THE EFFECTS OF CASHLESS PAYMENTS ON CORRUPTION

BY

GOH YAN YIN
LEONG SAW HUI
PANG MENG WEI
YEW SIN KAI
YOW ZI LIN

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DECLARATION

We hereby declare that:

(1) This undergraduate FYP is the end result of our own work and that due acknowledgement has been given in the references to ALL sources of information be they printed, electronic, or personal.

(2) No portion of this FYP has been submitted in support of any application for any other degree or qualification of this or any other university, or other institutes of learning.

(3) Equal contribution has been made by each group member in completing the FYP.

(4) The word count of this research report is 17119 words.

Name of Student:	Student ID:	Signature
1. GOH YAN YIN	15ABB03608	
2. LEONG SAW HUI	15ABB06191	
3. PANG MENG WEI	15ABB03907	
4. YEW SIN KAI	15ABB06621	
5. YOW ZI LIN	15ABB05404	

Date: 1ST APRIL 2019

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LIST OF ABBREVIATIONS

ANOVA	Analysis of Variance
AR(1)	First-order Serial Correlation
AR(2)	Second-order Serial Correlation
CHE	Cheque
CNB	Central Bank of Nigeria
CP	Cashless Payment
CPA	Central Public Authorities
CPI	Corruption Perception Index
CT	Credit Transfer
DD	Direct Debit
DEM	Democracy
DOI	Diffusion of Innovation
ECB	European Central Bank
EGMM	Efficient GMM
ePSO	e-Payment System Observatory
EU	European Union
GDP	Gross Domestic Product
GMM	Generalized Method of Moments
GOVT	Government Size

ICRG	International Counter Risk Guide
ICT	Information and Communication Technology
IMF	International Monetary Funds
IV	Instrument Variable
LDCs	Less Developed Countries
MM	Method of Moment
MPay	Moldova Governmental e-Payment Gateway
OLS	Ordinary Least Squares
SEPA	Single Euro Payment Area
WDI	World Development Indicators

PREFACE

For many years, corruption was seen as a problem of developing countries. European Union (EU) has faced the same problem since the incorporation of EU with unfinished transition and economic crisis, and causes their control of corruption is difficult to sustain. This research mainly examines the relationship between cashless payments and corruption in European countries.

This research consists of 3 major sections:

First section: Preliminary pages that include copyright pages, declaration, acknowledgement, dedication, contents page, list of tables, list of figures, list of abbreviation, preface and abstract.

Second section: The content of the research.

Chapter 1: Introduction

Chapter 2: Literature Review

Chapter 3: Methodology

Chapter 4: Data Analysis

Chapter 5: Conclusion

Third section: The end materials consist of references and appendixes.

This research provided various useful information on the impacts of cashless payments on corruption in European countries that is beneficial for future researchers.

ABSTRACT

The main purpose of this study is to examine the relationship between cashless payments and corruption in European countries from period of year 2000 to 2015. This is a secondary-based research whereby all the data is obtained from European Central Bank (ECB) data warehouse, with a total of 432 observations. This research examines empirically whether the corruption level is related to changes in Cashless Payments, Government Size, Democracy and Economic Prosperity. Generalized Method of Moments is adopted in this study to capture the effects of independent variables due to the fact that we used dynamic panel date in this research. The empirical result showed that both cashless payments and economic prosperity are significantly and negatively correlated to corruption. On the other hand, government size and democracy are found to be significantly and positively correlated to corruption. This research allows the government to understand the variables that may impact corruption level. Thus, this research is useful for the government in choosing the method of cashless transaction to focus on in bringing down the rate of corruption.

CHAPTER 1: INTRODUCTION

1.0 Introduction

Chapter one provides the outline of the research. Research background, problem statement, research questions, research objectives, hypotheses, significance of study and definitions of terms will be included in this chapter. The main objective of this research is to investigate the relationship between cashless payment and corruption in Europe countries. The controlled variables that have been chosen are democracy, government size and economic prosperity.

1.1 Background of study

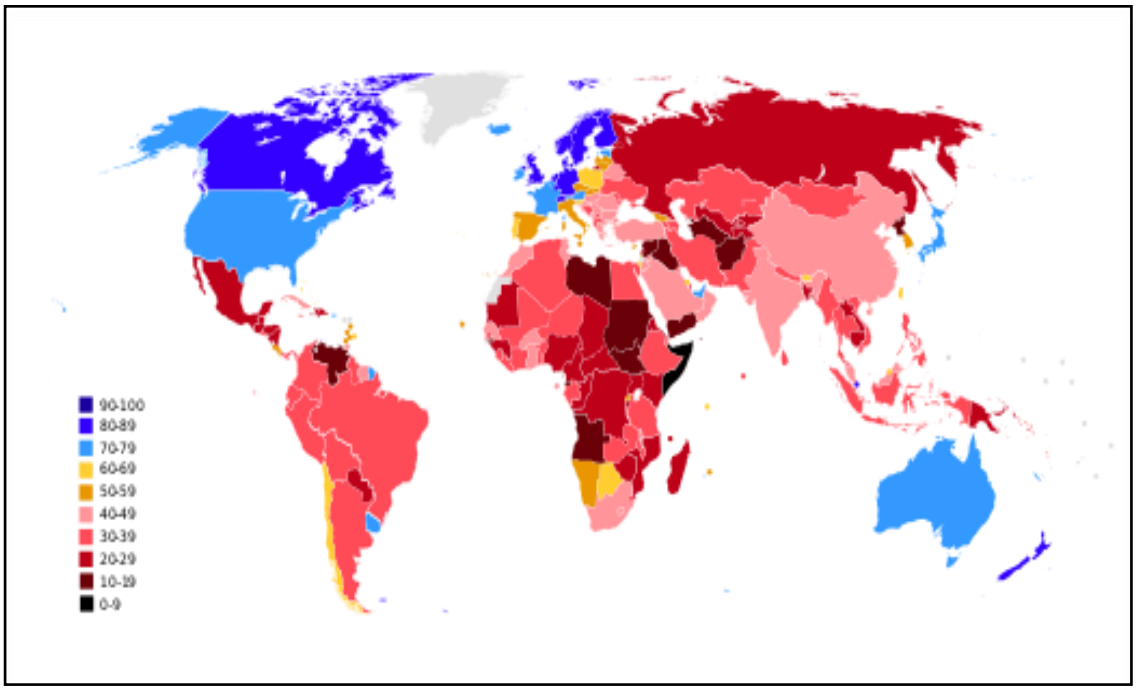
Corruption is defined as the misuse of public office for private gain which is difficult to monitor (Treisman, 2000). For example, government officials often collect bribes for providing permits and licenses, for prohibiting the entry of competitors, or for giving passage through customs. Corruption also refer to deviation from the norm because it assume that authority should promote public interest in fairness, instead of promoting private gain of any kind (Pippidi, 2013).

Corruption can be classified into three major categories, which are petty corruption, grand corruption and systemic corruption (Ayoola, 2013). Petty corruption refers to corruption related to tips or commissions that are usually demanded by officers from public in exchange for official services. On the other hand, grand corruption, also refers to political corruption, where politicians paying bribes to award those who use their position to influence the election outcome. Lastly, systemic corruption refers to a wholly corrupted system that the society accepted corruption as a mean of conducting daily transaction (Ayoola, 2013).

For many years, corruption was seen as a problem of developing countries. However, corruption is common too in the developed countries, where government

sometimes sell contracts for personal gain (Shleifer & Vishny, 1993). Yet, the expansion of trade and economic reforms have provided an unexpected opportunity for corruption. Pippidi (2013) found that the European Union (EU) has faced the same problem since the incorporation of EU with unfinished transition and economic crisis, and causes their control of corruption is difficult to sustain. The increase in corruption level of Spain, Portugal, Greece and Italy since they joined the EU has raised doubt about the EU transformative effects on its members (Pippidi, 2013). These corruption have been blamed for hindering countries from developing. Mauro (1995) argued that malfunctioning government institution constitute a serious hurdle to investment, entrepreneurship and innovation. Also, recent research has found that there is a negative relationship between corruption and economic growth (Treisman, 2000). The topic of fighting corruption and increasing transparency is becoming more important nowadays.

Figure 1.1: Global Perceived Levels of Corruption 2017

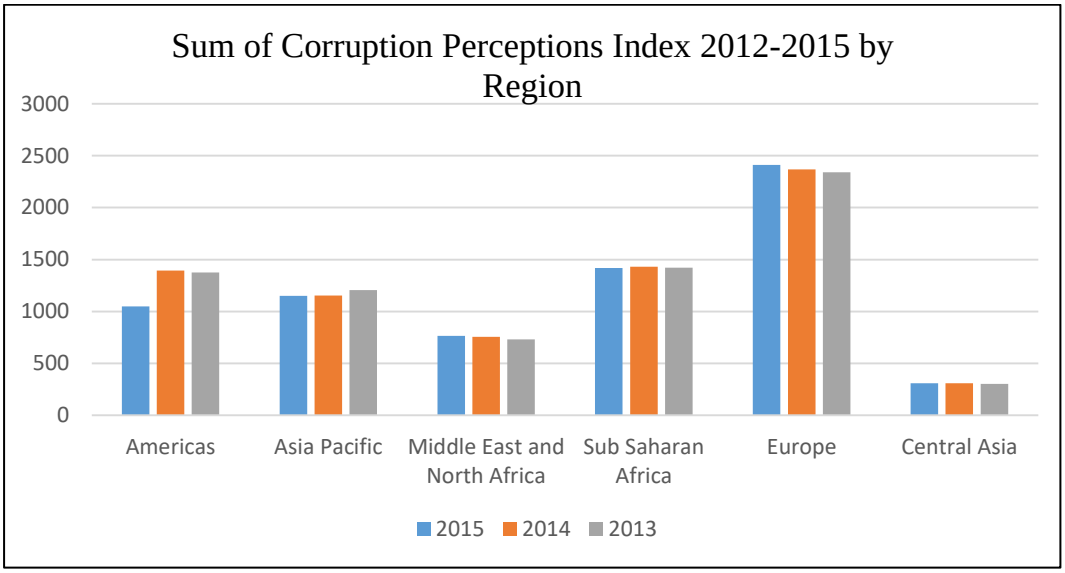


Source: Transparency International (2017)

Figure 1.1 shows the levels of corruption perception across the world in 2017. The CPI (Corruption Perceptions Index) currently ranks 180 countries on a scale from 100 (very clean) to 0 (highly corrupt). The best performing region is Western Europe with an average score of 66. Denmark, Sweden, Netherlands and United

Kingdom rank the highest with scores of 88, 84, 82 and 82 respectively in the Europe region. On the other hand, the worst performing regions are Sub-Saharan Africa (average score 32) and Central Asia (average score 34). Somalia, South Sudan and Syria rank lowest with scores of 9, 12 and 14 respectively (Transparency International, 2017).

Figure 1.2: Global Perceived Levels of Corruption from 2012 - 2015



Based on the six major regions, when examining the total Corruption Perceptions Index, only Europe has exceeded the 2000 mark in the three years, 2013-2015 (refer to figure 1.2). The other 3 regions CPI remained below 1500 even up till the year 2017, with the Sub Saharan Africa region barely over 1400 in the year 2017. The European region shows a distinct level of corruption as compared with the other regions, even with developed regions such as America.

