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*A scientific paper*

**Petar Pepur, Ph. D.**

University of Split, Department of Professional Studies, Croatia

E-mail address: [ppepur@oss.unist.hr](mailto:ppepur@oss.unist.hr)

**Jelena Hrga**

University of Split, Croatia

E-mail address: [jelena.hrga@unist.hr](mailto:jelena.hrga@unist.hr)

**Ivan Peronja, Ph.D., Assistant Professor**

University of Split, Faculty of Maritime Studies, Croatia

E-mail address: [iperonja@pfst.hr](mailto:iperonja@pfst.hr)

## THE IMPACT OF THE COVID-19 PANDEMIC ON PAYMENT BEHAVIOUR

### ABSTRACT

*Pandemic difficulties caused by Covid-19 significantly affected not only the healthcare system but also and the payment system in the Republic of Croatia. With the aim of reducing the spread of the Covid-19 virus, various measures were introduced to limit the movement of people and promote a new contactless society. The new contactless society required the application of new payment methods that are in line with the development of the "new normal" way of life. By promoting new methods of payment, an effort was made to reduce the physical contact resulting from handling cash, thereby reducing the spread of the Covid-19 virus and providing people with an additional sense of security. Financial institutions, through the continuous development of new technologies, adapted the available payment instruments to the new conditions in order to make online transactions easier, safer and more accessible to clients, which contributed to an easier transition to digital payments. The adoption of new contactless society has resulted in a change in the payment structure i.e. the shift in payment behaviour and payment preferences, evident in the increase of digital payments and moving away from the cash. Accordingly, the question arises: "Is Covid-19 a fundamental factor in changing the structure of payments in the payment system of the Republic of Croatia?", so this paper's purpose is to examine the effect of Covid-19 on payment behaviour and to explain the adoption of new payment methods during the Covid-19 pandemic. To explore the Covid-19 effect on payment behaviour, we collected payment behaviour data from the web site of Croatian National Bank and Covid – 19 data from the web site of Croatian Institute of Public Health for period from April 2020 to October 2022. To explore relationship between payment behaviour and Covid-19 we employed logistic regression. The results show positive and statistically significant impact of Covid-19 on the payment behaviour in the payment system of the Republic of Croatia.*

**Key words:** covid-19, contactless society, payment behaviour.

## 1. Introduction

The Covid -19 pandemic has had a significant impact not only on the global healthcare system but also on world markets and the economy. Since March 11, 2020, when the World Health Organization declared Covid - 19 pandemic, we have faced dramatical changes in our lives. Pandemic conditions have affected our lives and created a new normal way of life marked by social distance. New normal way of life demanded the application of new technologies in line with current conditions. Social distancing and fewer physical interactions have led to faster adoption of contactless payments, because people avoided touching banknotes and coins physically to reduce the chance of Covid-19 infection. Over time, Covid - 19 turned from a global threat of the economy and financial markets into a global opportunity and push factor for the application of new digital technologies. Contactless payments during the Covid - 19 pandemic have become a necessity forced by governments and banks and in that way, people shifted away from cash to reduce the possibility of the Covid - 19 spread. So, this paper's purpose is to explain the adoption of new payments methods during the Covid - 19 pandemic and explore the correlation between the changes in payment behaviour and the aforementioned pandemic, considering also the impact of new technologies and the development of the financial sector.

## 2. Covid – 19 as driver of global changes

The Covid - 19 pandemic represented a significant threat to the global healthcare and economic system and probably the most challenging period in recent history. Since March 2020, Covid – 19 has fundamentally changed the world and set the new conditions for life and business. At the macro level, the Covid - 19 outbreak caused the worst global recession since 1930, when the economy got absolutely creamed (Shen, et al., 2020, 2213). The effect of the Covid -19 pandemic is visible in the report of the World Bank which indicates that a record 92.9% of the world's countries were in recession in 2020. This level is well above the previous high record of 83.8% in the Great Depression. It also exceeds the highs registered in 1914 at 70%, 1918-1921 at 70%, and 2008-09 at 61.2% (Hunt, 2020, 1). Also, through the literature we found a lot of previous research showing a negative impact of Covid - 19 on different economic aspects, as impact on the stock market (Liu, et al., 2020, 3), on the firm performance in the energy industry (Fu & Shen, 2020, 4) and on the corporate bankruptcies and job losses (Fu & Shen, 2020, 4). The negative impact of Covid - 19 is also visible through the reduction in economic activity across the following sectors in the Euro area (Næss-Schmidt , et al., 2020, 1) as seen in Table 1.:

