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Cashless Payments Impact to Economic Growth: Evidence in G20 Countries and Vietnam—Vietnamese Government with a Policy to Support Cashless Payments

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Abstract

This study investigates the relationship between cashless payments and economic growth in G20 countries and Vietnam. Using annual data ranging from 2011 to 2020, the results indicate that cashless payment in the form of check payments stimulates economic growth in G20 countries and Vietnam. Specifically, the growth enhancing effect is found to have an impact on economic growth; Secondly, the positive relationship between economic growth and check payments is robust after controlling for the effect of endogeneity, omitted variable bias and outliers. Based on the findings, this study offers some policy recommendations for Vietnam with respect to the continuing implementation of existing policies concerning cashless payments.

Keywords

Cashless Payments, Vietnam, Economic Growth, Financial Policies

1. Introduction

Times have changed; payment methods have also changed. The future of monetary transactions will slowly migrate to the digital platform. Countries such as the U.S., Canada, China, Korea, India, UK, France, to name a few, are using this form of payment. According to the International Monetary Fund (IMF), "A mobile payment wallet is a virtual wallet that stores payment card information on a mobile device. Mobile wallets are a convenient method to help users make payments in-store or can also be used by merchants". Mobile payment wallet is a di-

gitized version of a physical wallet, almost any card whose value is stored in a physical wallet can also be stored in a mobile wallet (driver's license, social security card, etc.) Vietnam is a potentially promising market due to its wide coverage area, low internet services fee, and rapid increase in the percentage of people using smart devices. Modern supermarkets, shopping malls, and distribution facilities all allow consumers to make cashless payments for purchases in many forms: payment cards, e-wallets, e-payment gateways, payments via mobile phone account. Consequently, cashless payments will be an inevitable trend and a major driving force in the development of local economy and global trade. This paper researches the impact of cashless payments on economic growth in G20 countries and Vietnam. Specifically, this paper aims to answer the question of which cashless payment instruments (debit card, credit card, e-money and check) would result in a growth enhancing effect for G20 countries and Vietnam and how these growth enhancing effects can be applied to promote cashless payments in Vietnam.

The format of this paper will be structured in the following manner. The paper will start with a literature review of the empirical studies on the nexus between cashless payments and economic growth. This will be followed by the methodology used in this paper with provided data and empirical model. The paper will then provide estimation results and be followed by the robustness checks. Finally, the paper will conclude with a discussion of the estimation results, provide a situation of cashless payments in Vietnam, and set forth conclusions and policy recommendations for Vietnam.

2. Literature

2.1. Impact of Cashless Payments on Economic Growth

Cash payments are less popular and are decreasing in popularity in many countries around the world. Instead, cashless payments are an inevitable trend and a driving force in the development of global trade and economy. In fact, cash-based economies tend to slow down and miss out on significant opportunities in global commercialization. So much so that economies that have actively transitioned to electronic payments have achieved more success and have taken advantage of opportunities to simplify payment processes and macro-currency management.

Cashless payments are an inevitable trend in the process of global economic and commercial development. In general, cashless payment instruments can be divided into three categories: paper-based (checks or money-order), card-based (credit or debit), and electronic-based (money wiring or money transaction applications). Cashless payments instruments coupled with the increasing volume of cashless transactions from year to year have prompted governmental agencies to see their rise in importance when making monetary policies.

According to Akhalumeh and Ohiokha (2012), cashless payment is an economic activity where the action of trading products and services happens without the use of physical cash, but rather, with electronic transfer and check pay-

ment. According to Snellman et al. (2001), e-payment is part of the cashless payment that provides an electronic exchange of monetary substances without physical contact of the transacting parties. Consequently, e-payment is the payment caused by using credit cards, debit cards, prepaid cards, mobile wallets, and automated teller machines (Oyewole et al., 2013a). The innovation in the payment system and instruments have caused a change in the choice of payment methods among the consumers. Consumers are expected to benefit from the convenient payment instruments, both in terms of timing and costs. Therefore, cashless payment is expected to facilitate consumption, thereby increasing economic growth.

Valente & Rogers (1995) developed and adopted a new idea which highlights the interaction between people through interpersonal networks. In this context, the dissemination of cashless payments should occur where consumers seek improvement, convenience during the time of payments, and companies search for new profit opportunities. The consequences of diffusion in cashless payments depend on the willingness of society to quickly accept cashless payments at various stages of the innovation process along with the knowledge of the existence of cashless payments and the belief in a positive attitude of cashless payments. Furthermore, positive results of cashless payments will spur the decision to accept cashless payments, implement a system of cashless payments, and confirm acceptance of a cashless payment system. The economic impact of cashless payment have been examined from the perspective of banking, financial economics, macroeconomics, monetary and regulatory economics (Humphrey et al., 1996; Berger, 2003; Bolt et al., 2008; Scholnick et al., 2008; Hasan, Schmiedel, & Song, 2009; Kahn & Roberds, 2009; Hasan, Renzis, & Schmiedel, 2012; Oyewole et al., 2013a; Oyewole et al., 2013b; Zandi et al., 2013; Tee & Ong, 2016; Zandi et al., 2016; Mustapha, 2018).

Positive relations between cashless payments and economic growth were noticed, inter alia, by Hasan et al. (2012). The authors examined the relationship between retail payments and general economic growth based on data from 27 countries from 1995 to 2009. Their research showed that electronic retail payments (e-payments) stimulated overall economic growth, consumption, and trade. E-payments is defined as a payment that is initiated, executed, and received electronically. According to Arai (2004), e-payments made using payment cards have become a special feature of modern economics. The impact on economic growth observed in the case of card payments, credit transfer, and direct debit were higher than the impact of checks on economic growth, consumption, and trade (Arai, 2004).