Figure 1.3: Corruption Perceptions Index of European Union from 2005 to 2015

Country	Rank	2015	2014	2013	2012	2011	2010	2009	2008	2007	2006	2005
Denmark	**2**	**91**	**92**	**91**	**90**	**94**	**93**	**93**	**93**	**94**	**95**	**95**
Finland	**3**	**90**	**89**	**89**	**90**	**94**	**92**	**89**	**90**	**94**	**96**	**96**
Sweden	**6**	**89**	**87**	**89**	**88**	**93**	**92**	**92**	**93**	**93**	**92**	**92**

Luxembourg	**8**	**85**	**82**	**80**	**80**	**85**	**85**	**82**	**83**	**84**	**86**	**85**
Netherlands	**8**	**84**	**83**	**83**	**84**	**89**	**88**	**89**	**89**	**90**	**87**	**86**
United Kingdom	**8**	**81**	**78**	**76**	**74**	**78**	**76**	**77**	**77**	**84**	**86**	**86**
Germany	**12**	**81**	**79**	**78**	**79**	**80**	**79**	**80**	**79**	**78**	**80**	**82**
Austria	**16**	**76**	**72**	**69**	**69**	**78**	**79**	**79**	**81**	**81**	**86**	**87**
Belgium	**16**	**77**	**76**	**75**	**75**	**75**	**71**	**71**	**73**	**71**	**73**	**74**
Ireland	**19**	**75**	**74**	**72**	**69**	**75**	**80**	**80**	**77**	**75**	**74**	**74**
Estonia	**21**	**70**	**69**	**68**	**64**	**64**	**65**	**66**	**66**	**65**	**67**	**64**
France	**23**	**70**	**69**	**71**	**71**	**70**	**68**	**69**	**69**	**73**	**74**	**75**
Portugal	**29**	**64**	**63**	**62**	**63**	**61**	**60**	**58**	**61**	**65**	**66**	**65**
Slovenia	**34**	**60**	**58**	**57**	**61**	**59**	**64**	**66**	**67**	**66**	**64**	**61**
Poland	**36**	**63**	**61**	**60**	**58**	**55**	**53**	**50**	**46**	**42**	**37**	**34**
Lithuania	**38**	**59**	**58**	**57**	**54**	**48**	**50**	**49**	**46**	**48**	**48**	**48**
Latvia	**40**	**56**	**55**	**53**	**49**	**42**	**43**	**45**	**50**	**48**	**47**	**42**
Cyprus	**42**	**61**	**63**	**63**	**66**	**63**	**63**	**66**	**64**	**53**	**56**	**57**
Czech Republic	**42**	**56**	**51**	**48**	**49**	**44**	**46**	**49**	**52**	**50**	**48**	**43**
Spain	**42**	**58**	**60**	**59**	**65**	**62**	**61**	**61**	**65**	**67**	**68**	**70**
Malta	**46**	**60**	**55**	**56**	**57**	**56**	**56**	**52**	**58**	**58**	**64**	**66**
Italy	**54**	**44**	**43**	**43**	**42**	**39**	**39**	**43**	**48**	**52**	**49**	**50**
Slovakia	**54**	**51**	**50**	**47**	**46**	**40**	**43**	**45**	**50**	**49**	**47**	**43**
Croatia	**57**	**51**	**48**	**48**	**46**	**40**	**41**	**41**	**44**	**41**	**34**	**34**

Greece	**59**	**46**	**43**	**40**	**36**	**34**	**35**	**38**	**47**	**46**	**44**	**43**
Romania	**59**	**46**	**43**	**43**	**44**	**36**	**37**	**38**	**38**	**37**	**31**	**30**
Hungary	**66**	**51**	**54**	**54**	**55**	**46**	**47**	**51**	**51**	**53**	**52**	**50**
Bulgaria	**71**	**41**	**43**	**41**	**41**	**33**	**36**	**38**	**36**	**41**	**40**	**40**
		1836	**1798**	**1772**	**1765**	**1733**	**1742**	**1757**	**1793**	**1798**	**1791**	**1772**

Source: Transparency International (2017)

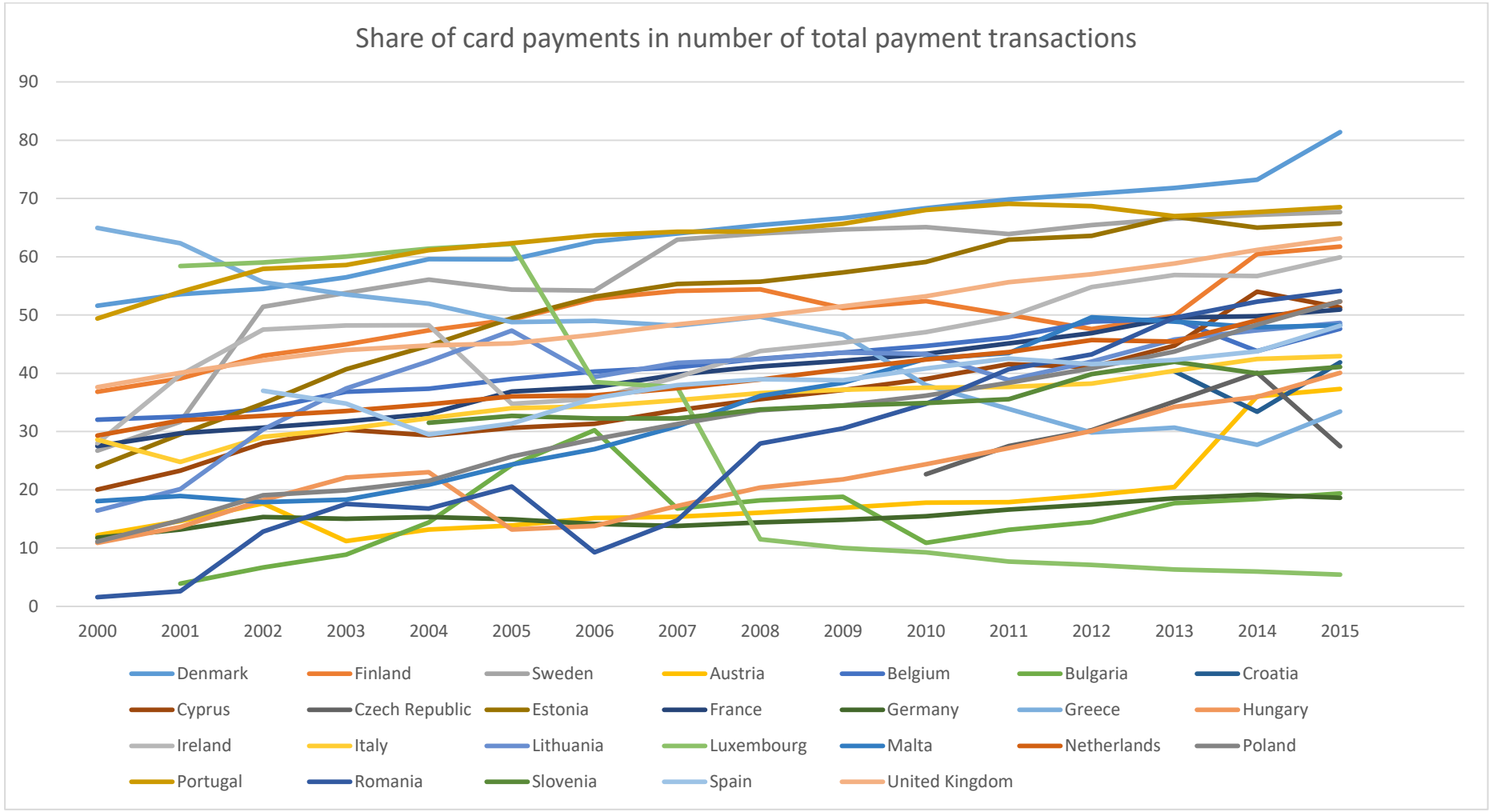
Upon closer inspection, in can be observed that 5 of the 28 European Union countries, Denmark, Finland, Sweden, Luxemberg, Netherlands and the United Kingdom, are ranked within the top 10 least corrupted countries based on CPI in the year 2017(refer to figure 1.3). The total CPI score for European Union showed an increase from 1772 to 1836 from the year 2005 to 2015. 14 countries improved dramatically from 2005 to 2015. The top the countries that increased in CPI over the 5 years include countries such as Poland, whose CPI score increased by 29 points in 10 years which is a 46% increase, Romania with a 16 point or 35% increase and Croatia with a 17 point or a 33% increase. Latvia, Czech Republic, Lithuania, Slovakia and Estonia showed 25%, 23%, 19%, 16% and 9% increase respectively. But what induced or caused this improvement? Identification of these factors and determinants that lead to this reduction in corruption can help distinguish elements that can aid other countries.

In the recent years, information and communication technology or otherwise referred to as ICT has allowed the traditional payment system to evolve. Rather than previous means of transaction such as cash or cheques, transactions can be carried in out other various methods. After this innovation, individual are able to easily make payments for goods or services over the counter or even through the internet. This marvel of payments that do not require cash is known as cashless payment or E-payment (Gholami, Ogun, Koh, & Lim, 2010). The trend of cashless payment that began in United States over some decades ago has become the in-thing globally. The cashless policy does not refer to an absence of cash transactions in the economy but in which the amount of cash-based transaction are kept to the minimum (Ayoola,

2013). In a cashless economy, transactions can be done without carrying physical cash as a mean of exchange for transaction but rather with the use of debit or credit card payment for goods and services (Omotunde, Sunday & John, 2013). For many years, developed countries like Sweden, Canada, France and United Kingdom have run their economy through electronic payment without difficulties.

But what of the development of cashless payments in the European Union? The European Central Bank (ECB) has been operating a system called ePSO, the e-Payment System Observatory since the year 2003 to ensure the payment system can operate smoothly, and also which the aim of supporting the development of a much more secure and efficient payment mechanism (Hartmann, 2006). Apart from that, The EU has recently established the Single Euro Payment Area (SEPA) which has successfully integrated all of European's electronic payment system (Tee & Ong, 2016). The SEPA allows all domestic and cross-border Euro payment by eliminating the geographic and technical barrier of electronic payment in Europe Area (Tee & Ong, 2016). Interestingly, more and more European Countries have also implemented their own cashless payment system while dealing with less cash or paper money. For example, United Kingdom has introduced Mondex, an electronic cash on card. It was designed to replace cash and the transactions with Mondex are extremely fast and incur no charges (Mas & Rotman, 2008). Besides, Spain also introduced a mobile payment mechanism called Mobipay. This system allows customers to pay for goods and services through their mobile phone using a range of payment instrument, such as debit card and credit card. (Mas & Rotman, 2008). Surprisingly, some less Developed Countries (LDCs) like Nigeria will also be transitioning from a pure cash economy to cashless economy for developmental purposes (Achor & Robert, 2013).

Figure 1.4 Share of card payments in number of total payment transactions



Coincidentally, cashless payments showed an increase in volume over the same time period, from the years 2000 to 2015. All European Union countries had an increase in number of card payments in these 15 year. With the exception of Luxembourg which faced political issues and from 2009 to 2013 (Clauwaert & Schömann, 2016) accompanied by a financial crisis in 2009 (Székely & Noord, 2011), which lead to the loss of confidence in the government and unemployment rates to rise, contributing to the decrease in economic performance. The percentage of card payments within the total payment transactions for the 3 top ranked countries Denmark, Finland and Sweden stood at 51.57%, 36.81% and 26.71% in the year 2000 respectively. Experiencing a significant rise over the years, arriving at 81.37%, 61.73% and 67.66% respectively (refer to figure 1.4). Is this simply a concurrence of two conditions that shows no evident causal connection, or does cashless payments actually have a significant impact on corruption? This study is conducted with the aim to find out just that.

According to (Mehrotra & Goel, 2011), the method in which financially related transactions are carried out can bring an effect to the amount of illegal activity within a specific country, in this case this study looks at corruption. There is no escaping the fact that various parties attempt to conceal their personal gains using different methods to evade exposing their offences and evading penalties. It is clear that transaction related to cash are the hardest to uncover by law enforcers as they are harder to trace. When looking at other means of financial transactions, each method will have a different degrees of effectiveness on contributing to the act of corruption. For example, cheques in comparison to credit card payments are deemed to have a greater difficulty in tracing. So will the elimination of cash and introduction to cashless payments affect corruption? The cashless policy involves adopting of electronic processes to documenting all payment thereby providing an effective database for audit trail. This process is capable of reducing corruption because it encourages transparency and accountability as funds are no longer channelled through cash which is easily diverted (Jatau & Dung, 0214). Not surprisingly, there has been a growing global movement to fight corruption. Lately, the cashless system of payment have been introduced by the government to combat corruption (Ayoola, 2013).

This research focused on European Countries as the corruption perception level of European Region is the lowest as compared to the rest of the world. So, this study aims to examine whether is it their cashless payment system contributed to the low level of corruption in the countries.

1.2 Problem Statement

In recent years, the importance of government payments as part of the transparency programs have been much discussed. This is because corruption can change the size and the complexity of the project because higher spending on one capital project will reduce the resources available for other spending (Tanzi & Davoodi, 1997). It will cause an increase in the share of public investment in GDP, reduce the average productivity of an investment because of the budgetary constraint, and possibly reduce some public spending such as maintenance, education and health. As a result, it will have a negative impact on the rate of growth of a country economy (Tanzi & Davoodi, 1997). However, very little is known about what causes corruption to be higher in one country than another (Treisman, 2000). Corruption can be seen as one of the main obstacles post-communist countries face in aiming to achieve economic stability and growth (Shleifer, 1997). Also, the difficulty of measuring levels of relative corruption in different countries also presented a major barrier. Yet, recently, political scientist and economists have begun to analyse corruption perception index prepared by business risk analysts and polling organizations, based on survey responses of businessmen and local residents (Treisman, 2000).

