risks

MDPI

Article

Financial Transactions Using FINTECH during the Covid-19 Crisis in Bulgaria

Ivanka Vasenska [1,*], Preslav Dimitrov [1], Blagovesta Koyundzhiyska-Davidkova [2], Vladislav Krastev [2], Pavol Durana [3] and Ioulia Poulaki [4]

[1] Department of Tourism, South-West University, 2700 Blagoevgrad, Bulgaria; preslav.dimitrov@swu.bg
[2] Department of Economics, South-West University, 2700 Blagoevgrad, Bulgaria; vesi_8808@abv.bg (B.K.-D.); vladislav_swu@law.swu.bg (V.K.)
[3] Faculty of Operation and Economics of Transport and Communications, Department of Economics, University of Zilina, 010 26 Zilina, Slovakia; pavol.durana@fpedas.uniza.sk
[4] Department of Tourism Management, University of Patras, 26504 Patras, Greece; ipoulaki@upatras.gr
* Correspondence: ivankav@swu.bg; Tel.: +359-899-953-396

Abstract: In the context of current crises following COVID-19 and growing global economic uncertainties, the issues regarding financial transactions with FINTECH are increasingly apparent. Consequently, in our opinion, the utilization of FINTECH financial transactions leads to a risk-reduction approach when in contact with other people. Moreover, financial transactions with FINTECH can save up customers' pecuniary funds. Therefore, during crises, FINTECH applications can be perceived as more competitive than the traditional banking system. All the above have provoked us to conduct research related to the utilization of financial transactions with FINTECH before and after the COVID-19 crisis outbreak. The aim of the article is to present a survey analysis of FINTECH utilization of individual customers before and after the crisis in Bulgaria. The methodology includes a questionnaire survey of 242 individual respondents. For the data processing, we implemented statistical measures and quantitative methods, including two-sample paired *t*-tests, Levene's test, and ANOVAs performed through the computer language Python in a web-based interactive computing environment for creating documents, Jupyter Notebook. The findings bring out the main issues related to the implementation of financial transactions with FINTECH under the conditions of the crisis. The findings include the identification of problems related to FINTECH transactions during the COVID-19 crisis in Bulgaria.

Keywords: FINTECH; financial transactions; COVID-19; crises and risk management; customer behavior

Citation: Ivanka, V.; Dimitrov, P.; Koyundzhiyska-Davidkova, B.; Krastev, V.; Durana, P.; Poulaki, I. Financial Transactions with FINTECH during the Covid-19 Crises in Bulgaria. *Risks* **2021**, *9*, 48. https://doi.org/10.3390/risks9030048

Academic Editor: Alexande Szimayer

Received: 26 January 2021
Accepted: 1 March 2021
Published: 5 March 2021

1. Introduction

Nowadays, one of the biggest crises in the world is the ongoing COVID-19 pandemic. It presumably started near a meat market in Wuhan in central China, in December 2019, in contrast to the global financial crisis (GFC) of 2008, which started in New York (Wójcik and Ioannou 2020). Following this, in late February or early March 2020, the contagion spread rapidly, first throughout Europe and then through the USA. In response to the growth of infections (European Centre for Disease Prevention and Control 2020) and, in particular, to the exponential increase in deaths, most of Europe was placed under lockdown, with the USA adopting similar measures. Consequently, the COVID-19 pandemic developed into a real global crisis, directly affecting almost every location on the planet. Inevitably, the world's economy was disrupted by the COVID-19 crisis. Nevertheless, economists underestimated and considered the pandemic as a simple and natural event that originated outside of the economic system and, ergo, had nothing to do with eco-

nomic spheres (Nowlin 2017). Afar from the immediate health crisis, COVID-19 is basically a crisis of economized societies rooted in the growth-paradigm (Ötsch 2020). Moreover, governments worldwide reacted to the crisis based on forecasts for GDP shortfalls and steep increases in unemployment, with "rescue packages" and "shock therapies" on an unprecedented scale (Gretzel et al. 2020). Consequently, the financial sector was among the first and most affected economic sectors. Despite policymakers' efforts to curb the negative economic impact of the epidemic, financial markets have become highly labile. For that reason, policymakers are opposed to tough possible courses of action. If no action is taken, the number of infections grows exponentially along with the death toll. However, prolonged and total lockdowns may lead to local and global economic collapse. All stakeholders need to trade off economic costs against avoided death or, more generally, public health; this is difficult but not new per se. Considering the coronavirus outbreak, medical costs should not be the main target of the discussion, and a price on the lives saved by social distancing must not influence governmental offices to undertake further drastic measures. The societal and political response to a major outbreak like COVID-19 is highly dynamic, often changing rapidly with increasing case numbers (Gros et al. 2020). In order to lower the increasing case numbers, scholars have examined a range of determining factors for the ongoing COVID-19 epidemic, in particular, the effect of quarantine (Peng et al. 2020) and that community-level social distancing may be more important than the social distancing of individuals (Siegenfeld and Bar-Yam 2020). The originality of the research is within the combination of the survey conducted on financial transaction utilization with FINTECH implementations during the COVID-19 crisis, with the adaption of the computer language "Python" to the methods of statistical analysis. The utilization of FINTECH should limit the possibility of direct contact with COVID-19. In the meantime, this utilization could help the population comply with the declared pandemic state of emergency measures.

Therefore, we were provoked to elaborate on research regarding FINTECH utilization of individual customers' attitudes before and after the crisis in Bulgaria under elaborate risk. Moreover, the analysis results bring out the main issues related to the implementation of financial transactions with FINTECH under the conditions of the unfolding crises. The current study aims to establish individual customers' utilization of FINTECH before and after the Covid-19 crisis in Bulgaria due to the fact that such research has not been performed, and the findings could provide the FINTECH sphere with information to target, diversify, and popularize their products better on the Bulgarian market. For this reason, we prepared and conveyed a survey questionnaire conducted on 242 individual respondents. Moreover, we tested the information derived from the research question hypotheses in a computer-generated environment using the Python language. Following the global trend among economic researchers for digitalized analysis implementation on an international level, we decided to provide a new perspective towards statistical survey analysis.

The leading role of technology in finance has become very important, with a specific term describing the intersection between the two—FINTECH. One notion of "financial technology" interprets it as the utilization of new technological improvements to products and services in the financial sphere (Schueffel 2016; Leong and Sung 2018; Milian et al. 2019; Di Pietro et al. 2021; Wamba et al. 2019; Ratecka 2020). The FINTECH definition is rather broad and also combines "innovative ideas that improve financial service processes by proposing technological solutions according to different business situations, while the ideas could also lead to new business models or even new businesses" (Leong and Sung 2018). Following previous definitions (Schueffel 2016; Leong and Sung 2018; Milian et al. 2019; Ratecka 2020), the sector of financial technologies (FINTECH) cannot be determined as a novel industry but as one that has progressed at an extremely volant pace.

The paper is divided into three main parts.

The literature review represents how the COVID-19 pandemic and FINTECH utilization are related, with definitions and elaborations on the surveyed financial instrument

applications. The part regarding research objectives and methodology describes the conducted survey questionnaire, the implemented scale, the methods used, and their statistical background theory. Statistical calculations and the tested hypothesis are located in the section on results and discussions. Regarding manuscript theory implementation, we consider that the methods implemented can contribute to the methodology used for identifying individual customers' attitudes towards FINTECH use in Bulgaria during periods of risky conditions and crisis.

2. Literature Review

Over the past decades, the frequency and scale of crises have increased dramatically, which is evident from the scope of the current COVID-19 crisis. On a global level, people are faced with more crises and disasters than ever before (Pennington-Gray 2018). Moreover, the extending coronavirus pandemic has hindered the free movement of people and goods, ceased air travel, quarantined a large part of the world's population, precipitated depression on a large scale, and disturbed the ongoing development of global capitalism (Mostafanezhad 2020). Just as the GFC encompassed the world through international financial and economic interrelatedness, globalization has helped turn COVID-19 into a pandemic through international travel. Thus, the ongoing COVID-19 crisis is endogenous and should have been anticipated (Woolhouse et al. 2016).

The development and exploitation of new technologies generate opportunities, especially for many local economies, to promote their products globally at low cost, expecting a bigger share not only from local markets but also from the global travel market (Koutras et al. 2016) and following the same path when it comes to financial transactions. Thus, at the core of the development of financial services has been information technology (IT). It started in the middle of the twentieth century when Barclays introduced the automatic teller machine (ATM); financial services were transformed by the development of the analog era to the digital era of electronic payment systems and the rise of automated securities trading and online banking (Arner et al. 2015; Wójcik and Cojoianu 2018). In the aftereffect of the GFC, researchers attested to the boom of a new wave of financial innovations, referred to as FINTECH, which is powered by development in data science and computational power to store and analyze large financially related datasets (Cojoianu et al. 2020). In addition, technology can be perceived as substantive to natural, social, and economic systems and can be applied to solve particular issues associated with a crisis without esteeming larger societal consequences. Hence, data science is observed as a tool to accomplish the technological progress needed to overcome crises (Gretzel et al. 2020).

All the same, a new generation of financial technology called FINTECH has arisen, with an industry of start-ups employing online platforms, blockchain, artificial intelligence (AI), and other technologies and transforming existing business models in the financial sphere (Hendrikse et al. 2019). That is why FINTECH is one of the trendiest areas in finance. According to Imerman and Fabozzi (2020), from 2010 through the end of 2019—a period referred to as the "FINTECH Revolution"—more than $165.5 billion was poured into FINTECH companies. Furthermore, the authors suggest that the digital transformation led by FINTECH innovations relies on a catalyst—the global financial crisis. Such catalysts can provoke the market adaptation of FINTECH innovations; if they do not provide a solution to customers and businesses, they can inevitably fall by the wayside following the COVID-19 pandemic (Imerman and Fabozzi 2020). Additionally, FINTECH is going to change customers' expectations and preferences while increasing the number of users who expect fast and easily accessible services that are available on mobile phones and other electronic devices (Vučinić 2020).

FINTECH has been developing rapidly, which is why a large number of documents refer to the summary of definitions on the topic. The Financial Stability Board identifies FINTECH as a technologically empowered revolution in financial services that may lead to new business models, applications, processes, or products, with a related material effect on financial markets, financial institutions, and the provision of financial services (Vučinić

2020). Lee and Teo (2015) stress the five principles of FINTECH: low profit margins, light assets, expandability, innovation, and easy compliance. Some authors have constructed a literature review on FINTECH and analyzed future research directions of FINTECH that are more cross-country and cross-regional peer-to-peer transfer systems, including the smartphone in financial transactions and wearable facilities for financial transactions (Gomber et al. 2017). Haddad and Hornuf (2018) observe that FINTECH occurs more frequently in countries with well-developed economies or more fragile financial sectors. Stressing the importance of FINTECH expansion to financial services, the International Monetary Fund and the World Bank launched the Bali FINTECH Agenda, with the aim of fostering international cooperation and helping member states to harness the benefits and opportunities of fast development in financial technology and mitigate potential risks (IMF 2018). The development of financial services could contribute to macroeconomic stability by lowering constraints, resulting in faster economic growth, less poverty, and lower-income inequality, and helping customers overcome crises and risk periods (Vučinić 2020).

During the past twenty years, digitalization has shaped a lot of industries, providing new entrepreneurial opportunities and facilitating new systems of innovation (Barrett et al. 2015; Autio et al. 2018). The latest FINTECH business model research hotspots are mobile payments, microfinance, P2P lending, and crowdfunding. Thirdly, it puts forward blockchain and crowdfunding as future trends of FINTECH studies (Liu et al. 2020). Therefore, the financial applications that are studied in our questionnaire survey are ePay.bg, Paysera, P2P platforms, applications for digital portfolios, and crowdfunding due to the fact that they are among the most used FINTECH applications globally (Pricewaterhouse Coopers 2017). Through ePay.bg, it is possible to make payments for goods or services to registered merchants and order transfers to other persons using bank cards and microaccounts.

