party abuses the distress, inexperience, mental weakness, emotional distress or recklessness of the other contracting party in order to gain profit of grossly disproportionate value to the mutual performance. (Eliáš, 2012).

Amongst the explicitly stated subjective (assessed objectively) states of the party in disadvantage the New Civil Code mentions distress, inexperience, mental weakness, emotional distress and recklessness. The authors Crosato – Dalla Pellegrina (2019) even consider usury to be a crime mainly against the poor. To illustrate the matter better it is convenient to briefly analyse the substance of these “states” and their possible projection into legal transactions:

Distress is possibly the most significant prerequisite of usury in terms of subjective states of the disadvantaged party of the obligation. The Supreme court of the Czechoslovak republic commented on the purposes of usury loans by stating that “the term distress presumes such a state of the debtor’s wealth, that the debtor feels a pressing need to obtain the finances lacked through a loan and is, due to this reason of pressing need, forced to and compliant with promising or providing a payment of a strikingly disproportionate value in comparison with what is obtained through the loan” (Judgment of the Supreme Court ČSR from 19. 10. 1925, sp. zn. Zm II. 247/275 (Vážného collection).

This definition, however, affects exclusively the area of usury loans, but its substance is much broader. The term “distress” was aptly defined by the Austrian OGH (Supreme Court): “state of distress is not conceptually identical to material distress and often the term distress includes all situations in which the injured party is left to choose whether to enter into a disadvantageous agreement or to suffer even greater harm by not concluding such an agreement” (Judgment OGH 14. 5. 1969, sp. zn. 5 Ob 60/69). Concluding a usury agreement in distress can thus be defined as the lesser of two evils when compared to not entering into such an agreement. It remains to be said that distress (as well as all the other subjective obstacles) must be assumed through objective criteria, therefore not deriving from a subjective feeling of the acting person.

Inexperience means either a complete non-existence of knowledge or a deficiency in life experience or knowledge of a business matter. Inexperience is therefore linked to a flaw in life experience and knowledge of circumstances involved in the given legal transaction. A person can be deemed inexperienced while being objectively (assuming from his/her age, education, social background etc.) considered to be experienced, but in the particular undertaken legal transaction not so. The Supreme Court, concerning the purpose of inexperience, stated that “the sign of inexperience is usually defined as inexperience in dealing with property matters, insufficient knowledge of prices, purchase op-
tions, etc.” (Judgment of the Supreme Court from 14. 3. 2012, sp. zn. 11 Tdo 552/2011).

By mental weakness can be understood a state, where the acting person is obviously lacking the ability to act upon rational motives and is therefore not capable of appropriately assuming the objectivity of mutual obligations or lacks the ability to assume the legal consequences of his or her legal actions (Hohendorf, 2012). This element does not fall under the area of legal capacity which understandably has a different legal regime.

Usury and its substance copies the legislation used in the Penal Code. Emotional distress can thus be derived from criminal law as “a strong mental reaction, caused by an immediately preceding event, which at the same time intensively influenced the mental or emotional integrity of the acting person”. The consequence then being that the acting person is not immediately able to comprehend the consequences of his or her legal actions which is in result harmful to this person. The Supreme court (Judgment of the Supreme Court from 25. 8. 2010, sp. zn. 7 Tdo 793/2010) defined the state of emotional distress as “a mental state in which a person internally and usually externally as well shows a significant emotional excitement or uneasiness, which influences his or her subsequent actions... this justifiable mental reaction can follow only after impulses of exceptional intensity and severity...”.

Recklessness can be considered an unreal judgement of a particular transaction, where the acting person is not able to understand the consequences of his or her actions in the given moment. Recklessness falls under the category of negligence and a person acts recklessly who knew or in view of all the circumstances of the matter must have known that the legal action in question would not be beneficial for him/her.

**Abuse**

Abuse in terms of the Civil Code Commentary concerning § 1796 is a situation when the abuser knew or must have known of the distress, inexperience, mental weakness, emotional distress, recklessness or other deficiency or gross disproportion of performance and took advantage of them nonetheless (Hulmák, 2014).

The second subjective element (third in total) which must be met, this time on the part of the usurer, is the deliberate abuse of a weakness of the disadvantaged contracting party. The abuse of a weakness of the contracting party (“...promises or provides obligation to himself or to another...”) must be deliberate and thus the civil actus reus cannot be committed (more so the penal one) through negligence. An intention is required at least in its eventual form.

**Gross disparity of performance**

The concept of usury in Czech conditions is constructed upon the combination of an objective and two subjective elements (foreign sources sometimes speak of a usury structure consisting of four descriptive elements, the difference, however, only being in the division of one of the subjective elements into two individual parts, thus making any more detailed analysis on this approach wholly secondary). A subjective element on the side of the injured party will typically be distress. The second subjective element then being deliberate abuse of such a weakness by the other agreement party. Value of performance is the last part, the objective element.

The disparity must be gross, meaning objectively easily distinguishable. Where the value of performance is only half of the counter-performance value, it is a gross disparity (the value being 50:100). The interest rate used in a given situation by banks can serve as a guideline. Gross disparity of performance can then be a situation where the interest laid out in the agreement exceeds at least twice the interest demanded by banks in similar conditions. If the interest exceeds this rate even four times, it can be considered a gross disparity beyond any doubt. The decisive moment for defining whether the disparity is gross or not is the moment of conclusion of the agreement; any posterior price development has no influence on whether § 1796 will be applied or not. This provision affects credit agreements as well.

In the case of usury as a criminal offense the element of gross disparity of performance was defined by the Supreme Court Judgment of the Supreme Court from 12. 1. 2005, sp. zn. 5 Tdo 1282/2004), which in this ad hoc adjudication ruled that “...providing a financial loan with an interest of 70-200 % per year sets a disparity in mutual performance beyond any doubt...” In the previous adjudication the Supreme Court (Judgment of the Supreme Court from 22. 4. 2003, sp. zn. 5 Tdo 248/2003) reached a decision that “…it is not the borrowed principal that has the nature of usury in sense of § 253 sec. 1 sentence two of the Penal Code which the injured party was obliged to repay, but rather
the agreed upon usurious interest of 66 % per year forming the accessory of the original loan. Interest is a payment for use of the principle.”

This decision is frequently referred to not only by Case law itself but by appellants also. An interest rate of 66 %, proclaimed to be usurious by the Supreme Court in 2003 is the lowest interest rate defined as usurious for the purposes of usury in the sense of a criminal offense; in the decision of the Supreme Court f. no. 21 Cdo 1484/2004 the Court stated that an interest rate of 60 % is in variance with good manners. In this decision the Court was dealing only with the question of interest and not APR. In the reference date of the aforementioned decisions of the Supreme Court, the APR for loan agreements ranged from 9 to 14% per annum for banking institutions. A person has thus committed a criminal offense of usury, or acted in variance with good manners, when an interest rate five times higher than the APR usual in the given place and time was demanded.

**Defining the limits of usury**

The Czech civil case law has not, until this day, provided an answer to the question of what can be considered a gross disparity of performance. Despite providing the definition of usury agreements already in 2003, the Supreme Court did not venture into more detail concerning the issue of criteria, meaning the value of performance, which could be used as a basis for denomination of gross disparity and thus a possible invalidity of a relevant agreement provision. Paradoxically, the civil law jurisprudence found greater use in the conclusions of the penal senates of the Supreme Court.

Relatively strange situations came to pass when appellants in civil cases raised the objection of usury and in a civil litigation pointed out legal conclusions which had been presented by penal senates. In the case of usury as a criminal offense the element of gross disparity of performance was defined by the Supreme Court (Judgment of the Supreme Court from 12. 1. 2005, sp. zn. 5 Tdo 1282/2004), which in the following ad hoc adjudication ruled that “…providing a financial loan with an interest of 70-200 % per year sets a disparity in mutual performance beyond any doubt…” In the previous adjudication the Supreme Court (Judgment of the Supreme Court from 22. 4. 2003, sp. zn. 5 Tdo 248/2003) reached a decision that “…it is not the borrowed principal that has the nature of usury in sense of § 253 sec. 1 sentence two of the Penal Code which the injured party was obliged to repay, but rather the agreed upon usury interest of 66 % per year forming the accessory of the original loan. Interest is a payment for use of the principle.”

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When commenting on usury from the perspective of criminal law, the Supreme Court always targeted particular provisions between parties and did not accept a clearly defined criterium of gross disparity of performance, meaning performance which can be in its essence presumed as usurious and which meets the physical elements of usury as a criminal offense. Criminal case law has thus not until this day answered the crucial question of when can agreement parties expect a provision to be considered usurious, neither has it set any criteria for the basis of such an answer.

When defining the limits of gross disparity of mutual performance (like with laesio enormis) one must always build on objective, average values, therefore in this case average costs of a credit (loan), for which performance is provided in a given place and time (compared to the objective value theory). Only then can such a criterium be objective. Such a legal opinion of the Supreme Court, however, lacks elements of objectivity, if it was concluded that grossly disproportionate performance must be assessed.

**Presumptions of contestability**

By subjective elements of usury are meant the states of a person at a disadvantage, who, while concluding an agreement, acts in distress, inexperience,
mentally weak, emotional distress or recklessness and then the intentional abuse of such a state by the “usurer”. Despite not being agreed upon by everyone, from the perspective of the addressee of the legal norm the New Civil Code obviously builds on the penal actus reus of usury as defined in the Law No. 40/2009 Coll. Penal Code in § 218.

Amongst the explicitly stated subjective (assessed objectively) states of the party in disadvantage the New Civil Code mentions distress, inexperience, mental weakness, emotional distress and recklessness. To illustrate the matter better it is convenient to briefly analyse the substance of these “states” and their possible projection into legal transactions: distress is possibly the most significant prerequisite of usury in terms of subjective states on the side of the disadvantaged party of the obligation.

Inexperience means either a complete non-existence or a deficiency in life experience or knowledge of a business matter. Inexperience is therefore linked to a flaw in life experience and knowledge of the circumstances involved in the given legal transaction. A person can be deemed inexperienced while being objectively (assuming from his/her age, education, social background etc.) considered to be experienced, but in the particular undertaken legal transaction it is not so. The Supreme Court (Judgment of the Supreme Court from 14. 3. 2012, sp. zn. 11 Tdo 552/2011), concerning the purpose of inexperience, stated that “the sign of inexperience is usually defined as inexperience in dealing with property matters, insufficient knowledge of prices, purchase options etc.”

**Relationship between laesio enormis and usury**

Whereas laesio enormis is defined by one factual element, the gross disparity of mutual performance, usury derives from a number of factual elements. Elements of usury are divided into objective elements (performance of grossly disproportionate value to the mutual performances) and subjective elements (distress, inexperience, mental weakness, emotional distress or recklessness of one legal subject and abuse of such by the other legal subject). It is the gross disparity of mutual performances that represents the objective conceptual element and the predatory nature of usury is what represents the subjective ones.

The relationship between laesio enormis and usury is that usury represents a special case of the former. In both situations there must be a gross disparity of mutual performances (the so called objective conceptual element). It must therefore be a legal obligation with mutual performances, where the value of one of the performances is in gross disproportion to the other (§ 1793 sec. 1 and § 1796, Civil Code).

In the case of usury, however, there is another conceptual element present (the so called subjective conceptual element) and that is either distress, inexperience, mental weakness, emotional distress or recklessness of one legal subject and the abuse of such a state by the other legal subject. Usury therefore is not any gross disparity of mutual performances, but only such a disparity, where, while concluding the agreement, one subject abused the distress, inexperience, mental weakness, emotional distress or recklessness of the other party of the agreement (in other words preyed on the other legal subject).