There are many relevant studies that suggest the different opinions regarding the effect of cashless payment towards corruption, but the results shown by researchers are still in a vague situation, which will be discussed individually. First of all, Mai (2016) mentioned that the corruption level in many countries are low despite these countries having a massive usage of cash. He mentioned that although cashless payment can effectively reduce the crime rate related to physical cash, however, it may also create some new problems such as fraud or money laundering. Ayoola (2013) also claimed that cashless policy is not effective in curbing corruption. It can only reduce petty corruption which is the lowest level among all form of corruption.

He mentioned that cashless economy will not bring any tangible result in curbing corruption unless with good governance, transparency and accountability and legislative oversight (Ayoola, 2013). However, Jatau and Dung (2014) have a different point view. They suggested that cashless policy can be instrumental in eliminating corruption. This is because cashless policy involves process documenting of all payment. This process can help in reducing corruption because the fund can be easily traceable, therefore it enhance the monitoring and auditing processes. Researcher such as Nwankwo and Eze (2013) and Ajayi (2014) also stated that the use of cash is attributed to corruption problem. They stressed that cashless policy can curb corruption problem at the same time saving the country huge resources such as cost of transporting and printing the money. Replacing paper cash with cashless credits or electronic money transfers can at least reducing corruption, money laundering, bribery and other cash related fraudulent activities (Ajayi, 2014). Therefore, he believed that this cashless policy can effectively reduce the corruption level.

A number of studies have been conducted in the past to test the impact of cashless payments on the corruption. Mehrotra and Goel (2011) suggested that the use of non- paper based transaction in some developed countries such as Belgium, France, Germany, Sweden and United Kingdom is associated with less corruption. In their research, they found that the choice of payment instrument matter, where the paper credit transfer and cheque generally increase corruption. On the other hand, they also mentioned that direct debits does not have significant effect on corruption, while the credit transaction tend to reduce them (Mehrotra & Goel, 2011). However, the numbers of studies focused in the context of only Europe countries are very limited. Hence, this study aims to tackle the issues stated above by investigating is there any relationship between the cashless payment and the corruption in Europe countries.

1.3 Research Objective

1.3.1 General Objective

The general objective of this paper is to identify if there is a significant relationship between cashless payments and corruption in European countries. If a relationship exist, to discern whether the effect of cashless payment have a positive or negative impact on corruption, seeing that there are contradicting views on the matter. To distinguish which type of payment instrument will actually have an effect on corruption and if so, understanding if the impact is negative or positive, considering that each method of cashless transaction has been deemed to having different magnitudes of effect on corruption.

1.3.2 Specific Objectives

This study examines on:

1. To determine the impact of cashless payments on corruption in European countries.

1.4 Research Questions

This section will discuss about the questions related to the corruption in European countries. There are one research questions in this paper:

1. Does cashless payment bring a significant impact to corruption in European countries?

1.5 Hypothesis of Study

1.5.1 Use of electronic payments

H_0: There is no relationship between the use of electronic payments and corruption.

H_1: There is a relationship between the use of electronic payments and corruption.

1.6 Significance of Study

The purpose of this paper is to examine the relationship between cashless payments and corruption in European countries. The independent variables that have been selected for the study include democracy, government size, electronic payments and economic prosperity. The main contribution of the study is the actual significance of these variables and whether they actually have an impact on the corruption in European countries. Thus, it is hoped that the results from these studies can allow the government to understand the variables that may impact corruption and come up with suitable measures to reduce corruption. After identifying if there is a relationship between cashless payments and corruption, the government will then know if it is worth the effort to put resources in curbing corruption using cashless policy or redirect their focus on other variables that actually reduce corruption. This study will also aid the government is choosing which method of cashless transaction to focus in bringing down the rate of corruption as this study aims to find out the magnitude of each method of cashless transaction. In the long run, society also benefits as a better understanding towards the ways of reducing corruption, it is understood that corruption harms a specific country's economic wellbeing, if the government can effectively reduce it, it will bring economic benefits towards the country.

There are currently a few studies that discuss individually the variables that have an impact on corruption such as Johannesson & Steendam (2014) who concluded that mobile banking may lead to an increase in corruption in Kenya. Although another study by Mehrotra & Goel (2012) had included all the variables, the study was based on countries such as Belgium, Canada, Japan and Singapore. This study aims to have a more in depth study in European countries only which include cashless payments.

Other than that, the studies conducted was back in 2012, where cashless payments were just introduced, we aim to capture the previous study result from other countries and compare with the result we have in this study to provide more updated results.

1.7 Chapter Layout

In chapter 1, the basic information and contribution of the study are introduced. Followed by chapter 2 which will include previous literature and theoretical model that will be reviewed and proposed. The data collection and analysis of finding will be covered in chapter 3 and 4. Lastly in chapter 5, the conclusion and implication will be covered.

CHAPTER 2: LITERATURE REVIEW

2.0 Introduction

In this chapter, reviews on previous studies about the relationship between dependent and independent variables will be carried out. A clearer picture in the related area of study will be given in this chapter by presenting different opinions by different researchers. Independent variables are economic prosperity, government size, democracy and electronic payment. Relevant theory in this study is Diffusion of Innovation Theory (DOI).

2.1 Diffusion of Innovation Theory (Theory)

Nowadays, cashless payment is commonly used to transact goods and service without cash, through cheque payment or electronic transfer. According to Tee and Ong (2016) Diffusion of Innovation Theory (DOI) can be used to analyse the effects of electronic payment on a nation's economy. This theory was introduced by Rogers in 1962. In his first book, he showed how innovation was diffused to individuals of a social system after periods of time (Rogers, 1983).

There are 4 main elements in Diffusion of Innovation Theory (DOI) which are innovation, communication channels, time and social system. The first element is innovation, "An innovation as an idea, practice, or object that is perceived as new by an individual or another unit of adoption" (Rogers, 1983, p. 11). In fact, sometimes innovations want by one adopter in one circumstance might be undesired for another potential adopter that is in alternative circumstances. Thus, the context and adopter's perceived attributes can determine its rate of adoption. There are five attributes of innovation which are relative advantage, observability, trialability, compatibility and complexity. Next, communication channels is defined by Rogers (1983, p. 17) as "The means by which messages get from one individual to another". He claimed that mass media channels such as television, radio, newspaper and so

on are the most effective and rapid way to deliver the existence of a new idea or innovation. This is because such mass mediums enable individuals to reach an audience of many and thus, the innovation can be transfer to public (Rogers, 1983).

The third element is time. The time dimension is involved in diffusion research in the innovation process, innovativeness and an innovation's rate of adoption. The innovation decision process can be best described as a process at which an individual is first exposed to the innovation, developed an attitude or impression of the innovation, which leads to the decision on whether the individual chooses to adopt or reject this specific innovation. If the innovation is adopted, the new idea will be implemented and finally the last stage of the process would be confirmation of the decision that has been made. The degree of innovation for one that is adopted is will rely on the whether the adoption was adopted at an earlier stage of later stage when comparing with other individuals within a system. Next, the adoption rate can be commonly defined as the amount of individuals of a specific system which have adopted the innovation within a specific time period. Lastly, a social system is known as "A set of interrelated units that are engaged in joint problem solving to accomplish a common goal" (Rogers, 1983, p. 37). A social system has structure that provides regularity and stability to individuals' behaviour in the system. The communication and social structure of a social system accelerate the diffusion of innovation into a system (Rogers, 1983).

According to DOI, interaction between individuals via interpersonal networks is the root cause for adoption of innovation. Under this context, diffusion can be said to be the spreading or dissemination of electronic payments as consumers continuously seek for more enhanced or convenient means of transaction while organization look for more opportunities to profit. Based on DOI, the diffusion of electronic payments will most likely lead to an increase in the adoption of electronic based transaction within societies or even communities, which will depend on not only the innovation-decision process but also the various from of innovation adopters. In addition, the effects of the adoption of electric payment are various in different communities. This is because the effects of such adoption depend on how rapidly the individuals of a social system are willing to adopt electronic payment via various stages of innovation process (Tee & Ong, 2016). In addition, Diffusion

of Innovation Theory (DOI) was widely used to explain the adoption of new cashless payment and mobile financial services. For example, mobile payments (Apanasevic, Markendahl & Arvidsson, 2016; Eriksson Talls & Trinh, 2012; Oliveira, Thomas, Baptista & Campos, 2016; Nyirenda & Chikumba, 2013), internet banking (Gerrard & Barton Cunningham, 2003) and mobile financial services (Chemingui & Ben lallouna, 2013). In addition, Diffusion of Innovation Theory (DOI) was also commonly used to explain the adoption of online payment system and governmental services. Al-Lawati and Fang (2016) used Diffusion of Innovation Theory (DOI) to explain how government services were make available electronically throughout the country while Eder and Mutsaerts (2013) explained how an electronic payment system can affect the diffusion of renewable electricity in the rural place by using Diffusion of Innovation Theory (DOI) as well.

Furthermore, the adoption of cashless payment system can improve transparency, reduction of corruption and economic growth (Lazo & Casu, 2017). They explained and justified on how the adoption of cashless payments are able to reduce both corruption and bureaucracy at the governmental level in Moldova with the use of DOI. The diffusion of innovation for cashless payment at governmental level is a necessity to reduce corruptive related practices. The Moldova Governmental e-Payment Gateway or otherwise known as MPay, is an online payment instrument, and was successfully diffused and was able to develop amid the central public authorities (CPA). The electronic payment was embedded in government portals and gave individuals and corporations the convenience of making payments for public services which include anything from police fines, excessing criminal records, business licenses, taxes and so on. The transformation from a fully cash based payment system to a more sophisticated cashless payments system that allow for the payments for public services was a huge improvement in the struggle to reduce financial related corruptive practices. Before electronic payments, there lacked a consistent method for payment to public services and thus, lead to a higher rate of corruption. This is because most of the public service providers chose to go for similar payment providers and avoiding any competition policies every year. This inconsistency was obviously raising corruption. Besides, road police in Moldova was having a terrible reputation due to corrupt interactions between policemen and drivers. Nevertheless, Mpay system made the payments of public

service and fines more secure, transparent and easier. This is due to electronic payments enhance the traceability and measurement of payments made and this significantly eliminates corruption and cash related fraud.

According to Tee and Ong (2016) they found that diffusion of public electronic payment system reduces corruption for cash payments and improves transparency via transaction history. They justified this statement by claiming that a high volume of usage in cash is the root and leading cause of corruption, even money laundering and other cash-related activities. These sort of activities can be greatly reduced with the adoption of cashless payments policies. This is because most of the transactions are done via electronic means after the diffusion of innovation of cashless payment in the community. Thus, individuals within the community have a lower need to carry on hand, or move around with physical cash. Besides, wired transfer can be easily tracked with cashless transaction through electronic devices and thus, people will tend to be more accountable. This not only allows a decrease in corruption but also lead to an improvement in service time. In short, cashless payments system is affecting the diffusion of innovation among e-transformation of public services and this successfully reduces corruption, money laundering and all other cash-related fraud in a country (Lazo & Casu, 2017).

2.2 Independent Variables

2.2.1 Economic Prosperity

Many of the economic findings have examined the determinants of corruption, and one of it is economic prosperity (Treisman, 2000; Goel & Budak, 2006; Gundlach & Paldam, 2009; Lambsdorff, 2006; Mehrotra & Goel, 2011). According to Murphy, Clemens, Palacios and Veldhuis (2014) they claimed economic prosperity means more than just money. They stated that the availability of job opportunities, innovation, acquisition of education and skilled training are other aspects included in prosperity.