Paysera's clients can make low-budget money transfers through a system of bank accounts within countries, and Paysera provides their customers with cross-border transfers at the cost of domestic transfers. Peer-to-peer investing is most often made through specialized internet platforms. This type of company allows people with savings to provide it to those who need a loan at a certain interest rate. Through applications for digital portfolios, the customer can register his/her debit or credit card with a mobile application of a bank, and, after that, he/she can pay directly with their digital device. A universal understanding of the term "crowdfunding" is that small amounts of capital can be raised from a large number of individuals to finance a new business venture. Crowdfunding provides easy access to networks of people through social media, and crowdfunding websites bring investors and entrepreneurs together, expanding the pool of investors beyond the traditional circle of owners, relatives, and venture capitalists. In our opinion, the use of financial instruments of FINTECH companies by customers will become an alternative to some of the more expensive banking services.

The survey questionnaire was distributed among the Bulgarian population due to the unique circumstances that have placed Bulgaria as one of the countries in the region, if not in the EU, with one of the lowest numbers of SARS-CoV-2 infections. Here, we consider it appropriate to elaborate briefly on the situation in Bulgaria. The Bulgarian government announced a state of emergency on 13 March 2020 due to the COVID-19 pandemic, which lasted until 13 May 2020. Besides measures that applied to the entire population, the government also declared numerous measures directed at foreigners in the country. All pending administrative procedures were ceased until 13 May 2020, as well as those that were related to migrants and refugees. Governmental Order RD-01-183 temporarily prohibited the entry of all third-country nationals into Bulgaria, although this ban did not apply to family members of Bulgarian citizens and persons with permanent or long-term residence status in Bulgaria and their family members, among other categories of individuals (European Commission 2020). This situation provoked us to define two periods in the survey questionnaire—"before" and "after"—due to the fact that all foreign

and local experts (Ivanov 2020; Damyanov 2020; Blagoev and Boyadzhiev 2020) believed that the state of emergency should be lifted immediately after 13 May 2020, following their opinion that the number of SARS-CoV-2 coronavirus infections would decrease in the summer (Mandal and Panwar 2020; Ma et al. 2020; Zhu et al. 2020; Wu et al. 2020; Demongeot et al. 2020; Qi et al. 2020; Shi et al. 2020). In due course, according to the data from the Centre for Systems Science and Engineering (CSSE 2020), the cases in Bulgaria as of 13 May 2020 were 46 (42 for the 7-day average), which was one of the main arguments for the Bulgarian health minister and the National Operational COVID-19 Headquarters to lift the state of emergency, with a perspective for the restoration of socioeconomic life. Consequently, due to the low active cases per day, for a period of 15 days, numerous social and economic activities started to operate under the conditions of an emergency situation, where people were obliged to observe the required physical distance measures and wear masks while performing their daily activities. Furthermore, the so-called effective reproductive number (R) remained at 1 (i.e., one patient infects one person), and the 14-day quarantine for arrivals in the country from the EU, Northern Macedonia, and Serbia was lifted, and no PCR-tests were not required upon entering in Bulgaria. Thus, and based on the data and measures during that period from neighboring countries (Greece, Romania, Northern Macedonia, and Turkey), which had increasing numbers of new cases, high R numbers, and tightening measures, we decided to study the Bulgarian population in order to contribute to filling the research gap on the topic. Furthermore, Bulgaria was among the top five countries in Eastern and Central Europe (ECE) where the level of FINTECH development by country was estimated as "innovating" by the World Bank Group (2020). Moreover, only a small number of studies have been done on the topic of how FINTECH utilization and usage can be related to the risky conditions of the ongoing pandemic compared to such usage before the COVID-19 crisis. Can the population perceive the risk of virus exposure as an opportunity to change their attitudes towards FINTECH instruments? Can they consider increasing their FINTECH to change their quality of life? For the purpose of answering these questions, we formed two hypotheses.

Just after the GFC, the Bulgarian FINTECH sector was studied, among others in the region, by a limited number of researchers in the scope of FINTECH venture capital (Cumming and Schwienbacher 2018), cash payments for utility bills, remittances as a percentage of GDP (World Bank Group 2020), FINTECH adoption driven by COVID-19 based on mobile app download data from the AppTweak platform (Fu and Mishra 2020), clustering analysis of e-commerce enterprises (Zoroja et al. 2020), FINTECH innovation in the Western Balkans (Odorović et al. 2020), Bulgarian financial technology market size estimation (Deloitte 2016), alternative and FINTECH payment solutions for airlines (Romānova et al. 2019), FINTECH for sustainable development (Michael 2020), pro-communist countries' challenges for digital innovations (Kerényi 2018), and in a study on competition issues in the area of financial technology (conducted by European Parliament in 2018). Unfortunately, no extensive research on the topic has been done in Bulgaria, if not in Europe, particularly of individual FINTECH usage before and after the immediate COVID-19 crisis. According to World Development Indicators (2017–2018), Bulgaria was in second place for secure internet servers per one million people across the European and Central Asian (ECA) region. FINTECH in the Central and Eastern European region (World Bank Group 2020) is increasing steeply. As was reported, Russia, Turkey, and Bulgaria have the largest numbers of FINTECH enterprises in the region as of mid-2018. Since 2018, 70 FINTECH companies have been registered in Bulgaria; most of them operate in the transaction, resource management, and investment spheres (Matthews 2018) despite the fact that the country has been perceived as a small domestic market constrained by cybersecurity risks and risks arising from new products and business models (World Bank Group 2020).

3. Research Objective and Methodology

The current study aims to establish individual customers' utilization of FINTECH before and after the Covid-19 crisis. The population evaluation is based on the results of a survey questionnaire conducted on 242 Bulgarian adult respondents for the period March–May 2020. Our research used a sampling method via virtual networks and, more precisely, social networks in order to study "hard-to-reach" populations. Baltar and Brunet (2012) argue that "in the ambit of social research, the use of new technologies is still questioned because selection bias is an obstacle to carrying out scientific research on the internet". Moreover, their research states that the use of social networking sites can be effective for the study of "hard-to-reach" populations. Baltar and Brunet (2012) further elaborate that the main advantages of this technique are that it can expand the geographical scope of the research and facilitates the identification of individuals with barriers to access. Thus, we consider the lockdown conditions imposed by the government in Bulgaria as such barriers; therefore, our population was "hard-to-reach" during the self-isolation period from March 2020 to May 2020. That is why the survey was conducted using a Google form in Bulgarian, which was distributed through Facebook networks. The survey distribution was based on Facebook groups for students, Ph.D students, and researchers and lecturers in Bulgaria due to the fact that younger, highly educated respondents are considered more technically savvy. Consequently, the implementation of virtual networks in survey-based research for nonprobabilistic samples is considered to increase the sample size and its representativeness. Thus, we decided to implement the so-called "snowball" sampling method. The method refers to a technique that involves targeted sampling, in which the researchers start with a small population of well-known respondents and expand the sample by asking these initial participants to identify others who are willing to participate in the study. In other words, the sample starts small but "snowballs" into a larger sample during the period of the survey. A snowball sampling procedure was used to distribute links to an online survey through individual friendship networks, including Facebook pages and groups and university websites (Johnson et al. 2014). Participation in an online survey can be perceived as altruistic conduct, and many instances of altruistic conduct are induced by others. For instance, people are more inclined to contribute when others participate (Frey and Meier 2004). Such conduct may lead to a snowball effect or vice versa—people are less likely to contribute if there are fewer previous contributions (Liang et al. 2020).

The advantages and disadvantages of online surveys, as compared to other data collection methods, have often been studied and applied (Dillman 2000; Couper 2001; Fricker and Schonlau 2002; Couper et al. 2004; Wright 2005; Johnson et al. 2014; González-Bailón et al. 2014; Barnes et al. 2020). Compared to face-to-face, telephone, and mail surveys, online surveys have the advantage of being cheaper, faster, and independent in terms of time and space; last but not least, social networks and online searches notably increased during the COVID-19 pandemic (Ahani and Nilashi 2020). The disadvantage is that they depend on the availability of internet access (Blasius and Brandt 2010). Furthermore, when conducting online research, investigators can encounter problems as to sampling (Wright 2005). Researchers link some groups almost completely to the internet so that surveys of business clients and business risks (Deutskens et al. 2006; Paino et al. 2014; Reuschke and Mason 2020), students (Kwak and Radler 2002; Kaplowitz et al. 2004; Arulogun et al. 2020), and other selected target groups (e.g., users of online banking, eBay, or Amazon) are mainly conducted online. On the other hand, there are other groups who are almost entirely excluded from online surveys, for example, the elderly with low educational attainment (Blasius and Brandt 2010). With internet access being so unequally distributed even in the 21st century, it seems almost impossible to obtain representative results for the entire population, which is often desired. Despite the continuously growing number of internet users (in 2019, the number of internet users worldwide stood at 4.13 billion, which means that more than half of the global population is currently connected to the internet (Clement 2020), the lack of representativeness of the entire population will remain

an unsolved problem, as will the question of how to obtain representative results using online surveys (Evans and Mathur 2005).

For data processing, we implemented statistical methods through the computer language Python in a web-based interactive computing environment for creating documents, Jupyter Notebook. In order to perform statistic calculations, we used software libraries such as Pandas v1.1.4 (written in Python programming language for data manipulation and analysis; McKinney 2011) and NumPy v1.19.0 (which added support for large, multidimensional arrays and matrices, along with a large collection of high-level mathematical functions to operate on these arrays; Ascher et al. 1999).

Statistical measures such as data mean, sample standard deviation of data, and single mode "most common value" of discrete or nominal data were used for the analysis and evaluation of the results of the survey (Appendix C). Average value, in its essence, is a generalizing numerical characteristic of qualitatively homogeneous aggregates. It expresses the general, typical meaning of a given feature of the population as a whole. The average value represents what is regular in the population and shows its central trend (Nikolova 2013). When using standard deviation, it is established to what extent each possible result differs from the expected mean value, using the root mean square value as the form of averaging (Koleva and Kasabova 2016). Most common value is the feature in which there is the greatest concentration of units or how often a given meaning of the feature participates in the population (Nikolova 2013).

Each of the methods may be applied in different ways (Adamko et al. 2015). After performing an experiment and getting data, the scientific method requires that we form a hypothesis. In the simplest case, we have two hypotheses:

- Null hypothesis H_0—the status quo is real, "nothing interesting is happening";
- Alternate hypothesis H_1—what we are trying to demonstrate.

According to our opinion and based on scientific thought since 1710 (the first statistical test done by John Arbuthnot), the only nonbias approach based on the scientific method is for the scientists to obey the data. That is why we refer to the Null Hypothesis Significance Testing framework (NHST), which is a combination of the concepts of significance testing developed by Fisher in 1925 and of acceptance based on critical rejection regions developed by Neyman and Pearson in 1928 (Neyman and Pearson 1928). According to Fishers' theory, only the null hypothesis is tested, and thus *p*-values are determined to be used with a graded technique to determine whether the evidence is worth further research and/or replication: "it is open to the experimenter to be more or less exacting in respect of the smallness of the probability he would require […]" and "no isolated experiment, however significant in itself, can suffice for the experimental demonstration of any natural phenomenon" (Fisher 1971). Later on, the method allows us to compute the probability of observing a result at least as extreme as a test statistic, assuming the null hypothesis of no effect is true (Fisher 1934, 1955, 1959). The probability or *p*-value reflects the conditional probability of achieving the observed outcome or larger, namely, $p(\text{Observations} \geq t | H0)$ and, therefore, a cumulative probability rather than a precise estimate (Pernet 2017). Later on, Neyman and Pearson (1933) proposed a statistical framework based on the establishment of an alternative hypothesis along with an a-priori effect size, which notably differs from Fisher's approach for scientific inference, conditioned only on the null hypothesis. The methods also require the fulfillment of several assumptions (Svabova and Durica 2016).