**Table 1:** Current reduction in activity across sectors in the Euro area

Sectors	Reduction
Arts, entertainment and recreation	84%
Hotels and restaurants	75%
Wholesale and retail trade	75%
Construction	50%
Operational services and knowledge-based activities	39%
Manufacturing	26%
Transporting	22%

Sectors	Reduction
Information and communication	16%
Utilities	12%
Total economy	27%

*Source: Authors' work based on estimates from the OECD, Dansk Industri, Dansk Erhverv, Danske Bank and Copenhagen Economics*

All of the above points to catastrophic economic consequences which have forced governments to find solutions and answers to the fundamental question "How to stop the spread of Covid - 19 and stop the economic decline and encourage the economy to move forward? ". As one of the measures to mitigate the effect of Covid-19 and start the economy progress is the introduction of new technologies. The growing use of technology in working, playing and staying connected have created new digital behaviours. Covid - 19 has shaped a demand for touchless technology that allows users to avoid physical touching of surfaces and other people while severely impacting the world economy (Puriwat, Tripopsakul, 2021, 85). Starting from this point of view, authors point out Covid - 19 as driver of changes in the financial sectors through the new digital payment behaviours which realized as a mechanism for reducing spread of Covid – 19. Covid-19 as a driver of change was noticed by Visković, Kordić and Miletić (2022), who found that banks in Croatia increased their total factor productivity by 2.2% on average, mainly due to an increase in technological change (1.93%), implying innovation and new banking services. Moreover, the Covid - 19 pandemic crisis has further accelerated the race for efficiency. Indeed, the results show that the improvement in efficiency was more remarkable than the average of the period studied, especially in terms of technical efficiency (1% in 2020 compared to the mean of the period of 0.28%), but also due to technological efficiency (2.02% in 2020 compared to the mean of the period of 1.93%). Finally, the Covid - 19 pandemic crisis affected efficiency in different ways with respect to the size of banks. Large banks improved their total factor productivity by 7.19%, small banks by 2.64%, and medium-sized banks reduced it by 1.38%. In addition, large banks achieved efficiency improvements due to technological change, while small banks focused on both technical (1.70%) and technological (0.98%) efficiency improvements.

## 2. Payment behaviours theoretical background

The first studies regarding the choice between different payment instruments were published at the beginning of the 1990s as a result of the introduction of new electronic payment instruments. Previous research related to payment behaviours cites a very wide range of significant factors. Payment behaviours are under a significant influence of different factors, e.g. cash usage increase with age and decrease with education and income (Jonker, 2007, 287), electronic payment is more likely than cash payment in cases of larger amounts (Wang, Wolman, 2016, 94), payment choice depends on the ability to monitor liquidity (von Klackreuth et.al., 2014, 1753). Also, through the literature it can be observed that payment methods are correlated with maintaining control over one's budget (Hernandez, Jonker and Kosse, 2017, 91) and the perceived speed of the payment, its user-friendliness and security (Jonker, 2007, 287). Importance of social norms, attitudes and feelings are also significant factors of payment behaviours and, alongside that, (Solnick, 2007, 316) it was revealed that participants using cash were less generous towards other participants than those using alternative ways to track their monetary rewards. The influence of the introduction of new technology on payment methods is also mentioned through the literature. According to Powell