In 2000, Treisman published a paper in which they described the various causes of corruption. He found out one of the elements that made low level of corruption was economically developed countries where the residents are more educated, by using OLS estimate. In other words, the greater the economic prosperity of a country, the lower the level of corruption. Similarly, Goel and Budak (2006) found that economic prosperity was indeed related to corruption by using the same estimate. The result from them was in accordance with Treisman (2000). Furthermore, one study by Gundlach and Paldam (2009) examined the relationship between income and corruption in long run by using OLS estimate. In their paper, they discovered in long run, the level of corruption of a country would reduce when the income increased, therefore the transition from poverty to honesty occurred. In addition, it has been determined that the economic prosperity plays a significant role in affecting corruption by using Extreme-Bounds Analysis (Serra, 2006). However, the study stated that corruption might affect economic prosperity at the same time and it is undeniable. Additionally, in an investigation into economic prosperity, Paldam (2001) also found that poor countries had higher level of corruption, after going through the transition of becoming richer, corruption dropped significantly. Later, Billger and Goel (2009) discussed the different reasons of corruption by comparing the highly corrupt countries with least corrupt nations. Again, they discovered economic played a vital role in determining the level of corruption. Moreover, it has been suggested that economic prosperity are independent of the corruption by Lambsdorff (2006a). He claimed the countries that were advanced industrialized had low corruption level, compared to developing countries, using the data from 1980 to 1990.

Overall, there seems to be some evidences to indicate that economic prosperity is a vital determinants in affecting the level of corruption, as all of the findings have shown that when economic prosperity of a nation increased, thus the corruption level reduced.

2.2.2 Government Size

A number of studies have proposed general definition for public sector (e.g. Lane, 2009; Peters & Heisler, 1983). According to Lane (2009) government is about "State general decision making and its outcomes". Meanwhile, Peters & Heisler (1983) described government as an institution that conveyed its direction to the public by using distinct ways of collective decision making and hence exercised the state's power every day. In short, they defined government as a unitary, centrally organized decision body that focused more on authorities.

Basically, there are numbers of studies on government size that shown different kind of results. In a study which set out to determine government size, Mehrotra and Goel (2011) have found that the government size actually do have negative impact on corruption. In other words, if the government size is too enormous, the level of corruption may be lower. Basically, their findings are in accordance with Serra (2006) and Treisman (2000).

On the other hand, a research carried out by Goel and Budak (2006) have found out the larger government size could lead to a lower corruption level, the result which is in contrast with findings by Mehrotra and Goel (2011), Serra (2006) and Treisman (2000). The method that they used was OLS estimation as well. Furthermore, Goel and Nelson (1998) have found that there was a positive relationship between corruption and the size of state-local governments, while negative relationship on the size of federal government. The methodology that they used was LIMDEP. In addition, another interesting findings by Kotera, Okada and Samreth (2012) using GMM estimation, have resulted that the increment in government size could reduce corruption level, only when the democracy was sufficiently penetrated in the country itself. Besides that, Montinola and Jackman (2002) also claimed that larger government size did not seem to make the corruption level become higher. Another research done by Billger and Goel (2009) which using OLS have shown that basically government size has negative relationship on corruption level in some of the most corrupted countries.

In contrast, Husted (1999) found out the government size does not influence corruption. The research was based on OLS estimation. Collectively, there seems to be some evidence to indicate that different data used for the research may get different results. However, majority of the studies stated there were negative relationship between government size and corruption.

2.2.3 Democracy

Theoretically, democracy associates with lower corruption level because citizens can avoid voting politicians who are corrupt or do not stop corruption. With high level of democracy, politicians' behaviours are influenced and corruption might be lessened (Boehm, 2015). However, viewing from other aspects, corruption may not be stopped in highly democratic countries because financing political campaigns increases the likelihood of corruption as politicians demand money to carry out such campaigns. As a result, politicians may exchange prejudiced political decisions for funds (Kolstad & Wiig, 2011).

According to Schopf (2011), hard-data approach should be applied to identify corruption. This approach is to identify whether rents have been exchange among institutions, the advantage is that rents are easier to spot compared to bribes and other illegal activities. The reason Schopf (2011) suggests this approach is because most corruptions are unknown to general public, some countries who are claimed to be highly corrupted country may not be true, because this perceived corruption level is the result from survey. In a democracy country, media is able to stimulate perceived corruption despite there may be no actual case happening in the country. Therefore, Schopf (2011) says, democracy and corruption have a positive relationship under this situation although the country is not corrupt as we think they are. On the contrary, Kolstad and Wiig (2011) argues that democracy can reduce corruption effectively if endogeneity of democracy is considered, meaning that whether or not democracies have conflict among themselves. They instrumented democracy by using dummy variable to identify whether a

country had been in conflict in 1946-2009. The instrument variable (IV) regression shows that not only democracy is able to combat corruption, but also the effect is greater than previous studies and OLS estimates which do not consider the endogeneity of democracy. To conclude, they found that democracy is highly negatively correlated to corruption.

Similar result is obtained from the study of Saha and Campbell (2007), they reported that democracy and corruption are inversely correlated. The study does not simply assume democracy as "the right to vote"; instead, they assume democracy as "independence of various institutions" such as judiciary, police and media. Under such assumption, institutions detect corrupt activities and punish the individuals involved more effectively, thereby decreasing the corruption level. Saha and Campbell (2007) added that the impacts toward corruption are uncertain if a country is democratic in the sense that citizens have the right to vote.

On the other hand, Sung (2004) who identified the corruption-democracy relationship by using hierarchical polynomial regression found that democracy and corruption have inverted U-shape relationship. Meaning that some countries who have just started democracy can experience high level of corruption. During the transformation, many countries had experienced higher corruption level than before the transformation, and many returned to autocracy due to the rampant corruption during the process. This finding is similar to Boehm (2015)'s and Stefansdotter (2004)'s.

Boehm (2015) claims that corruption can be reduced if a country has been democratic for a long period of time. This is because citizens who used to live under autocracy system do not vote, they believe autocrats will perform their best for the welfare of the country, this is why democracy system required time for citizens to accustom. Additionally, Sung (2004) offers a different reason for the corruption in the early stage of democracy which just transformed from autocracy. He mentions that the large scale of political bickering and state restructuring bring corruption. For instance, the government, business community and civil society must collaborate together and gain support for reforms. This is why the corruption is prevalent in a changing environment.

2.2.4 Cashless Payment

Corrupt countries would encounter obstacles when come to collection of taxes, the countries then may impose capital controls. However, this could exacerbate the corruption because bribes could be used to avoid this regulation. Traditionally, it has been argued that the effective strategy to minimize such corrupt practices is transparency and traceability, meaning that the flows of money are recorded and investigable. This is because prevalent use of cashless instruments associates with high degree of transparency and traceability, and such usage of cashless instruments tend to lower the degree of corruption (Mehrotra & Goel, 2011).

In their research, Lazo and Casu (2017) says that transparency in Eastern Europe that emerged from cashless policy has an important role in combating corruption. The country chosen in the study was Moldova, the first country joined the World Bank's e-Transformation Initiative. In one year, the welfare of the citizens showed increment. In 2013, Moldova Governmental e-Payment Gateway (MPay), the cashless payment instrument, was introduced. All payments for public services such as taxes, fines, visas, licenses, etc. can be executed via this platform. In 2015, MPay opened to both public and private sectors. However, as a developing country, Moldova faced one problem, that is the preference for traditional cash payment among their citizens. The diffusion of innovation (DOI) of cashless payment is deemed as a vital factor to determine the successful implementation.

Meena (2017) also has the similar assertion. The researcher compares India to Sweden by using statistical figures. India's corruption index ranked 76th only had 22% use of cashless payment; on the other hand, Sweden ranked 3rd had 89% use of cashless payment, note that higher corruption index links with higher corruption. Another similarity between Lazo and Casu (2017) and Meena (2017) is that Meena (2017) asserts that developed countries are generally less corrupt than developing countries because of the gap in advancement of digital economy.

In a survey where both primary and secondary data are gather, Ayoola (2014) found that most respondents (48%) claimed that the cashless policy in curbing corruption is not effective in Nigeria, the country who has adopted cashless policy. Only 5% and 29% of the respondents believed the cashless policy is highly effective and somewhat effective in controlling corruption. More importantly, 72% of the respondents agreed that only petty corruption, which is the most insignificant corruption, can be reduced through cashless policy. Ayoola (2014) concludes that though cashless policy can reduce corruption but without complementing with other reforms in E-governance and Transparency and Accountability, just to name a few; it will not curb corruption in an effective way. Several studies such as Okoye and Ezejiofor (2013) and Olusola, Oludele, Chibueze and Samuel (2013) also recommended that certain reforms should be made although they are non-compulsory.

Okoye and Ezejiofor (2013) used ANOVA and chi-square to find out how cashless policy affects Nigeria. In general, the findings show cashless policy is advantageous towards the country, including lower corruption level. Similar to the finding of Ayoola (2014), Okoye and Ezejiofor (2013) also claims that certain reforms should be done for the corruption reduction. For example, cyber security and illiteracy problem should be resolved. Additionally, Olusola, Oludele, Chibueze and Samuel (2013) also obtains a similar result by using simple percentage procedure. 41.3% of the respondents expect corruption to be reduced under the adoption of cashless policy. Again, the researchers mention about the cybercrime and illiteracy problem. Still, certain transformation is encouraged in Nigeria.

The paragraphs above show corruption and cashless payment generally are negatively related. This is similar to Singh and Bhattacharya (2017)'s conclusion. They conducted a research to investigate the relationship between currency in circulation and corruption level by utilizing panel Granger causality test and system GMM estimator. They found that aggregate currency in circulation has uni-directional causality, and large denomination banknotes have bi-directional causality with corruption level.

As they conclude, government should limit cash transactions to mitigate corruption problems.

However, there are only limited researches investigate how the individual instruments of electronic payment will affect corruption. Mehrotra and Goel (2011) carried out the research on this subject, and the result shows the impact of electronic payment should not be generalized because electronic payment instruments have individual impact towards corruption. The impacts are: paper credit transfers and cheques contribute to corruption; nonpaper credit transfers have a mix effect; while direct debit transfer have no significant effect on corruption; and only credit card transactions able to suppress the corruption of countries.

2.3 Conclusion

Related studies on independent variables have been reviewed in this chapter. Some of the studies suggest the similar results while some do not. Various tests will be carried out in the following chapters to examine the consistency of results obtained from past studies. Next, some limitations from past researches are determined so that it can be improved in this research.

CHAPTER 3: METHODOLOGY

3.0 Introduction

This chapter provides clear information on the research model designed for this research. Besides, research design, source of data, data processing, expected sign for variables and research framework will be stated. Next, Generalized Method of Moments (GMM) which decided to be applied in this research will be explained.

3.1 Research Design

Causality is the research design adopted in this research. Causality can be applied when the occurrence of X leads to higher probability of the occurrence of Y. In this research, that is, for example, increase in cashless payment would more likely lead to decrease in corruption level. There are three criteria that have to be satisfied before making causal inferences: time order, concomitant variation, and elimination of other possible causal factors (Perri 6 & Bellamy, 2011).

3.1.1 Time Order of Occurrence

For time order of occurrence, the independent variable must occur either before of simultaneously with dependent variable. If independent variable occur later than dependent variable, a conclusion of "causality does not happen" may be drawn. In this research, the cashless payment occur simultaneously with corruption level. Hence, this criterion has been satisfied.

3.1.2 Concomitant Variation

Concomitant variation is the extent where independent variable and dependent variable fluctuate, together. In other words, changes in independent variable will result a change in dependent variable. This research has considered the hypothesis: Increase in cashless payment would reduce the level of corruption. Therefore, the second criterion has been fulfilled.

3.1.3 Absence of Other Possible Causal Factors

For this criterion, it states the relationship between independent variables and dependent variable should be the only possible explanation. In short, a third variable cannot affect the relationship between the independent variable and dependent variable. In other words, a change in third variable should not explain change in the dependent and independent variables.

3.2 Source of Data

According to Dell, Holleran and Ramakrishnan (2002) sample size should be larger if a population has greater variability. So, this study is able to access the data of 27 out of 28 EU countries from ECB data Warehouse; Slovakia has been excluded from the study because there is no data available whatsoever. The data period included in the study is from 2000 to 2015; hence, the data consists of 432 observations in general.

However, some data is unavailable for the first few years; the data included in this study is therefore considered as unbalanced panel data. Generalized Method of Moments being an appropriate methodology for unbalanced panel is able to withstand the missing values in the data (Roodman, 2006). In this paper, the discovery of the effect of cashless payments on corruption will be largely dependent on these observations.