According to Zandi et al. (2013 and 2016), cashless payments provide immediate credit to consumers, thereby increasing their consumption. Zandi et al. (2013) investigated the economic impact of electronic cards (credit and debit card) adoption for a group of 56 high-income countries from 2008 to 2012, the pooled OLS estimator shows that greater usage of electronic cards contributes 983 billion USD to the real GDP in the countries studied. Zandi et al. (2013)

show that cashless payments boost private consumption by 0.7 percent and the rise in consumption is found to contribute 0.17 percent to the GDP growth for a group of high-income countries among the 56 countries studied. This would increase private consumption and stimulate economic growth. The research of Zandi et al. (2016) on electronic card payment using the macroeconomic data of 70 countries from 2011 to 2015 showed that retail payments contribute to the growth of trade and consumption, which in turn supports production and overall economic growth.

The study by Slozko and Pelo (2014) showed that there is a positive impact of cashless payments on the economy. Slozko and Pelo (2014) proved that there is a positive correlation between the growth of e-payments and the growth of GDP. Slozko and Pelo came to the conclusion that the use of cashless payments is closely related to the level of economic development of a given country.

2.2. Adopting a Cashless Economy

Several empirical studies show that innovation using electronic money has a significant positive effect on economic growth as well as facilitating community activities (Tee & Ong, 2016; Ha, 2020; Zandi et al., 2013). Since money is stored in the card, consumers do not need to withdraw money from the bank prior to making monetary transactions, thereby creating an environment of greater efficiency. Tee & Ong (2016) examined the effect of adopting cashless payment in five European Union (EU) countries (Austria, Belgium, France, Germany, and Portugal) for the period from 2000 to 2012. Their research limited the study of the adoption of cashless payment to card payment, checks, telegraphic transfer, and electronic money in five EU countries. Tee & Ong (2016) concluded, in the short run, there was a change of transactional behaviors of consumers from check payment to telegraphic transfer and ultimately to card payment; In the long run, the adaptation of the cashless payment system in the five EU countries resulted in a significant impact to the economy.

"The Cashless Economy in Vietnam - The Situation and Policy Implications" by Ha (2020) argued that the benefits of a cashless economy are enormous: banks can reduce financing costs, the state can better regulate the amount of money put into circulation, and companies can control a good cash flow. In particular, consumers are not only aware of the fast and convenient way of using a card or using a paid smartphone, they are also aware of the high level of security in the system. However, in order to achieve the government's ambitious goal of achieving 90% cashless payments in Vietnam, the legal foundation, payment infrastructure, and investments to improve quality and reach need to continue to be improved. Furthermore, all parties involved must focus on enhancing the security of the payment system (Ha, 2020). From what is described in the study, it is almost impossible for Vietnam to meet the 90% target of being a cashless payments country by 2020 because policymakers still need to work with banks, local governments and businesses on implementation in order for everyone to be on board and consistent with implementation plans.

The paper on cashless payments in G20 countries and Vietnam will mainly study the situation of cashless payments in Vietnam, the benefits of cashless payments to the consumers, the market research of digital payment methods in Vietnam along with the opportunities and challenges of having a cashless payment system in Vietnam. The paper will provide a holistic picture of digital payments in Vietnam, illuminating the opportunities and challenges that the country faces as it moves towards a cashless society.

Based on the findings, this paper will contribute to the field on two fronts. First, this paper provides new evidence on the impact of cashless payments on economic growth for G20 countries and Vietnam whereas existing literature mainly focused on European countries, high-income nations and Nigeria, OECD countries. This paper evaluates the implication of cashless payments on economic growth in G20 countries and Vietnam. Due to different economic structure and levels of technology adoption, the positive impact of cashless payments on growth in Vietnam may not be generalizable for G20 countries. Therefore, this paper is important because it informs policy makers on whether Vietnam should continue to promote cashless payments or retain the conventional payment method. Furthermore, if cashless payments are found to be beneficial and stimulate economic growth, recommendations will be made to apply the cashless payment system in Vietnam.

2.3. Hypothesis Development

In line with the above-mentioned transmission channels of cashless payments and literature review, it can be hypothesized that:

- H1: Economic growth is positively associated with debit card payment.
- H2: Economic growth is positively associated with credit card payment.
- H3: Economic growth is positively associated with e-money payment.
- H4: Economic growth is positively associated with check payment.

This study examines the dynamic causal relationship of adopting cashless payment in G20 countries. Telegraphic transfer, card payment, electronic money, and check payment are the proxies for cashless payment. The real gross domestic product is computed by dividing gross domestic product (GDP) by its consumer price index (CPI). The real GDP has been used as a proxy for economic growth (Apergis & Payne, 2010; Slesman et al., 2015; Wang et al., 2016), economic activities (McCoskey & Selden, 1998; Cevik et al., 2016) and productivity (Conti, 2014). Thus, in this study, real GDP is employed as a proxy for economic growth.

2.4. Data

The cashless payments used in this study are the growth rate of debit, credit card, e-money payment and check transactions. This study covers the final sample of 21 G20 countries and Vietnam (**Table 1**) covering the period 2011 to 2020. The cashless payments used in this study are the growth rate of debit, credit

Table 1. List of sampled countries (Sample period: 2011-2020) and List of variables.