(2017) the new technology and innovative businesses increasingly affect daily financial lives. Mobile devices, high-speed data communication, and online commerce are creating expectations that convenient, secure, real-time payment and banking capabilities should be available whenever and wherever they are needed. At the same time, disruptive new technologies suggest that traditional financial service providers must innovate and adapt or expect to be left behind. In addition, Zhang, (2020, 49) found that mobile payment technology is positively associated with credit card use while being negatively associated with cash and check use. In addition to higher credit card usage, the adoption of mobile payment technology is associated with credit card revolving behaviour. From this point, it can be concluded that new technologies and technological innovations are reshaping payment systems, capitalizing on technological advances to better align with user preferences and sector-specific business requirements, e.g. touch or scan payment solutions such as Apple Pay, Google Pay and QR codes, which displaces cash from use. Considering that the Covid-19 pandemic primarily threatened the healthcare system, one of the starting points of this paper is the Health Belief Model which is often used to explain and predict individual changes in health behaviors. The Health Belief Model provides insights into how to educate individuals on performing actions to respond to health risks (Rosenstock, 1974, 355). Health Belief Model explains that individuals refer to two main components when determining whether to implement health-related behaviours, namely perceptions about risks and outcome expectancies regarding the behaviour (Maiman, Marshall, 1974, 336). Risk perception pertains to the perceived seriousness of the negative consequences of existing risks along with the perceived susceptibility to the risk; the former is a belief regarding the seriousness of the condition-induced consequences, and the latter is a personal belief about the likelihood of contracting the condition. Perceived health risks consist of 2 dimensions: perceived susceptibility to disease and perceived seriousness of disease. Perceived susceptibility is defined as "a persons' view of the likelihood of experiencing a potentially harmful condition," and perceived seriousness refers to "how threatening the condition is to the person" (Sreelakshmi & Prathap, 2020, 351). The application of the Health Belief Model in scientific research was updated with the emergence of Covid-19, because Covid - 19 has become the main health risk factor which determines the individual's behaviours. Among the first few authors who use Health Belief Model to explore factors influencing the intention to use digital technologies in the Covid - 19 pandemic was Walrave, Waeterloos and Ponnet (2020) who investigated factors influencing a contact tracing app use intention for containing Covid - 19 in Belgium. They found that the intention to use the contact tracing application was significantly predicted by the perceived usefulness of the application, self-efficacy and perceived barriers. The Covid -19 pandemic was a unique opportunity to apply the Health Belief Model in research related to payment behaviours. Most of the conducted research points to the fact that the Covid -19 pandemic has accelerated the application of contactless payments. Contactless payment in Covid - 19 pandemic times represent a tool for avoiding infection with Covid - 19 virus. This is supported by the statement of the spokesperson of the World Health Organization who noted: "When possible, it would be advisable to use contactless payments in order to reduce the risk of Covid-19 transmission" (Dong, 2020). According to the report of the Danish central bank (Danmarks Nationalbank, 2020) it can be concluded that contactless and online payments quickly gained ground while cash payments fell during the Covid - 19 lockdown. More specifically, 30% of the Danish respondents increased payment card use when compared to it before the lockdown, and 41% reported less cash usage. Also, studies conducted globally show adoption and significant increase of usage of contactless payment, e.g. Kornitzer, (2020) shows that 55% of United States consumers worried about paying with cash by using banknotes and that 82% of respondents believe that contactless payment is a safer way to pay. Also, in Thailand people are also aware of the

benefit of contactless payment technologies and 79% of Thai people are using contactless payments more often than they did two years ago, and 75% of Thai respondents who are not using contactless payments today are interested in doing so in the future (Bangkok Post, 2020).

### 3. Data and Methodology

The aim of this study was to examine the effect of Covid - 19 on payment behaviour and to explain the adoption of new payment methods during the Covid-19 pandemic. To explore the Covid-19 effect on payment behaviour, we collected payment behaviour data from the web site of Croatian National Bank ([www.hnb.hr](http://www.hnb.hr)) and from web site of Croatian Institute of Public Health we collected Covid-19 numbers for period from April 2020 to October 2022. We employed logistic regression to explore relationship between dependent variable (Payment behaviour) and two groups of independent variables, one connected with Covid – 19 impact (the number of Covid - 19 infections, the number of people on respirators, the number of deaths) and the other connected with development and modernization of financial sectors (the number of ATMs, the number of POS terminals, the number of cards). As it can be seen from Table 2, the sample consists the 31 observations for each of 10 different variables.