The purpose of distinction between laesio enormis as a general concept encompassing all situations when the principle of proportion is breached and of usury which, as a special case, affects only a part of such situations, is to associate these different concepts with legal consequences of different severity and strictness.

According to § 1796 of law no. 89/2012 Coll. Civil Code it is only usury that can be associated with invalidity. Invalidity is one of the most severe consequences known to private law, which represents its severity in legal life as well (Mayer-Maly, 2001). Laesio enormis is not as grave an offense as usury, its special case, and is therefore associated with milder legal consequences. Moreover, exceptions exist that eliminate the possibility of the aforementioned legal consequence of invalidity when laesio enormis happens. The first exception can be found in § 1793 sec. 1 second sentence of the Civil Code and concerns situations where the gross disparity of mutual performance is based on facts that the second agreement party (meaning the one not in disadvantage) did not or did not have to know.

The second exception is laid out in § 1794 sec. 1 Civil Code and concerns a special relationship between the acting legal subjects from which the reason of gross disparity of mutual performance arises. The third and last exception can be found in § 1794 sec. 2 Civil Code and can be described as an approach of the injured legal subject. In particular, it concerns situations where
the injured legal subject expressly waives his rights from laesio enormis and, at the same time, states that he accepts the payment for pretium affectionis or agrees with the disproportionate price of performance, although the real price was known or must have been known to him.

Despite the fact that gross disparity of mutual performance is present, either because the legal subjects wish so or because neither of them is aware of or does not have to know about it, these exceptions balance out these two basic principles of private law. Besides these exceptions there is one more to be found within the Czech legal system in § 1797 Civil Code and it concerns entrepreneurs. Unlike the previous three, this exception exists in order to fulfill the internal consistency of private substantive law, in particular the consistency between the principle of fairness and expert knowledge requirement.

**Predatory loans in the USA**

The hypothesis of predatory loans is based on the capping of interest rates which in return allows usurers, expelled from the market by its deregulation, to return. This hypothesis is frequently used by the defenders of short-term credit and defenders of the financial market deregulation. The History Repeats Itself: Why Interest Rate Caps Pave the Way for the Return of the Loan Sharks publication defends this hypothesis with a theory that creditors will not lend money to risky subjects on a regulated market. Regulation of credit prices then creates space for predatory lenders, the worst possible scenario, since they are willing to resort to violence.

This hypothesis, according to the predatory loan definition, is untrue or overly simplified. It divides predatory lenders into violent and non-violent, the second type being much more frequent. The number of violent lenders on the small loans market increased after the usury criteria was made stricter and they disappeared once more as a source of loans for the working class as they used to be before the deregulation at the end of the 1970s. The non-violent lenders thrived regardless of regulation. Deregulation does not force non-violent predators out of the market, on the contrary, it opens the door for them. The aim of legal regulation should be forcing both types of predatory lenders out of the market.

The term predatory loan (or loan shark) is not precisely defined, financially nor linguistically. Its meaning changes with time. It became popular in the end of the 19th century as a pejorative label, hinting at the predatory behaviour of sharks. During the American Civil War expensive, short-term loans, particularly inventory mortgages (against household inventory) or loans against forfeiture of wage started to appear. The term was used for the whole market, rather than for a single subject.

**Origin**

These lenders originally rarely resorted to violence and did not have ties to crime families which were very rare in those times. They even employed women as debt collectors because such a practice reduced the probability of violence. Loans began to be called predatory not because of how the money was collected but due to the conditions of the loan which resembled a trap. The purpose of this trap was to force the client to repeatedly accept loans and thus pay interest. As a result, the client is able to pay the interest only.

Another aspect of their behaviour is the extremely short duration of these loans and therefore a very high repayment, which forces the client to refinance the credit. Illegal predatory lenders have one goal, however, to get money from interest. This goal prevails over the long-term effort to capture the client in a debt trap.

**Second meaning**

The meaning of predatory lenders underwent a major change in the 1960s with the emergence of Mafia clans. The main pejorative meaning of the term shifted more towards the method of collecting the debt and mainly to violence. In 1968 the Congress passed the Consumer Credit Protection Act also known as the Anti-predatory Credits Act. Although this term was never explicitly stated in the Act, its meaning targeted the conditions of credits. Despite this fact violence became an element implicitly associated with predatory lenders rather than the concept of entrapping the client.

**Common denominator**

History shows that there are two main types of predatory lenders. The first type uses price, weakening of solvency and short-term duration to trap their clients. The second type uses the practices of the first one as well, however, loans provided by the Mafia often required repayment of the whole loan with interest.
together in one big installment. The client, unable to pay, thus had a tendency to delay the moment of payment, while being forced to pay the monthly interest. Some lenders had to resort to violence to make this model profitable in the long run. These two types coexist in a complicated relationship and steps taken to limit one of them usually benefit the other. Extreme steps are often very contraproducive.

If the aforementioned definitions should be deemed valid, it is then rather obvious that the number of predatory lenders was lowest in times when usury loans and interest rates were capped on average levels. Reducing yearly interest rates to 36 % proved to be most efficient in the elimination of predators. It is true that a certain number of violent lenders emerged in those times, however this happened on a local level only and the total number of such lenders decreased significantly. Deregulation led to the elimination of violent lenders from the market, however, it also led to the return of predatory lenders in full strength.

There are nowadays some bank loans (in the US) with total interest over 1000 %. Defenders of short-term loans claim that these banks resorted to predatory behaviour and hide behind a representative facade and that short-term loans help to fight against these predators.

It is nowadays a widely and often debated question whether short-term lending limits the use of very expensive overdraft products. It is possible to conclude, however, that it indeed is predatory lending because it results in a debt trap. Violent lenders, the most dangerous ones, are nowadays also the rarest and are a relic of times long gone and it is very improbable that they should return in the 21st century. The issue that needs to be tackled and confronted is legal predatory lending which is nowadays having an unprecedented boom.

**Illegal lending in the United Kingdom**

The estimated number of households which used services of illegal lenders is 165,000, half of which are located in financially endangered areas. This number represents 0.44 % of the adult population in the UK, 3% of low income households and 6 % of households from the poorest areas. To compare, the number of clients of legal, expensive, long-term loans is 2.3 million, 6.15 % of the adult population of the UK. In the poorest areas as 50 % of households used services of illegal lenders in the last five years. The estimated volume of the illegal loans market is said to be 40 million pounds per annum, the installment volume then being estimated at 120 million pounds.

In comparison the volume of the legal short-term loans market is 1.5 billion pounds and the estimated volume of installments 1.9 billion pounds. The total volume of money provided by illegal lenders forms 0.02 % of the consumer credit market. The layout of illegal lenders corresponds with models of social disadvantages, nationality and households that do not have access to the legal loans market. This correlates with the poorest of areas. The highest concentration can thus be found amongst households from urban and suburban areas with the lowest income. The majority of areas with the risk of illegal lending appears to be in Scotland, Northern and Western Midlands and on a smaller scale in London and Wales.

**Illegal lenders and their clients, modus operandi**

Clients of illegal lenders are often unable to access the market for legal loans due to many reasons. Approximately one out of five clients of illegal lenders lives in a place where legal loans are unavailable. Approximately half of the clients has unpaid legal credits or has reached the credit limit of legal loans. The profile of clients of illegal lenders is similar to that of legal short-term loan clients. These are mostly women with families, between the age of 30 and 40, although a certain bias against men and a greater tendency for these credits to be more disadvantageous than on the legal loans market is present. Most of the money from illegal loans is used for the same purposes as money from legal short-term loans. A significant minority exists, however, which spends these resources on alcohol and drugs.

Illegal lending happens most frequently in closed communities where lenders are well-known and have established a network of contacts. Relationships between lenders and clients are usually based on intimidation and lenders try to control the lives of their clients through the use of coercive means. Fear and violence provide lenders with a priority when a client repays debts and protects them against being reported to authorities. Control over clients is also reinforced through illegal pledges, most frequently those that control the victim’s income such as cheque books and/or credit cards. The client’s inability to repay the loan can then eventually lead to capturing the client in a net of

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criminal activities including drug distribution or prostitution.

A variety of illegal typologies of lenders has been identified. These range from a small number of more or less harmless lenders to violent, coercive lenders where illegal lending forms but a part of a wider criminal life. The latter appears to be the prevailing model, although not all illegal lenders indulge in other criminal activities. Illegal lending in the UK does not show signs of being linked to organised crime. It is mostly done by individuals or by families.

**Nature of the Problem**

Illegal lending is obviously harmful to the victims and to the community as a whole. While formulating relevant legislation it is necessary to take into account that part of the demand for illegal loans is ineliminable. Even though the volume of illegal lending is small, its layout, linked to the financially endangered communities, will be the same as the layout of these communities. According to evidence it is possible to suggest that the high price of legal short-term loans is not a desirable part of the solution, however, these loans are in every case a preferred alternative to illegal lending.

While attempting to reduce the prices of short-term loans through regulation it is necessary to take into account the need to balance out the benefit of the lower price for the majority and the price of a significantly increased risk of illegal loans for the most financially endangered persons. Mayer points out two main questions, which concern usury credits; a political question and a question of morale. Commercial short-term loans have probably reached their limit when it comes to lending to highly risky clients and no increase of such limits can be expected. Commercial and regulatory pressure exerted on legal, expensive and short-term lenders will lead to a quicker withdrawal of supply for most endangered clients, which will then lead to a potential increase of use of illegal loans and the reluctance of legal lenders to fill the vacuum made by the elimination of illegal lenders.

**Seeking alternatives to illegal lending**

Seeking out and fighting illegal lenders is a highly important part of their elimination from the market. Pilot teams used to combat these lenders reported first major successes and helped to condemn and eliminate illegal lenders, thus providing relief to communities and victims where these lenders lived and operated. Evidence suggests, however, that the most efficient way of fighting illegal lending are alternative loan options. It is essential to create alternatives of social lending used to pay for existing illegal debts and to fill the vacuum formed by the retreating illegal lenders. It is probable that legal lenders will withdraw faster than it will be made possible to prepare and launch social lending in a similar scope.

The most convenient source of alternative loans seems to be a narrowly aimed social fund because it is already in contact with a number of the victims of illegal lending. Broadening community grants can offer another alternative in the increase of sources. There is a danger that the social fund may not be flexible enough to drive out illegal lenders. The most promising approach seems to be in creating special units which will be financed through reserved sources and will cooperate with other offices. Some problems faced by the consumers of illegal loans are so complex, that their solution requires a holistic approach.

Some credit unions have obviously significant experience with lending to the riskiest of clients and can significantly contribute to the solution either on their own or in cooperation with administrative offices. After some time, some of the processes proven by these unions and based on their experience could be used to broaden the access to accessible credits and to solve the financial exclusion. Unfortunately, most of the credit unions do not have access to the affected communities so that they could form a vanguard in the battle against illegal lenders and earn experience with the riskiest of clients. Many measures that aim to broaden the market and make it accessible to the most financially endangered people are in their earliest stage of development and are rather limited in their reach.

Efficient infrastructure is yet to be developed. The price range of new solutions must be first tested in practice. Consulting and financial literacy will be an important part of any long-term strategy as will raising awareness of the dangers of illegal loans. It is improbable, however, that it would have an immediate effect on the number of illegal loans. There is nevertheless an obvious need of financial consulting for the victims of illegal lending or lending in the long run.

**Overlap of illegal loans and other credit instruments**

There is a far lower probability of the use of mainstream financial services amongst clients of illegal lend-
ers compared to other inhabitants of financially endangered areas. In areas where services of legal lenders are not available, illegal lenders are the main source of cash loans. In similarly endangered areas where, however, services of legal lenders are available, the main source of loans are these lenders and that by a significant margin. There is a significant overlap of the use of services provided by illegal lenders and expensive legal loans, social benefits and social funds.