21 Countries	**Argentina; Australia; Brazil; Canada; China; France; Germany; India; Indonesia; Italy; Japan; Korea; Mexico; Russia; Saudi Arabia; South Africa; Turkey; United Kingdom; United States; European Union; Vietnam**

Variables	Descriptions	Unit of measurement	Source
	Dependent variable		
GDP	GDP Real GDP growth rate	Annual %	WDI
	Independent variable-Cashless payment indicators		
DEBIT	Debit card transaction value	Logarithm of total value	BIS
CREDIT	Credit card transaction value	Logarithm of total value	BIS
EMONEY	E-money transaction value	Logarithm of total value	BIS
CHECK	Check transaction value	Logarithm of total value	BIS
	Control variables		
INF	Inflation rate	Annual %	WDI
POP	Population growth rate	Annual %	WDI
SECON	Secondary school enrollment	%	WDI
TRADE	Trade openness	GDP	WDI
	Additional variables for durability test		
FDI	FDI net inflow	% GDP	WDI
FD	FD Domestic credit to private sector	% GDP	WDI
GCF	GCF Gross capital formation	% GDP	WDI
ICT	ICT Broadband subscriptions	Per 100 inhabitants	WDI
INS	INS Institutional quality	Scaled from 0 to 100	WGI

Notes: WDI indicates World Development Indicator. BIS is the Bank for International Settlements. WGI is the World Government Index. Sample period: 2011-2020.

card, e-payments, and check transactions. The author used data from 2011 to 2020 because the author studied policies to apply in Vietnam, firstly, at that time of the study, Vietnam has not yet published data for 2021 and later, secondly before 2010 periods Vietnam's cashless payments are rarely used.

The dependent variable, the control variable, and the additional variables for the endurance test were collected directly from the World Bank by the author. Independent variables - Cashless payments index is collected from data provided by the Bank for International Settlements (BIS) of 20 G20 countries; cashless payments data of Vietnam is collected by the author from the official homepage of the State Bank of Vietnam (SBV). The special additional institutional quality variable (INS) obtained from the world government index (WGI) is applied in the study by Kaufmann et al. (2009) reporting on six common governance dimensions of more than 200 countries and territories for the between period

1996-2021 including: 1) Voice and accountability, 2) Political stability and no violence/terrorism, 3) Government efficiency, 4) Quality of regulation, 5) Rules of law, 6) Control of corruption. Institutional quality was calculated by averaging the sum of six governance dimensions and rounding the final result to fit a scale from 0 to 100. Data from Word Bank and Central Bank of Vietnam.

2.5. Empirical Model

The underlying empirical equation is specified as follows:

$$\begin{aligned} GDP_{it} = {} & \beta_0 + \beta_1 CASHLESS_{it} + \beta_2 INF_{it} + \beta_3 POP_{it} + \beta_4 SECOND_{it} \\ & + \beta_5 TRADE_{it} + \mu_i + \varepsilon_{it} \end{aligned} \quad (1)$$

whereby GDP_{it} is the gross domestic product for country i at time t, $CASHLESS_{it}$ is the total value of cashless payments transaction in country i at time t, $SECOND_{it}$ is the secondary school enrollment in country i at time t, and $TRADE_{it}$ is the trade openness in country i at time t, INF_{it} is the inflation for country i at time t, POP_{it} is the population growth rate for country i at time t, μ_i is country i specific effect, and ε_{it} is the error term of i country at time t.

Cashless refers to the vector of cashless payment instruments (growth rate of debit card transaction, credit card transaction, e-money transaction, and check transaction). Furthermore, control variables such as inflation (Inflation), population growth rate (Population), secondary school enrollment (Secondary) and trade openness (Openness) have been included in the model. The inclusion of the variables allows the model to capture the impact of inflation, demographic changes, human capital, and international trade on growth, respectively. Moreover, those control variables have been widely used in economic research to examine the determinants of a country's growth rate (Abdullah et al., 2013; Law et al., 2013; Law, Kutan, & Naseem, 2018; Lau & Yip, 2019).

Furthermore, to avoid the omitted variable bias in the model, additional variables such as net inflow of FDI, domestic credit to private sector, gross capital formation, broadband subscriptions, and the measure of institutional quality have been included into the model in the robustness check section. The inclusion of the variables allows the model to take into account the impact of foreign direct investment, financial development, general investment, and information and communication technology (ICT) development and institution quality on growth, respectively. Moreover, the inclusion of those variables is motivated by the economic growth following literatures (Solow, 1962; Law & Azman-Saini, 2012; Law et al., 2018; Bahrini & Qaffas, 2019; Hanivan & Nasrudin 2019; Rath & Hermawan, 2019).

2.6. Research Methodology

This paper employs the static panel method to quantify the relationship between economic growth and cashless payment for G20 countries and Vietnam. The model selection tests (Breusch-Pagan Lagrangian Multiplier test, Poolability F-test and Hausman test) show that Fixed Effects (FE) model is appropriate in the

context of this study. Three robustness checks have been conducted to ensure the validity of the baseline results.

3. Estimation Results

3.1. Descriptive Statistics

Descriptive statistics in this study include the following indicators: Total number of observations, Mean value, Standard deviation, Minimum and maximum values of the variable to get an overview of the research data. The following table shows the results of descriptive statistics extracted from Stata software after the author's data analysis.

Table 2 shows the dependent variable is the GDP variable representing the economic growth rate of the countries in the sample in the period 2011 to 2020. Statistical results of the GDP variable among countries have increased on average by 2.11%, the minimum is negative growth of 9.89% and the maximum is 11.2%.

The average logarithm of the total debit card value (DEBIT) is 7.23, the minimum value is 0 and the maximum value is 10.71. The standard deviation of 2009 is smaller than the mean, showing that the value of debit cards between countries is not too different from each other.

The average logarithm of total credit card value (CREDIT) is 6.72, the minimum value is 2079 and the maximum value is 9.6. The standard deviation of 1.61 is smaller than the mean, showing that the credit card value between countries is not too different from each other.

Table 2. Descriptive statistics.