When conducting statistical tests and, more particularly, hypothesis testing, one has to bear in mind that the *p*-value is not an indication of the strength or magnitude of an effect (Pernet 2017; Snijders 2002). If each analysis of the *p*-value in regard to the effect under examination (strength, reliability, probability) is inaccurate, then *p*-values are provisional on H_0. In addition, while *p*-values are randomly distributed (if all the presumptions of the test are attained) when there is no result, their distribution relies on both the population effect size and the number of participants, making it implausible to infer the

strength of effect from them (Pernet 2017; Snijders 2002). In the case of a small p-value calculation (below the initially stated significance level), this is not automatically an indication favoring a given hypothesis. Because a low p-value only indicates a misfit of the null hypothesis to the data, it cannot be considered confirmation in support of a specific alternative hypothesis more than any other feasible alternatives parallel to measurement error and selection bias (Gelman 2013).

Null hypothesis significance testing (NHST) is the statistical method of choice used to provide evidence of an effect in biological, biomedical, economic, and social sciences (Pernet 2017). Thus, the application of the t-test as a common statistical test of differences in means (Coman et al. 2013). The two-sample t-test (also called independent samples t-test) and the paired t-test are apparently the most extensively applied tests in statistics for the comparison of mean values between two samples (Xu et al. 2017). We compare two distributions, as observations in samples can be paired by examples of before/after observations, considering that a comparison between two different distributions applies to the same subjects.

The hypothesis cannot be accepted or rejected with complete certainty. Moreover, to measure the probability of producing a wrong hypothesis, a test statistic measure of deviations from H_0 should be used. Consequently, different tests produce different statistic measures on which the null hypothesis, based on the value of the test statistic, can be accepted or rejected.

Based on all the above, we propose the following test statistic application. Student's t-distribution is the sample distribution of the random variable $t = \frac{z}{\sqrt{(y/v)}}$, where z is a standard normal random variable, independent of the variable y, which has a χ_v^2—distribution; the t-distribution is a continuous distribution, which has the following properties:

- The probability density function has the form:

$$p(t) = \frac{t_0}{(1 + t_2/v)^{\frac{(v+1)}{2}}} \quad (1)$$

  where t is a constant that depends on v.
- It is characterized by v degrees of freedom. Therefore, the designation t_v fully describes the distribution.
- The distribution is symmetrical about zero.
- The distribution approaches the standard normal distribution as sample volume n increases. When n tends to infinity, the two distributions become identical.
- The percentage point or critical value of t, to the right of which lies a certain percentage (100α%) of the whole face of the surface locked between the probability density function $p(t)$ and the horizontal axis t, is written as $t_v(\alpha)$. Since t-distribution is symmetrical about zero, then $t_v = -t_v(1-\alpha)$.

Levene's test is pragmatic, as plenty of scientific problems are related to the variances of populations, somewhat more than their means or location parameters (centers). Prior to comparing the sample means, one should examine that the underlying populations have a general variance. We propose the use of Levene-type tests as a first-stage test to select whether the standard ANOVA test can be performed. With modern computers, software, and particularly with the help of computer languages such as Python (applied via Jupyter Notebook), one can easily perform ANOVA as it incurs only a small loss in power when the variances are uniform (Gastwirth et al. 2009). In short, Levene's technique incorporates applying the usual F-test for equality of means, calculated on what we will refer to as intermediary scores, which one identifies as the absolute deviations of the data points from an evaluation of the group center—i.e., a one-way ANOVA of the centered, original data (Nordstokke and Zumbo 2007). Both Levine's test and ANOVA are based on Fisher's statistics.

Fisher's F-distribution is the sample distribution of the random variable $F = \frac{\frac{u}{v_1}}{\frac{v}{v_2}}$, where u and v are independent random variables distributed as $\chi^2_{v_1}$ and $\chi^2_{v_2}$. The F-distribution is a continuous distribution with the following properties:

$$p(F) = F_0 \frac{F^{\frac{(v_1-2)}{2}}}{\left(1+\frac{v_1}{v_2}F\right)^{\frac{v_1+v_2}{2}}} \quad (2)$$

$F > 0$, where F_0 is a constant that depends on v_1 and v_2.

- It is characterized by v_1 and v_2 degrees of freedom. Therefore, the notation F_{v_1,v_2} fully describes the distribution.
- The distribution is positively asymmetric, i.e., right downloaded.
- $F_{1,v_2} = t^2_{v_2}$.
- The percentage point or critical value of F, to the right of which lies a certain percentage (100α%) of the entire face of the surface, locked between the probability density function $p(F)$ and the horizontal axis F, is written as F_{v_1,v_2}. The percentage points for different values of α and v_1 and v_2 are tabulated.

In the collection, summary, and analysis of empirical data, it is inevitable to use the tools provided by statistical methodology (Lambova 2018). Quantitative features are directly observable and allow unambiguous reflection through a numerical, relational system, the operation of which consists in the registration of numerical quantities using appropriate measuring instruments, while qualitative features are, in fact, characterized by meanings that cannot be primarily measured. Therefore, through a number system, they cannot be registered directly through measurement instruments as they represent verbal categories. For this reason, we should choose a scale to help us accurately represent our qualitative traits in a quantitative manner.

The scale applied in the questionnaire is the Likert Scale, which is a type of psychometric scale often applied in psychological surveys. It was developed and named by organizational psychologist Rensis Likert in 1932 (Likert 1932). One of the most widely applied tools in psychological research is self-disclosure inventories. Participants are required to state their level of agreement or disagreement according to a 5-point scale. Such a scale is often applied to assess personality, attitudes, and behavior. In order to develop a questionnaire survey and data process, the conventional Likert scale usually has the following format: from "complete disagreement" to "complete agreement".

4. Results and Discussion

COVID-19 has illustrated the fragility of life, but the same understanding has yet to be applied when addressing the global economy. Additionally, technology continues to be perceived as independent from natural, social, and economic systems and as something that can be implemented in order to solve exact problems related to the crisis without bearing larger societal consequences (Gretzel et al. 2020). The tendency is to make use of FINTECH tools and digitalized sources in order to avoid person-to-person contact and comply with the forced self-isolating measures, thus limiting virus contamination risks.

The impact of pandemic COVID-19 shocks has been reflected in the global economy and has generated considerable turbulence. The "new normal" has influenced, to a great extent, customer behavior worldwide, and their confidence is changing on a daily basis. Consequently, the main differences can be seen in income disposal, social contacts, and the utilization of internet and digital tools.

At the moment of data analysis, the situation with COVID-19 and its consequences on the Bulgarian economy are more than obvious: high levels of unemployment, an almost shattered hospitality and tourism sector, closed schools and universities (which teach via online resources), and lower projected annual GDP results; overall, economic sectors were forced to re-engineer their operations and management. In connection with

more complete and accurate disclosure of the issues, we advocate that it is necessary to outline the profile of Bulgarian respondents in terms of their gender, age, education, occupation, and personal income during the COVID-19 crisis (Appendix B).

The results of the survey showed the prevailing number of female respondents—79.3% (Table 1, Appendix A). As regards the age range of participants, it was found that the largest share of respondents (38.8%) fell in the age bracket of 30 to 39 years old. It is worth mentioning that the percentage of participants aged 40–49 and up to 29 were also quite considerable. As evident from Table 1, the majority of respondents had a higher education degree (70.2%). In the meantime, the results of the survey demonstrated that the people interviewed had a variety of occupations; most of them stated that they were employees (48.2%). As evident from Table 1, the biggest percentage of respondents had a personal income of BGN561–999. Based on the respondents' profiles, a general conclusion could be made that young and highly educated females tend to respond to such online surveys, particularly via social networks (Appendix D). Our survey results can be related to the result of research performed in Bulgaria among young people in 2014, where 70% of them stated that they owned a desktop computer in the household and almost every tenth young person stated that they have two or more desktop computers. A high share of young people (63%) stated that they owned a laptop, and 12% of households had two or more laptops, which allows greater individualization of consumption (Mitev and Kovacheva 2014). This may lead us to the assumption that young adults prefer to respond via the Web while older individuals prefer non-Web modes. Another general conclusion regarding our survey results could be that women tend to participate in such surveys due to the fact that women are perceived as more sensitive, caring, and concerned, while men are perceived as more independent, strong, and reasonable; such differences have been created by Bulgarian society.

In the uncertainty of a pandemic, it is very important to establish if people perceive the usage of digital financial tools as a way to avoid the risk of virus exposure and to what extent such digital instrument usage can be estimated as a change in their quality of life. In this regard, it is considered that the question of their familiarity rate with online financial instruments and their use before and after the crisis (Table 2) can be related to the population's quality-of-life change.

Thus, we consider that such statements should be formed as research questions. Moreover, only a small number of examinations have been done on the topic of how FINTECH utilization and usage can be related to the risky conditions of the ongoing pandemic compared to such usage before the COVID-19 crisis. Can the population perceive the risk of virus exposure as an opportunity to change their attitudes towards FINTECH instruments? Can they consider an increase in their FINTECH usage as a change in their quality of life? For the purpose of answering these research questions, we formed two hypotheses. The results of the hypothesis tests and their significance will provide us with information on whether the comparison between FINTECH usage (before and after the immediate COVID-19 crisis) based on the surveyed participants' estimations can be considered a change in their quality of life (life change).

The results indicated that for the question "To what extent were you familiar with financial technologies (ePay.bg, Paysera, P2P platforms, applications for digital wallets, crowdfunding; the so-called FINTECH) before the crisis of COVID-19?", the majority of respondents stated that they had not used the mentioned FINTECH technologies or had used them to a very small extent. The results of the question "To what extent would you use FINTECH technologies after the COVID-19 crisis?" shows that some respondents would tend to change their attitudes and use the technology a little more than before COVID-19, which is evident from the values of mean, mode, and standard deviation. This demonstrates to a large extent that these results differ from the results of the last question in the survey: "To what extent do you think that the use of FINTECH tools would change your quality of life?". Here, the mean of the experiments is close to the theoretical mean, and the value of the standard deviation indicates that the frequency is less than the mean.

Table 1. Profile of respondents.

Gender		Age					Education			
Female	**Male**	**30 to 39**	**40 to 49**	**up to 29**	**50 to 59**	**over 60**	**High School**	**College**	**Higher**	**PhD**
192	50	89	59	22	58	14	15	25	168	34

Occupation								Personal Income						
Employee	**Student**	**Midlevel Manager**	**Manager/ Owner**	**Self-Employed**	**Unemployed**	**PhD Student Start-Up Entrepreneur**	**Retired**	**561 to 699**	**1000 1499**	**up to 2000**	**1500 to 1999**	**up to 560**	**No Income at the Moment**	**No Income**
117	39	32	27	18	4	3	2	75	69	24	39	3	24	8

Source: own research.

Table 2. Mean, standard deviation, and mode of FINTECH usage calculated using Python via Jupyter Notebook.

Statistical Measures	Before	After	Life Change
mean	2.711	2.727	2.612
mode	1	3	3
standard deviation	1.443	1.301	1.204

Source: own research.

The relative difference between the use of FINTECH before COVID-19 and the attitude towards its use after COVID-19 can lead us to interpret its relationship with the next studied value as inversely proportional (Figure 1).