Approximately 1 out of 10 households in the most financially endangered areas admits to the use of illegal loans. Approximately half of the consumers of illegal loans had a legal short-term loan in the last year. Half of the consumers of illegal loans had a social fund loan in the last year. Amongst the consumers of illegal loans or people that were rejected by legal lenders are only scarce examples of credit union loans. However, credit unions that provide loans to the riskiest clients, even consumers of illegal credits, appeared, especially in Scotland.

**Price of loans from illegal lenders**

Illegal lenders try to control the lives of their victims with the objective of creating a stable, long-term income, which can be extended for as long as possible. Due to this reason the price of the loan, as well as other payment conditions, is hidden by various mechanisms. The most important amongst those are exorbitant and often automatic fees for delayed installments or small “additional” loans. These often serve to pay an installment which would otherwise be delayed. Because of these mechanisms there are usually no official records or contracts provided with the loan. Conditions are stated verbally, clients cannot calculate the remainder nor the repayment period. Money repaid with installments has not much to do with the remaining sum of the loan to be repaid and how much actually is paid to repay the debt.

The size of such a loan can be small, 250 pounds on average, they can, however, range between 30 and 50 pounds with the due date in the following week, which appears most commonly in Scotland. Average total interest is 83 pounds for every 100 pounds lent. The total repaid sum then being 183 pounds. The loan period is not clear. The price of illegal credit can therefore be even triple in comparison with the highest legally acceptable interest. It is also more than double of what people expect to pay. Mayer (2013), advocating for a capped rate, points to the differences on the deregulated market of the US where in Minnesota the rate of a 100 dollar loan is capped at 15 dollars, while in the neighbouring state of Wisconsin the limit for a 100 dollar loan is set to 23 dollars.

**Usury and financial literacy**

As a result of the financial crisis banks and solid non-banking companies were forced to evaluate the client’s solvency in a much stricter way, which made, especially between the years 2009 and 2013, space for increased existence of unfair business practices of smaller non-banking companies and other credit providers. Consumer credits are a frequently used product amongst socially excluded citizenry. This group of people, however, tends to be threatened by disadvantageous predatory loans which usually exploit their distress, ignorance or low financial literacy. This is the reason why unfair business practices appear in the area of consumer credit provision.

Unfair business practice is defined in § 4 of Act no. 634/1992 Coll. on Consumer Protection as amended (the last version is from 15th of April 2020). It generally considers such a practice to be an act towards a customer, in conflict with the requirements of professional care, which significantly disrupts his economical behaviour.

The issue of unfair business practices is closely linked to the level of financial literacy of citizens, which is important for the management of household budgets and the ability to manage household money. Insufficient financial literacy is very risky in the case of loans and credits which are usually provided to customers under very unfavorable conditions. It does often happen to over-indebted households. An over-indebted household is considered such a household that after paying all the essential expenses is not able to meet its obligations.

Financial literacy is a part of a wider economic literacy which includes the ability to ensure one’s income, consider the consequences of personal actions on present and future income, orientation on the labour market, ability to manage one’s expenses, etc. (Hruška-Ševčík, 2016).

Financial literacy as a whole is divided into:

1) money literacy – ability needed for the management of cash and cashless finances and transactions
with money as well as the management of instruments designed for this purpose (i.e. current account, payment instruments, etc.),

2) price literacy – ability essential to understand price mechanisms and inflation,

3) budget literacy – ability essential for the management of personal/family budget (i.e. ability to maintain a budget, set financial goals and decide about the allocation of financial means) and it includes the ability to deal with various life situations from a financial perspective (Ministry of Education, 2020).

Discussion

American experience with payday lending over the past 150 years teaches us that the total quantity of loan-sharking has been reduced the most when interest-rate ceilings are pegged at a moderate level (Mayer, 2012). Finally, reconciling the statutory language concerning criminal and civil usury would be a big step to help clear confusion and ambiguity in contracts already in place and protect and avoid borrowers paying a tremendous amount of interest that was once hidden usury on a financial instrument (Basile, 2020).

Usury laws are not, at the moment, at the top of the political agenda, although there has been some concern with “payday” loans. We should not, however, ignore usury laws on that account. Economic regulation and deregulation is a hardy perennial. And usury laws provide a good case study of how economic regulation is shaped through the interaction of economic ideas and economic conditions (Rockoff, 2003).

Although the performance of world economic growth and with it productive goods and services is increasing, at the same time the divide is opening between rich and poor countries, and at the same time between poor and rich people, as Štědroň (2012) points out. It is therefore necessary that the citizens be definitively educated and that the country have enough qualified experts in this field, as pointed out by Chlumská (2019).

Conclusion

The term usury in context of the Czech legal system is anchored in the New Civil Code. The basis of usury is an excess of a certain permitted level of payment for performance, which was provided by one agreement party to another and a payment that was promised or provided is disproportionate. The most significant prerequisite for the application of the term usury is distress, other elements are gross disparity of performance, mental weakness, alternatively recklessness.

Lending money for a fee appeared immediately after the origin of money already in ancient Mesopotamia, Egypt, Greece or Rome. Through the course of history, the definition and level of interest rates varied, and it is not fixedly set in current legislation and the Supreme Court will always decide individually. Judging from the results of the adjudication it is however evident that the limit of usury is around 60 % per annum, while the quadruple of the current interest rate is considered.

In comparison with the US and the UK the practices of usury provision are different. Usury loans in Great Britain are linked predominantly to illegal lenders inside closed communities. These communities are often extremely poor and out of reach of licensed lenders, who find it hard to profit from providing credit for interest capped by the state. In the US the term loan shark became associated with usurers. History of short-term loans with high interest dates back to the American Civil War; today’s understanding of the term, however, emerged in the 1960s in connection with the Mafia and violent practices involved in the collection of payments.

The issue of usury provision also has a strong linkage to insufficient level of financial literacy. While providing this type of credit, coercive or even aggressive business practices are often involved when usurers abuse the distress or mental weakness of clients or try to capture them in a debt trap where the client pays only the interest and the usurer is thus provided with a permanent income. To improve the situation of financial education, financial literacy was introduced as a mandatory subject in elementary schools and high schools in 2007. It is essential to continue with the education of financial literacy amongst citizens and people of all ages and especially those in the greatest financial danger.
References


Order OGH ze 14. S. 1969, sp. zn. 5 Ob 60/69.

FACTORS DRIVING E-LEARNING ADOPTION IN PALESTINE: AN INTEGRATION OF TECHNOLOGY ACCEPTANCE MODEL AND IS SUCCESS MODEL

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Abstract

One of the most significant changes in the field of education in this information age is the paradigm shift from teacher-centered to learner-centered education. Along with this paradigm shift, understanding of students’ e-learning adoption behavior among various countries is urgently needed. Despite being one of the many countries that are still at the early stages in implementing e-learning, Palestine is a country that has recently seen an expansion in the number of students and the quality of education, which has involved high investment in e-learning. Hence, studies in this area of research interest have yet to be made known within the field of education. This study attempted to address the disparity within the literature for an individual country, Palestine, on the significant influences towards adopting e-learning. A model that investigates the effects of quality features, perceived ease of use, perceived usefulness on the intentions and satisfaction of the learners towards the effects of e-learning is proposed in this study. This model encompassed the constructs and variables embedded in TAM and ISSM along with instructor quality. The outcomes of the model, such as actual use and the moderating effect of technical support towards e-learning in Palestine, were investigated. The study proposed that the quality of the course, instructor, service and system as well as perceived usefulness determined the satisfaction among students in use e-learning.

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INTRODUCTION

The continuous advancement in the field of Information and Communication Technology (ICT) since the early 1980s (Al-Emran & Salloum, 2017), has meant changes in acquiring information could be observed, especially in terms of the length in time and the strategies in processing the available and accessible information. By the 2000s, the information boom through the extensive use of the Internet has resulted in teachers and learners integrating current technology and electronic resources in the teaching and learning practices (Alkandari, 2015). Hence, the education industry has transitioned to incorporate multiple ICT tools in different aspects and areas of study, which require additional skill sets that enhance the existing learning strategies. While the professionals and educators are continually being exposed to new inventions in ICT to broaden the world of teaching and learning experiences, support from the authorities and management is equally essential. Most universities around the world have included e-learning as an extension to conventional physical learning to allow more extensive opportunities for accessibility and lifelong learning. Besides, with the progress of ICT, and the advancement of gadgets and tools used to explore the Internet, e-learning has become more adaptable, collaborative and well-constructed (Alkandari, 2015). In Palestine, the Ministry of Education has conceded the potential responsibility of ICT and the critical aspects associated with the teaching and learning processes (Obaid & Alias, 2015). Tertiary education institutions, such as Alazhar University and the Islamic University, have integrated ICT as an approach that could enhance the teaching and learning processes. Numerous software and applications are used during classes and lectures, such as Moodle, which is one of the educational tools that represent an effective virtual learning management system.

As the ICT advances with time, the environment for e-learning, as well as the relevant ICT tool, are highly influential in the field of education. With numerous benefits gained from e-learning, instructors from higher institutions have shown a positive response to using related systems, which would be incorporated and utilised to a certain extent by the students. Nonetheless, numerous studies have maintained that multiple factors could affect the success and effectiveness of the learning system. Most learners are found to move away from continuing the courses that employed the e-learning approach, which could be due to having only a “passive experience, which leads to surface learning” (Alkandari, 2015), among other setbacks. These existent issues would impact the degree of acceptance, readiness, and decisions of learners towards adopting e-learning (Kanwal & Rehman, 2017), and the success in sustaining these systems (Van Raaij & Schepers, 2008), within the field of education. Some researchers, such as (Lee, 2006), assert that external factors significantly affect the adoption of e-learning, which should be investigated and listed accordingly to consequence. Hence, this study aims to investigate the factors that affect the adoption of e-learning in Palestine within the education sector.

LITERATURE REVIEW

Technologies involved in education have evolved alongside the advancement of ICT (Salloum, 2019). Since the emergence of the Internet in the 1980s, numerous sectors, including education, have witnessed the transition from utilising conventional books and physical archives to electronic and virtual information systems in terms of teaching and learning approaches. Software and applications, such as Moodle, have expanded the mode of delivery for courses and lectures, which was still face-to-face, though remotely (Tarhini et al., 2013), which assisted distant learners who were able to access information without having to be physically at the campus. Nonetheless, e-learning required a specific set of skills that involves digital literacy and investment in compatible devices to access information such as the tablet, smartphone and laptop (Nguyen et al. 2014). Hence, there could be potential diversity in the perception of purposes and goals by different users, as well as digital knowledge and competencies to utilise the electronic tools in adopting e-learning systems and approaches (Lee, 2003).

Past studies have explored the acceptance of e-learning, which was employed from the technological, organisational, and environmental perspective (Jaradat, 2014). Urbach and Müller (2012) developed the IS success model, which was revised to stay relevant to the changes and progress of ICT over time. The model had identified six components towards successful adoption of e-learning, which were system quality, information quality, service quality, intention to use/not to use, user satisfaction, and net benefits. System use was acknowledged to be more important than user satisfaction, and positive experience because of the contribution in enhancing satisfaction, which led to higher intention for use (Petter et al., 2008). The revised IS success model was one of the most widely used models in studies on the successful adoption of e-learning systems.
Numerous models have investigated and evaluated the success of IS (Manchanda & Mukherjee, 2014) such as Technology Acceptance Model (TAM) by Davies, Information System (IS) success or impact model by Gable, Sedera and Chan, and Information System Success Model (ISSM) by DeLone and McLean. Davis proposed the Technology Acceptance Model (TAM) in 1989, which addressed the acceptance and willingness of users towards information technology, instead of success in use. On the other hand, ISSM prioritised net benefits as the primary focus for the successful use of IS. Hence, there was no particular model that best fit all purposes that could categorise the benefits and purposes of IS. These models were adopted to match the objective of this study.