Variable	Obs	Mean	Std.Dev.	Min	Max	Skewness	Kurtosis
GDP	210	2.1116	3.4368	−9.8952	11.2001	−0.7147	4.7530
CHECK	172	4.5519	2.0612	0	8.3121	−0.2180	2.1072
EMONEY	163	4.8250	2.1183	0	9.0642	−0.0519	2.5090
DEBIT	184	7.2392	2.0088	0	10.7181	−1.5397	5.9718
CREDIT	186	6.7219	1.6198	2.0794	9.6002	−0.71318	2.9732
INF	199	3.2923	3.1503	−2.0933	18.6777	1.9143	8.0288
POP	210	0.8330	0.6731	−1.8537	3.0907	0.1587	4.8731
SECON	163	102.7963	13.7476	66.2507	157.1677	0.5185	6.2563
TRADE	210	53.4022	19.6635	22.4862	105.5663	0.4144	2.3936
FDI	210	2.0750	1.4829	−1.1672	11.9291	1.7370	11.1504
FD	194	94.4422	47.6215	13.6676	216.5589	0.3025	2.1255
GCF	210	26.0993	9.7886	12.7455	72.3	1.9780	8.0731
ICT	208	22.5920	13.3038	1.0678	46.9210	−0.1246	1.7563
INS	210	63.8666	20.9645	29	96	0.0352	1.4716

Source: Data processing results from Stata 16.

The logarithmic average of the total check payments (CHEQUE) is 4.55, the minimum is 0 and the maximum is 8.31. The standard deviation of 2.06 is smaller than the mean, indicating that the value of check payments between countries is not too different from each other.

The logarithmic average of total cryptocurrency payments (EMONEY) is 4.82, the minimum is 0 and the maximum is 9.06. The standard deviation of 2.11 is smaller than the mean, showing that the value of cryptocurrency payments between countries is not too different from each other.

The average inflation rate (INF) across countries is 3.29%; the lowest value is negative 2.09% and the highest is 18.67%. The standard deviation was found to be 3.15%, which is close to the mean, so it can be seen that the inflation rate among the countries in the sample is relatively different in the period from 2011 to 2020.

The annual population growth rate (POP) of 0.83% is quite good compared to the average population growth in the world in 2019 of 1.08% (according to World Bank, 2019); The lowest value is negative 1.85% and the highest is 3.09%.

The average total lower secondary school enrollment (SECON) increased by 102.79% between 2011 and 2020. Accordingly, the minimum recorded value is 66.25% and the highest is 157.16%; standard deviation is 13.74%.

The average total export and import of goods (TRADE) is 53.4% share of gross domestic product, the lowest is 22.48% and the highest is 105.56%. The standard deviation is relatively low, so the data is less spread and relatively similar across the countries in the sample.

The average FDI inflow into the countries each year from 2011 to 2020 is 2.07% of gross domestic product, a lower standard deviation of about 1.48%. The minimum is −1.16 and the maximum is 11.92. FDI between G20 developed countries and developing countries like Vietnam in the sample is not too much of a difference.

Domestic credit in the private sector (FD) of the countries in the sample averaged 94.44% of gross domestic product, which can be seen as a sizable percentage of GDP. The minimum value is 13.66% and the highest is 216.55%.

Gross capital formation (GCF) averaged 26.09% of gross domestic product; The lowest value is 12.74% and the highest is 72.3%. The standard deviation of 9.78% shows that the GCF index between countries is evenly distributed and not too different from each other.

The average registered information technology (ICT) bandwidth coverage per 100 people is 22.59; The minimum and maximum values are 1.06 and 46.92, respectively.

Institutional quality measured from 0 to 100 across countries in the sample averaged 63.86; The lowest is 29 and the highest is 96. The standard deviation is 20.96, showing that the scale of assessing countries on institutional quality in the sample is relatively evenly spread.

Next, **Table 3** shows the correlation of the variables used in the analysis. Based on **Table 3**, the correlation coefficient matrix data between the above observed

Table 3. Correlation matrix.

	DEBIT	CREDIT	EMONEY	CHECK	INF	POP	SECON	TRADE	FDI	FD	GCF	ICT	INS
DEBIT	1.0000												
CREDIT	0.7273	1.0000											
EMONEY	0.3091	0.3196	1.0000										
CHECK	0.6106	0.5563	0.2612	1.0000									
INF	−0.1595	0.2089	0.1469	−0.0692	1.0000								
POP	−0.2944	−0.0685	−0.1357	−0.3356	0.4549	1.0000							
SECON	0.3542	0.2167	−0.2839	−0.0421	−0.2852	0.1138	1.0000						
TRADE	0.2917	0.0418	−0.0949	−0.0403	−0.2425	−0.2176	0.0336	1.0000					
FDI	0.1591	0.0676	−0.0461	0.1583	0.1329	0.1103	0.1824	−0.3260	1.0000				
FD	−0.0527	−0.0351	−0.3510	−0.0656	−0.3995	−0.2479	0.4539	−0.0850	−0.1965	1.0000			
GCF	−0.1049	0.0267	0.1150	−0.0688	0.1992	0.2712	−0.2534	−0.0100	0.0487	−0.2281	1.0000		
ICT	0.3700	0.0412	−0.4049	0.1425	−0.6344	−0.5707	0.4748	0.4172	−0.1221	0.5913	−0.2403	1.0000	
INS	0.2239	−0.1298	−0.2192	0.0227	−0.6711	−0.5140	0.4734	0.2589	−0.1147	0.6866	−0.3706	0.8335	1.0000

Source: Data processing results from Stata 16.

variables show that some of the independent variables have a relatively high correlation with each other. According to the results from the table, it can be seen that the correlation coefficient between INS and INCT is 0.83; the positive correlation between CREDIT and DEBIT is 072; the positive correlation between INS and FD is 0.68. Most of the remaining variables have relatively low correlation coefficient so the author will not list them further in this section. In general, the correlation coefficients between the variables are not highly correlated with each other and are all less than 0.8 (Gujarati & Porter 2003). Therefore, there is no multicollinearity error in the model.