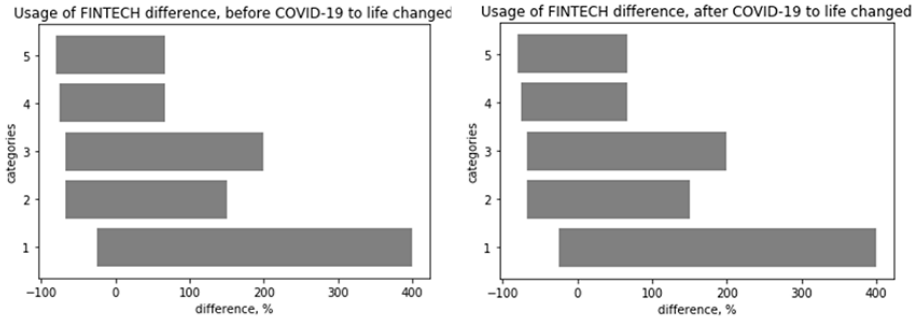


Figure 1. The relative difference of FINTECH usage before and after COVID-19 compared to daily life change. Source: own research.

Moreover, the use of FINTECH technologies is inversely related to attitudes towards daily life habits as a result of the risks involved with the COVID-19 crisis, even more in an unstable, risky environment. It may be concluded that the general public is not yet aware of the possibility of using FINTECH instruments for nonbank financial transactions. Therefore, it is not possible to determine with certainty whether the use or attitudes towards the use of these instruments would affect the financial circumstances of economic objects.

Of interest are the preferences related to the use of the FINTECH applications studied in the survey regarding the circumstances before and after the crisis of COVID-19 (Figure 2). Due to that reason, we included the following two questions in the questionnaire survey—"Which FINTECH tools did you use before the COVID-19 crisis?", "Which of the FINTECH tools would you use after the COVID-19 crisis?"—as more than one answer was possible.

The survey data showed that the most used FINTECH application before and after the crisis was ePay.bg (Appendix C). It is noteworthy that a large number of respondents would use online banking after the crisis. Based on mean and standard deviation estimations, it may be concluded that in times of crisis, respondents tend to limit their FINTECH usage to online banking and perhaps reduce their costs altogether, which may lead us to the assumption that people do perceive the situation as risky and uncertain. Moreover, our results may parallel those of Deloitte experts (Barua and Levin 2020) that have established a relationship between individual customer spending, investment and income, employment/unemployment, and the uncertainty regarding the pandemic itself. We may consider the fact that respondent uncertainty during the immediate start of the pandemic provoked them to be on the safe side and not to assume any risk with investments, lending/borrowing, and other financial transactions via FINTECH applications, but to stick to

the devil they know, e.g., the banks they have been trusting for a far greater period of time.

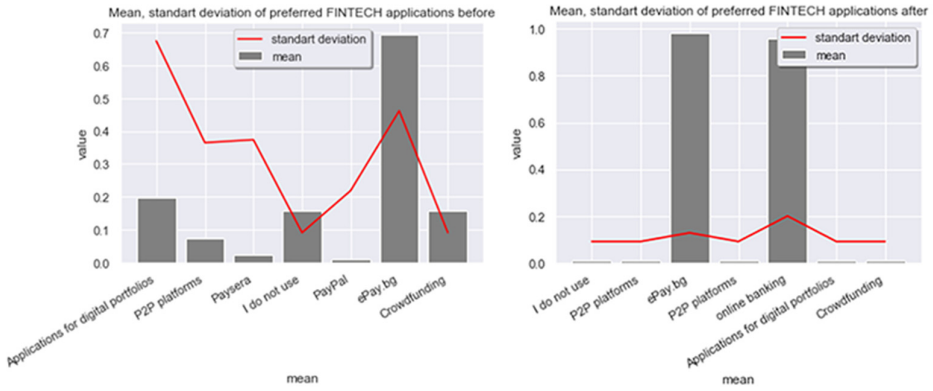


Figure 2. Preferred FINTECH applications before and after the COVID-19 crisis. Source: own research.

4.1. Hypothesis Testing

According to the scientific method, the next step in research should be the forming and testing of hypotheses. For the purpose of our research, we formed two hypothesis—the null hypothesis (H_0) and an attributive hypothesis (H_1):

H_0. *There is no correlation between the utilization of FINTECH before and after COVID-19*;
H_1. *There is a correlation between the utilization of FINTECH before and after COVID-19, which may lead to life changes for the respondents*.

If we gather enough evidence, we will be able to reject the null hypothesis; then, we can assume there is enough evidence to support the alternative hypothesis. First, H_o was tested using the Python computer language and SciPy, which is a free and open-source Python library.

Two-Sample Paired *t*-Test, Levene's Test, and ANOVA Test

Since the null and alternative hypotheses are contradictory, one must examine evidence to decide if sufficient evidence is available in order to reject the null hypothesis or not, bearing in mind that hypothesis testing is based on probability laws. The evidence is in the form of sample data. The significance level was set at $\alpha = 5\%$, and two-sample paired *t*-tests, Levene's test, and ANOVA tests were performed (Appendix C).

According to the results of the *t*-test, the *p*-value result was higher than the 5% confidence interval set beforehand. Based on these results, we cannot reject H_0. This, however, does not mean that there is no correlation between the variables; it means we could not prove convincingly enough that there is such a correlation. There can be a correlation, but because we do not have enough data at the moment, the results of the test are not sufficient enough for a conclusion. A common misinterpretation is that nonrejection implies support for the null hypothesis (Pernet 2017; Snijders 2002). Nonrejection should be comprehended, however, as a tentative outcome: there is not enough proof against the null hypothesis, but this does not entail that there is proof for the null hypothesis. One of the reasons could be that the sample size is narrow or the error variability is significant, so the data does not consist of much information (Pernet 2017; Snijders 2002).

Levene's (1960) original article was motivated by the k-sample problem. Before comparing sample means, one should check that the underlying populations have a common variance. At the time, procedures that were easy to calculate were desired. Researchers consider the use of Levene-type tests as a first-stage test to select either the standard or k-sample ANOVA (Gastwirth et al. 2009). The applications of such a flexible proceeding

employ a preparatory test to cast the estimator or test for the final analysis to enhance the accuracy of the final inference. As evident from Table 3, the probability value of Levene's test may be perceived as significant in order to reject H_0. This contradicts the tests performed beforehand and could lead us to the assumption that in order to rely on the survey results and be confident enough in the H_0 rejection or acceptance, we need to perform further testing. As mentioned beforehand, this is the reason why we proposed the use of Levene-type tests—as a first-stage test to select whether the standard ANOVA test can be performed. Evidently (Table 3), the ANOVA test results confirmed the *t*-test results. Therefore, we consider that H0 cannot be rejected based on the sample experiment volume as it is due to its limitations. Consequently, there is insufficient evidence to suggest the usage of the examined FINTECH applications before and after the Covid-19 crisis. Moreover, as the results of the test failed to reject H_0, we cannot establish a direct relationship to the respondents' improvement in their quality of life as a result of FINTECH application usage, either before or after the Covid-19 crisis.

Table 3. Two-sample paired *t*-test, Levene's test, and ANOVA calculations via Jupyter Notebook and statistical functions (scipy.stats).

Tests Performed for Testing H_0	Level of Significance (a Theoretical *p*-Value)	Probability/*p*-Value Comparing Usage Before and After	Probability/*p*-Value Comparing Usage Before and Life Change	Probability/*p*-Value Comparing Usage After and Life Change	Probability/*p*-Value Comparing Usage Before, After, and Life Change
Two-sample paired *t*-test	$\alpha = 5\%$	0.895	0.412	0.310	-
Levene's test	$\alpha = 5\%$	0.011	0.0002	0.252	-
ANOVA	$\alpha = 5\%$	0.895	0.412	0.310	0.581

Source: own research.

Following the test calculations, we cannot reject the H_0 hypothesis; therefore, according to the scientific method, we need to gather more data and perform additional experiments. Moreover, we intend to perform further Levene tests, the results of which differed from the other hypothesis tests. In addition, in random experiments, we have error sources—human error, systematic error, and random errors. That is why we cannot accept or reject a hypothesis with complete certainty. Bearing that in mind, we are aware that two types of errors could have been made: a type-I error, where H_0 has been rejected although it is true (false-positive), and a type II error, where H_0 has been accepted while H_1 is true as well (false-negative). Even though the results were inconclusive, the research can be used as a model for data analysis of financial transactions using FINTECH implementation during crises.

5. Conclusions

The current Covid-19 situation is unprecedented as, within a space of months, the framing of the global economy shifted; FINTECH utilization was boosted, on the one hand, due to a lack of trust and confidence in big banks as the aftermath of the GFC and, on the other hand, from the speed of resonating pandemic crisis. Despite this, it can be observed that bank customers are making a comeback towards brands that have gained their trust over the course of their lives and seem less inclined to trust start-up companies with their money. With an increase in economic risks due to the COVID-19 crisis, which may be reflected in decreasing customer income, FINTECH can help ease consumption through more efficient payments and lending systems. This is particularly relevant for individual households in the gig economy that have less structured work arrangements (Abraham et al. 2018). Thus, an increase in financial inclusion may occur as more individuals within the households will be provided with possibilities to access financial services. It is expected that FINTECH will play an increasingly important role alongside traditional banks, even replacing their functions in the not-so-distant future. Additionally, individuals will become more and more tech-skilled in IT over the generations and will

embrace FINTECH in their day-to-day activities; a surge in its usage should occur due to a strong connection in cross-societal relationships.

The current study made an attempt to establish individual customer utilization of FINTECH before and after the immediate Covid-19 crisis in Bulgaria in order to fill part of the research gap as such research had not yet been performed. The findings could provide the FINTECH sphere with information to target, diversify, and popularize their products better on the Bulgarian market. Our findings are applicable to the so-structured sample of Bulgarian customers. Regarding manuscript theory implementation, the authors consider that the methods implemented and executed can provide an addition to the methodology used for individual customer studies on attitudes towards FINTECH usage in Bulgaria during periods of risky conditions and crisis.

The main findings of the research demonstrate that the majority of respondents are less familiar and have not used FINTECH technologies on a large scale before the COVID-19 crisis. Nevertheless, some respondents will change their attitudes and use the technology a little more after COVID-19. The results obtained from the current research reveal that most of the population are not yet aware of the possibility of FINTECH instrument utilization for bank and nonbank financial transactions, thus determining whether the use or attitudes towards the use of these instruments would affect the financial stability of economic objects during the crisis. From the above-formulated aim, the survey data show that in times of crisis, respondents tend to limit their payments to online applications and perhaps reduce their costs altogether, which may lead us to the assumption that people do perceive the situation as risky and uncertain.

Some limitations can be identified in the research despite our elaborations on the literature review, calculations, analyses, and implied methods. We examined the attitudes of the Bulgarian population towards the COVID-19 crisis and perceived scientific expert opinions that if not immediately after the summer of 2020, then at the end of autumn, the severe situation should have been finished. Unfortunately, the virus did not disappear or slow down its spread, and moreover, it is obvious that COVID-19 is here to stay. Hence, the authors consider that the survey results could be limited by the questionnaire's scope and size due to the fact that FINTECH-savvy clientele could not be approached directly. Regarding this paper's strength, we investigated FINTECH usage and utilization among the Bulgarian population during the COVID-19 crisis, which could aid and provoke other academics in the field to further research and enhance the topic. It is further considered that the studied FINTECH companies may benefit from our research by examining respondents' attitudes and building-up their promotions and advertisements in order to be more recognizable and competitive on the market.