Table 3.1: Source of Data

Variables	Abbreviation	Definition	Expected Sign	Sources
Corruption	CPI	Corruption Perception Index	-	International Counter Risk Guide
Cashless Payment	CP	Number of cashless payment as % share of EU total	Negative	Euro Central Bank
Democracy	DEM	Democratic Accountability	Negative	International Counter Risk Guide
Government Size	GOVT	General government final consumption expenditure	Negative	World Development Indicators
Economic Prosperity	GDP	GDP per capita	Negative	World Development Indicators

3.2.1 Corruption

Corruption is defined as misuse of public office for private gain which is difficult to monitor (Treisman, 2000). According to Lambsdorff (2006) Corruption Perception Index (CPI) has been widely used to measure the level of corruption, which is the dependent variable in all nations. The data used in this research will be the CPI of the European Union from year 2000 to year 2015 on yearly basis.

3.2.2 Cashless Payment

Cashless payment is the transactions done without carrying physical cash but rather with the use of debit or credit card payment for goods and services.

According to Mehrotra and Goel (2011) credit transfer, direct debit, card payment and cheque can be used as an instrument of cashless payment. The data use in this research will be the number of cashless payment as percentage share of European Union total from year 2000 to 2015 on yearly basis. The expected sign of cashless payment with level of corruption is negative. According to Mehrotra and Goel (2011) cashless payment could reduce corruption as it is easy to trace the electronic transactions, as compared with cash transactions.

3.2.3 Democracy

Democracy is a system of government in which people choose their leader by voting in election. Sung (2004) stated that political rights and civil liberties index is used to measure democracy, the controlled variable. The data used in this research will be the Political Right Index of European Union from year 2000 to 2015 on yearly basis. Furthermore, the expected sign of democracy would be negative, as according to Boehm (2015) stated citizen can avoid voting for politicians that collects bribe. Moreover, Kolstad and Wiig (2011) disserted that democracy could reduce the corruption level, after considering the endogeneity of democracy. In addition, Saha and Campbell (2007) assumed democracy as "independence of various institutions", therefore if there is any bribery found, institutions such as judiciary and media would detect corruption activity and punish the individuals involving in corruption more effectively.

3.2.4 Government Size

Government size often has an important contribution to the economic development of a country. Berry and Lowery (1984) stated that government final expenditures to the total output of the economy can be used to measure of the size of government, the controlled variable. The data used in this

research are the General government final consumption expenditure in European Union from year 2000 to 2015 on yearly basis. The expected sign of government size would be negative, as numerous studies have attempted to explain the negative relationship of government size with corruption, for example Kotera, Okada and Samreth (2012) ; Montinola and Jackman (2002) ; Goel and Budak (2006). According to Goel and Budak (2006) the government size could reduce corruption level effectively if government has greater checks and balances.

3.2.5 Economic Prosperity

Economic Prosperity is often refer to an increase in economic wealth, investment, living standard and employment. Mercan and Sezer (2014) proved that real gross domestic product is the indicator for economic growth. The data used in this research will be the real GDP of European Union from year 2000 to 2015 on yearly basis. Moreover, the expected sign of economic prosperity would be negative as Mehrotra and Goel (2011) mentioned it is negatively related with corruption level, by increasing the opportunity cost of illegal acts (Bardhan, 1997). Once the opportunity cost increased, individuals would think twice before involving in an illegal activity.

3.3 Target Population

The primary objective of this paper is to examine the impact of cashless payments on corruption in 48 European countries. Among the 48 European countries, 28 countries are the member of the European Union. Except EU member Slovakia which data is unavailable, the remaining 27 member countries are selected as the sample of European countries to examine the impact of cashless payments on corruption in Europe. Today, the total population of the continent shown by IMF is above 700 million while the EU countries occupy more than 500 million out of the 700 million people. On top of that, IMF also shows that the economy of EU

countries plays a significant role in Europe. For example, the GDP of EU was $16.42 trillion compared to the total GDP of Europe $19.10 trillion in 2015. Meaning that the EU countries are the major player in Europe and they can represent vast array of Europe continent.

Aside from that, Archick (2014) also claims that the EU has a significant role towards Europe, it possesses the power to influence various aspects of the continents such as peace, stability and prosperity. Therefore, in this paper, the EU will be the representative that assesses the relationship between the corruption and cashless payment, and the result will be generalized to all countries in Europe. As what Phrasisombath (2009) says, the conclusion drawn from sample is only valid in the condition that it represents the target population well.

3.4 Model

$$CPI_{it} = \hat{\beta}_0 + \hat{\beta}_1 GDP_{it} + \hat{\beta}_2 GOVT_{it} + \hat{\beta}_3 DEM_{it} + \hat{\beta}_4 CP_{it} + \hat{\beta}_5 CPI_{it-1} + \boldsymbol{\varepsilon_{it}}$$

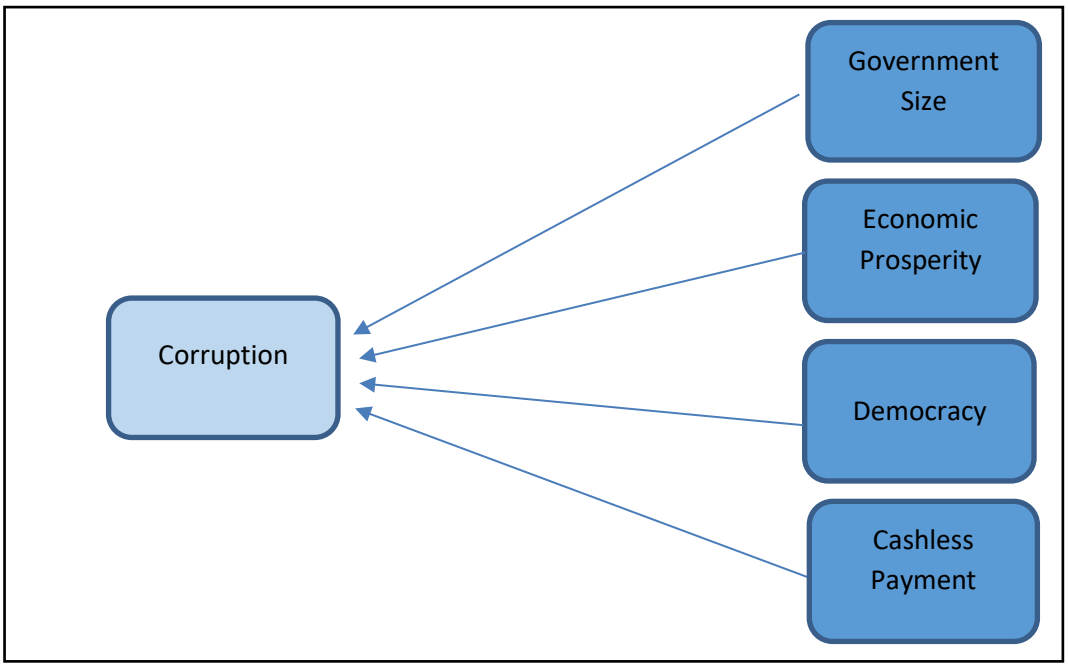
Where CPI represents Corruption, GDP represents Economic Prosperity, GOVT represents Government Size, DEM represents Democracy and CP represents Cashless payment.

i = Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherland, Poland, Portugal, Romania, Slovenia, Spain, Sweden, United Kingdom

t = 2000, 2001, 2002, …, 2015

3.5 Reasearch Framework

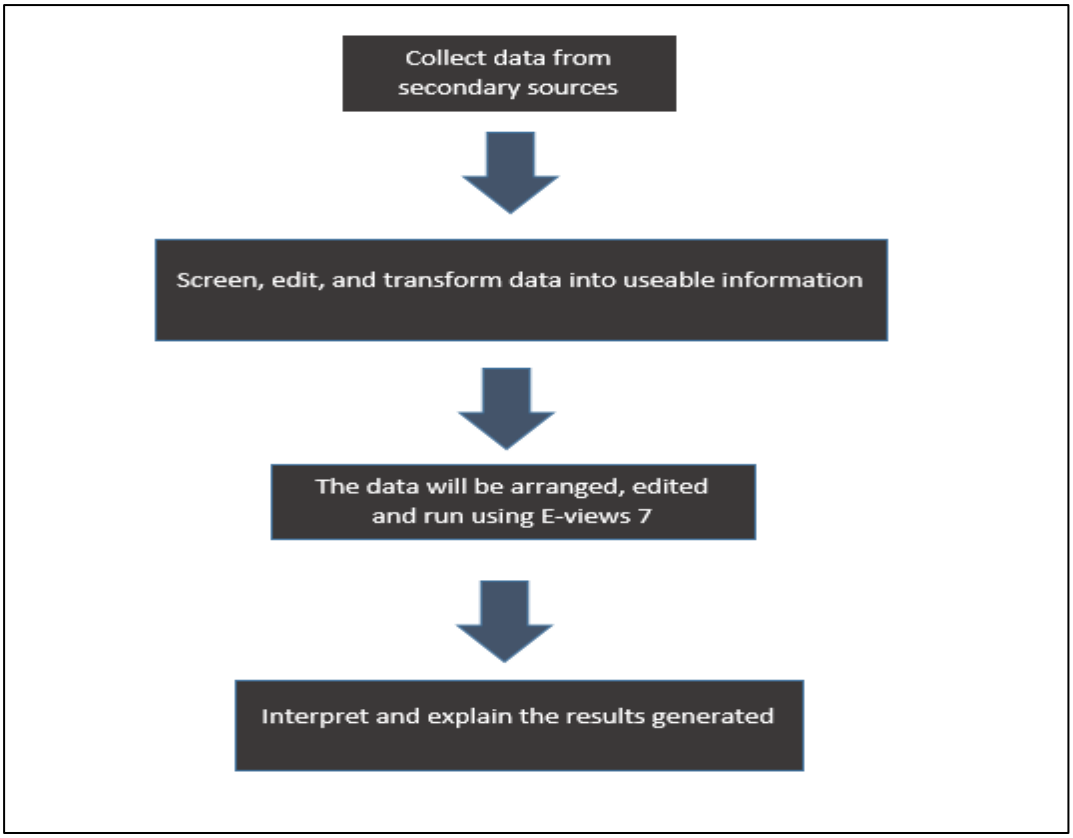
Figure 3.1: Research Framework



Based on our model, there is a negative expected relationship between the government size and the corruption. This means that when government size become larger, the corruption level will decrease (Serra, 2006; Treisman, 2000). Next, the expected relationship between eoconomic prosperity and corruption showed a negative sign, which indicates that the higher level of the economic prosperity will have lesser corruption (Treisman, 2000; Goel & Budak 2006; Gundlach & Paldam, 2009; Billger & Goel, 2009). Next, democracy also showed an expected negative relationship with the dependent variable, which represent that the higher the level of democracy, the lower the level of corruption (Boehm, 2015; , Kolstad & Wiig, 2011). Lastly, the cashless payment is expected to contribute negatively to the corruption level, which indicates that with more people using cashless payment, the lower the corruption level (Mehrotra & Goel, 2011; Ayoola, 2014; Okoye & Ezejiofor, 2013; Olusola, Oludele, hibueze & Samuel, 2013).

3.6 Data Processing

Figure 3.2: Data Processing



3.7 Generalized Method of Moments (GMM)

GMM is a dynamic panel data estimator which is used for **estimating parameters** in statistical method. In an equation, the values of parameters are not known, so GMM as one of the statistical methods is to be applied to estimate those parameters. GMM, introduced by Lars Hansen in 1982, fits well to the restrictions of economic models and will not impose additional restrictions. It originates estimates of unknown parameters by integrating observed economic data with the information in population moment conditions (Zsohar, 2010).

The information collected from population is called sample. It could be very similar to population. The simple example provided by Zsohar (2010) is the connection between population expected value and sample mean. By applying the analogy principle, sample equivalents are generated by using population moment conditions. Consider:

Population moment condition: $E[\varkappa_i] = \mu$

Sample analogue $\bar{x} = \frac{1}{n}\sum_{i=1}^{n} x_i = \hat{\mu}$

The sample analogue will then be used to solve the equation of unknown parameter. Certainly, the sample moments follow the rule of central limit theorem, which shows an approaching normal distribution as the sample size increases.