3.2. Panel Regression Results

The author conducts tests to select the most suitable model between two models: the fixed effects (FEM) versus the random effects (REM) models in the next section. The OLS model is rejected because it rejects the hypothesis H1: the suitable model is OLS, when compared with the FEM model, specifically, the F-Test in the FEM model has F-Value < 0.05 (significant level of 5%) leads to the argument of excluding the OLS model from the above comparison (Gujarati & Porter 2003). The FEM model is suitable to perform the regression after using the Hausman Test with the REM model. The FEM model is presented as follows:

$$\begin{aligned} GDP_{it} = {} & \beta_0 + \beta_1 CASHLESS_{it} + \beta_2 INF_{it} + \beta_3 POP_{it} + \beta_4 SECOND_{it} \\ & + \beta_5 TRADE_{it} + \mu_i + \varepsilon_{it} \end{aligned} \quad (1)$$

According to the results from **Table 4**, it can be seen that payments by debit card, credit card, and e-money payment have a negative impact on economic growth. While payment by check was found to have a positive effect on economic

Table 4. Regression results of FEM model.

GDP	(1) FEM	(2) FEM	(3) FEM	(4) FEM
CREDIT	−1.6445***			
	(−3.37)			
DEBIT		−1.3914***		
		(−3.91)		
EMONEY			−0.7049***	
			(−2.85)	
CHECK				1.2208**
				(2.56)
INF	−0.4732***	−0.4861***	−0.5611***	−0.4129***
	(−5.29)	(−5.50)	(−5.69)	(−3.79)
POP	0.2003	−0.1742	0.3301	0.3780
	(0.27)	(−0.23)	(0.46)	(0.48)
SECON	0.0199	0.0329	0.0220	−0.0078
	(0.56)	(0.92)	(0.57)	(−0.21)
TRADE	0.0952***	0.0907**	0.1022***	0.0824**
	(2.68)	(2.59)	(2.85)	(2.14)
_cons	7.7411	6.4536	−0.9351	−6.3349
	(1.62)	(1.48)	(−0.22)	(−1.37)
F-Value				
N	137	137	122	129

Note: The above results were estimated using a Fixed Effects model (FEM) with strong standard errors (Robust Standard Errors). Significance of the symbol*: *$p < 0.1$ (significant level of 10%), **$p < 0.05$ (significant level of 5%), ***$p < 0.01$ (significant level of 1%). The number in brackets () is the t value in the regression model. Source: Data processing results from Stata 16.

growth. The explanatory variables that reach statistical significance include the negative impact of inflation on economic growth and the positive impact of trade opening on the economic growth of countries. The results from the regression table are quite similar to the expectations, but these results may still suffer from different econometric phenomena and defects such as inverse causality, omitting important variables, the deviation from the variable is removed and the influence from outliers. Therefore, the study will test the strength of the model and ensure the consistency and validity of the results, the regression results will be based on testing the reliability of the model.

4. Robustness Checks

4.1. Control for Reverse Causality

The negative causal relationship is formed because the endogeneity occurs from

the correlation between the explanatory variables and the error. A negative causal relationship occurs between the independent variables and the dependent variable and causes the estimated parameters of the regression model to be biased. To avoid the effect of negative causality, the author has chosen to replace all the explanatory variables in the model with their own lagged values of 1st order. The model Equation (1) can be rewritten as:

$$\begin{aligned} GDP_{it} = {} & \beta_0 + \beta_1 CASHLESS_{it-1} + \beta_2 INF_{it-1} + \beta_3 POP_{it-1} + \beta_4 SECOND_{it-1} \\ & + \beta_5 TRADE_{it-1} + \mu_i + \varepsilon_{it} \end{aligned} \quad (2)$$

Table 5 shows the estimated results for the reverse causality redress model. Notably, after controlling for the effect of inverse causality, the payment factors remained the same as the results of Table 5, but a positive effect of the population growth rate was detected on economic growth that the previous model did not detect. Therefore, the next analysis will focus only on the relationship between economic growth and debit card payments.

Table 5. Estimation results of Equation (2).

GDP	(1) FEM	(2) FEM	(3) FEM	(4) FEM
L.DEBIT	−2.2429**			
	(−2.83)			
L.CREDIT		−3.0626**		
		(−2.34)		
L.EMONEY			−1.0565**	
			(−2.72)	
L.CHECK				2.8410***
				(4.33)
L.INF	−0.2383***	−0.2263***	−0.2053**	−0.0573
	(−3.78)	(−3.85)	(−2.15)	(−0.35)
L.POP	2.4562***	2.7298***	3.1624***	2.8549***
	(3.13)	(2.95)	(3.26)	(3.11)
L.SECON	0.0161	0.0018	0.0163	−0.0574
	(0.47)	(0.05)	(0.47)	(−1.04)
L.TRADE	−0.0348	−0.0342	−0.0258	−0.0818*
	(−1.01)	(−1.05)	(−0.43)	(−1.96)
_cons	18.0325**	23.0113**	4.0749	−3.9247
	(2.80)	(2.34)	(0.76)	(−0.56)
N	132	132	117	124

Note: The above results were estimated using a Fixed Effects model (FEM) with strong standard errors (Robust Standard Errors). Significance of the symbol*: *$p < 0.1$ (significant level of 10%), **$p < 0.05$ (significant level of 5%), ***$p < 0.01$ (significant level of 1%). The number in brackets () is the t value in the regression model. Source: Data processing results from Stata 16.

4.2. Control for other Control Variables

To control the strength of the next model, the author proceeds to add variables related to economic growth including net foreign direct investment (FDI), domestic credit to the private sector (FD), total capital formation (GCF), logarithm of fixed broadband subscription statistics per 100 population (LnICT) and logarithm of the institutional quality index (LnINS) into the model. The purpose of adding these variables is to allow the model to avoid biased variables.

The results from Table 6 show negative relationships between debit, credit card and e-money payments; positive relationship between check payments and economic growth. This result further confirms that the growth-enhancing effects of cashless payments are not affected by the inclusion of additional variables in the model.

