DOES CORRUPTION AFFECT PUBLIC DEBT IN DEVELOPED AND DEVELOPING COUNTRIES? AN EMPIRICAL ANALYSIS

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A final year project submitted in partial fulfillment of the requirement for the degree of

BACHELOR OF BUSINESS ADMINISTRATION
(HONS) BANKING AND FINANCE

UNIVERSITI TUNKU ABDUL RAHMAN

FACULTY OF BUSINESS AND FINANCE
DEPARTMENT OF BANKING AND FINANCE

AUGUST 2019

DECLARATION

We hereby declare that:

(1) This undergraduate research project 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 research project 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 research project.

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ACKNOWLEDGEMENT

With the assistance and co-operation of various authorities, this research project has been successfully carried out. Hence, we wish to express our greatest appreciate to those people who guide, helped and supported us in completing this research.

First of all, we would like to thank University Tunku Abdul Rahman (UTAR) for giving us this opportunity to involve in the research. Throughout this research, we gain a lot of experience, knowledge and expose to situation which cannot be learnt in syllabus and definitely going to be helpful in future.

Secondly, we would also like to express our deepest gratitude to our supervisor, Dr. Yiew Thian Hee who had guided us throughout the whole research. He always patient and advices us for doing this research so that we can done it smoothly. We sincerely appreciate what she had done to guide us.

Last but not least, we are grateful to our family members and friends who had supported us to the end of the project.

DEDICATION

This research project is dedicated to all individual who have been contributed to this research whether directly or indirectly.

Firstly, we would like to dedicate this research project to our beloved supervisor, Dr. Yiew Thian Hee, who contributed his precious time and effort in guiding us. Without her guidance and full support, we would not be able to complete this research project on time.

Secondly, we would like to dedicate this research project to our family members, friends and classmates whom have supported us unconditionally throughout the process. They have been providing us with umpteenth encouragement and motivation in completing this research project.

Last but not least, we would like to dedicate this research project to Universiti Tunku Abdul Rahman (UTAR) which have provided us with sufficient facilities and resources to conduct this research project. Without the help of all these parties, this research project will not be a success.

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LIST OF ABBREVIATIONS

PD	Public Debt
CPI	Corruption Perception Index
INF	Inflation
GS	Government Spending
GDP	Gross Domestic Product
EG	Economic Growth
GMM	Generalized Method of Moments

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PREFACE

It is compulsory to carry out this research project in order to accomplish our study which is Bachelor of Business Administration (Hons) Banking and Finance. The topic of this research project is "To examine the impact of corruption on public debt in developed and developing countries". This topic is conducted to raise awareness of undergraduate students in UTAR regarding the impact of corruption on public debt.

In this era of globalization, public debt become a big issue to the country's economic development. Corruption is one of the main issue that cause the public debt in the country became seriously.

This research project take corruption into consideration to explain the significance influence of public debt. In short, this research project will provide the public with clear information and data for the impact of corruption on public debt.

ABSTRACT

While corruption on public debt has been widely investigated in many different countries, it is often overlooked some specific countries in the world. However, corruption was the main issue that affect public debt in the country and bring negative impact to the country's economy. Hence, this study aimed at examining the influence of corruption and other control variable on public debt in developed and developing countries. GMM was apply to investigate the result of corruption and other control variable on public debt. The result indicate corruption has a significant and positive impact on public debt.

Keywords: Public Debt, Corruption, Government spending, Inflation, Economic Growth

CHAPTER 1: RESEARCH OVERVIEW

1.0 Introduction

In the research overview, chapter one provides a brief introduction of the research background regarding topic include the detailed illustration of the problem statement. Furthermore, it also includes the research objectives, research question, hypothesis test, significance of this research, chapter layout and eventually the conclusion of this research.