Davis and Bagozzi proposed the Technology Acceptance Model Lee (2010), in 1989 which became an essential innovation adoption model that many researchers used to explore the influence of new technology on the users (Abbad, 2009). Davis (1989) suggested that the temporal association between belief, attitude, intention and behaviour, can assist in predicting the use of new technologies. Based on IS in terms of perceived usefulness and perceived ease of use, TAM was an adaptation of TRA, which determined an individual attitude towards the intention to use (Al-Fuqaha et al., 2015). Also, perceived ease of use had been considered to affect perceived usefulness directly (Talebian, 2014).

DeLone and McLean initially proposed ISSM in 1992 based on studies by Shannon and Weaver (1963), as well as Mason in 1978 (Rabaei & Gable, 2009). The model mirrored success measures from past studies based on six constructs, which included the quality of the system, the information, the use of technology, user satisfaction, the individual impact, and the organisational impact. These constructs were determined to be interdependent except for the individual impact, and the organisational impact that had been identified as dependent variables. Hence, the model explained that the quality of the information and the system affected the use of technology, which influenced the satisfaction of use for individuals or groups. Rabaei and Gable (2009) also observed that ISSM was the most widely used model as the success measure for IS. Similarly, (Chan, 2008) measured the information system and success of use holistically based on the information, individual, and organisation dimensions.

Several studies (Ajoye & Nwagw, 2014) have used these models to examine user satisfaction in e-learning. Therefore, this study intended to examine user satisfaction in higher institutions of the e-learning system on an individual scale based on the ISSM constructs proposed by DeLone and McLean. Nonetheless, the scope of this study was limited to the learners, instead of advancement and consumption of the system.

**Related theories**

Several related theories that underpinned this study included the Theory of Planned Behaviour (TPB), the Social Cognitive Theory (SCT), the Diffusion of Innovation Theory (IDT), the Decomposed Theory of Planned Behavior (DTPB), and the Unified Theory of User Acceptance of Technology (UTAUT). TPB described how individual attitudes and beliefs preceded the behavioural intention to adopt behavior towards the extent of behavioural control, which could be influenced by other external factors. On the other hand, SCT was a framework developed to understand, predict, and change an individual due to interactions between personal factors, behaviours, and the environment. IDT considered the adoption of IS as a social construct that would progressively develop as the society expands. At the same time, DTPB perceived ease of use and perceived usefulness as mediators of behavioural intention as an extended version of TAM. UTAUT highlighted four critical constructs, which were performance expectancy, effort expectancy, social influence, and facilitating conditions, to determine the intention of use and behaviour among users (Hanafizadeh et al., 2014).

**Research model**

The satisfaction of use primarily determined individual use of IS systems through the specific service, which supported the associations between determinants, satisfaction, behaviour and outcomes within the IS model (Islam, 2013). On the other hand, quality aspects, perceived ease of use and usefulness were found to be the primary determinants of past studies that had employed TAM in exploring the use of e-learning that could influence the outcomes. Hence, a framework that incorporated the components of e-learning between the IS success model and TAM was developed in this study (Islam, 2013). The components included in the framework included quality aspects, perceived ease of use and usefulness, and learning outcomes, which were satisfaction, actual use, and perceived learning assistance. This study proposed that individual use of e-learning system would be affected by satisfaction, which was a significant measure to evaluate the success of IS.
Learners were found to experience improved and developed learning performance when there was satisfaction with the e-learning system used (Xu et al., 2014). As argued by (Islam, 2013), an effective online learning system would be valuable for learners in managing and controlling the learning process, which offered an influential and significant construct towards perceived learning assistance. Learners would perceive that the specific e-learning system being used assisted the learning experience and enhanced the learning performance. This study considered this learning assistance as an outcome of e-learning as higher institutions should offer quality information, service, and a system that catered to the many intentions to use. More importantly, the IS success model theoretically supported these indirect influences (Islam, 2013).

Multiple past studies that were carried out from different view points on e-learning have resulted in challenges in identifying a proper model that could accurately determine a single approach towards the success in adopting e-learning. Hence, commonalities in variables emphasised by past studies have been one of the most appropriate ways to ascertain the suitable approach in predicting the successful adoption of e-learning. The significant factors and indicators for each factor were ascertained, extracted and hypothesized from previous literature for this study. Results from this study will hopefully inform decision-makers and future researchers in Palestine on the aspects that affected the use of e-learning.

**Figure 1: The proposed research model**

![Image showing the research model](Source: Own elaboration)

**Course quality**

The quality of a course can be referred to as the judgement made by learners based on the extent to which the e-learning system was viewed as valuable content that met specific needs (Adeyinka & Mutula, 2010). Quality course content included both content richness and update regularity (Chengh, 2012) that could be measured against timeliness, accuracy, relevance, and format of the information (Seddon & Kiew, 1996). Tarigan (2011) described how learner satisfaction could also be influenced more by the course quality than by the type of technology used to deliver the instructions.

**System quality**

The quality of a system was usually based on the extent of the system was free from computer virus, and
the ease of use (Seddon & Kiew, 1996). The quality of the system could significantly affect the satisfaction of the learners, primarily through the features that could impact the ways learners would use the system. These features included ease of use, ease of learning, and user-friendliness (Petter et al., 2008). Therefore, learners would often use the system if the system was easy to use, which would result in increased use that can be viewed as a positive impact based on satisfaction.

**Perceived ease of use**

Although clearly defined within the models, this study intends to describe the constructs within the parameters of this study. Hence, perceived ease of use would be the extent of belief by a learner in using a particular system based on the effort of use (Davis, 1989). Through the extent of effort needed to use the system, the learner would be influenced towards accepting the latest applications in ICT (Venkatesh, 2000). Multiple past studies had revealed positive associations in the effects of perceived ease of use on the intention to use e-learning (Obaid et al., 2020). Besides, perceived ease of use had always been assumed to have an indirect effect on the intention to use through perceived usefulness (Jouda, 2020).

**Perceived usefulness**

The adoption of more innovative and accessible technologies could be an effect of perceived usefulness, which this study asserted to be a primary determinant of intention (Pikkarainen et al. 2004). The perception of using highly influenced the willingness of an individual to use a specific IS in carrying out digital and virtual activities (Hanafizadeh et al., 2014). Since perceived usefulness had significant positive effects on the intention of use towards e-learning services (Islam, 2013) this study hypothesised that higher perceived usefulness of e-learning system would have a more positive intention and likelihood to be used. Hence, the following hypothesis was developed.

**Service quality**

Service quality could be measured from the value of support services received from the IT department or IT support personnel (Delone & McLean, 2003). In the e-learning context, service quality can be considered as the support services delivered by instructors and IT technicians (Ozkan & Koseler, 2009). These services included training, hotline, and helpdesk (Urbach & Müller, 2012). On the other hand, Raphael and Mtebe (2016) argued that the student support services was one of the most critical responsibilities of a higher institution, which could profoundly impact the extent of success for learning among the learners. Therefore, service quality should be included as a factor that can impact the satisfaction of the learners towards the e-learning system used at UDSM.

**Instructor quality**

The quality of an instructor was considered to be a crucial reason in recognising the satisfaction of learners towards e-learning systems (Chengh, 2012). Instructors in this current world of technology were expected to have both the technical skills and the pedagogical skills to facilitate courses offered via e-learning systems. Many researchers had argued that the quality of instructors significantly influenced the satisfaction of learners towards e-learning systems (Ozkan & Koseler, 2009). Chengh (2012) believed that response timeliness and teaching style by lecturers, as well as help that was given to learners through e-learning system, were some of the measurements that can be used to determine the quality of an instructor. Similarly, Ozkan and Koseler (2009) asserted that the satisfaction of learners towards e-learning system would be positive when instructors responded to learners in a timely fashion, as well as having effective teaching methods and control over the technology used.

**Satisfaction**

Satisfaction is defined as the individuals’ perceptions of the extent to which their needs, goals, and desires have been fully met (Sanchez-Franco, 2009) and refers to their overall view of IS (Sanchez-Franco, 2009). It sounds better to note that user satisfaction refers to the extent to which users are pleased with IS and support services (Petter et al., 2008). The updated IS success model assumes that system use precedes user satisfaction which leads to an increased satisfaction which sequentially results in a higher intention to use (Petter et al., 2008). Satisfaction has been found to have a significant positive effect on intention towards use of e-learning services in some studies (Chang, 2013;
Islam, 2013). Satisfaction has been found to have a significant positive effect on actual use as well. Hassanzadeh et al. (2012) in their study uncovered the positive effect of satisfaction on actual use of e-learning system. Therefore, in the context of this study, satisfaction assumed to have a positive impact on both intention to use and actual use.

INTENTION

Intention, which is the main dependent variable identified in the studies conducted based on the TAM, is defined as the likelihood that an individual will use an IS. Intention plays a critical role in the actual use of a new technology (Davis, 1989). Intention to use can also be considered as an attitude (Delone & McLean, 2003). In the acceptance domain, some researchers have studied the relationship between intention and actual use in e-learning context (Hassanzadeh et al. 2012) note that to refrain more complexity, IS success model did not distinct between intention to use and system use in their updated model, but intention to use is generally an individual level construct. Venkatesh (2000) confirms the positive relationship between intention to use and actual use. Thus, in the context of this study, intention assumed to have a positive impact on actual use.

CONCLUSION AND RECOMMENDATIONS

In this globalised educational environment, there is a need to have a whole some understanding of the transitions and uses of e-learning. Due to the limitations of time and contextual parameters, learners undergoing the conventional approach of learning would be required to study within specific designated time and location, which would be a challenge for many, especially those in remote or areas. In contrast, the e-learning approach is more flexible in terms of time and space, whereby learners have accessibility to study at their own pace or through distant learning. Moreover, this contemporary approach of learning could also help learners save costs and facilitate the process of learning, both intensively and extensively. As educational institutions and commercial corporations are increasingly adopting e-learning, the success factors for adoption by the learners require extensive attention and intensive consideration to develop systems that are efficient, relevant and sustainable.

The population of students and high standards of education in Palestine has resulted in cost-effective investments for e-learning. Since Palestine is a developing country that is beginning to implement e-learning, there is limited literature from Palestine in this area of research interest. By examining the crucial factors on the adoption of e-learning in Palestine, this study attempts to contribute to the literature and address the knowledge gap at the level of a developing country. Moreover, this study also intends to determine the factors that affect the intentions of learners at higher institutions to accept e-learning, whereby a model has also been proposed to describe the aspects involved.

The model proposed in this study is an integration of TAM and ISSM to investigate the perceptions of e-learning, and factors that affect the intentions and satisfaction of use. Hence, the aspects that have been used to investigate the factors are actual usage of the system, the effects of quality in the instructors, perceived usefulness and ease of use. The study has also included the use of the e-learning system as a mediator between ease of use and intention to understand behavioural patterns of the learners further. The outcomes have provided invaluable information on the patterns of behaviour among learners.