Table 6. Estimation results for Equation (2) with additional control variables.

GDP	(1) FEM	(2) FEM	(3) FEM	(4) FEM
L.DEBIT	−2.6199**			
	(−2.37)			
L.CREDIT		−2.9137*		
		(−1.75)		
L.EMONEY			−0.9354*	
			(−2.13)	
L.CHECK				3.0912***
				(4.98)
L.INF	−0.2093*	−0.1979*	−0.1864	−0.1261
	(−2.09)	(−2.03)	(−1.44)	(−0.73)
L.POP	3.0976***	3.4577***	3.4653***	3.0803***
	(3.98)	(3.30)	(3.57)	(4.21)
L.SECON	0.0053	−0.0123	0.0288	−0.0581
	(0.13)	(−0.30)	(0.72)	(−1.12)
L.TRADE	−0.0579	−0.0586	−0.0304	−0.1163**
	(−1.58)	(−1.50)	(−0.53)	(−2.29)
L.FDI	0.2749	0.3246	0.3445	0.4732**
	(1.52)	(1.67)	(1.22)	(2.41)
L.FD	−0.0151	−0.0394	−0.0350	−0.0872*
	(−0.29)	(−0.69)	(−0.40)	(−1.80)
L.GCF	0.0353	0.0644	−0.0425	0.0841
	(0.49)	(0.70)	(−0.23)	(0.52)
L.lnICT	2.5227	0.9528	−1.3040	−1.3908
	(1.55)	(0.65)	(−0.45)	(−0.67)

Continued

L.lnINS	−0.5046	−1.9206	−0.2311	−6.7691
	(−0.07)	(−0.25)	(−0.03)	(−0.66)
_cons	17.9880	30.5875	10.2247	33.6350
	(0.54)	(0.84)	(0.24)	(0.71)
N	122	122	107	114

Note: The above results were estimated using a Fixed Effects model (FEM) with strong standard errors (Robust Standard Errors). Significance of the symbol*: *$p < 0.1$ (significant level of 10%), **$p < 0.05$ (significant level of 5%), ***$p < 0.01$ (significant level of 1%). The number in brackets () is the t value in the regression model. Source: Data processing results from Stata 16.

4.3. Control for Outliers

To control the outliers, the author uses the winorisation technique based on the suggestions of Lim, Hooy, Chang and Brooks (2016) to remove outliers that exist in the model 2, adding the control variable in the Table 7. The removal of outliers in the 1st and 99th percentiles is shown in Table 7 and the 5th and 95th percentiles are shown in Table 8, respectively.

The results from Table 7 and Table 8 show that the variables (credit card, debit card, and e-money) are relatively synchronous after removing outliers at the 1st, 5th, 95th, and 99th percentiles of the explanatory variables. Payment by credit card, debit card, and e-money have a negative impact on economic growth in Table 7; no impact from credit cards on economic growth is recorded in Table 8; payments by check have a positive effect on the economic growth rates of the countries as shown in Table 7 and Table 8.

5. Results and Discussion

Tables 4-8 have shown relatively consistently that economic growth in the G20 countries and Vietnam is negatively related to payments by debit, credit cards and e-money payment; Economic growth is positively related to check payments. Payments by debit card have a negative impact on GDP of G20 countries and Vietnam thus rejecting the author's hypothesis (H1). It is hypothesized that debit card payments facilitate economic growth in countries. The results are in contrast to the findings of Zandi et al. (2013, 2016) who claimed that debit card payments stimulate economic activities and subsequently promote economic growth. The present study's findings may provide a new perspective to previous studies of G20 countries and Vietnam with having the same discovery with the study of Mengistu & Saiz (2018). The results find that the impact of financial inclusion (considering from the debit card) is not always positive and turns out to be negative in some cases on the country's economic growth. Similar results can be obtained in the case of credit cards.

The economic growth of the G20 countries and Vietnam did not respond to

Table 7. Results from the removal of outliers in the 1st and 99th percentiles.

GDP	(1) FEM	(2) FEM	(3) FEM	(4) FEM
L.DEBIT	−2.7234**			
	(−2.44)			
L.CREDIT		−3.0200*		
		(−1.77)		
L.EMONEY			−0.9998**	
			(−2.19)	
L.CHECK				3.1927***
				(4.94)
L.INF	−0.2183*	−0.2041*	−0.1954	−0.1304
	(−2.10)	(−2.03)	(−1.48)	(−0.75)
L.POP	2.4778*	3.0620*	2.9956*	2.4712*
	(1.88)	(1.84)	(1.85)	(1.86)
L.SECON	0.0104	−0.0090	0.0328	−0.0550
	(0.25)	(−0.21)	(0.84)	(−1.02)
L.TRADE	−0.0723*	−0.0747	−0.0455	−0.1362**
	(−1.89)	(−1.71)	(−0.68)	(−2.55)
L.FDI	0.2749	0.3296	0.3583	0.5019**
	(1.29)	(1.45)	(1.09)	(2.23)
L.FD	−0.0053	−0.0305	−0.0208	−0.0773
	(−0.11)	(−0.55)	(−0.25)	(−1.63)
L.GCF	0.0657	0.0905	−0.0523	0.1198
	(0.78)	(0.84)	(−0.28)	(0.66)
L.lnICT	2.1802	0.6762	−1.6325	−1.8336
	(1.35)	(0.44)	(−0.54)	(−0.81)
L.lnINS	−1.3968	−2.8617	−0.8950	−8.0003
	(−0.19)	(−0.37)	(−0.10)	(−0.77)
_cons	22.5052	35.3235	13.9150	38.8551
	(0.67)	(0.98)	(0.32)	(0.81)
N	122	122	107	114

Table 8. Results from the removal of outliers in the 5th and 95th percentiles.