Parameters, β are crucial in quantifying how a variable influences another. Though there are many estimations available; however, the quantification of parameters should not impose additional restrictions on the statistical behaviour of variables that are stated by economic models, because imposition of additional restrictions triggers more assumptions, which may put ourselves at the risk of invalidity (Zsohar, 2010). Zsohar (2010) mentions that the statistical estimation method should just involve the restrictions of the economic models. Most often, the restrictions that economic theories impose is known as "population moment conditions", it is a set of mathematical equation that is formed in consistent with economic theories. Although the population moment conditions demonstrate information of unknown parameters; however, such information is not always accurate (Zsohar, 2010).

In Zsohar (2010)'s article, the motivation of GMM is that Method of Moments (MM) cannot estimate unknown parameters if the number of moment conditions (q) is more than the number of unknown parameters (p). When q < p, multiple solutions are available to the equations systems, meaning that there will be no exact solution to all of the moment conditions, the estimation of parameters is therefore not possible (Brown & Newey, 2002). The principle of GMM is that q must be greater than or equal to p ($q \geq p$). When q = p, GMM and MM are the same. In the case of q > p, it is called over-identification which we do not have any solution to the equation system; nevertheless, we can still find the GMM estimator. Instead of coming up with an exact solution, GMM allows us to estimate $\hat{\beta}$ that the value is closest to solving the sample moment conditions (Zsohar, 2010); in other words, $\hat{\beta}$ will make sample moments as close to zero as possible (Brown & Newey, 2007).

3.7.1 Efficiency and Feasibility

GMM Estimator:

$$\hat{\beta}_A = (X'ZAZ'X)^{-1}X'ZAZ'Y$$

X: Regressor Matrix; Z: Instrument Matrix

According to Roodman (2006) different alternatives of weighting matrix, A will result in different estimator of β. Choosing the A scalar is intuitive, inefficient and instructive. High variance or covariance among moments is the symptom of such inefficiency. The A scalar will always be inefficient unless moments $\frac{1}{N} z_i' E$ have equal variance and uncorrelated; in other words, $Var[Z'E]$ is itself scalar. The variance and covariance should be inverted for A to weight moments in order to achieve efficiency. To simplify, we have to inverse the variance of the population moments, and is sometimes known as asymptotic variance of sample moments if certain conditions are met. The weighting matrix will be:

$$A_{EGMM} = Var[Z'E]^{-1} = (Z'Var\,[E|Z]Z)^{-1} = (Z'\Omega Z)^{-1}$$

EGMM: Efficient GMM

Additionally, weighting matrix, $Var[Z'E]^{-1}$ or equivalent $(Z'\Omega Z)^{-1}$ is the key to make the EGMM practical. Roodman (2006) suggested that we can use sandwich estimator, which also known as robust covariance matrix estimator, to choose robust and cluster options.

We must assume $\widehat{\Omega}$ is constructed with the property $\frac{1}{N}Z'\widehat{\Omega}Z$ that is the consistent estimator of $Var[z\varepsilon]$. Then, $\left(\frac{1}{N}Z'\widehat{\Omega}Z\right)^{-1}$ or equivalent $\left(Z'\widehat{\Omega}Z\right)^{-1}$ will be the weighting matrix. The result is the feasible efficient GMM estimator:

$$\hat{\beta}_{FEGMM} = \left(X'Z\left(Z'\widehat{\Omega}Z\right)^{-1}Z'X\right)^{-1}X'Z\left(Z'\widehat{\Omega}Z\right)^{-1}Z'Y$$

Up to one-step GMM, we will only set $A = (Z'HZ)^{-1}$, where H is the estimated **Ω** based on minimally arbitrary assumption about the errors. One of the possible assumptions could be homoscedasticity.

The replacement of **Ω** by arbitrary H enables us to obtain the residuals from the estimation, the residuals obtained will then be used to construct sandwich proxy for **Ω** in the second step, notating it as $\widehat{\Omega}_{\hat{\beta}_1}$.

$$\text{Set } A = (Z'\widehat{\Omega}_{\hat{\beta}_1}Z)^{-1}$$

$$\hat{\beta}_2 = \hat{\beta}_{FEGMM} = \left(X'Z(Z'\widehat{\Omega}_{\hat{\beta}_1}Z)^{-1}Z'X\right)^{-1}X'Z(Z'\widehat{\Omega}_{\hat{\beta}_1}Z)^{-1}Z'Y$$

The two-step estimator is both efficient and robust. However, downward bias exists in standard errors of two-step reduced the usage of two-step GMM in the past.

3.7.2 One-step and Two-step GMM

In second step, we need an estimate of $\hat{\beta}_1$ in order to obtain optimal weighting matrix, $(Z'\widehat{\Omega}_{\hat{\beta}_1}Z)^{-1}$, which then could be used to estimate $\hat{\beta}_2$

efficiently (Zsohar, 2010). To simplify, two-step GMM uses first step estimate parameter to estimate the parameter in the second step (Roodman, 2006). The details are:

$$\hat{\beta}_A = (X'ZAZ'X)^{-1}X'ZAZ'Y$$

First step : The weighting matrix, $A = (Z'\Omega Z)^{-1}$ will be replaced by sub-optimal weighting matrix, $A = (Z'HZ)^{-1}$. Then, minimize the function below by using the sub-optimal weighting matrix. $\hat{\beta}_1 = (X'Z(Z'HZ)^{-1}Z'X)^{-1}X'Z(Z'HZ)^{-1}Z'Y$. The result obtained will be denoted as $\hat{\beta}_1$, the estimate is consistent but asymptotically inefficient.

Second step: Use the $\hat{\beta}_1$ to construct optimal weighting matrix, $(Z'\widehat{\Omega}_{\hat{\beta}_1}Z)^{-1}$. Set $A = (Z'\widehat{\Omega}_{\hat{\beta}_1}Z)^{-1}$. Then, minimize the function

$\hat{\beta}_2 = \left(X'Z(Z'\widehat{\Omega}_{\hat{\beta}_1}Z)^{-1}Z'X\right)^{-1}X'Z(Z'\widehat{\Omega}_{\hat{\beta}_1}Z)^{-1}Z'Y$, the result obtained will be denoted as $\hat{\beta}_2$, the estimate is now both consistent and efficient.

In the past, researchers prefer to use one-step GMM instead of two-step GMM because the standard errors in two-step will have the downward bias problem although two-step is asymptotically more efficient (Roodman, 2006). Referring to above paragraph, the weighting matrix in one-step GMM is independent of estimated parameters whereas the weighting matrix in two-step GMM is dependent to initial consistent estimated parameters, this is the root for the downward bias problem. In other words, the downward bias is caused because of the use of estimated parameters in constructing the weighting matrix during the second step (Windmeijer, 2005).

However, Windmeijer (2005)'s finite-sample correction able to minimize the downward bias in two-step. Therefore, in Stata, we will be using

xtabond2 instead of xtabond to make the finite-sample correction available to the standard errors in two-step estimation (Roodman, 2006).

3.7.3 Estimating standard errors

$$Var\left[\hat{\beta}_A\right] = (X'ZAZ'X)^{-1}X'ZAZ'\Omega ZAZ'X(X'ZAZ'X)^{-1}$$

As what we mentioned earlier, Let $A = (Z'HZ)^{-1}$ as the sub-optimal weighting matrix in one-step will not cause parameter estimates inconsistent although the H is based on arbitrary assumptions about the variance of the errors. However, it is important to note that using the H to proxy **Ω** will cause variance to be inconsistent, meaning that the standard error estimates are not robust to heteroscedasticity or autocorrelation in the errors. The solution to such problem will be replacing **Ω** with sandwich-type proxy, $\widehat{\Omega}_{\hat{\beta}_1}$, which will make the one-step standard errors be the robust estimator (Roodman 2006).

$$\widehat{Var}[\hat{\beta}_1]$$
$$= (X'Z(Z'HZ)^{-1}Z'X)^{-1}X'Z(Z'HZ)^{-1}Z'\widehat{\Omega}_{\hat{\beta}_1}Z(Z'HZ)^{-1}Z'X(X'Z(Z'HZ)^{-1}Z'X)^{-1}$$

In two-step GMM, it is more complicated. As previously stated, $A_{EGMM} = (Z'\Omega Z)^{-1}$.

$$Var\left[\hat{\beta}_A\right] = (X'ZAZ'X)^{-1}X'ZAZ'\Omega ZAZ'X(X'ZAZ'X)^{-1}$$

⬇ Simplifies for EGMM

$$Var[\hat{\beta}_{A_{EGMM}}] = (X'Z(Z'\Omega Z)^{-1}Z'X)^{-1}$$

⬇ Transform for FEGMM

$$\widehat{Var}[\hat{\beta}_2] = \left(X'Z\left(Z'\widehat{\Omega}_{\hat{\beta}_1}Z\right)^{-1}Z'X\right)^{-1}$$

In this case, the standard errors will face downward bias problem, especially when number of instruments is large. The reason is because reweighting

small sample moments based on own estimated variances and covariances will end up mining data, which will overweight observations that fit the model and underweight that do not (Roodman, 2006). Windmeijer (2005)'s finite-sample correction can be used to solved the two-step standard errors downward bias problem.

3.7.4 Difference and System GMM

In data generating process, Difference and System GMM have been making lesser assumptions throughout the history. They are also the very complex estimation used to isolate information; nevertheless, the usage of such methods is increasingly popular today. These estimators are for the analysis of "Small T, large N" panel data, and have few assumptions in data generating process (Roodman 2006).

Data generating process:

$$y_{it} = \alpha y_{i,t-1} + x'_{it}\beta + \varepsilon_{it}$$

$$\varepsilon_{it} = \mu_i + v_{it}$$

$$E[\mu_i] = E[v_{it}] = E[\mu_i v_{it}] = 0$$

Where μ_i is fixed effect and v_{it} is idiosyncratic shocks

Assumptions:

i. Arbitrary distributed fixed individual effect, the identification of parameters is possible despite different time period in the panel data.

ii. Dynamic, dependent variable is regressed by itself in the past

iii. Some variables are endogenous variables

iv. Unique patterns of heteroscedasticity and autocorrelation could be existed among idiosyncratic error terms

v. Among idiosyncratic error terms, there should be no correlation.

vi. Independent variables are predetermined but not strictly exogenous, meaning that the independent variables are not depending on current disturbances but they are influenced by past ones.

vii. Small T, large N

viii. Instruments are available only within the data set, based on lags of instrumental variables.

$$y_{it} = \alpha y_{i,t-1} + x'_{it}\beta + \varepsilon_{it}$$

$$\varepsilon_{it} = \mu_i + v_{it}$$

Dynamic panel bias is the problem with this equation, meaning that the $y_{i,t-1}$ is endogenous to the μ_i. The correlation between independent variable and error violates the basic assumption of OLS.

There are two ways GMM can resolve the endogeneity problem. First way is to transform the data to remove the fixed effects, it is called Difference GMM. Second way is to instrument $y_{i,t-1}$ and other endogenous variables which are uncorrelated with the fixed effects, it is called System GMM.

For Difference GMM, there are two common transformations to remove fixed effects, namely first-difference transform and forward orthogonal deviation.

First-difference transform:

$$y_{it} = \beta_0 + \alpha y_{i,t-1} + x'_{it}\beta + \varepsilon_{it}$$

First-difference transform

$$\Delta y_{it} = \alpha \Delta y_{i,t-1} + \Delta x'_{it}\beta + \Delta v_{it}$$

The fixed effects μ_i disappears but $\Delta y_{i,t-1}$ can still be endogenous. Consider the following:

$$\Delta y_{i,t-1} = y_{i,t-1} - y_{i,t-2}$$

$$\Delta v_{it} = v_{it} - v_{i,t-1}$$

$y_{i,t-1}$ and $v_{i,t-1}$ is still correlated

First-difference transform also tends to magnify gap in unbalanced panels. For instance, if y_{it} is missing, both Δy_{it} and $\Delta y_{i,t+1}$ will also absent. This is what give rise to "forward orthogonal deviation". Forward orthogonal deviation able to withstand more missing data. Unlike first-difference transform which subtracts last year observation with this year observation, forward orthogonal deviation subtracts the average of all future available observation of a variable (Roodman 2006).