Author Contributions: Conceptualization, I.V. and B.K.-D.; methodology, I.V., B.K.-D., and P.D. (Preslav Dimitrov); software, I.V.; validation, I.V., B.K.-D., V.K., I.P., and P.D. (Pavol Durana); formal analysis, I.V., B.K.-D., and V.K.; investigation, I.V., B.K.-D., V.K., I.P., and P.D. (Pavol Durana); resources, I.V., P.D. (Preslav Dimitrov), B.K.-D., V.K., I.P., and P.D. (Pavol Durana); data curation, I.V. and B.K.-D.; writing—original draft preparation, I.V. and B.K.-D.; writing—review and editing, I.V., P.D. (Preslav Dimitrov), B.K.-D., V.K., I.P., and P.D. (Pavol Durana); visualization, I.V.; supervision, I.V., P.D. (Preslav Dimitrov), B.K.-D., V.K., I.P., and P.D. (Pavol Durana); project administration, P.D. (Preslav Dimitrov); funding acquisition, P.D. (Pavol Durana). All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Aknowledgements: This research was financially supported by the Ministry of Education, Science, Research and Sport of the Slovak Republic and Slovak Academy of Sciences VEGA 1/0121/20: Research of transfer pricing system as a tool to measure the performance of national and multinational companies in the context of earnings management in conditions of the Slovak Republic and V4 countries.

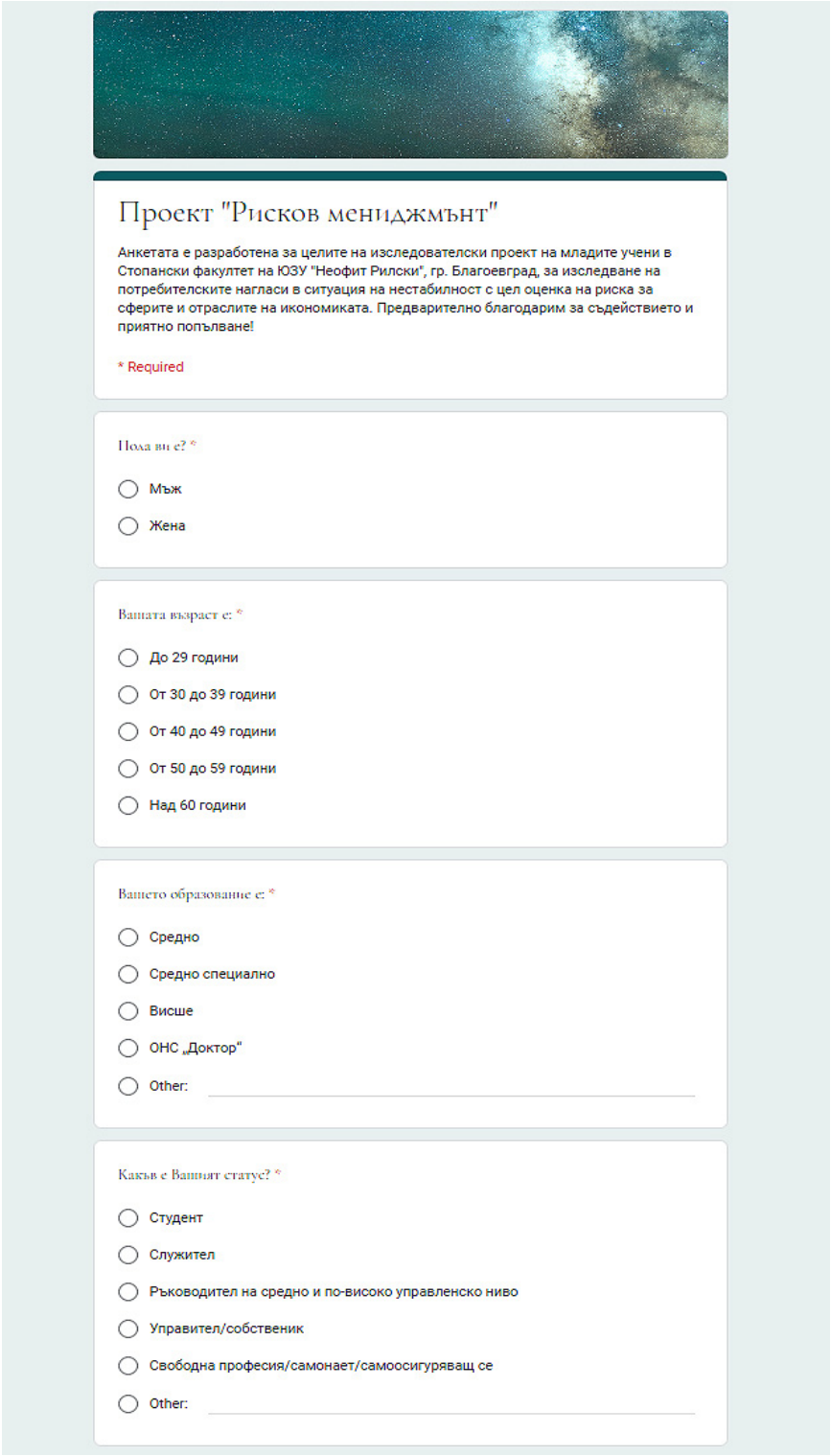
Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: The synthetic data used in this study will be made available per request addressed to Ivanka Vasenska.

Conflicts of Interest: The authors declare no conflict of interest.

Appendix A



Проект "Рисков мениджмънт"

Анкетата е разработена за целите на изследователски проект на младите учени в Стопански факултет на ЮЗУ "Неофит Рилски", гр. Благоевград, за изследване на потребителските нагласи в ситуация на нестабилност с цел оценка на риска за сферите и отраслите на икономиката. Предварително благодарим за съдействието и приятно попълване!

* Required

Пола ви е? *

- Мъж
- Жена

Вашата възраст е: *

- До 29 години
- От 30 до 39 години
- От 40 до 49 години
- От 50 до 59 години
- Над 60 години

Вашето образование е: *

- Средно
- Средно специално
- Висше
- ОНС „Доктор“
- Other:

Какъв е Вашият статус? *

- Студент
- Служител
- Ръководител на средно и по-високо управленско ниво
- Управител/собственик
- Свободна професия/самонает/самоосигуряващ се
- Other:

До каква степен бяхте запознати с финансовите технологии (ePay.bg, Paysera, P2P платформи, Приложения за дигитални портфейли, Crowdfunding, т.нар. FINTECH) преди настъпването на кризата COVID-19? *

	1	2	3	4	5	
Не съм запознат	○	○	○	○	○	Много повече съм запознат

До каква степен бихте използвали FINTECH технологиите след кризата COVID-19? *

	1	2	3	4	5	
Никога	○	○	○	○	○	Винаги

Кои от FINTECH инструментите използвахте преди настъпването на кризата COVID-19? Възможен е повече от един отговор *

- [ ] ePay.bg
- [ ] Paysera
- [ ] P2P платформи
- [ ] Приложения за дигитални портфейли
- [ ] Crowdfunding
- [ ] Other: _____

Кои от FINTECH инструментите бихте използвали след кризата COVID-19? Възможен е повече от един отговор *

- [ ] ePay.bg
- [ ] Paysera
- [ ] P2P платформи
- [ ] Приложения за дигитални портфейли
- [ ] Crowdfunding
- [ ] Other: _____

До каква степен смятате, че използването на FINTECH инструментите би променило начина Ви на живот? *

	1	2	3	4	5	
Не би променило	○	○	○	○	○	Много би променило

Ще се промени ли и как начина Ви на използване на FINTECH инструментите след кризата? *

Your answer

Submit

Appendix B

Figures A1–A5.

Figure A1. Profile of respondents by gender. Source: own research.

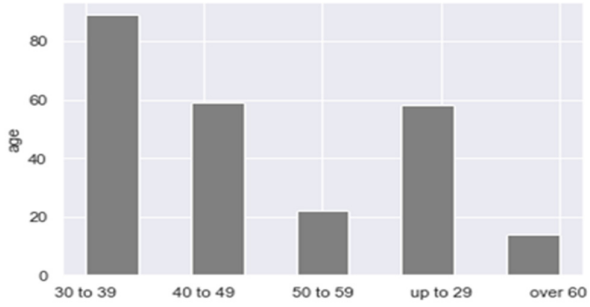


Figure A2. Profile of respondents by age. Source: own research.

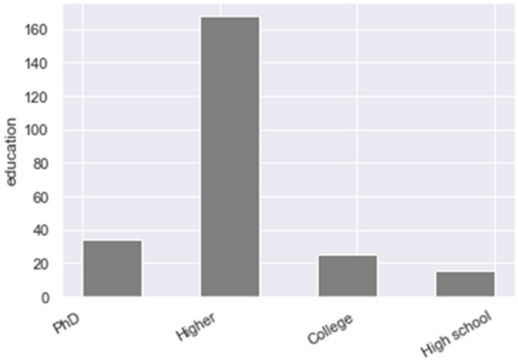


Figure A3. Profile of respondents by education. Source: own research.

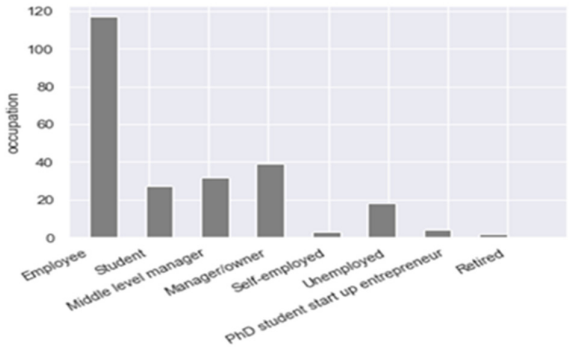


Figure A4. Profile of respondents by occupation. Source: own research.

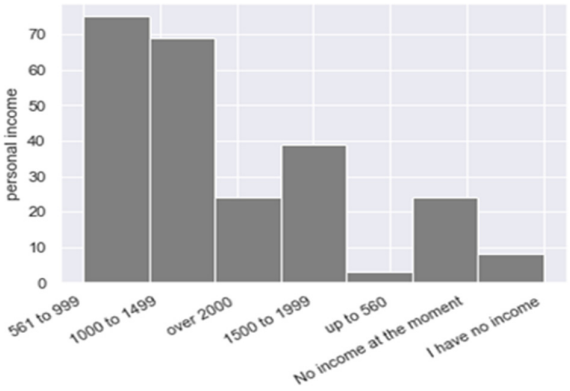


Figure A5. Profile of respondents by personal income. Source: own research.

Appendix C

Figures A6–A9 and Table A1.

```
In [42]: mean_fintech = usage_fintech.mean()

In [43]: mean_fintech

Out[43]: before         2.710744
         after          2.727273
         life change    2.611570
         dtype: float64

In [44]: mode_fintech = usage_fintech.mode()

In [45]: mode_fintech

Out[45]:
```

	before	after	life change	Which FINTECH before	Which FINTECH after	Sex	Age	Education	Occupation	Personal income
0	1	3	3	ePay.bg	ePay.bg, online banking	Woman	30 to 39	Higher	Employee	561 to 999

```
In [46]: std_fintech = usage_fintech.std()

In [47]: std_fintech

Out[47]: before         1.442899
         after          1.301133
         life change    1.204224
         dtype: float64
```

Figure A6. Mean, standard deviation, and mode of FINTECH usage calculated using Python via Jupyter Notebook. Source: own research.

```
In [44]: st.ttest_ind(fin_data["before"],fin_data["after"])

Out[44]: Ttest_indResult(statistic=-0.13234249084750072, pvalue=0.8947686275948207)

In [45]: st.ttest_ind(fin_data["before"],fin_data["life change"])

Out[45]: Ttest_indResult(statistic=0.8208922448591522, pvalue=0.4121134542922307)

In [46]: st.ttest_ind(fin_data["after"],fin_data["life change"])

Out[46]: Ttest_indResult(statistic=1.0152455737933135, pvalue=0.3104981221625096)
```

Figure A7. Two-sample paired t-test calculation via Jupyter Notebook and statistical functions (scipy.stats). Source: own research.

```
In [47]: st.levene(fin_data["before"], fin_data["life change"])
Out[47]: LeveneResult(statistic=13.731582461606946, pvalue=0.0002353290348031598)
```

Figure A8. Levene's test calculation via Jupyter Notebook and statistical functions (scipy.stats). Source: own research.

```
In [52]: st.f_oneway(fin_data["before"], fin_data["after"])
Out[52]: F_onewayResult(statistic=0.017514534883720862, pvalue=0.8947686275947139)

In [53]: st.f_oneway(fin_data["before"],fin_data["life change"])
Out[53]: F_onewayResult(statistic=0.6738640776699028, pvalue=0.41211345429202284)

In [54]: st.f_oneway(fin_data["before"], fin_data["after"], fin_data["life change"])
Out[54]: F_onewayResult(statistic=0.5441037488186493, pvalue=0.5805991529282615)
```

Figure A9. ANOVA calculation via Jupyter Notebook and statistical functions (scipy.stats). Source: own research.