GDP	(1) FEM	(2) FEM	(3) FEM	(4) FEM
L.DEBIT	−3.4071***			
	(−3.17)			
L.CREDIT		−3.0568		

Continued

		(−1.63)		
L.EMONEY			−0.9786**	
			(−2.22)	
L.CHECK				3.2069***
				(4.17)
L.INF	−0.2972**	−0.2522*	−0.2661	−0.0915
	(−2.25)	(−1.83)	(−1.11)	(−0.41)
L.POP	2.0076	3.1871	2.6967	2.4813
	(0.94)	(1.29)	(1.11)	(1.12)
L.SECON	0.0254	0.0004	0.0407	−0.0424
	(0.47)	(0.01)	(0.78)	(−0.62)
L.TRADE	−0.0896	−0.0303	−0.1025	−0.1457*
	(−1.72)	(−0.61)	(−1.33)	(−2.02)
L.FDI	0.3775	0.3923	0.4029	0.6154***
	(1.47)	(1.63)	(1.24)	(2.98)
L.FD	0.0319	−0.0129	−0.0023	−0.0444
	(0.70)	(−0.24)	(−0.02)	(−0.88)
L.GCF	−0.0411	−0.0450	0.0610	0.2153
	(−0.30)	(−0.24)	(0.29)	(0.73)
L.lnICT	2.4726	0.2483	−2.2033	−1.1725
	(1.36)	(0.11)	(−0.68)	(−0.52)
L.lnINS	0.6397	1.3844	−2.4138	−5.9883
	(0.09)	(0.18)	(−0.27)	(−0.59)
_cons	17.8334	17.6431	20.0392	22.1968
	(0.54)	(0.57)	(0.47)	(0.56)
N	122	122	107	114

Note: The above results were estimated using a Fixed Effects model (FEM) with strong standard errors (Robust Standard Errors). Significance of the symbol*: *$p < 0.1$ (significant level of 10%), **$p < 0.05$ (significant level of 5%), ***$p < 0.01$ (significant level of 1%). The number in brackets () is the t value in the regression model. Source: Data processing results from Stata 16.

the increase in credit card transaction value as detailed in Table 8. This may be due to the offset effect from the positive impacts and negative impacts of paying by credit card. The positive effect of credit card payments is to provide instant credit to consumers, thereby increasing their purchasing power and leading to higher aggregate demand in the economy which increases economic growth (Zandi et al., 2013, 2016). The function of a credit card is not the same as a debit card. Debit card is created to store personal savings prior to spending whereas a credit card is borrowed money for expenditures. Thus, using a lot of credit cards

will lead to debt for individuals and households. While the negative effect of credit cards is the accumulation of debt of individuals and households, which in turn increases the default rate in the economy and affects the economic growth of the country (Kang & Ma, 2009). This is especially true in the context of the G20 countries and also in Vietnam. While the rapid increase in credit availability has made real estate easier to own, which led to a significant increase in household debt, which led to the 2008 Global Financial Crisis. Therefore, the positive and negative effects of credit card payments offset each other, leading to a negligible impact on the economic growth of countries.

The negative effects of credit card payments in **Table 7** and **Table 8** contrast with previous studies in which credit cards promote economic growth in European, and high income counties (Hasan et al., 2012; Zandi et al., 2013). One possible explanation for this difference is that the findings based on European countries and high-income countries may not be generalizable to G20 countries and Vietnam due to the economic structure and degree of pressure using different technologies.

Payment by check has a positive effect on economic growth in European markets (Hasan et al., 2012). The high transaction value would imply that check payments remain an important cashless means of payment in the G20 economies and Vietnam. Along with this, Hasan et al. (2012) found that there exists a positive relationship between economic growth and check payments.

Next, this study found a negative impact of e-money payments on economic growth. Accordingly, the issue of network security, according to the World Economic Forum's 2017 Global Risks Report, is considered to be the most worrying risk in the business activities of the G20 countries and Vietnam. The study's findings are in line with the findings of Wulandari et al. (2020). Findings from the study of Lintangsari (2017) showed that e-money payments have an impact on reducing interest rates. That means low savings rates will make people want to hold more money for transactions to increase the available money supply and will have the effect of increasing inflation thereby reducing economic growth. E-money payments have a significant impact in the short term, and are gradually negatively related to economic growth in the long run. Specifically, in the short term, the volume of e-money payments in the first quarter of each year will reduce economic growth; this is mainly due to the fact that there is an increase in consumers' aggregate spendings for New Year, at the beginning of the year, and during holidays, such as Christmas.

The inflation rate (INF) has a negative effect on economic growth in most of the results from **Tables 3-8**. It can be seen that high inflation rate can help the country increase production and business investment to offset the difference created by this rate as well as offset the economic growth economic deficit (Kryeziu & Durguti, 2019).

Annual population growth rate (POP); Trade openness (TRADE) and foreign direct investment have a positive effect on GDP growth. These results align with the study of Roshan (2008) and Peterson (2017).

6. The Situation of Cashless payments in Vietnam and Policies to Support the Growth of Cashless Payments of the Vietnamese Government

In Southeast Asian countries, and especially in Vietnam, the cashless payments trend has the potential to grow strongly due to a young population and high rates of mobile device and internet usage. Cashless payments is an inevitable trend of the whole world and Vietnam is no exception. E-money and technology for cashless payments in Vietnam, especially electronic payments, continue to be focused on investment, quality improvement, and better response to increasing payment needs of society and adapt to the process of international economic integration. The interbank cashless payments system is operated safely, efficiently, and smoothly. Automated electronic clearing system for retail payment transactions with real-time payment capabilities, multichannel, multimedia transaction processing is being tested for official operation to serve the needs of money transfer, retail payment transactions, and payment for utility services.