Nonetheless, several differences should be made aware of in this study. Firstly, this study has developed an integrated model of the revised IS success model and TAM within the context of e-learning. Hence, the focus of this study was on the effects of influential variables towards the learning outcomes. These outcomes, such as the actual use based on the intention to use, are different from past studies that have examined the influential variables directly on the intention to use the e-learning system. Different outcomes are expected from the results of this study, which could contribute to further insight into the behavioural patterns of the learners. Nonetheless, these factors need to be included in future researches to build a more comprehensive model, while maintaining clarity of the model. Besides, this study has focused on e-learning within the higher education institutions in Palestine, which does not reflect on the perceptions of employees towards e-learning in business settings at large. This study also recommends the need to address the perceptions of learners within the context of corporate employees to analyse the perception and differences between these two scopes of samples in future studies. As the world becomes globalised, there is also a need to understand cross-cultural issues that can emerge from e-learning.
Researchers, education institutions, and business organisations are encouraged to investigate the use of e-learning system from a cross-cultural perspective that could shed more valuable insights to contribute to the literature.

References


Abstract

Financial data sets are growing too fast and need to be analyzed. Data science has many different techniques to store and summarize, mining, running simulations and finally analyzing them. Among data science methods, predictive methods play a critical role in analyzing financial data sets. In the current paper, applications of 22 methods classified in four categories namely data mining and machine learning, numerical analysis, operation research techniques and meta-heuristic techniques, in financial data sets are studied. To this end, first, literature reviews on these methods are given. For each method, a data analysis case (as an illustrative example) is presented and the problem is analyzed with the mentioned method. An actual case is given to apply those methods to solve the problem and to choose a better one. Finally, a conclusion section is proposed.
INTRODUCTION

Financial analysis refers to standard practices to give stakeholders an accurate depiction of a company’s finances, including their revenues, expenses, profits, capital, and cash flow, as formal records that provide in-depth insights into financial information. Financial data analysis is one of the bedrocks of modern business. While you may already know that financial data analysis is important (mainly because it’s a legal requirement in most countries), you may not understand its untapped power and potential. It’s clear that financial analyzing tools could serve to benefit your business by giving you a more informed snapshot of your activities. Utilizing financial data with the help of online data analysis tools allows you to not only share vital information both internally and externally but also to leverage metrics or insights to make significant improvements to the very area that allows your business to flow.

Each of these financial KPIs is incredibly important because they demonstrate the overall ‘health’ of a company – at least when it comes to the small matter of money. These types of KPI reports don’t offer much insight in the way of a company’s culture or management structure, but they are vital to success, nonetheless. Financial analysis is used by owners, managers, employees, investors, institutions, government, and others to make important decisions about a business. If you’re considering investing money in a company, it only makes sense that you’ll want to know how well that company is doing – according to a standardized litmus test; not measurements that a company has fabricated to make them look good. This is where the importance of financial data analysis comes into play for investors. This also applies to credit vendors and banks who are considering lending money to a company.

In these situations, you will need to gain an accurate understanding of how likely you are to be paid back so that you can charge interest accordingly.

The velocity, variety and volume of financial data sets have exploded. To analyze this increasing volume of data and observations, techniques such as data science is necessary.

Data science has many applications in various fields of finance, especially in financial engineering. Constructing predictive models, running live simulations, analyzing new data sets and storing diverse data sets are some needs of financial data which is solved by data science techniques like sentiment analysis, real-time analysis, customer segmentation, big data analysis and related techniques. Predictive analysis and methods have a main role among data science techniques. They have many applications in risk analysis, forecasting market behavior, customer segmentations, high frequency trading, making calculated predictions, running winner strategies, identifying online precursors for stock market moves and many other fields of finance. For a comprehensive review of applications of data science predictive techniques in financial data sets, see Kovalerchuk and Vityaev (2000).

Several techniques are commonly used as part of the predictive methods. Using several types of predictive methods makes the comparison, trend and structure of the data clear at a glance. In addition there are many types of financial data sets, in practice from different points of view such as risk management, money management, sale management, etc. Therefore, many types of predictive methods are needed to analyze a specified financial data set. In this way, in the current paper, to cover most important techniques used in a financial data analysis for different purposes, almost 22 individual or hybrid predictive methods are considered. They are categorized to four classes namely, data mining and machine learning, numerical analysis, operation research techniques and meta-heuristic techniques. The first category contains CART, cross validation, decision trees, particle filter and EM algorithm, bootstrap, Jacknife, K-means, K-neighborhood, kernel density estimation (KDE), naive Bayes and principal component analysis (PCA). The second category, i.e., numerical analysis involves Kuhn-Tucker, numerical computations, and Spline techniques. The operation research category contains integer and quadratic programming methods, dual and sensitivity analyses, data envelopment analysis (DEA) and TOPSIS as a multi-criteria decision-making technique. Finally, simulated annealing is studied as a meta-heuristic technique approach. The current paper studies the application of the above-mentioned methods in various financial example models. Sixteen problems are considered and throughout these examples the computational methods are applied to real data sets. Each method is important for any of the purposes which are described. For some of them data analyses are done and for some of them, the mathematical results are presented. This paper can be viewed as a practical instruction of data analysis useful for almost all participants of financial markets. The following Table gives the structure of the method applied in this paper.

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study for machine learning classifiers applied to financial datasets.


The rest of the paper is organized as follows. In the next section, literature review of the above-mentioned methods is presented. In section 3, nine problems are proposed and using the mentioned methods are solved. An actual case is given to apply those methods to solve the problem and to choose a better method. Finally, a conclusion section is presented.

**LITERATURE REVIEW**

Hwang and Yoon (1981) studied the applications of multiple attribute decision making in many fields such as finance. Breiman et al. (1984) used the CART algorithm in many applications such as finance, economics, engineering, statistics and biology. One famous example of a financial application is the credit scoring of bank customers. Olave and Miguel (2000) used the bootstrap method for forecasting exchange rates. They used GARCH modeling for exchange rates to obtain prediction intervals and to present various measures for predictions. Das (2003) applied the K-means clustering method for hedge fund classification. He used asset class, size of hedge fund, incentive fee, risk level and liquidity of hedge fund as cluster variables. Miyazaki (2003) considered the dual analysis on hedging VaR of a bond portfolio using options. Huck and Guegan (2007) used the k neighborhood method for forecasting in predicting the price of commodities, stock indexes and interest rates. Zhou et al. (2008) applied a particle filtering framework for a randomized optimization algorithm. Sensitivity analysis is done to capture the change in a response variable throughout the change in one variable at a specific time, for example, changes in net present value (NPV) because of change in risk free and discount rates. Break even analysis and calculating operating leverage are two examples of sensitivity analysis, see Winston (2010). Lai (2010) used simulated annealing in multifactor equity portfolio management. Robles-Granda and Belik (2010) proposed a comparison study for machine learning classifiers applied to financial datasets.


**ILLUSTRATIVE EXAMPLES**

Here, illustrative examples are given to propose the financial applications of the above-mentioned methods in four categories, namely data mining and machine learning methods, meta-heuristic approaches, operation research based methods and numerical analysis methods.

**DATA MINING AND MACHINE LEARNING TECHNIQUES**

**CART METHOD**

Better stock price predictions yield better trading systems. There are many good econometric methods...
The classification and regression trees CART are a nonparametric method for construction of decision trees for discrete variables which is called the classification tree and for continuous variables which is referred to as a regression tree. Usually, a large sample divided into two categories exists. The aim is to relate each category to some covariate variables. For example, consider a sample of bank clients. The interest is in predicting whether a specified client may default or not. Covariate variables are age, education, gender and job. The largest tree is designed and then it is revised. Some pollution criteria like a Gini index are calculated. The simplest tree with the minimum pollution criteria is selected. The following diagram presents the result of CART in selection of portfolios. The right direction is "yes" and the left direction is "no". The following Figure gives the related decision tree.

Naive Bayes and Cross validation methods

The naive Bayes is a classifier method in the machine learning field. In this problem it is used to separate two categories of financial companies with high and low systematic risks. Following Robles-Granda and Belik (2010), the research variables are volatility in the market which is calculated by (high price-low price)/(high price + low price) and reinvestment rate. The naive Bayes is a non-parametric method for classification using posterior information. Similar to the Bayesian network the posterior of a new generation given the information of the previous generation is calculated and it is used for classification. Naive Bayes is a machine learning technique and it is a learning classifier based on Bayes rule. To derive the posterior f(y|x) use available data to derive likelihood f(y|x) and prior f(y) and then combine this information together with the Bayes rule to obtain the posterior.
menting the Bayesian classification to extract likelihood and prior will need estimation of many parameters. The naive Bayes assumes a version of conditional independence. Indeed, the naive Bayes is based on the Bayes rule and conditional independence assumption. Consider attributes $X_1, ..., X_n$ are given, then

$$P(Y = y_k | X_1, ..., X_n) = \frac{P(X_1, ..., X_n | Y = y_k)P(Y = y_k)}{\sum_{k=1}^{m} P(X_1, ..., X_n | Y = y_k)P(Y = y_k)}$$

Therefore, $y_k$ belongs to classifications which maximizes the $P(X_1, ..., X_n | Y = y_k)P(Y = y_k)$. Indeed,

$$y_k = \arg\max_{y_k} P(X_1, ..., X_n | Y = y_k)P(Y = y_k).$$

Patil (2014) used the naive Bayes to predict heart disease. Here, the data sets are again the first seven companies of the S&P500 like in problem 1. The cross validation is very similar to in-sample-out-sample and rolling analysis of econometric time series. The sample is divided into two folds: test and evaluation sets. The statistical inference is performed on test parts and the performance of the first fold is evaluated by the second fold, i.e., the evaluation fold. Then, the role of test and evaluation folds is replaced and finally an averaging proposes the final decision. The sample may be divided to k-folds. To run the 3 fold cross validation is used. It is seen that the best first category is (ABT, AES, MMM, ACN) and (ABBV, ATVI, AAP).

**K-means and K-nearest neighborhood (KNN)**

The K-means separates the observation to k homogenous categories by defining k circles. The method first determines the suitable value of k. Then, suitable centers and radiiuses are selected to obtain the most homogenous circles. The KNN is also a similar method, however, the best homogenous neighborhood is introduced. It is attempted to propose the smallest k. Indeed, KNN algorithm surveys all cases and using a similarity measure, the new case is classified. It has many applications in statistical pattern recognition. Following Sutton (2012), the algorithm is summarized as follows:

1) a positive integer k is specified, along with a new sample,

2) select the k entries in our database which are closest to the new sample,

3) the most common classification of these entries is found,

4) this is the classification which is assigned to the new sample.

Applying the k-means algorithm with $k = 3$ to the problem of 3.1, the following category is derived. (ABT, AES, AAP), (ACN, ABBV) and (ATVI, MMM). The KNN method with $k = 3$ results the following categories (ABT, AAP), (MMM, ATVI), (ABBV, ACN, AES).

**Jacknife vs Bootstrap**

Jacknife belongs to the class of re-sampling methods like the bootstrap method. Suppose that $\hat{\theta}_n = \ell(x_1, ..., x_n)$ is the estimate of parameter $\theta$ using the sample $x_1, ..., x_n$. The Jacknife estimate of $\theta$ is given by

$$\hat{\theta}_{n}^{\ast} = \frac{1}{n} \sum_{i=1}^{n} \hat{\theta}_{n, i}$$

where $\hat{\theta}_{n, i} = \ell(x_1, ..., x_{i-1}, x_{i+1}, ..., x_n)$. Jacknife removes the bias of $\hat{\theta}_n$. Next, suppose that $x_{1i}^{\ast}, ..., x_{ni}^{\ast}$, $i = 1, 2, ..., B$ is the B resamples of $x_1, ..., x_n$ with replacement. Let $\hat{\theta}_{n, i}^{\ast}$ be the estimate of $\theta$ using $x_{1i}^{\ast}, ..., x_{ni}^{\ast}$. Then, the bootstrap estimate of $\theta$ is given by

$$\hat{\theta}_{n, B} = \sum_{i=1}^{B} \hat{\theta}_{n, i}^{\ast} / B.$$  

Habibi (2011) studied the VaR estimates under the GARCH modeling using the bootstrap method. Let $r_t$ be the return of a specified portfolio. Then, for the normally distributed portfolio, the value at risk is given by

$$\text{VaR}_\alpha = -\mu + z_\alpha \sigma$$

where $\mu$ and $\sigma$ are the mean and variance of portfolio return. However, the quantile $z_\alpha$ may be obtained by the bootstrap method. Another method is Jacknife. The following Table gives the maximum and median of errors of VaR between bootstrap and Jacknife methods.