Table A1. Preferred FINTECH applications before and after the COVID-19 crisis. Source: own research. * Value counts in absolute value; more than one answer was possible.

Which FINTECH Have You Used before Covid-19 *		Which FINTECH Have You Used after Covid-19 *	
ePay.bg	142	ePay.bg	238
Paysera	6	Paysera	0
P2P platforms	18	P2P platforms	4
Applications for digital portfolios	48	Applications for digital portfolios	2
Crowdfunding	2	Crowdfunding	2
Other—I do not use; PayPal	40; 2	Other—I do not use; online banking	2; 232

Appendix D

Pivot Table of Respondents' Profiles

Count of Sex					
Sex	Age	Education	Occupation	Personal income	Total
Men	30 to 39	Higher	Employee	1000 to 1499	1
				561 to 999	2
				over 2000	1
			Employee Total		4
			Manager/owner	over 2000	1
			Manager/owner Total		1
			Middle-level manager	1000 to 1499	1
				1500 to 1999	2
				over 2000	2
			Middle-level manager Total		5
			Self-employed	1000 to 1499	1
			Self-employed Total		1
		Higher Total			11
		PhD	Employee	561 to 999	2
				over 2000	1
			Employee Total		3
			Middle-level manager	1000 to 1499	1

		Middle-level manager Total		1
	PhD Total			4
30 to 39 Total				15
40 to 49	Higher	Employee	1000 to 1499	2
			561 to 999	4
		Employee Total		6
		Manager/owner	1500 to 1999	1
			over 2000	1
		Manager/owner Total		2
		Middle-level manager	1000 to 1499	1
		Middle-level manager Total		1
	Higher Total			9
	PhD	Employee	1000 to 1499	3
			561 to 999	1
		Employee Total		4
	PhD Total			4
40 to 49 Total				13
50 to 59	College	Employee	561 to 999	2
		Employee Total		2
	College Total			2
	Higher	Employee	1000 to 1499	1
			1500 to 1999	1
		Employee Total		2
		Manager/owner	over 2000	2
		Manager/owner Total		2
		Middle-level manager	561 to 999	2
		Middle-level manager Total		2
		Self-employed	over 2000	1
		Self-employed Total		1
	Higher Total			7
50 to 59 Total				9
over 60	Higher	Employee	561 to 999	2
		Employee Total		2
	Higher Total			2
	PhD	Employee	1000 to 1499	1
		Employee Total		1
	PhD Total			1
over 60 Total				3
up to 29	College	Self-employed	561 to 999	1
		Self-employed Total		1
		Student	561 to 999	2
			No income at the moment	1
		Student Total		3
	College Total			4
	High school	Employee	561 to 999	1
		Employee Total		1
		Student	I have no income	1
		Student Total		1
	High school Total			2
	Higher	Manager/owner	1500 to 1999	1
		Manager/owner Total		1

			Student	561 to 999	1
				up to 560	2
			Student Total		3
		Higher Total			4
		up to 29 Total			10
Men Total					50
Woman	30 to 39	College	Employee	1500 to 1999	2
			Employee Total		2
			Manager/owner	1000 to 1499	2
			Manager/owner Total		2
			Student	561 to 999	2
			Student Total		2
		College Total			6
		Higher	Employee	1000 to 1499	9
				1500 to 1999	2
				561 to 999	8
				over 2000	5
				up to 560	2
			Employee Total		26
			Manager/owner	1000 to 1499	2
				over 2000	1
			Manager/owner Total		3
			Middle-level manager	1000 to 1499	6
				1500 to 1999	5
				over 2000	4
			Middle-level manager Total		15
			Self-employed	1000 to 1499	3
				561 to 999	2
				over 2000	2
			Self-employed Total		7
			Student	up to 560	2
			Student Total		2
		Higher Total			53
		PhD	Employee	1000 to 1499	9
				561 to 999	4
				over 2000	1
			Employee Total		14
			Middle-level manager	1000 to 1499	1
			Middle-level manager Total		1
		PhD Total			15
		30 to 39 Total			74
	40 to 49	Higher	Employee	1000 to 1499	8
				1500 to 1999	2
				561 to 999	4
				over 2000	6
			Employee Total		20
			Manager/owner	1500 to 1999	2
				over 2000	6
				up to 560	2
			Manager/owner Total		10
			Middle-level manager	1000 to 1499	1

		Middle-level manager Total		1
		Self-employed	up to 560	2
		Self-employed Total		2
		Unemployed	561 to 999	2
			No income at the moment	2
		Unemployed Total		4
	Higher Total			37
	PhD	Employee	1000 to 1499	4
			561 to 999	1
			up to 560	2
		Employee Total		7
		Middle-level manager	over 2000	2
		Middle-level manager Total		2
	PhD Total			9
40 to 49 Total				46
50 to 59	College	Employee	561 to 999	3
		Employee Total		3
	College Total			3
	Higher	Employee	1000 to 1499	3
			1500 to 1999	2
		Employee Total		5
		Manager/owner	over 2000	2
		Manager/owner Total		2
		Middle-level manager	561 to 999	2
		Middle-level manager Total		2
		Self-employed	over 2000	1
		Self-employed Total		1
	Higher Total			10
50 to 59 Total				13
over 60	Higher	Employee	1000 to 1499	2
			561 to 999	2
		Employee Total		4
		Manager/owner	up to 560	2
		Manager/owner Total		2
		Retired	up to 560	2
		Retired Total		2
		Self-employed	1000 to 1499	2
		Self-employed Total		2
	Higher Total			10
	PhD	Employee	1000 to 1499	1
		Employee Total		1
	PhD Total			1
over 60 Total				11
up to 29	College	Self-employed	561 to 999	1
		Self-employed Total		1
		Student	561 to 999	4
			No income at the moment	1
			up to 560	4
		Student Total		9
	College Total			10
	High school	Employee	561 to 999	3

			Employee Total		3
			Student	561 to 999	6
				I have no income	2
				No income at the moment	2
			Student Total		10
			High school Total		13
		Higher	Employee	1000 to 1499	4
				561 to 999	3
			Employee Total		7
			Manager/owner	1500 to 1999	2
			Manager/owner Total		2
			Middle-level manager	1500 to 1999	2
			Middle-level manager Total		2
			PhD student start-up entrepreneur	561 to 999	3
			PhD student start-up entrepreneur Total		3
			Self-employed	No income at the moment	2
			Self-employed Total		2
			Student	561 to 999	5
				up to 560	4
			Student Total		9
		Higher Total			25
		up to 29 Total			48
	Woman Total				192
(blank)	(blank)	(blank)	(blank)	(blank)	
			(blank) Total		
		(blank) Total			
		(blank) Total			
	(blank) Total				
Grand Total					242

References

Abraham, Katharine G., John Haltiwanger, Kristin Sandusky, and James R. Spletzer. 2018. Measuring the Gig Economy: Current Knowledge and Open Issues. *IO Theory eJournal* doi:10.3386/w24950.

Adamko, Peter, Erika Spuchlakova, and Katarina Valaskova. 2015. The history and ideas behind VaR. *Procedia Economics and Finance* 24: 18–24.

Ahani, Ali, and Mehrbakhsh Nilashi. 2020. Coronavirus outbreak and its impacts on global economy: The role of social network sites. *Journal of Soft Computing and Decision Support Systems* 7: 19–22. Available online: http://www.jscdss.com/index.php/files/article/view/222 (accessed on 15 February 2021).

Arner, Douglas W., Janos Nathan Barberis, and Ross P. Buckley. 2015. The Evolution of Fintech: A New Post-Crisis Paradigm? *SSRN Electronic Journal* doi:10.2139/ssrn.2676553.

Arulogun, Oladiran Tayo, Oluwatobi Noah Akande, Akinyinka Tosin Akindele, and Taofeeq Alabi Badmus. 2020. Survey dataset on open and distance learning students' intention to use social media and emerging technologies for online facilitation. *Data in Brief* 31: 105929. doi:10.1016/j.dib.2020.105929.

Ascher, David, Paul F. Dubois, Konrad Hinsen, Jim Hugunin, and Travis Oliphant. 1999. Numerical Python. The Regents of the University of California. Available online: https://www.cs.mcgill.ca/~hv/articles/Numerical/numpy.pdf (accessed on 23 January 2021).

Autio, Erkko, Satish Nambisan, Llewellyn D. W. Thomas, and Mike Wright. 2018. Digital Affordances, Spatial Affordances, and the Genesis of Entrepreneurial Ecosystems. *Strategic Entrepreneurship Journal* 12: 72–95. doi:10.1002/sej.1266.

Baltar, Fabiola and Ignasi Brunet. 2012. Social research 2.0: virtual snowball sampling method using Facebook. *Internet Research* 22: 57–74. doi:10.1108/10662241211199960.

Barnes, Larisa Ariadne Justine, Lesley Barclay, Kirsten McCaffery, Margaret I Rolfe, and Parisa Aslani. 2020. Using Facebook to recruit to a national online survey investigating complementary medicine product use in pregnancy and lactation: A case study of method. *Research in Social and Administrative Pharmacy* 16. doi:10.1016/j.sapharm.2020.07.011.

Barrett, Michael, Elizabeth Davidson, Jaideep Prabhu, and Stephen L. Vargo. 2015. Service Innovation in the Digital Age: Key Contributions and Future Directions. *MIS Quarterly* 39: 135–54. doi:10.25300/misq/2015/39:1.03.

Barua, Akrur, and David Levin. 2020. What's Weighing on Consumer Spending: Fear of COVID-19 and Its Economic Impact. Economics Spotlight. Available online: https://www2.deloitte.com/us/en/insights/economy/spotlight/economics-insights-analysis-08-2020.html (accessed on 1 August 2020).

Blagoev, Dimitar, and Radostin Boyadzhiev. 2020. Methodological aspects of portfolio management of investment projects for real assets in business organizations. *Narodnostopanski Arhiv* 73: 79–102. Available online: https://www.researchgate.net/publication/343426152_Narodnostopanski_arhiv_2020_br3_godina_LXXIII_COVID-19_tematicen_broj_na_naucnoto_spisanie_ECONOMIC_ARCHIVE_2020_vol3_Year_LXXIII_COVID-19_thematic_issue_of_the_journal_in_Bulgarian (accessed on 15 February 2021).

Blasius, Jörg, and Maurice Brandt. 2010. Representativeness in Online Surveys through Stratified Samples. *Bulletin of Sociological Methodology/Bulletin de Méthodologie Sociologique* 107: 5–21. doi:10.1177/0759106310369964.

COVID-19 Data Repository by the Center for Systems Science and Engineering (CSSE) at Johns Hopkins University. 2020. Available online: https://github.com/CSSEGISandData/COVID-19 (accessed on 4 February 2021).

Clement, J. 2020. Internet Usage Worldwide—Statistics & Facts. Available online: https://www.statista.com/topics/1145/internet-usage-worldwide/ (accessed on 15 February 2021).