For System GMM, its motivation is that Difference GMM uses past levels to convey little information about future changes. To tackle this, System GMM is augmented from Difference GMM. According to Roodman (2006) System GMM differs from Difference G MM by making an additional assumption, which is the first differences of instrumenting variables are uncorrelated with fixed effects.

$$E[w_{it}\mu_i] = 0 \text{ for all } i \text{ and } t$$

Where w is instrumenting variable and μ is fixed effect

If the assumption holds, $\Delta w_{i,t-1}$ will be a valid instrument variables.

$$E\left[\Delta w_{i,t-1}\varepsilon_{it}\right] = E\left[\Delta w_{i,t-1}\mu_i\right] + E\left[w_{i,t-1}v_{it}\right] - E\left[w_{i,t-2}v_{it}\right] = 0 + 0 - 0$$

To simplify, Difference GMM is to remove the fixed effects while System GMM is to transform the instruments, making them exogenous to the fixed effects.

Assuming the instruments and fixed effects are not correlated enables more instruments to be introduced and can improve efficiency. The main disadvantage of Difference and System GMM is that they are extremely complicated and can generate invalid estimates very easily.

3.7.5 GMM Diagnostics

When dealing with the GMM model, lies a specific requirement for the instrumental variable that needs to be met, that is ensuring that the instrument is independent from unobservable error process (GMM is exogenous in instrumental variables). Under the circumstances that the equation is over-identified (excess instruments), the test for identifying if the instruments are in fact not correlated to the error process. The issue arises normally under the circumstances that the excluded number of instruments in the equation is greater than the number of endogenous variables included within the equation. In GMM, Roodman (2006) says Sargan/ Hansen test is to determine the overall validity of instrument used. In exactly-identified, the detection will not be possible because the estimator will make $Z'\hat{E} = 0$ by choosing the $\hat{B}$ for us despite $E[z\varepsilon] \neq 0$. In over-identified, the null of joint validity is $\frac{1}{N} Z'\hat{E}$ randomly distributed around zero. In the event that these conditions do arise, the reliability of the model may be question as they imply an incorrect model specification and does not fulfil the orthogonality conditions. Since most of system GMM regressions tend to be over-identified, this problem must be tested (Bowsher, 2002).

The test used is the Sargan/Hansen test, which tests for over-identifying restriction or in other words, making sure that there are no endogenous variables. Endogeneity refers to the situation in which a variable correlates with not only the error term within the model, but also the independent variables model. According to Roodman (2006) the Sargan/ Hansen test is to determine the overall validity of instrument used. Below is the hypothesis statement of Sargan/Hansen test:

H_0: The instruments are valid

H_1: The instruments are not valid

Failure to reject the null hypothesis implies that the instruments are valid.

Aside from Sargan/ Hansen test, Arellano-Bond test will also be used in GMM. The test is developed to detect autocorrelation in idiosyncratic

disturbance term, v_{it} (Roodman, 2006). The formula for full disturbance, ε_{it} is:

$$\varepsilon_{it} = \mu_i + v_{it}$$

where μ_i is the fixed effect, v_{it} is the idiosyncratic shocks

Full disturbance is the combination of fixed effects and idiosyncratic shocks. Therefore, full disturbance is often assumed auto-correlated because of the fixed effects. However, Arellano-Bond test is to detect autocorrelation for idiosyncratic shocks, excluding fixed effects.

H_0: There is no serial correlation

H_1: There is serial correlation

If autocorrelation problem among idiosyncratic errors exists, the instruments will be invalid.

CHAPTER 4: DATA ANALYSIS

4.0 Introduction

In this chapter, hypothesis testing and diagnostic checking will be carried out in order to study the data collected. This research will include results of Dynamic Panel Difference GMM Estimations for all independent variables together with control variables. There are two diagnostic checking tests which are Hansen Test and Arellano-Bond Serial Correlation Test. Furthermore, the results generated from the tests will be interpreted and shown in this chapter.

4.1 Results from Dynamic Panel GMM Estimations

Table 4.1: Results of dynamic panel GMM estimation in European Union for Credit Transfer (xtabond2 ly l.ly l0.lx2 l9.lx10 l3.lx17 l3.lx20, gmm(ly lx2 lx10 lx17 lx20, lag(1 4)collapse) iv(year, e (l)) two robust)

	One-Step Difference GMM (1)	Two-Step Difference GMM (2)	Two-Step Robust Difference GMM (3)	One-Step System GMM (4)	Two-Step System GMM (5)	Two-Step Robust System GMM (6)
CPI	0.00000296	0.0170	0.0170	0.605***	0.619***	0.619***
	(0.00)	(0.76)	(0.16)	(11.21)	(29.31)	(6.09)
CT	0.324***	0.239***	0.239	0.0840***	0.0727***	0.0727*
	(4.32)	(3.29)	(1.48)	(3.75)	(3.56)	(1.82)
GDP	0.149***	0.149***	0.149**	0.0906***	0.0899***	0.0899***
	(4.99)	(6.79)	(2.45)	(4.30)	(8.76)	(2.77)
GOVT	-0.248*	-0.154**	-0.154	-0.313***	-0.283***	-0.283**
	(-1.91)	(-2.10)	(-0.85)	(-2.64)	(-9.84)	(-1.98)
DEM	-0.246	-0.219	-0.219	-1.011***	-1.039***	-1.039*
	(-0.61)	(-1.59)	(-0.91)	(-3.62)	(-7.04)	(-1.91)

CONS				2.319*** (4.70)	2.271*** (7.93)	2.271** (2.51)
AR(1)	-1.640	-2.489**	-1.272	-7.556***	-3.135***	-2.940***
AR(2)	0.770	0.777	0.755	2.066**	1.237	1.229
Hansen		17.95	17.95		19.42	19.42

Notes: t statistics are shown in parentheses. *, **, and *** are representing the significant level at 10 percent, 5 percent, and 1 percent, respectively.

The results of the estimations using dynamic panel GMM are represented in Table 4.1, and all the estimations were executed using STATA software. It shows mainly two types of GMM estimations, consisting Difference GMM and System GMM. However, this research will interpret the results with emphasis on System GMM. The reason is because Difference GMM will turn bias when the series is highly persistent (Blundell and Bond, 1998). In other words, if lagged levels of the series weakly correlated with following first differences, the independent variable could not be a good variable in explaining dependent variable. Therefore, Arellano and Bover (1995) and Blundell and Bond (1998) developed System GMM, in which added additional moment restrictions in to Difference GMM. Thus, biasness will be removed in System GMM, and lagged first differences is allowed to use as instruments in the level equations. Hence, the estimation found in System GMM are all significant, hence only Two-Step System GMM will be interpreted. Two Step System GMM are presented in Model 5, 11 and 17 respectively.

The Corruption Perceptions Index (CPI) varies from 0 to 10, whereby the higher the value, the lower the level of corruption. The table 4.1 shows by using the Corruption Perceptions Index as dependent variable, the transactions using credit transfer (CT) is positive and statistically significant at significant level of 1 percent, under Two-Step System GMM. Hence, an increase of 1 percent in credit transfer, on average, Corruption Perceptions Index will increase by 0.0727 percent, by holding other variables constant. In other words, an increase in credit transfer leads to lower corruption level. The current result agrees with the findings by Okoye and Ezejiofor (2013), and Ayoola (2014). A possible explanation for this result may be due to the removal of a middleman in bribe relations (Mehrotra & Goel, 2012). To further explain, the bribe taker have to deal directly with the bribe payer in cashless transaction, unlike accepting cash bribe by sending a middleman.

Regarding on the first control variable, economic prosperity (GDP), is positively correlated with Corruption Perceptions Index. Specifically, an increase of 1 percent in GDP will lead to an increase of 0.0899 percent on average, ceteris paribus. In short, greater economic properity will result lower level of corruption (Treisman, 2000; Gundlach & Paldam 2000; Serra, 2006; Billger & Goel, 2009). This results could be explained by the fact that greater economic prosperity increases the opportunity costs of illegitimate acts (Bardhan, 1997). The net benefits of legitimate activity forgone to involve in criminal act are considered as opportunity cost. For instance, the legal income and opportunity to get promotion.

For the following control variables, government size (GOVT) and democracy (DEM) are statistically significant at 1 percent respectively. Surprisingly, these two control variables are negatively correlated with Corruption Perceptions Index. An increase of 1 percent in government size, on average, will lead to a decrease of 0.283 percent in Corruption Perceptions Index, ceteris paribus. Furthermore, an increase of 1 percent in democracy, leads to a decrease of 1.039 percent in Corruption Perceptions Index. In short, increase in government size and democracy would make a country have higher level of corruption. According to Rose-Ankerman (1999) large government size would contributes to bureaucracy, thus corruption level increase. On the other hand, according to the research done by Quah (2004) he mentioned that democracy contributes to corruption, as the new government elected by citizens, would try to come out with new laws to defeat bribe related activities. However, the multiplication of law would then multiples the probability of corruption (Huntington, 1968, p.62).

Table 4.2: Results of dynamic panel GMM estimation in European Union for Cheque (xtabond2 ly l.ly l5.lx4 l9.lx10 l7.lx17 l2.lx20, gmm(ly lx4 lx10 lx17 lx20, lag(4 4)collapse) iv(year, e (l)) two robust)

	One-Step Difference GMM (7)	Two-Step Difference GMM (8)	Two-Step Robust Difference GMM (9)	One-Step System GMM (10)	Two-Step System GMM (11)	Two-Step Robust System GMM (12)
CPI	1.259	1.259	1.259	0.791***	0.784***	0.784***
	(0.42)	(0.58)	(0.58)	(7.31)	(7.26)	(6.73)

CHE	-0.0600 (-0.11)	-0.0600 (-0.16)	-0.0600 (-0.16)	0.0203** (2.18)	0.0210** (2.02)	0.0210* (1.72)
GDP	-0.103 (-0.11)	-0.103 (-0.16)	-0.103 (-0.16)	0.0467* (1.86)	0.0483** (2.19)	0.0483** (2.17)
GOVT	0.737 (0.08)	0.737 (0.11)	0.737 (0.11)	-0.754*** (-2.97)	-0.770*** (-4.67)	-0.770*** (-4.91)
DEM	-0.588 (-0.08)	-0.588 (-0.10)	-0.588 (-0.10)	-2.290** (-2.39)	-2.246** (-2.13)	-2.246** (-2.15)
CONS				6.133*** (2.87)	6.090*** (3.14)	6.090*** (3.10)
AR(1)	-0.385	-0.538	-0.538	-5.147***	-3.434***	-3.389***
AR(2)	0.274	0.397	0.397	1.680*	1.027	1.025
Hansen		1.76e-22	1.76e-22		0.452	0.452

Notes: t statistics are shown in parentheses. *, **, and *** are representing the significant level at 10 percent, 5 percent, and 1 percent, respectively.

Table 4.3: Results of dynamic panel GMM estimation in European Union for Card Payments (xtabond2 ly l.ly l0.lx8 l3.lx10 l7.lx17 l0.lx20, gmm(ly lx8 lx10 lx17 lx20, lag(1 4)collapse) iv(year, e (l)) two robust)

	One-Step Difference GMM (13)	Two-Step Difference GMM (14)	Two-Step Robust Difference GMM (15)	One-Step System GMM (16)	Two-Step System GMM (17)	Two-Step Robust System GMM (18)
CPI	0.334*** (5.41)	0.321*** (15.08)	0.321*** (3.97)	0.540*** (11.16)	0.521*** (29.37)	0.521*** (3.73)
CP	0.127** (2.10)	0.144*** (7.04)	0.144* (1.75)	0.0837*** (3.97)	0.0828*** (7.14)	0.0828* (1.68)
GDP	0.0641* (1.94)	0.0526*** (6.05)	0.0526 (1.43)	0.0714*** (2.66)	0.0667*** (13.65)	0.0667* (1.67)
GOVT	-0.516*** (-2.63)	-0.440*** (-4.13)	-0.440* (-1.69)	-0.689*** (-4.26)	-0.618*** (-9.98)	-0.618** (-2.35)
DEM	-0.382 (-0.38)	-0.466 (-1.21)	-0.466 (-0.34)	-1.157*** (-4.55)	-1.378*** (-5.85)	-1.378** (-1.96)

CONS				3.930***	4.171***	4.171***
				(5.57)	(10.04)	(2.85)
AR(1)	-6.073***	-3.053***	-2.485**	-5.421***	-3.261***	-2.561***
AR(2)	1.484	0.960	0.947	1.058	0.749	0.737
Hansen		21.00	21.00		22.37	22.37

Notes: t statistics are shown in parentheses. *, **, and *** are representing the significant level at 10 percent, 5 percent, and 1 percent, respectively.