**Table 2:** Descriptive statistic

Variable	Obs.	Mean	Std. Dev.	Min	Max
Number of card transaction	31	50.434.926	10.963.106	27.797.543	76.570.323
Value of card transaction	31	18.257.208.034	4.546.478.737	10.579.158.098	29.569.145.214
Number of cash transaction	31	4.189.017	511.147	3.509.842	6.359.340
Value of cash transaction	31	16.098.728.518	2.807.830.418	9.274.116.919	22.025.606.012
Covid - 19 infections	31	40.194,26	49.159,73	162,00	224.246,00
People on respirators	31	282,32	288,74	2,00	995,00
Deaths	31	500,61	575,47	3,00	2.134,00
ATMs	31	5.608,65	734,33	4.647,00	6.744,00
POS terminals	31	115.729,68	5.867,36	106.204,00	126.072,00
Cards	31	8.876.805,32	244.839,76	8.696.880,00	9.705.166,00

*Source: Authors*

Using several independent variables can lead to a distorted and unrealistic assessment of contributions of individual independent variables when trying to explain the dependent variable. This problem resulting in high collinearity of two or more than two independent variables. Before the linear regression analysis, we explored the multicollinearity between the independent variables. An absolute value of the Pearson coefficient higher than 0.7 indicates a strong correlation between independent variables. As seen in Table 2, there is multicollinearity problem between independent variables related to Covid – 19 (Covid - 19

infections, People on respirators and Deaths) as expected. Multicollinearity is expected, which is logical because the movement of one variable depends on another. For example, the higher number of Covid - 19 infected people, should imply the higher number of people on respirators and higher number of deaths. Due to that, this problem of multicollinearity is ignored and the research continues with all variables.

**Table 3: Correlation Matrix**

	Covid - 19 infections	People on respirators	Deaths	ATMs	POS terminals	Cards
Covid - 19 infections	1.0000					
People on respirators	0.7634	1.0000				
Deaths	0.7032	0.9578	1.0000			
ATMs	-0.5621	-0.6316	-0.6524	1.0000		
POS terminals	0.0547	-0.2756	-0.3215	0.3854	1.000	
Cards	-0.3241	-0.3046	-0.3393	0.4527	-0.1205	1.0000

Source: Authors

After examining the problem of multicollinearity between independent variables we tested if there is presence of heteroscedasticity. If the error terms do not have constant variance, they are heteroscedastic. If the heteroscedasticity is present, the standard errors are biased. This can lead to bias in test statistics and confidence intervals. To test the presence of heteroskedasticity in the research, the Breusch-Pagan test for heteroskedasticity was applied. In case the results of the Breusch-Pagan test for heteroscedasticity indicated that heteroscedasticity was present, robust standard errors were applied, while in cases where heteroscedasticity was not established, standard errors were applied. The following table summarizes the final result of the empirical analysis regarding the payment behaviour which we explored by movements in card transactions and cash transactions.

**Table 4: Linear regression analysis**

Variables	Number of card transactions	Value of card transactions	Number of cash transaction	Value of cash transaction
Covid - 19 infections	0.0519902* (0.0290371)	0.0475182* (0.0232811)	-0.0025576* (0.312093)	0.0734078** * (0.0253538)
People on respirators	-0.0296839 (0.097081)	0.0055583 (0.0814745)	-0.0697062 (0.0732927)	-0.594699 (0.0914459)
Deaths	0.0323467 (0.0943845)	0.0011653 (0.0803802)	0.0848164 (0.0963018)	0.0317197 (0.0912237)
ATMs	0.9738477*** (0.2125265)	1.148686*** (0.2015621)	0.689646*** (0.2791354)	0.8896722** * (0.2043861)
POS terminals	2.136769*** (0.3847875)	2.168353*** (0.4575909)	0.8683579** * (0.3256635)	1.05798*** (0.3472503)