Cojoianu, Theodor Florian, Gordon L. Clark, Andreas G. F. Hoepner, Vladimir Pažitka, and Dariusz Wójcik. 2020. Fin vs. Tech: Are Trust and Knowledge Creation Key Ingredients in Fintech Start-Up Emergence and Financing? *Small Business Economics*. doi:10.1007/s11187-020-00367-3.

Coman, Emil N., Katherine Picho, John J. Mcardle, Victor Villagra, Lisa Dierker, and Eugen Iordache. 2013. The Paired *t*-Test as a Simple Latent Change Score Model. *Frontiers in Psychology* 4. doi:10.3389/fpsyg.2013.00738.

Couper, Mick P. 2001. Web Surveys: The Questionnaire Design Challenge. Presented at the 53rd Session of the ISI. Available online: https://2001.isiproceedings.org/pdf/263.PDF (accessed on 15 February 2021).

Couper, Mick P., Roger Tourangeau, Frederick G. Conrad, and Scott D. Crawford. 2004. What They See Is What We Get: Response Options for Web Surveys. *Social Science Computer Review* 22: 111–27. doi:10.1177/0894439303256555.

Cumming, Douglas J., and Armin Schwienbacher. 2018. Fintech venture capital. *Corporate Governance: An International Review* 26: 374–89. doi:10.1111/corg.12256.

Deloitte. 2016. Fintech in CEE. Department for International Trade, UK. Available online: https://www2.deloitte.com/content/dam/Deloitte/global/Documents/About-Deloitte/central-europe/ce-fintech-in-cee-region-2016.pdf (accessed on 15 February 2021).

Damyanov, Atanas 2020. Eclectic Views on the Consequences of Covid-19. *Narodnostopanski Arhiv* 73: 31–43. Available online: https://www.researchgate.net/publication/343426152_Narodnostopanski_arhiv_2020_br3_godina_LXXIII_COVID-19_tematicen_broj_na_naucnoto_spisanie_ECONOMIC_ARCHIVE_2020_vol3_Year_LXXIII_COVID-19_thematic_issue_of_the_journal_in_Bulgarian (accessed on 15 February 2021).

Demongeot, Jacques, Yannis Flet-Berliac, and Hervé Seligmann. 2020. Temperature decreases spread parameters of the new Covid-19 case dynamics. *Biology* 9: 94. doi:10.3390/biology9050094.

Deutskens, Elisabeth, Ad de Jong, Ko de Ruyter, and Martin Wetzels. 2006. Comparing the generalizability of online and mail surveys in cross-national service quality research. *Marketing Letters* 17: 119–36. doi:10.1007/s11002-006-4950-8.

Dillman, Don A. (2000). *Mail and Internet Surveys: The Tailored Design Method*, 2nd ed. New York: John Wiley and Sons.

Di Pietro, Roberto, Simone Raponi, Maurantonio Caprolu, and Stefano Cresci. 2021. New Dimensions of Information Warfare. In *Advances in Information Security*. Cham: Springer, vol. 84, pp. 1–4. doi:10.1007/978-3-030-60618-3_1.

European Centre for Disease Prevention and Control. 2020. An Agency of the European Union. Available online: https://www.ecdc.europa.eu/en/covid-19-pandemic (accessed on 23 January 2021).

European Commission. 2020. Impact of Government Measures Related to COVID-19 on Third-Country Nationals in Bulgaria. Available online: https://ec.europa.eu/migrant-integration/news/impact-of-government-measures-related-to-covid-19-on-third-country-nationals-in-bulgaria (accessed on 15 February 2021).

Evans, Joel R., and Anil Mathur. 2005. The value of online surveys. *Internet Research* 15: 195–219. doi:10.1108/10662240510590360.

Fisher, Ronald. 1934. Statistical Methods for Research Workers. (Vol. 5th Edition). Edinburgh: Oliver and Boyd. Available online: https://www.worldcat.org/title/statistical-methods-for-research-workers/oclc/4972023 (accessed on 14 February 2021).

Fisher, Ronald. 1955. Statistical Methods and Scientific Induction. *Journal of the Royal Statistical Society, Series B* 17: 69–78. doi:10.1111/j.2517-6161.1955.tb00180.x.

Fisher, Ronald. 1959. *Statistical Methods and Scientific Inference*, 2nd ed. NewYork: Hafner Publishing. Available at: https://www.worldcat.org/title/statistical-methods-and-scientific-inference/oclc/1516472 (accessed on 4 March 2021).

Fisher, Ronald. 1971. *The Design of Experiments*, 9th ed. New York: Hafner. Available online: https://home.iitk.ac.in/~shalab/anova/DOE-RAF.pdf (accessed on 14 February 2021).

Frey, Bruno S. and Stephan Meier. 2004. Social Comparisons and Pro-Social Behavior: Testing "Conditional Cooperation" in a Field Experiment. *The American Economic Review* 94: 1717–22. doi:10.1257/0002828043052187.

Fricker, Ronald D., and Matthias Schonlau. 2002. Advantages and Disadvantages of Internet Research Surveys: Evidence from the Literature. *Field Methods* 14: 347–67. doi:10.1177/152582202237725.

Fu, Jonathan, and Mrinal Mishra. 2020. Fintech in the Time of COVID-19: Trust and Technological Adoption During Crises. *Swiss Finance Institute Research Paper* 20–38. doi:10.2139/ssrn.3588453.

Gastwirth, Joseph L., Yulia R. Gel, and Weiwen Miao. 2009. The Impact of Levene's Test of Equality of Variances on Statistical Theory and Practice. *Statistical Science* 24: 343–60. doi:10.1214/09-sts301.

Gelman, Andrew. 2013. Commentary: P values and statistical practice. *Epidemiology* 24: 69–72. doi:10.1097/EDE.0b013e31827886f7.

Gomber, Peter, Jascha-Alexander Koch, and Michael Siering. 2017. Digital Finance and FinTech: Current Research and Future Research Directions. *Journal of Business Economics* 87: 537–80. doi:10.1007/s11573-017-0852-x.

González-Bailón, Sandra, Ning Wang, Alejandro Rivero, Javier Borge-Holthoefer, and Yamir Moreno. 2014. Assessing the bias in samples of large online networks. *Social Networks* 38: 16–27. doi:10.1016/j.socnet.2014.01.004.

Gretzel, Ulrike, Matthias Fuchs, Rodolfo Baggio, Wolfram Hoepken, Rob Law, Julia Neidhardt, Juho Pesonen, Markus Zanker, and Zheng Xiang. 2020. e-Tourism beyond COVID-19: A Call for Transformative Research. *Information Technology Tourism* 22: 187–203. doi:10.1007/s40558-020-00181-3.

Gros, Claudius, Roser Valenti, Lukas Schneider, Kilian Valenti, and Daniel Gros. 2020. Strategies for controlling the medical and socio-economic costs of the Corona pandemic. *arXiv* arXiv:2004.00493. Available online: https://arxiv.org/pdf/2004.00493v1.pdf (accessed on 23 January 2021).

Haddad, Christian, and Lars Hornuf. 2018. The Emergence of the Global Fintech Market: Economic and Technological Determinants. *Small Business Economics* 53: 81–105. doi:10.1007/s11187-018-9991-x.

Hendrikse, Reijer, Michiel Van Meeteren, and David Bassens. 2019. Strategic Coupling between Finance, Technology and the State: Cultivating a Fintech Ecosystem for Incumbent Finance. *Environment and Planning A: Economy and Space* 52: 1516–38. doi:10.1177/0308518×19887967.

Imerman, Michael B., and Frank J. Fabozzi. 2020. Cashing in on Innovation: A Taxonomy of FinTech. *Journal of Asset Management* 21: 167–77. doi:10.1057/s41260-020-00163-4.

International Monetary Fund. 2018. The Bali Fintech Agenda—CHAPEAU PAPER: A Blueprint for Successfully Harnessing Fintech's Opportunities. Washington, D.C. Available online: https://www.imf.org/en/Publications/Policy-Papers/Issues/2018/10/11/pp101118-bali-fintech-agenda (accessed on 15.02.2021).

Ivanov, Dimitar. 2020. Macroeconomic challenges and risks posed by global coronavirus CRISIS. *Narodnostopanski Arhiv* 73: 3–30 Available online: https://www.researchgate.net/publication/343426152_Narodnostopanski_arhiv_2020_br3_godina_LXXIII_COVID-19_tematicen_broj_na_naucnoto_spisanie_ECONOMIC_ARCHIVE_2020_vol3_Year_LXXIII_COVID-19_thematic_issue_of_the_journal_in_Bulgarian (accessed on 15 February 2021).

Johnson, Timothy, Karena Burke, and Susan Williams. 2014. Online snowballing: An effective method of data collection in australian young adults. *Journal of Nutrition & Intermediary Metabolism* 1: 42. doi:10.1016/j.jnim.2014.10.152.

Kaplowitz, Michael D., Timothy D. Hadlock, and Ralph Levine. 2004. A comparison of web and mail survey response rates. *Public Opinion Quarterly* 68: 94–101. doi:10.1093/poq/nfh006.

Kerényi, Ádám. 2018. The fintech challenge: Digital innovations from post-communist EU member countries. *Centre for Economic and Regional Studies HAS Institute of World Economics Challenges* 233. Available online: http://real.mtak.hu/89231/1/Challenges_233_Kerenyi.pdf (accessed on 15 February 2021).

Koleva, Rositsa, and Stela Kasabova. 2016. Statistical methods of business risk analysis. *Ikonomika* 21: 1–25. Available online: https://www2.uni-svishtov.bg/economics21/title.asp?title=582 (accessed on 23 January 2021).

Koutras, Athanasios, Alkiviadis Panagopoulos, and Ioannis A. Nikas. 2016. Forecasting tourism demand using linear and nonlinear prediction models. *Academica Turistica-Tourism and Innovation Journal* 9: 85–98. Available online: http://academica.turistica.si/index.php/AT-TIJ/article/view/47/20 (accessed on 23 January 2021).

Kwak, Nojin, and Barry Radler. 2002. A Comparison Between Mail and Web Surveys:Response Pattern, Respondent Profile, and Data Quality. *Journal of Official Statistics* 18: 257–73. Available online: https://www.scb.se/contentassets/ca21efb41fee47d293b-bee5bf7be7fb3/a-comparison-between-mail-and-web-surveys-response-pattern-respondent-profile-and-data-quality.pdf (accessed on 14 February 2021).

Lambova, Margarita. 2018. Measurement—The Unregulated Problem in Empirical Studies Carried Out with the Aid Statistical Instrumentary of. Available online: https://www.nsi.bg/spisaniestatistika/page/bg/details.php?article_id=180&tab=en (accessed on 23 January 2021).

Lee, David K. C., and Ernie G. S. Teo. 2015. Emergence of Fintech and the Lasic Principles. *SSRN Electronic Journal* doi:10.2139/ssrn.2668049.

Leong, Kelvin, and Anna Sung. 2018. FinTech (Financial Technology): What is it and how to use technologies to create business value in fintech way? *International Journal of Innovation, Management and Technology* 9: 74–78. doi:10.18178/ijimt.2018.9.2.791.

Levene, Howard. 1960. *Contributions to Probability and Statistics: Essays in Honor of Harold Hotelling*. Stanford: Stanford University Press, pp. 278–92. Available online: https://www.itl.nist.gov/div898/handbook/eda/section3/eda35a.htm (accessed on 15 February 2021).

Liang, Sai, Chunxiao Li, Xiaoxia Zhang, and Hui Li. 2020. The snowball effect in online travel platforms: How does peer influence affect review posting decisions? *Annals of Tourism Research* 85: 102876. doi:10.1016/j.annals.2020.102876.

Likert, Rensis. 1932. A technique for the measurement of attitudes. *Archives of Psychology* 22: 1–55.