<table>
<thead>
<tr>
<th>$\alpha$</th>
<th>0.1</th>
<th>0.05</th>
<th>0.025</th>
<th>0.008</th>
<th>0.0025</th>
<th>0.0005</th>
<th>0.00025</th>
</tr>
</thead>
<tbody>
<tr>
<td>max</td>
<td>1.4</td>
<td>1.80</td>
<td>1.250</td>
<td>1.190</td>
<td>1.1200</td>
<td>1.0200</td>
<td>1.02000</td>
</tr>
<tr>
<td>med</td>
<td>1.1</td>
<td>1.50</td>
<td>1.000</td>
<td>1.020</td>
<td>1.0300</td>
<td>0.9900</td>
<td>0.98000</td>
</tr>
</tbody>
</table>

Source: Researcher results

---

Reza Habibi
Application of predictive methods in financial data sets

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**Particle Filter and EM Algorithm**

The Plain Particle Filter Framework (PPF) algorithm of Zhou et al. (2008) provides a good description for particle filter. The PPF algorithm in this problem is given as follows:

**PPF Algorithm**

1) Initialization. Sample \( \{x_{0i}^1\}_{i=1}^N \) i.i.d from initial distribution \( P_0 \). Set \( t = 1 \).

2) Importance sampling. Sample \( x_t^i \) from \( p(x_t|x_{t-1}^i), i = 1,2, ..., N, k = 0,1 \).

3) Bayes updating. Let \( p_t(x_t) = \sum_{i=1}^N w_t^i \delta(x_t - x_t^i) \),

where \( \delta \) the Dirac delta function is. Weights are calculated as \( w_t^i \propto p(y_t|x_t^i), i = 1,2, ..., N \), and normalized.

4) Re-sampling. Sample \( \{x_{t+1}^i\}_{i=1}^N \) i.i.d from \( p_t(x_t) \) and go to step 2.

Idvall and Jonsson (2008) applied the EM algorithm to algorithmic trading problem. Under the CAPM model

\[ E(r_t) = \alpha + \beta (E(r_m) - r_f) \]

Then,

\[ r_t = x_t + e_t \]

This defines a state space model. Applying the particle filter the following Table for the Value at Risk of a stock is obtained.

<table>
<thead>
<tr>
<th>Scenarios</th>
<th>( S_1 )</th>
<th>( S_2 )</th>
<th>( S_3 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Expected loss</td>
<td>14503</td>
<td>14668</td>
<td>17655</td>
</tr>
<tr>
<td>VaR(0.95)</td>
<td>43736</td>
<td>43775</td>
<td>52554</td>
</tr>
<tr>
<td>VaR(0.975)</td>
<td>55775</td>
<td>55988</td>
<td>96888</td>
</tr>
<tr>
<td>VaR(0.99)</td>
<td>51154</td>
<td>52257</td>
<td>122442</td>
</tr>
<tr>
<td>VaR(0.995)</td>
<td>74776</td>
<td>75136</td>
<td>168332</td>
</tr>
</tbody>
</table>

*Source: Researcher results*

**KDE Method**

The kernel density estimation (KDE) proposes a density based on a function called kernel and some parameters called bandwidth. There are many kernels like cosine, Gaussian, Epanechnikov and Triangular kernels. The general formulae for kernel density estimation are\( \hat{f}_h(x) = \frac{1}{Nh} \sum_{i=1}^N K\left( \frac{x - x_i}{h} \right) \). Grith et al. (2010) derived the risk neutral density using the kernel density estimation.

The main idea comes from this fact that under the risk neutral measure the discounted expectation of a financial derivative is its price. Here, using the historical data of the monthly call option of Intel Corporation during 2000-2015 and using the following kernels this density is estimated as follows. The following Table gives the maximum (max) and median (med) errors and asymptotic mean integrated squared error of bandwidth \( h \).

<table>
<thead>
<tr>
<th>kernel</th>
<th>formula</th>
<th>max</th>
<th>med</th>
<th>h</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gaussian</td>
<td>( \frac{1 - x^2}{\sqrt{2\pi}} )</td>
<td>0.020</td>
<td>0.010</td>
<td>0.01</td>
</tr>
<tr>
<td>Cosine</td>
<td>( \frac{T}{4 \cos(\frac{\pi}{2} u)} I(</td>
<td>u</td>
<td>\leq 1) )</td>
<td>0.004</td>
</tr>
<tr>
<td>Epanechnikov</td>
<td>( \frac{3}{4} (1 - u^2) I(</td>
<td>u</td>
<td>\leq 1) )</td>
<td>0.030</td>
</tr>
<tr>
<td>Triangular</td>
<td>( (1 -</td>
<td>u</td>
<td>) I(</td>
<td>u</td>
</tr>
</tbody>
</table>

*Source: Researcher results*
Consider the case 3.1. The TOPSIS is a multi-criteria decision-making like AHP, proposed by Hwang and Yoon (1981). It contains seven steps including an evaluation matrix consisting of alternatives and criteria, normalizing matrix, calculating the weighted normalized decision matrix, determining the worst alternative and the best alternative, calculating the related distances, calculate the similarity to the worst condition, and finally ranking the alternatives. In this problem, the category of TOPSIS is similar to KNN method, i.e., (ABT, AAP), (MMM, ATVI), (ABBV, ACN, AES).

Data Envelopment Analysis (DEA) is a widely used management tool. This method first was introduced in the seminal work by Charnes, Cooper, and Rhodes. It is usually used for evaluating efficiency in business, bank-

**Meta-heuristic methods**

**Simulated annealing**

Consider the case of part 3.1. For a given function defined in a large discrete support domain, there is a meta-heuristic optimization approach called simulated annealing to approximate the global optimum. There are some other search methods like brute-force search or gradient descent, however, simulated annealing is preferred when local optimum is more important than the global optimum. It is based on accepting worse solutions like other meta-heuristics methods. The logic behind it is similar to the process of heating and cooling a material. This process is done to alter the physical properties of material because of changes in internal structure. The cooled metal gets its new structure and receives its new properties. Lai (2010) applied the simulated annealing method in multifactor equity portfolio management. Ibanez et al. (2016) applied the simulated annealing method to study the stability of protein interaction networks in cancer and neurological disorders. The technique of Lai (2010), here, is used in the portfolio of case 3.1. It is seen that the weights are (0.1, 0.2, 0.15, 0, 0.3, 0.1, 0.05).

**Operation research technique, empirical results**

**TOPSIS**

Consider the case 3.1. The TOPSIS is a multi-criteria decision-making like AHP, proposed by Hwang and Yoon (1981). It contains seven steps including an evaluation matrix consisting of alternatives and criteria, normalizing matrix, calculating the weighted normalized decision matrix, determining the worst alternative and the best alternative, calculating the related distances, calculate the similarity to the worst condition, and finally ranking the alternatives. In this problem, the category of TOPSIS is similar to KNN method, i.e., (ABT, AAP), (MMM, ATVI), (ABBV, ACN, AES).

**DEA method**

Data Envelopment Analysis (DEA) is a widely used management tool. This method first was introduced in the seminal work by Charnes, Cooper, and Rhodes. It is usually used for evaluating efficiency in business, bank-

---

**Table 4: Weights of variables**

<table>
<thead>
<tr>
<th>Ratios</th>
<th>Contains</th>
<th>Input/Output</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Liquidity Ratio</td>
<td>Current Ratio</td>
<td>in</td>
<td>0.45</td>
</tr>
<tr>
<td></td>
<td>Quick Ratio</td>
<td>in</td>
<td>0.30</td>
</tr>
<tr>
<td></td>
<td>Working Capital Ratio</td>
<td>in</td>
<td>0.25</td>
</tr>
<tr>
<td>Activity Ratio</td>
<td>Accounts Receivable Turnover Ratio</td>
<td>in</td>
<td>0.30</td>
</tr>
<tr>
<td></td>
<td>Inventory Turnover Ratio</td>
<td>in</td>
<td>0.30</td>
</tr>
<tr>
<td></td>
<td>Asset Turnover Ratio</td>
<td>in</td>
<td>0.20</td>
</tr>
<tr>
<td></td>
<td>Collection Period Ratio</td>
<td>in</td>
<td>0.20</td>
</tr>
<tr>
<td>Leverage Ratio</td>
<td>Debt Ratio</td>
<td>in</td>
<td>0.30</td>
</tr>
<tr>
<td></td>
<td>Interest coverage Ratio</td>
<td>in</td>
<td>0.35</td>
</tr>
<tr>
<td></td>
<td>Equity Ratio</td>
<td>in</td>
<td>0.35</td>
</tr>
<tr>
<td>Profitability Ratio</td>
<td>ROA</td>
<td>out</td>
<td>0.26</td>
</tr>
<tr>
<td></td>
<td>ROE</td>
<td>out</td>
<td>0.27</td>
</tr>
<tr>
<td></td>
<td>Return On Current Assets</td>
<td>out</td>
<td>0.25</td>
</tr>
<tr>
<td></td>
<td>Return On Equity</td>
<td>out</td>
<td>0.10</td>
</tr>
<tr>
<td></td>
<td>Operating Profit to Sales</td>
<td>out</td>
<td>0.12</td>
</tr>
</tbody>
</table>

Source: Researcher results
Applying this method to the case of 3.1, weights (0, 0.35, 0.2, 0.15, 0.05, 0.22, 0.2) are derived.

**Sensitivity analysis**

Besides the optimized solution in a linear programming, the sensitivity analysis is also important. That is what event happens for an optimal solution when data values are changed. Standard approaches in linear programming presents many good answers to this question. For example, we refer to what occurs to the optimal tableau (see Winston, 2010). A natural question arises that under what changes in the arbitrage opportunity is removed. This needs the sensitivity analysis with real data sets.

**Kuhn-Tucker equation**

For a general problem \( \min_{x \in \mathbb{R}^n} f(x) \) subject to \( h_i(x) \leq 0, i = 1, 2, ..., m \) and \( l_j(x) = 0, j = 1, 2, ..., r \), the Kuhn-Tucker conditions (see Hillier and Lieberman, 2012) are:

1. \( 0 \in \partial f(x) + \sum_{i=1}^{m} u_i \partial h_i(x) + \sum_{j=1}^{r} v_j \partial l_j(x) \)
2. \( u_i h_i(x) = 0 \) for all \( i \)
3. \( h_i(x) \leq 0, i = 1, 2, ..., m, l_j(x) = 0, j = 1, 2, ..., r \)
4. \( u_i \geq 0 \) for all \( i \).

The Kuhn-Tucker solution for this problem is:

\[
\begin{align*}
    u_i & \sum_{j=1}^{n} w_j = 1, \\
    w_i & \sum_{i=1}^{n} w_i p_i^T = 0.
\end{align*}
\]

Solving this linear programming it is seen that

\[
    w_1 = \frac{p_2^T}{p_2^T - p_1^T}
\]

For \( n = 2 \) then \( w_1 + w_2 = 1 \) and \( u_1 - p_1^T u_2 = p_0^T \) this yield the \( w_1 = \frac{p_2^T}{p_2^T - p_1^T} \). An important result is the equilibrium condition for removing the arbitrage opportunity is \( p_i \) be independent of \( i \).