Subsequently, the cashless payment using number of cheque as percent share of EU total (CHE) and also number of card payments as percent share of EU total (CP) are consistent in reducing level of corruption. Both the cheque and card payment appear to be positively correlated with corruption level and significant at 5 and 1 percent respectively. In short, credit transfer and cheque, as well as card payments, show consistency regarding on the relationship with corruption level. Surprisingly, the economic prosperity, government size and democracy also draw consistency with the result in table 4.1.

4.2 Diagnostic Tests

The diagnostic tests available in the model are AR(1), AR(2) and Hansen Test. AR(1) is representing the first-order serial correlation. From the results in table 4.1 to 4.3 in this research, each AR(1) has p-value less than 0.1, respectively. In other words, first-order serial correlation is available, and it is expected to be happened. The reason is because dynamic panel model is being used in this research, hence the effect in period t would affect the period in t+1. On the other hand, AR(2) indicates the second-order serial correlation. Referring to the table 4.1 to 4.3, AR(2) has p-value more than 0.1. Results of AR(2) are placed more important by compared to AR(1) in GMM, as AR(2) takes the error terms in AR(1) into account. Therefore, we could draw a conclusion that there is no autocorrelation and model misspecification occurring in the model. Next, the aim of Hansen Test is to test the validity of independent variables in the model. Overall, Hansen Test in the results has p-value more than 0.1. In other words, the independent variables are valid in the model. Alternatively, the use of cheque and card payment has shown the same result as the use of credit transfer. Therefore, Hansen test is consistent in this findings.

4.3 Robustness Check

Table 4.4: Results of dynamic panel GMM estimation in European Union for Direct Debit (xtabond2 ly l.ly l2.lx6 l6.lx10 l4.lx17 l2.lx20, gmm(ly lx6 lx10 lx17 lx20, lag(1 3)collapse) iv(year, e (l)) two robust)

	One-Step Difference GMM (19)	Two-Step Difference GMM (20)	Two-Step Robust Difference GMM (21)	One-Step System GMM (22)	Two-Step System GMM (23)	Two-Step Robust System GMM (24)
CPI	0.165**	0.140***	0.140*	0.210***	0.212***	0.212*
	(2.82)	(3.58)	(1.73)	(3.96)	(11.05)	(1.86)
DD	-0.296*	-0.220*	-0.220	0.113***	0.140***	0.140**
	(-1.83)	(-1.91)	(-1.10)	(4.45)	(4.66)	(1.99)
GDP	0.172***	0.142***	0.142***	0.107***	0.0768***	0.0768**
	(10.51)	(6.47)	(3.30)	(8.95)	(5.90)	(2.14)
GOVT	-0.354**	-0.377***	-0.377**	-0.372***	-0.361***	-0.361**
	(-2.26)	(-3.73)	(-1.99)	(-2.74)	(-6.02)	(-2.54)
DEM	-0.377*	-0.265*	-0.265	-0.847***	-0.603***	-0.603*
	(-1.63)	(-1.91)	(-1.12)	(-5.40)	(-3.52)	(-1.76)
CONS				2.451***	2.284***	2.284***
				(6.43)	(7.23)	(3.46)
AR(1)	-4.105***	-2.355**	-1.747*	-3.651***	-3.009***	-1.916*
AR(2)	2.216**	1.565	1.552	2.172**	1.573	1.564
Hansen		13.48	13.48		14.27	14.27

Notes: t statistics are shown in parentheses. *, **, and *** are representing the significant level at 10 percent, 5 percent, and 1 percent, respectively.

This research has performed robustness check in order to show the validity of the findings. The robustness check is using alternate cashless payment, in which the use of the number of direct debit (DB) as percent share in EU total. The result of using direct debit shown positive relationship with corruption level. In other words, an increase of 1 percent in direct debit, the Corruption Perceptions Index increases by 0.14 percent. In short, direct debit could reduce the corruption level. Furthermore, economic prosperity is again positively correlated with corruption level. When economic prosperity increases by 1 percent, on average, the Corruption Perceptions

Index will increase by 0.0768 percent, ceteris paribus. Hence, the economic prosperity is negatively related to corruption as well. The estimations on government size and democracy showing positive relationship with level of corruption as result in table 4.4. When government size increase by 1 percent, on average, the Corruption Perceptions Index decreases by 0.361 percent, ceteris paribus. On the other hand, when democracy increase by 1 percent, on average, the Corruption Perceptions Level decreases by 0.603 percent, ceteris paribus. In conclusion, the findings are robust and reliable.

4.4 Conclusion

In this chapter, the results of Dynamic Panel Difference GMM Estimations for all independent variables together with control variables had been included. Besides, diagnostic checking has been conducted and explained. From the results in table 4.1 to 4.4, it has proven the Diffusion of Innovation Theory developed by Everett M. Rogers. Cashless payment is a kind of innovation that fastened the transaction and tracking work can be done easily. This innovation has been diffused into our daily life among people and organizations. With passage of time, the adoption of cashless payments are increasing significantly. In addition, the mass media and governmental mandates also being a catalyst in popularity of cashless payment. According to Tee and Ong (2016) they mentioned cashless payments reduce corruption and improve transparency of each transaction, in which the statement is in accordance with this findings. Further discussion will be explained in the following chapter.

CHAPTER 5: CONCLUSION

5.0 Introduction

The objective of this study is to examine the effects of cashless payments on corruption level in the European Countries. Due to Mehrotra and Goel (2011)'s conclusion, this study intends to identify the effect of each type of cashless payment on corruption, namely credit transfers, cheques, direct debits and card payments. Generalized Method of Moments, as our methodology, has been used to examine the relationship between corruption level and cashless payment. In this chapter, this study will discuss the summary of the study, policy implication, limitation and recommendation of the study.

5.1 Summary of Study

Corrupt activities of a country are very often due to the untraceable financial transactions (Mehrotra & Goel, 2011). This paper intends to discover the relationship between corruption and cashless payments, which are more traceable than cash transactions, in the European Countries. Based on the conclusion from Mehrotra and Goel (2011), we intended to identify the effect of each type of cashless payment on corruption, the cashless payment types are credit transfers, cheques, direct debits and card payments. Other than that, we have also included economic prosperity, government size and democracy as our control variables. In this paper, we have obtained 16-year yearly data from 2000 to 2015 from ICRG, WDI and ECB, and have included 27 EU countries in our study.

Based on the hypothesis testing, all of these control variables and independent variables are significant to the dependent variable. We expected all cashless payments, economic prosperity, government size and democracy to be negatively correlated to corruption. But, our results show that only cashless payments and economic prosperity are negatively correlated to corruption; both government size

and democracy are found positively correlated with corruption which is different from our expectation.

Economic prosperity is found to have a negative relationship with corruption, implying when a country's economy is better, the corruption problem will be reduced. For government size, it is found to be positively correlated with corruption, meaning that when a government size is bigger, the corruption problem will be more severe. Democracy is also found to be positively correlated with corruption, showing that if a country is more democratic, its corruption problem tends to be more critical.

In Chapter 3, we have also expected the cashless payments will contribute negatively to corruption. All of the results show that our expectation was right. First of all, we found that credit transfers are in a negative relationship with corruption, meaning that the corruption will be lower if a country's citizens prefer to use credit transfers. Cheques are found to be negatively correlated to corruption as well, indicating the usage of cheques is able to reduce corruption. Additionally, we found that corruption and direct debits have negative relationship, which implies when the usage of direct debit increases, corruption will be decreased. Lastly, card payments are negatively correlated with corruption, indicating that prevalent use of card payments will reduce a country's corruption.

5.2 Policy implication

The volume of cashless transactions in the Western countries have significantly increased over the years ever since the vision of a cashless society by institutional banks in the 1960s. With the banks efforts, technology has greatly eliminated a vast number of paper based payments. Americans, despite still having check books, are using them less frequently. Even certain stores or merchants have stop the use of personal checks. In the European Union, specifically Iceland can be considered as the closest to a cashless society. In Iceland, when measuring purchase value, turnover paid by cash is at only 9%. Besides that, all European Union countries have been showing a steady rise in volume of e-payments per inhabitant from the year 2002 to the year 2006. But despite the rise in volume of cashless transactions,

there is only a 2% to 3% decline in use of cash a year, which implies that there will still be a long period in which traditional and modern payment mechanisms will still need to coexist (Bátiz-Lazo, Haigh, & Stearns, 2014) Cash will still undoubtedly prevail for a significant amount of years, and this holds true for both central and southern Europe. Thus, a full cashless policy implementation would still be out of reach for the years to come.

But what are the implications is the cashless policy was implemented in the European Union? To answer that, observe Nigeria, with the efforts of Central Bank of Nigeria (CBN), the country successfully implemented the policy of the cashless Nigeria Project in the year 2020. Upon successful application of the policy, it is expected to hit several objectives. These objectives include modernization and improvement in the payment systems allowing the country to improve its economy; decrease in banking service costs such as cost of credit; urge financial inclusion and reach through additional efficient transaction options; creating limitation on usage of cash allowing the improvement of monetary policy, thus controlling inflation and supporting economic growth; eliminate risk of handling cash which promotes theft, robberies and crimes relating to cash (Ayoola, 2013). The country in which implements the cashless policy benefit from many advantages from the economic and crime perspectives. But what about the implications of the policy on corruption?

With the adoption of electronic payments in various segments such as generation of revenue, payment of salary, contract payments and also end to end transaction that involve the government. Through these few processes, it will be possible to restrict any inefficiencies and even corruption that are caused by multiple systematic leakages or even block these channels of leakages entirely. It will even be possible to produce an audit trail for these transactions (Jatau & Dung, 2014). This will urge government accounting officials to be more transparent.

Although it is possible for controlling corruption through the means of a cashless economy, it will not be able to eliminate corruption entirely unless implemented alongside additional anti-corruption systems. In a corrupt environment, adoption of the cashless policy will not abolish corruption. In general, corruption can be categorized into three distinct types, including political, systematic and petty corruption. A cashless policy can decrease the amount of petty corruption upon

automation of process in payments within government agencies that will encourage transparency, but systematic and political corruption are dependent on the authorities who utilise them with no integrity. There is no single best way of dealing with corruption, it requires an effort that consists of various complicated measure in distinct spheres of society. A cashless economy itself will not be able to effectively do away with corruption unless taken up with several other measures, including good governance, transparency and accountability, legislative oversight, judicial reforms, civil service reforms, societal reforms and promoting ethical principles.

5.3 Limitation

When conducting this research, there were several issues and limitations faced that may cause and affect the accuracy of the results found. Thus, the results that have been obtained may not be able to fully reflect the relationship between cashless payment and the corruption level. Future research that is conducted based on this study would have to be wary of the limitations and use the results accordingly. The limitations are as below.

In this research, our cashless settlement method sample data is limited due to constraints in the availability of comparable data across different countries. It would be better if the sample data can include more countries such as some emerging economies, rather than only developed countries. This is because using only developed countries data may not be able to capture the actual effect of cashless settlement methods toward corruption level since the results would vary significantly if more data were included. Therefore, the availability of data will be an important issue here.

In addition, the research conducted was based on corruption perception index as a benchmark to capture the corruption level in European Union. However, different website use different scales to measure the corruption level across nations. For instance, Transparency International measures the corruption level using the score of one to hundred while WorldBank measures the corruption level with the rating

of one to six. Thus, the variation in the unit of measurement may affect the reliability of the results. This is due to the fact that each independent variables might react or have different sensitivity towards different dependent variable data.

Future researches who based their studies on this research should bear in mind these limitations while using the information in this study. In conclusion, users of this study should refer to the limitations before using information from this study in conducting their research.

5.4 Recommendation for Future Research

In this study, there are some recommendation to the researchers who going to further explore with this topic.

First and foremost, this study recommend that the future research to study the cashless settlement method of more countries rather than only European Union in order to get a clearer picture about its effects towards corruption. This is due the implementation of cashless settlement method varies across countries, so their effect towards corruption also varies across countries. Hence, increasing the sample size can improve the reliability of research result.

Also, future researchers might want to consider the use of judicial records, press reports and records from anti-corruption agencies to measure the degree of corruption. Since many incidents of corruption are never discovered, such documentary evidence may forms an alternative measure of the actual degree of corruption. Furthermore, press and government agencies in various countries are more likely to have different conceptions of corruption, and varying styles in collecting data across countries. This helps to increase the reliability of the data by minimizing the effects of any biases of individual survey because the perceptions of a larger population were surveyed (Montinola & Jackman, 2002).

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