Variables	Number of card transactions	Value of card transactions	Number of cash transaction	Value of cash transaction
Cards	1.18347 (0.9950129)	1.577051 (0.942151)	1.022868 (0.7297683)	1.882058*** (0.8448936)
cons	-35.05911 (18.08994)	-37.30942 (16.94763)	2.967419 (14.956)	-27.21823 (16.07039)
Observation	31	31	31	31
F (6, 24)	24.17	27.84	9.30	46.39
Prob > F	0.0000	0.0000	0.0000	0.0000
R-squared	0.8641	0.8744	0.8503	0.8449
Breusch-Pagan test	p value = 0.0499	p value = 0.9840	p value = 0.0127	p value = 0.0186

\*, \*\*, \*\*\* Statistically significant at the: 10%, 5%, 1% level, respectively. Standard errors and are robust standard errors between parentheses.

Source: Authors

Statistical significance of the models can be determined based on the p-values of the empirical F-ratios in the table. If the p-value of the empirical F-ratio is statistically significant, this leads to a conclusion that the independent variable significantly affects the dependent variable. More specifically, it can be said that the models are statistically significant. F-ratio of the tested models are less than 1% in all four cases, and it can be argued that the models as a whole are statistically significant.

Results of linear regression analysis for number of card transactions shows the proportion of variance of the dependent variable interpreted by the model. The coefficient ( $R^2$ ) is 0.8641, i.e. 86.41 % of the variance of the share of payment behaviour explained with the Covid – 19 infections and contained variables. The coefficient ( $R^2$ ) serves as a measure of representativeness of the model and the value indicates a highly representative model. The data show that Covid – 19 infections statistically significantly affect the number of card transactions at the 10 % level. Covid – 19 infections have a positive impact on the number of card transactions [coef. .0519902]. So, we conclude that new Covid – 19 infections have led to an increase in likelihood to pay with cards and in that way avoid the contact with the cash and shift the payment behaviour. The table shows that ATMs and POS terminals are also significantly affecting the number of card transactions at the 1% level. The ATMs have a positive impact on the number of card transactions [coef. 0.9738477], and the POS terminals also have a positive impact on the number of card transactions [coef. 2.136769], which is clear because the development of the banking sector through greater availability of ATMs and POS terminals imply increasing likelihood to use the cards. The result of linear regression analysis for the value of card transactions shows the proportion of variance of the dependent variable interpreted by the model. The coefficient ( $R^2$ ) is 0.8744, i.e. 87.44 % of the variance of the share of payment behaviour explained with Covid – 19 infections and contained variables. The coefficient ( $R^2$ ) serves as a measure of representativeness of the model and the value indicates a highly representative model. The data show that the Covid – 19 infections statistically significantly affects the value of cards transactions at the 10 % level. Covid – 19 infections have a positive impact on the value of cards transactions [coef. 0.0475182], therefore, it can be assumed that due to the covid pandemic, people bought goods in larger quantities in order to create supplies for their household needs. The table shows that ATMs and POS terminals are also significantly affecting the value of cards transactions at the 1% level. The ATMs have a positive impact on the number of cards transactions [coef. 1.148686],