In Vietnam, Decision No. 291/2006/QD-TTg issued by the Prime Minister on December 29, 2006 approving the cashless payments scheme for the period 2006-2010 and orientation to 2020 is considered the first legal corridor dealing with cashless payment activities. Decision No. 2545/QD-TTg, dated December 30, 2016, from the Prime Minister approved the project on development of cashless payment for the period between 2016-2020. Decision No. 241/QD-TTg, dated February 23, 2018, approved the scheme to promote payment through banks for public services: tax, electricity, water, tuition, hospital fees, and payment of programs Social Security. Decision No. 10/CT-TTg, dated April 11, 2018, strengthened the management of activities related to Bitcoin and similar virtual currencies. In Resolution No. 02/2019/NQ-CP, dated 01/January 2019, the government continued to perform tasks and solutions to improve the business environment, enhance national competitiveness in 2019 and orientation to 2021. The government of Vietnam has requested to accelerate payment online and provide level 4 online public services, including: tuition fees, hospital fees, electricity, water, environment. On May 26, 2020, the Prime Minister continued to issue Decision No. 22/CT-TTg to promote the implementation of cashless payment development solutions in Vietnam. Cashless payments is a major policy of the government of Vietnam, widely deployed with the advantages of "benefiting the country, benefiting the house". After 5 years of implementing the project to develop cashless payments in Vietnam for the period between 2016 to 2020. Decision No. 2545/QD-TTg, dated December 30, 2016, from the Prime Minister reported that cashless payments activities in Vietnam, and for public services have achieved positive results.

First, the cashless payments system thrives with the participation of many institutions. According to the State Bank of Vietnam, as of May 2020, there are 78 organizations providing payments services via the internet, 49 organizations providing mobile payment services, 30 commercial banks, and 6 organizations

providing intermediary services (payment coordinated payment implementation with about 80 thousand points accepting quick response codes - QR Code).

Second, the infrastructure and technology for cashless payments are focused on investment, especially electronic payment, to better the increasing payment needs of the society. Modern technologies in payment such as fingerprint authentication technology, face recognition, QR Code, card information encryption, etc. are currently being researched, cooperated, and applied by banks, especially is the payment by QR Code associated with promoting payment via mobile phones in line with the development trend in the world and consumer behavior.

Third, the total value of cashless payments increased significantly and became a payment trend in the economy of Vietnam. According to data from the State Bank, in the past 5 years, the total number of payments via internet channels increased by 262.5%, the payment value increased by 353%. Mobile payments in volume also increased by 1000% and its value up 3000%. In the first 9 months of 2020, the number and value of e-commerce transactions increased by 75.2% and 30%, respectively, over the same period in 2019; especially, the number and value of transactions via mobile phone channels increased by nearly 125% and 130% respectively over the same period in 2019. Also according to the statistics of the State Bank, the number of ATM devices being installed in the first 9 months of 2020 increased by 3.61% and POS/EFTPOS/EDC increased by 0.44% over the same period in 2019. ATM transaction value increased by 0.44% and POS/EFTPOS/EDC increased by 2.40% over the same period in 2019. The number and value of transactions via mobile channels increased by 102.47% and 116.71%, respectively, over the same period in 2019.

For public services, cashless payments also achieved certain results. In the past years, the State Treasury has actively coordinated with various sub-governmental agencies to deploy and develop a cashless payments system for public services such as the state budget revenue. The treasury department of Vietnam has developed a system of cashless payments and have deployed a project to modernize state budget revenue, sharing collection data and coordinating state budget collection electronically with commercial banks or through the portal of the General Department of Taxation and the General Department of Customs; collection of administrative fines in the field of road traffic (via the National Public Service Portal); pay salaries through accounts for salary beneficiaries from the State Budget.

7. Limitations of the Study

After the Covid-19 pandemic, cashless payments have been popular and developed. But this paper cannot collect data during this period data doesn't public. Consequently, some conclusions about which cashless payment methods should be applied in Vietnam don't coincide with the actual situation of Vietnam. As I mentioned, the most used check payment is corporate companies, not people. Vietnamese people after the Covid-19 pandemic have been using cards and e-money instead. Because of the problem of data collection, I will make it much

clearer in the following papers.

8. Conclusion

This paper helps to add to the main research findings in two specific ways: First, this study shows the relationship between cashless payments and economic growth in G20 countries. Second, this study provides evidence that cashless payments will be effective in promoting growth in G20 countries through check payment during the research period from 2011 to 2020. It is the substitution effect between debit and credit card payments and e-money payments. As a result, consumers and merchants will prefer to pay by check rather than pay by other methods. Although payment methods such as debit and credit cards have been found to have a negative impact on the economic growth of the G20 countries, there is still no specific research to conclude the exact development. This phenomenon and this conclusion can completely change the impact sign in terms of sample, study time as well as the difference between economic structure and technology. Overall, our results are consistent with the thesis that cashless payments can have a significant impact on the economic growth of countries. The study emphasizes the importance of paying by check and debit as well as credit card even though the results of these two cards are not as expected and are not a growth engine for the economy.

Besides, because of the difference between regional size and technology between Vietnam and G20 countries, based on the research, there is still enough evidence to conclude that cashless payments have a positive impact on economic growth in Vietnam. But we need to consider which means of payment will positively and strongly affect Vietnam. Since the samples were taken between 2011 and 2020, during this period, Vietnamese payment has not really exploded, and cashless payments via check are used by payment companies in wholesale transactions and sales. Therefore, it is impossible to conclude that cashless payments by check will positively affect economic growth in Vietnam since this process of payments is not widely popular with the general public. In Vietnam, after the Covid-19 pandemic, forms of cashless payment boomed; this is evident by the government's willingness to develop policies pertaining to cashless payments in Vietnam. Again, the results of this study are that cashless payments have a positive impact on economic growth. As a policy suggestion, Vietnam should continue to promote cashless payments as it exerts the highest positive impact on economic growth. Hence, the country would be able to reap the benefits from a cashless economy (Roshan, 2008; Peterson, 2017).

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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