Liu, Jiajia, Xuerong Li, and Shouyang Wang. 2020. What Have We Learnt from 10 Years of Fintech Research? A Scientometric Analysis. *Technological Forecasting and Social Change* 155: 120022. doi:10.1016/j.techfore.2020.120022.

Ma, Yueling, Yadong Zhao, Jiangtao Liu, Xiaotao He, Bo Wang, Shihua Fu, Jun Yan, Jingping Niu, Ji Zhou, and Bin Luo. 2020. Effects of temperature variation and humidity on the death of COVID-19 in Wuhan, China. *Science of the Total Environment* 724: 138226. doi:10.1016/j.scitotenv.2020.138226.

Mandal, Chandi C., and Mahaveer Singh Panwar. 2020. Can the summer temperatures reduce COVID-19 cases? *Public Health* 185: 72–79. doi:10.1016/j.puhe.2020.05.065.

Matthews, Amy. 2018. 10 Hottest Places to Launch a Fintech Startup in Central and Eastern Europe. July 12. Available online: https://www.equities.com/news/10-hottest-place-to-launch-afintech-startup-in-central-and-eastern-europe (accessed on 15 February 2021).

McKinney, Wes 2011. Pandas: A Foundational Python Library for Data Analysis and Statistics. Available online: https://www.dlr.de/sc/Portaldata/15/Resources/dokumente/pyhpc2011/submissions/pyhpc2011_submission_9.pdf (accessed on 23 January 2021).

Michael, Bryane. 2020. The FinTech Dividend: How Much Money Is FinTech Likely to Mobilize for Sustainable Development? Available online: http://hdl.handle.net/10419/216745 (accessed on 15 February 2021).

Milian, Eduardo Z., Mauro de M. Spinola, and Marly M. de Carvalho. 2019. Fintechs: A literature review and research agenda. *Electronic Commerce Research and Applications* 34: 100833. doi:10.1016/j.elerap.2019.100833.

Mitev, Petar-Emil, and Siyka Kovacheva. 2014. *Young People in European Bulgaria Sociological Portrait*. Sofia: Friedrich Ebert Stiftung, ISBN 978-954-2979-21-0. Available online: http://library.fes.de/pdf-files/bueros/sofia/12568.pdf (accessed on 15 February 2021).

Mostafanezhad, Mary. 2020. Covid-19 Is an Unnatural Disaster: Hope in Revelatory Moments of Crisis. *Tourism Geographies* 22: 639–45. doi:10.1080/14616688.2020.1763446.

Neyman, Jerzy, and Egon S. Pearson. 1928. On the Use and Interpretation of Certain Test Criteria for Purposes of Statistical Inference: Part I. *Biometrika* 20A: 175–240. doi:10.1093/biomet/20A.1-2.175.

Neyman, Jerzy, and Egon Sharpe Pearson. 1933. IX. On the problem of the most efficient tests of statistical hypotheses. Philosophical Transactions of the Royal Society of London. *Series A, Containing Papers of a Mathematical or Physical Character* 231: 694–706. doi:10.1098/rsta.1933.0009

Nikolova, Nadezhda. 2013. Statistika. Obshta Teoriya. Tempto, Sofiya. ISBN 978-619-160-140-0.

Nordstokke, David W., and Bruno D. Zumbo. 2007. A Cautionary Tale About Levene's Tests for Equal Variances. *Journal of Educational Research & Policy Studies* 7: 1–14.

Nowlin, Christopher. 2017. Understanding and Undermining the Growth Paradigm. *Dialogue: Canadian Philosophical Review = Revue Canadienne de Philosophie* 56: 559–93. doi:10.1017/S0012217317000555.

Odorović, Ana, Grigory McKain, Kieran Garvey, Emmanuel Schizas, Bryan Zheng Zhang, Philip Rowan, and Tania Ziegler. 2020. FinTech Innovation in the Western Balkans: Policy and Regulatory Implications and Potential Interventions. *SSRN* doi:10.2139/ssrn.3619214.

Ötsch, Walter. 2020. What Type of Crisis Is This? The Coronavirus Crisis as a Crisis of the Economicised Society. Working Paper Series 57. Available online: https://www.econstor.eu/handle/10419/216728 (accessed on 23 January 2021).

Paino, Halil, Khairul Anuar Abdul Hadi, and Wan Mardyatul Miza Wan Tahir. 2014. Financial statement error: client's business risk assessment and auditor's substantive test. *Procedia-Social and Behavioral Sciences* 145: 316–20. doi:10.1016/j.sbspro.2014.06.040.

Peng, Liangrong, Wuyue Yang, Dongyan Zhang, Changjing Zhuge, and Liu Hong. 2020. Epidemic Analysis of COVID-19 in China by Dynamical Modeling. *MedRxiv* doi:10.1101/2020.02.16.20023465.

Pennington-Gray, Lori. 2018. Reflections to Move Forward: Where Destination Crisis Management Research Needs to Go. *Tourism Management Perspectives* 25: 136–39. doi:10.1016/j.tmp.2017.11.013.

Pernet, Cyril. 2017. Null Hypothesis Significance Testing: A Short Tutorial. *F1000Research* 4: 621. doi:10.12688/f1000research.6963.1.

Pricewaterhouse Coopers. 2017. Redrawing the Lines: FinTech's Growing Influence on Financial Services. In Global FinTech Report 2017. Available online: https://www.pwc.com/gx/en/industries/financial-services/assets/pwc-global-fintech-report-2017.pdf (accessed on 23 January 2021).

Qi, Hongchao, Shuang Xiao, Runye Shi, Michael P. Ward, Yue Chen, Wei Tu, Qing Su, Wenge Wang, Xinyi Wang, and Zhijie Zhang. 2020. COVID-19 transmission in Mainland China is associated with temperature and humidity: A time-series analysis. *Science of the Total Environment* 728: 138778. doi:10.1016/j.scitotenv.2020.138778.

Ratecka, Patrycja. 2020. FinTech—definition, taxonomy and historical approach. *Zeszyty Naukowe Małopolskiej Wyższej Szkoły Ekonomicznej w Tarnowie* 1: 53–67. Available online: http://cejsh.icm.edu.pl/cejsh/element/bwmeta1.element.desklight-31b2710c-e961-4d90-bc3f-730f08934191 (accessed on 15 February 2021).

Reuschke, Darja, and Colin Mason. 2020. The engagement of home-based businesses in the digital economy. *Futures* 102542. doi:10.1016/j.futures.2020.102542.

Romānova, Inna, Simon Grima, Jonathan Spiteri, and Rebecca Dalli Gonzi. 2019. A Study of Alternative and FinTech Payment Solutions for Airlines. *International Journal of Finance, Insurance and Risk Management* 9: 132–46. Available online: https://www.researchgate.net/profile/Simon_Grima/publication/338007706_A_Study_of_Alternative_and_FinTech_Payment_Solutions_for_Airlines_A_Study_of_Alternative_and_FinTech_Payment_Solutions_for_Airlines_133/links/5dfa0dcb4585159aa4850b8f/A-Study-of-Alternative-and-FinTech-Payment-Solutions-for-Airlines-A-Study-of-Alternative-and-FinTech-Payment-Solutions-for-Airlines-133.pdf (accessed on 15 February 2021).

Schueffel, Patrick. 2016. Taming the beast: A scientific definition of fintech. *Journal of Innovation Management* 4: 32–54. doi:10.24840/2183-0606_004.004_0004.

Shi, Peng, Yinqiao Dong, Huanchang Yan, Chenkai Zhao, Xiaoyang Li, Wei Liu, Miao He, Shixing Tang, and Shuhua Xi. 2020. Impact of temperature on the dynamics of the COVID-19 outbreak in China. *Science of the Total Environment* 728: 138890. doi:10.1016/j.scitotenv.2020.138890.

Siegenfeld, Alexander F., and Yaneer Bar-Yam. 2020. Eliminating covid-19: A community-based analysis. *arXiv* arXiv:2003.10086. Available online: https://arxiv.org/pdf/2003.10086.pdf (accessed on 23 January 2021).

Snijders, Tom A. B. (2002). The statistical evaluation of social network dynamics. *Sociological methodology* 31: 361–95. doi:10.1111/0081-1750.00099

Svabova, Lucia, and Marek Durica. 2016. A closer view of the statistical methods globally used in bankruptcy prediction of companies. Paper presented at 16th International Scientific Conference on Globalization and Its Socioeconomic Consequences, Rajecke Teplice, Slovakia, October 5–6, pp. 2174–81.

Vučinić, Milena. 2020. Fintech and Financial Stability Potential Influence of FinTech on Financial Stability, Risks and Benefits. *Journal of Central Banking Theory and Practice* 9: 43–66. doi:10.2478/jcbtp-2020-0013.

Wamba Fosso, Samuel, Jean Robert Kala Kamdjoug, Ransome Epie Bawack, and John G. Keogh. 2019. Bitcoin, Blockchain and Fintech: A systematic review and case studies in the supply chain. *Production Planning & Control* 31: 115–42. doi:10.1080/09537287.2019.1631460.

Wójcik, Dariusz, and Theodor F. Cojoianu. 2018. A global overview from a geographical perspective. *International Finance Centres after Global Financial Crisis Brexit* 207: 1–272.

Wójcik, Dariusz, and Stefanos Ioannou. 2020. COVID-19 and Finance: Market Developments So Far and Potential Impacts on the Financial Sector and Centres. *Tijdschrift voor Economische en Sociale Geografie* 111: 387–400. doi:10.1111/tesg.12434.

Woolhouse, Mark E. J., Liam Brierley, Chris Mccaffery, and Sam Lycett. 2016. Assessing the Epidemic Potential of RNA and DNA Viruses. *Emerging Infectious Diseases* 22: 2037–44. doi:10.3201/eid2212.160123.

World Bank Group. 2020. Fintech in Europe and Central Asia: Maximizing Benefits and Managing Risks. Available online: https://openknowledge.worldbank.org/bitstream/handle/10986/33591/Fintech-in-Europe-and-Central-Asia-Maximizing-Benefits-and-Managing-Risks.pdf?sequence=1&isAllowed=y (accessed on 15 February 2021).

Wright, Kevin B. 2005. Researching Internet-based populations: Advantages and disadvantages of online survey research, online questionnaire authoring software packages, and web survey services. *Journal of Computer-Mediated Communication* 10: JCMC1034. doi:10.1111/j.1083-6101.2005.tb00259.x.

Wu, Yu, Wenzhan Jing, Jue Liu, Qiuyue Ma, Jie Yuan, Yaping Wang, Min Du, and Min Liu. 2020. Effects of temperature and humidity on the daily new cases and new deaths of COVID-19 in 166 countries. *Science of the Total Environment* 729: 139051. doi:10.1016/j.scitotenv.2020.139051.

Xu, Manfei, Drew Fralick, Julia Z. Zheng, Bokai Wang, Xin M. Tu, and Changyong Feng. 2017. The differences and similarities between two-sample *t*-test and paired *t*-test. *Shanghai Archives of Psychiatry* 29: 184. doi:10.11919/j.issn.1002-0829.217070.

Zhu, Liting, Xiaobo Liu, Haining Huang, Ricardo David Avellán-Llaguno, Mauricio Manuel Llaguno Lazo, Aldo Gaggero, Ricardo Soto-Rifo, Leandro Patiño, Magaly Valencia-Avellan, Benoit Diringer, and et al. 2020. Meteorological impact on the COVID-19 pandemic: A study across eight severely affected regions in South America. *Science of The Total Environment* 744: 140881. doi:10.1016/j.scitotenv.2020.140881.

Zoroja, Jovana, Igor Klopotan, and Ana-Marija Stjepić. 2020. Quality of e-commerce practices in European enterprises: Cluster analysis approach. *Interdisciplinary Description of Complex Systems* 18: 312. doi:10.7906/indecs.18.2.17.