and the POS terminals also have a positive impact on the number of cards transactions [coef. 2.168353], which is expected considering the greater availability of POS terminals. Result of linear regression analysis for the number of cash transactions shows the proportion of variance of the dependent variable interpreted by the model. The coefficient ( $R^2$ ) is 0.8503, i.e. 85.03 % of the variance of the share of payment behaviour explained with the Covid – 19 infections and contained variables. The coefficient ( $R^2$ ) serves as a measure of representativeness of the model and the value indicates a highly representative model. The data show that Covid – 19 infections statistically significantly affect the number of cash transactions at the 10 % level. Covid – 19 infections have a negative impact on the number of cash transactions [coef. -0.0025576], therefore, it can be assumed that due to the Covid-19 pandemic, people avoid the cash and they don't want to have physical contact with banknotes and coins to avoid infection. From the table it can be seen that the ATMs and POS terminals are also significantly affecting the number of cash transactions at the 1% level. The ATMs have a positive impact on the number of cash transactions [coef. 0.689646]. The authors see the explanation of this connection in the fact that ATMs are becoming more accessible to citizens (a greater number of ATMs means greater access to cash), so citizens have greater opportunities to withdraw cash, which ultimately affects a greater number of cash transactions. On the other hand, the POS terminals have a negative impact on the number of cash transactions [coef. -0.8683579], which implies that people use cards instead of cash for payments. A greater number of POS terminals leads to less use of cash, and citizens start paying smaller amounts of bills with cards. The result of linear regression analysis for the value of cash transactions shows the proportion of variance of the dependent variable interpreted by the model. The coefficient ( $R^2$ ) is 0.8449, i.e. 84.49 % of the variance of the share of payment behaviour explained with Covid – 19 infections and contained variables. The coefficient ( $R^2$ ) serves as a measure of representativeness of the model and the value indicates a highly representative model. The data show that the Covid – 19 infections statistically significantly affect the value of cash transactions at the 1 % level. Covid – 19 infections have a positive impact on the value of cash transactions [coef. 0.0734078], therefore, it can be assumed that due to the Covid-19 pandemic, people, when they have to use cash, try to increase the volume of their purchases and create adequate stocks. From the table it can be seen that ATMs, POS terminals and number of cards are also significantly affecting the value of cash transactions at the 1% level. A positive relationship between ATMs and value of cash transaction is expected because a larger number of ATMs means greater access to cash and thus a higher value of cash transaction. However, the positive relationship between the number of POS terminals and the card number with the value of cash transaction is unexpected for the authors of this paper and opens up the possibility of further research into the same relationship. The authors believe that this connection can be explained by the fact that greater possibilities of different payment methods (including the increased number of POS terminals and cards) leads to a psychological effect on customers and they spend more (and thus the value of cash transaction increases). Summarizing the aforementioned results, it can be pointed out that Covid-19 infections have a significant impact on the payment behaviour.

#### **4. Conclusion**

The appearance of the coronavirus at the end of 2019 in China and its subsequent spread through the world forced the World Health Organization to declare the Covid-19 pandemic, which had numerous adverse consequences worldwide on different aspects of human life such as health, social activities, financial activities etc. In Croatia, the first positive case of Covid -

19 was recorded in February 2020, which also had a significant impact on the reduction of economic and social activities. The Covid-19 pandemic has created an era of a new normal way of life known as contactless society. The Covid -19 pandemic has created an era of a new normal way of life known as contactless society. Contactless society demands a contactless payment which was recognized as a tool to stop the Covid - 19 pandemic spread. In accordance with this premise, we employed the Health Belief Model to explain the effect of Covid - 19 on the contactless payment. Based on empirical research, we found that Covid-19 increased the use of contactless payments and the shift away from the cash. The abovementioned and empirical results give us the positive answer to the fundamental question in the paper: "Is Covid-19 a fundamental factor in changing the structure of payments in the payment system of the Republic of Croatia?". The positive answer is visible through the following findings and conclusions:

- Covid – 19 infections have a positive impact on the number of card transactions, which leads to a conclusion that because of fear of Covid -19 people avoid contact with cash and shift the payment behaviour towards cards and contactless payment,
- Covid – 19 infections have a positive impact on the value of card transactions, which leads to a conclusion that due to the Covid - 19 pandemic, people bought goods in larger quantities in order to create supplies for their household needs and, in that way, keep themselves safe,
- Covid – 19 infections have a negative impact on the number of cash transactions, which leads to a conclusion that due to the Covid - 19 pandemic, people avoid cash and they don't want to have physical contact with banknotes and coins to avoid infection
- Covid – 19 infections have a positive impact on the value of cash transactions which leads to a conclusion that due to the Covid - 19 pandemic, when they have to use cash, people try to increase the volume of their purchases and create adequate stocks.

The above results show and confirm that Covid-19 has a statistically significant impact on the payment behaviour in the payment system of the Republic of Croatia.

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