**Quadratic programming**

When the objective function is quadratic and constraints are linear, the program is quadratic program-
Decision variables of linear programming are continuous. For example, a producer can easily produce 100.34 gallons. However, sometimes this is not a realistic assumption. In this case, the decision variables are integer and the problem is referred as the integer programming. The Bayesian perspective to this problem is to choose a binary random variable $J = 0, 1$ such that

$$\text{Min} Z = p^0_J w_1 + p^0_J w_2 + p^0_J g(w_1, w_2)$$

subject to $Ax \leq b$ where $B$ is a squared matrix and $A$ is a general matrix, see Winston (2010). Next, suppose that three assets exist, then

$$\text{Min} Z = p^0_J w_1 + p^0_J w_2 + p^0_J g(w_1, w_2) \geq 0$$

$$w_1 + w_2 + g(w_1, w_2) = 1.$$

This is a non-linear programming. For example, for $g(w_1, w_2) = w_1^2 + w_2^2 + aw_1w_2$ this is a quadratic programming. The Lagrange multiplier equation is:

$$\Lambda = p^0_J w_1 + p^0_J w_2 + p^0_J g(w_1, w_2) - \lambda_1 (p^0_J w_1 + p^0_J w_2 + p^0_J g(w_1, w_2) - 1).$$

The Lagrange multiplier equations are:

$$p^0_J - \lambda_1 (p^0_J + p^0_J \frac{\partial g}{\partial w_1}) - \lambda_2 (1 + \frac{\partial g}{\partial w_1}) = 0$$

$$p^0_J + p^0_J (1 - J) - \lambda_2 (1 - J) \geq 0.$$ 

This is an integer programming.

### INTEGER PROGRAMMING

Decision variables of linear programming are continuous. For example, a producer can easily produce 100.34 gallons. However, sometimes this is not a realistic assumption. In this case, the decision variables are integer and the problem is referred as the integer programming. The Bayesian perspective to this problem is to choose a binary random variable $J = 0, 1$ such that

$$\text{Min} Z = p^0_J + p^0_J (1 - J)$$

$$p^0_J + p^0_J (1 - J) \geq 0.$$ 

This is an integer programming.

### NUMERICAL ANALYSIS METHODS

#### NUMERICAL COMPUTATION

The Black method is an appropriate method for approximation of the price of financial derivatives. The following Table gives these prices. Here, $k = 500$, $T = 1$, $r = 0.07$, $\sigma = 0.2$. The option has dividend yield. Here, it is assumed that the dividend yield is one USD for each month. To approximate the Black method sometimes techniques like Spline are applied. The following Table gives the results. The Black method is not applicable for American type options.

<table>
<thead>
<tr>
<th>Option type</th>
<th>10</th>
<th>40</th>
<th>80</th>
<th>120</th>
<th>250</th>
<th>Black value</th>
</tr>
</thead>
<tbody>
<tr>
<td>European Call</td>
<td>45.34</td>
<td>45.21</td>
<td>45.07</td>
<td>44.97</td>
<td>45.98</td>
<td>44.98</td>
</tr>
<tr>
<td>American Call</td>
<td>46.31</td>
<td>46.07</td>
<td>45.93</td>
<td>45.83</td>
<td>45.83</td>
<td>*</td>
</tr>
<tr>
<td>European put</td>
<td>31.54</td>
<td>31.41</td>
<td>31.27</td>
<td>31.18</td>
<td>31.18</td>
<td>31.18</td>
</tr>
<tr>
<td>American put</td>
<td>31.99</td>
<td>31.89</td>
<td>31.76</td>
<td>31.88</td>
<td>31.88</td>
<td>*</td>
</tr>
</tbody>
</table>

*Sources: Researcher results*

### ACTUAL CASE

Here, four methods including CART, K-means, TOPSIS, and simulated annealing are compared in the case of a customer churn example with real data set. However, because of security arguments, its name should be hidden. Consider a simulated bank where about five percent of its customers are churn. Here, churn customers are persons that have not contributed with the bank during the current six months. It is interesting to estimate this proportion using sample surveys. A real
data set is used including variables age, region, education, gender, cheque situation, occupation, account balance, and turnover. About discrete variables, Region has four levels indexed by 1,...,4, education has four levels Diploma or lower is 1, Bachelor is indexed by 2, Master by 3 and PhD or upper is 4. Cheque situation is zero is one if person has a dishonored cheque and zero otherwise. Occupation four levels and Churn has two levels: zero for loyal and 1 otherwise. Other variables are continuous variables. Using the Cochrane formula 384 is anticipated. They are categorized to two classes: churn and loyal. About nine percent of the sample is churn that is 35 persons. As follows, results of each method are given:

1) the K-means clusters are given,

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Cluster 1</th>
<th>Cluster 2</th>
<th>Cluster 3</th>
<th>Cluster 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>51.54</td>
<td>46.08</td>
<td>26.59</td>
<td>27.16</td>
</tr>
<tr>
<td>Region</td>
<td>1.27</td>
<td>1.96</td>
<td>3.19</td>
<td>4.19</td>
</tr>
<tr>
<td>Education</td>
<td>2.71</td>
<td>2.94</td>
<td>3.71</td>
<td>3.98</td>
</tr>
<tr>
<td>Cheque Situ.</td>
<td>0.12</td>
<td>0.36</td>
<td>0.82</td>
<td>0.94</td>
</tr>
<tr>
<td>Occupation</td>
<td>3.25</td>
<td>2.94</td>
<td>0.62</td>
<td>1.18</td>
</tr>
<tr>
<td>Account-Bal.</td>
<td>0.98</td>
<td>1.25</td>
<td>4.57</td>
<td>3.24</td>
</tr>
<tr>
<td>Turnover</td>
<td>0.34</td>
<td>0.42</td>
<td>1.25</td>
<td>1.49</td>
</tr>
<tr>
<td>Churn</td>
<td>1.00</td>
<td>1.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
</tbody>
</table>

Source: Researcher results

2) the tree of CART method is given as follows: It is seen that variables turnover and occupation have no effect on the tree structure,

![CART algorithm for customer churn](image)

Source: Researcher results

3) the simulated annealing (SA) gives weights (0.22, 0.05, 0.27, 0.11, 0.14, 0.18, 0.03) for each variable to construct discriminate function,

4) the TOPSIS provides gives weights (0.25, 0.12, 0.1, 0.07, 0.12, 0.29, 0.05) for each variable to construct discriminate function.
The following Table gives the probabilities of types I and II, for each method.

<table>
<thead>
<tr>
<th>Method</th>
<th>K-means</th>
<th>CART</th>
<th>TOPSIS</th>
<th>SA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Error I prob.</td>
<td>0.04</td>
<td>0.07</td>
<td>0.01</td>
<td>0.03</td>
</tr>
<tr>
<td>Error II prob.</td>
<td>0.02</td>
<td>0.03</td>
<td>0.06</td>
<td>0.04</td>
</tr>
</tbody>
</table>

Source: Researcher results

According to the probabilities of error types I and II, it can be seen that, in this case, the best procedure is TOPSIS, the second best is simulated annealing, then K-means and finally CART.

Conclusions

Probability of error type I are sorted from smallest to largest for TOPSIS, SA, K-means and CART. Also, the smallest to largest probability of error type II belongs to the K-means, CART, SA and TOPSIS. Although almost all four methods seem reasonable applications in practice. These methods are chosen as selected methods of the mentioned categories. The criteria for choosing methods are types I and II errors probabilities. Although, these probabilities are sorted and methods are chosen, similar to the hypothesis testing approach, by keeping the type I error probability at the level of 0.05, then the best methods are K-means, SA and TOPSIS.

Acknowledgments

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References


Abstract

An important role in ensuring effective forms of management and increasing competitiveness is played by the process of forecasting the activity of the enterprise. This work analyzed the performance of a food industry enterprise, for which a wide range of statistical methods were applied such as methods of cluster, correlational and regression analysis, statistical tests of Fisher, Student, Farrar-Glauber, Durbin-Watson, Goldfeld-Quandt, \( \mu \)-criterion, multifactor regression, trend, auto-regression models, and models of seasonal fluctuations, which provided a view of the economic properties of the enterprise profit process, in particular the auto-regression component of revenue dependence on its value last year, seasonal quarterly dependence on sales and marketing costs, product price, etc. The detected patterns will allow us to take into account these features for forecasting future revenues and for adjusting the enterprise’s decision-making system taking into account seasonal features and results of the previous year.

\[ \text{JEL classification: A1, C1, C5, C6, C8} \]
\[ \text{Keywords: multifactor regression, forecasting revenue, correlational and regression analysis} \]
**INTRODUCTION**

The confectionery market of Ukraine is a dynamic market, where there are constant fluctuations in the volume of production, revenues and profits of enterprises, as well as every year there is increased competition (today in this area there are 5,459 companies: 6 large, 274 medium and 5,179 small firms). The events of 2014 significantly weakened the positions of large confectionery companies located in the temporarily occupied territories, in particular PJSC AVK and JSC PU "Konti", so these companies were forced to return their leadership positions. An important role in ensuring effective forms of management and increasing competitiveness is played by the process of forecasting the activity of the enterprise, which is responsible for the selection, evaluation and interpretation of financial, economic and other data affecting the process of making important decisions.

**Literature review**

The main issues of forecasting the activity of enterprises are highlighted in scientific works by such scientists as Drobysheva, Zakabluk, Sidorova and Burkina, Sapun, Seleznева and Soboń, Rogozińska-Mitrut and Soboń and others. However, as practice shows, in rapidly changing market situations not enough attention is paid to the forecasting process on the part of managers of enterprises, which negatively affects the final results of their activities.

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Thus, this company is a bright representative of the confectionery industry, which led to the research on its example. For the analysis, the data of PrJSC "VMZ "Roshen" for 2014-2018 were used on the main types of goods sold by the enterprise:

1) milk fat dehydrated (t 32°),
2) butter “Extra” 82.5% fat,
3) the lactosecent product condensed with vegetable fat and sugars "Moles” 8.5% fat,
4) skimmed milk powder,
5) whole milk powder 26% fat,
6) other.

The first step of the study was to identify uniformity on the set of indicators of the enterprise’s activity by the main types of products. Indicators chosen for the analysis are:

\[ Y \] - revenue from sales of products, thousand UAH,
\[ X_1 \] - sales costs, thousand UAH,
\[ X_2 \] - marketing and advertising costs, thousand UAH,
\[ X_3 \] - average selling price, UAH/ton,
\[ X_4 \] - total production, UAH.
The first stage of the study with the help of the Statistica Enterprise 10.0 program was implemented clustering on the selected features by the k-means method of 3 clusters, which is reflected in Figure 1.

Figure 1: Clustering of the main types of goods of the enterprise, left to right: $X_1$, $X_2$, $X_3$, $X_4$, $Y$

The first cluster includes 15 observations. It has average values in terms of revenues and the largest in terms of manufactured products. The largest amount of money is spent on the promotion of goods in this cluster. The third cluster consists of 14 observations. It has the lowest revenue value, average marketing costs, and sales. Thus, cluster analysis allowed us to polish the inputs, to detect their relative homogeneity for further analysis.

The study of the impact of all indicators on revenue was carried out by correlational and regression analysis. The correlation matrix, given in Table 1, shows the impact of all selected factors on the resulting revenue from the sale of products.

The construction of a multifactory regression model took place by step-by-step exclusion. Four factor linear model $\hat{y} = \hat{a}_0 + \sum_{i=1}^{4} \hat{a}_i x_i$ is built on all factors selected:

$$\hat{y} = 78885.91 + 14.26 x_1 + 295.74 x_2 + 5.43 x_3 - 0.28 x_4$$

($R^2 = 0.984$, $R^2_n = 0.979$).
a study of the prerequisites used by the method of the least squares, which is the basis for obtaining the coefficients of the model.

Verification of multicollinearity between the two factor arguments was carried out according to the Farrar-Glauber test, which allowed us to draw the following conclusions:

\[ \chi^2_{\text{fact}} < \chi^2_{\text{table}} \] (0.846<3.841), then there is no multicollinearity in the \( X_2, X_3 \) variable array.

Since condition \( F_{\text{fact}} > F_{\text{table}} \) \((F_{\text{table}} = 3.592)\) is performed for statistics \( F_2 \) and \( F_3 \), then the conclusion (with a probability of 95%) about the statistical non-significance of the multiple correlation coefficients of \( X_2, X_3 \) and the absence of close linear dependence of each factor with the other is confirmed.

Since statistics \( t_{23} \) are met by the condition \( t_{\text{fact}} < t_{\text{table}} \) \((t_{\text{table}} = 2.1)\), there is no close linear dependency between \( X_2 \) and \( X_3 \).

Thus, the Farrar-Glauber test proved the absence of multicollinearity between the selected factors.

To verify the results of the model, we will conduct a study of the prerequisites used by the method of the least squares, which is the basis for obtaining the coefficients of the model.

Verification of multicollinearity between the two factor arguments was carried out according to the Farrar-Glauber test, which allowed us to draw the following conclusions:

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Thus, the Farrar-Glauber test proved the absence of multicollinearity between the selected factors.

To check the fulfillment of the conditions of homoskedasticity for the two-factor model \( \hat{y} = 40875.58 + 161.1 \times_2 + 5.85 \times_3 \) was applied the \( \mu \) criterion that proved that the constructed model has heteroscedastic remnants, because \( \mu > \chi^2_{\text{table}} \) (8.59>7.81).

Table 1: Correlation matrix of factors of the enterprise

<table>
<thead>
<tr>
<th></th>
<th>Sales costs, thousand UAH</th>
<th>Marketing and advertising costs, thousand UAH</th>
<th>Average selling price, UAH/ton</th>
<th>Total production, thousand UAH</th>
<th>Revenue from sales of products, thousand UAH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sales costs, thousand UAH</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Marketing and advertising costs, thousand UAH</td>
<td>0.001949359</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average selling price, UAH/ton</td>
<td>0.654027305</td>
<td>0.217208649</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Volume of manufactured products, thousand UAH</td>
<td>0.398120650</td>
<td>0.907875708</td>
<td>0.488470552</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Revenue from sales of products, thousand UAH</td>
<td>0.636067789</td>
<td>0.496587375</td>
<td>0.941233385</td>
<td>0.723728068</td>
<td>1</td>
</tr>
</tbody>
</table>

Source: Author’s elaboration

When checking the significance of the model, it is found that:

\[ F_{\text{fact}} = 17.8, F_{\text{table}} (\alpha = 0.05, v_1 = 4, v_2 = 15) = 3.0556. \]

Since \( F_{\text{fact}} > F_{\text{table}} \) \((17.8>3.0556)\), \( P(F_{\text{fact}} < F_{\text{table}}) \leq \alpha : 2.8610 \times 10^{-13} \)<0.05, the resulting model is statistically significant with a reliability of at least 95%. However, there are no significant coefficients for variables \( X_1 \) and \( X_4 \), the error of which is greater than the specified value \( \alpha = 0.05 \). In the process of step-by-step selection of factors, a two-factor linear model \( \hat{y} = \hat{\alpha}_0 + \hat{\alpha}_2 x_2 + \hat{\alpha}_3 x_3 \) was obtained, which is significant in all criteria with a relative approximation error of 5.09% in the form of:

\[ \hat{y} = 40875.58 + 161.1 \times_2 + 5.85 \times_3 (R^2 = 0.975 \ R^2_n = 0.973). \]

The resulting model allowed us to find that while increasing the cost of marketing and advertising for each thousand UAH (subject to the immutability of other factors) revenue from sales of products increases by an average of 161.1 thousand UAH. With the increase in the average selling price of 1 UAH/t (subject to the immutability of other factors), revenue from the sale of products will increase by an average of 5.85 thousand UAH.

To verify the results of the model, we will conduct

\[ \gamma = 40875.58 + 161.1 \times_2 + 5.85 \times_3 \] (\( R^2 = 0.975 \ R^2_n = 0.973 \)).

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To verify the results of the model, we will conduct

\[ \gamma = 40875.58 + 161.1 \times_2 + 5.85 \times_3 \] (\( R^2 = 0.975 \ R^2_n = 0.973 \)).
To determine which of the variables is the cause of heteroskedasticity, a check was made for each variable using the Goldfeld-Quandt test, which concluded (with 95% reliability) that variable $X_2$ is not the cause of heteroskedasticity of the model residues, as $F^{(2)}_{\text{fact}} < F_{\text{table}}$ (0.047 < 5.05) and $F^{(3)}_{\text{fact}} < F_{\text{table}}$ (0.007 < 5.05). So, variable $X_3$ is not the cause of heteroskedasticity of the remnants of the model. Thus, none of the indicators causes heteroskedasticity alone.

Due to the fact that the current trend is influenced by the latest values of the indicator, it was decided to consider the reduced sample. After removing the four first observations $y_1, y_2, y_3, y_4$ to the $\mu$ criterion the hypothesis of heteroscedasticity was rejected: $\mu < \chi^2_{\text{table}}$ (3.33 < 7.81).

$$\bar{y} = 36527.50 + 161.65 x_2 + 5.91 x_3$$

High determination ratio $R^2 = 0.95$, Fisher’s criterion $F = 121.3406$, and low average relative error of approximation $\xi = 4.94\%$, the presence of homoskedasticity and lack of multicollinearity characterize the sufficiently high quality of the model.

Another important aspect that often arises in economic research and impairs the quality of regression models is the presence of autocorrelation. To test the hypothesis of the presence of autocorrelation of the constructed model, the Durbin-Watson test was applied. The actual value of the criterion is close to zero, so it was concluded that there is autocorrelation. To improve the quality of the model, minding the detected autocorrelation, another factor $y_{t-1}$ was introduced into the model, in result the model took the form:

$$y = 23233.66 + 90.33 x_2 + 4.18 x_3 + 0.32 y_{t-1}$$

The resulting model has even higher quality indicators. In particular, the coefficient of determination $R^2 = 0.974$ became higher and proves that the constructed model explains the variance of the effective characteristic $Y$ by 97.4%, and only 2.6% is due to factors not accounted in the model.

At the significance level $\alpha = 0.05$ all coefficients of the model are significant, and the whole model is also significant according to Fisher’s criterion: $F_{\text{fact}} > F_{\text{table}}$ (150.84 > 3.49). The approximation error is only $\xi = 3.27\%$, which demonstrates an even higher quality of the model.

The results of the models constructed are shown in Table 2.

### Table 2: Comparison of econometric models

<table>
<thead>
<tr>
<th>#</th>
<th>Model</th>
<th>$n$</th>
<th>$R^2$</th>
<th>$R^2_{\text{norm}}$</th>
<th>$\xi$</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>$\hat{y} = 40875.58 + 161.1 x_2 + 5.85 x_3$</td>
<td>20</td>
<td>0.975</td>
<td>0.973</td>
<td>5.09%</td>
</tr>
<tr>
<td>2</td>
<td>$\hat{y} = 36527.50 + 161.65 x_2 + 5.91 x_3$</td>
<td>16</td>
<td>0.949</td>
<td>0.941</td>
<td>4.94%</td>
</tr>
<tr>
<td>3</td>
<td>$y = 23233.66 + 90.33 x_2 + 4.18 x_3 + 0.32 y_{t-1}$</td>
<td>16</td>
<td>0.974</td>
<td>0.968</td>
<td>3.27</td>
</tr>
</tbody>
</table>

Source: Author’s elaboration

The latest model is the best, so it was used for forecasting. As a result, the forecast values of the volume of revenues from sales

$$y_{17} = 492369.2779 \text{ thousand UAH}, \text{ and} \ y_{18} = 478112.7284 \text{ thousand UAH}$$

were obtained with an average fluctuation of about 6%.

The next step of the study was to find out the seasonal properties of the sale of products, thousand UAH. To do this, the time interval was extended and the data was chosen quarterly. 28 quarters for 2012-2018 were analyzed, according to which the graphic depicted in Fig. 2 was constructed and demonstrates a clear trend toward revenue growth.
To find the cycle length, the coefficients of autocorrelation of deviations with a lag of 1, 2, 3, 4, etc. were successively calculated. The largest in absolute value autocorrelation coefficient determines the length of the cycle in 12 quarters.

The calculated indicators of the absolute oscillation force provided the following results. The amplitude of fluctuations between the largest and smallest in absolute magnitude deviation from the trend is 64,406.18711 thousand UAH. The average linear deviation is 23,033.82, that is, the specific values of revenue from the sale of time series products deviate from the trend by an average of 23,033.82 thousand UAH. The average standard deviation shows that the levels of the time series are in a wide range of values.

Seasonality indices were calculated according to two methods – by average without the trend and on trend indicators that characterize the existing trend. According to the first method, the peak falls in the fourth quarter, and the second method gives the first quarter, and the smallest value in the first method is for the first quarter, the second method gives the third quarter, which once again confirms the importance of taking into account a sufficiently stable trend toward growth.
Taking into account the fact that the existing seasonal fluctuations do not have a clear size shape, seasonality indices were calculated using the algorithm of adjustment of parameters for asymmetric seasonal fluctuations taking into account the trend.

The trend equation for a conditional time looks like: \( \hat{y} = 320643.96 + 18106.6 \times t \).

When calculating the parameters, the peaks are sharply allocated for the fourth quarter, for \( t \) on average it will be zero weight. The minimum levels of the first quarters fall on the values of \( t \) which on average give a negative weight. The values of the levels of the 2nd quarter are lower than the average for the year, their weight \( t \) is on average zero. The positive weight of "emissions" falls on the 3rd quarter. To adjust the calculation, it is necessary to "remove" from the numerator of the parameter \( b \) the specified inequality, i.e. the excess of positive deviations from the trend in the third quarters over the negative values of deviations in other quarters. The adjusted equation of the trend obtained has the form:

\[ \hat{y} = 320643.96 + 17951.84 \times t. \]

Thus, the exaggeration of the average increase in levels of the series per quarter due to the asymmetric distribution of seasonal peaks was 0.86%.

Seasonality indices are not much different. With the adjusted trend, the value of seasonal fluctuations decreased by less than 1%, which once again emphasizes the significance of the existing fluctuations, which should be taken into account in the design of the company's further activities, although they are not strongly manifested, but present.

Graphical indices of seasonality are presented in Figure 3.

![Figure 3: Schedule of seasonal fluctuations in sales revenues](Source: Author's elaboration)

According to the results of clustering, a series of models was also built, but clustering on the one hand increases the uniformity of input data, and on the other hand reduces the volume of sampling. In this case, the sample reduction was critical and the resulting models on individual clusters had poorer quality than the module obtained throughout the database, which once again emphasizes the sufficient uniformity of input data and a sufficiently stable decision-making system implemented at the enterprise, according to which the production and sales strategy does not depend heavily on the time and type of products.

**Conclusion**

Thus, the work analyzed the performance of the food industry enterprise, for which a wide range of statistical methods were applied such as methods of
dependence on sales and marketing costs, product price, etc. The detected patterns will allow us to take into account these features for forecasting revenues for the coming years and adjust the system of acceptance of decisions at the enterprise taking into account seasonal features and results of the previous year.

References