1.1 Research Background

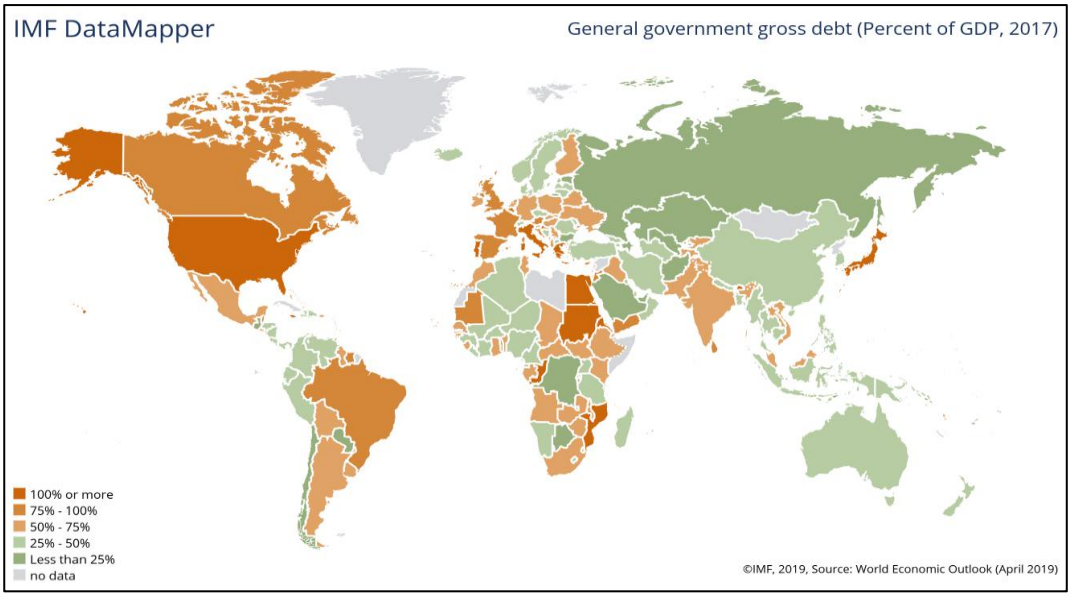
The worldwide global financial and economic crisis has led to an unprecedented increase in public debt across the world. Public debt is not only a big issue to the government but also to the common public. Furthermore, public debt may cause the country in the crisis of budget deficit. Huge budget deficit may bring a financial burden on government and policymakers on the mechanism to finance the basic development projects (Lartey, Musah, Okyere, & Yusif, 2018). On the other hand, public debt causes an increase in inflation and devalue the money causing economic repercussions (The Star, 2018). This situation reduces the purchasing power of the public since they need to pay more in order to purchase the same amount of goods and services compared with before. The condition was far worse and getting more concern by policymaker and economists across the year. Since the burden will bring a very big effect on the economy in the country.

According to Sutherland & Hoeller (2012), higher debt may increase the sensitivity of household or firm change in macroeconomic condition. The legacy of historically high and rising the level of public indebtedness across the advance economics was due to the recent financial crisis and recession (Reinhart, Reinhart, & Rogoff, 2012). A broader definition of the public debt is the government's liabilities and how much the country owed to the lender (The Star, 2018).

A study by Agim & Teuta (2014) found that the current economic crisis and the reduction of tax under the flat tax on public income collection were the major cause of the budget deficit and public debt. The reduction on the income tax and other tax may bring a key factor of reducing the government receipt of income. When the public debt increases, the government should increase the tax collection to cover the debt. External and internal debt has a significant and positive relationship with taxes (Alawneh, 2017). Economic crisis may reduce the number of business due to the business income decreased and bring the impact on revenue in the public budget.

In the perspective of macro-economic theory, government debt which spends expenditures such as education, healthcare, and nutrition must have a positive relationship on economic growth (Freeman & Webber, 2009). Basically, public debt refers to the accumulation of budget deficits. Budget deficits always appear when government spending greater than tax revenues. To deal with deficits, most governments would tend to borrow external and domestic debt instead of causing high inflation, economic crisis and some economic problems such as the rise in the interest rate. Higher public debt will lead to a higher interest rate to investors. Investors would like to earn more return for higher risk. Therefore, revenue has gone more toward repayment of public debt, and less toward government services.

Figure 1.1: Percentage of Public Debt in 2017



Source: World Economic Outlook (2019)

Figure 1.1 shows that the percentage of public debt perception across the world in 2017. The Percentage of Gross Domestic Product (GDP) currently rank 237 countries on a scale from 100% or more (high debt) to less than 25% (low debt). The worst performing region was North America with a percentage of 102.1, followed by Western Hemisphere with a percentage of 95.8 and East Asia with a percentage of 92.3%. In contrast, the well-performing region was Central Asia and the Caucasus with a percentage of 27.2%, followed by Eastern Europe with a percentage of 33.4% and Pacific Islands with a percentage of 38.8% (World Economic Outlook, 2019).

Corruption is a deadly affair because it can increase the percentage of public debt in the country. This situation increased the financial burden of the country. In 2017, Malaysia has lost around RM46.9 billion because of corruption that happened in the public sector which reduced the competitiveness of the country

(The Star, 2018). Undeniably, corruption brings a serious problem, and it was further aggravated by the current financial crisis and might be damaging the performance of the economy. It can be defined as the illegal and benefit-oriented usage of public power (Akca, Ata, & Karaca, 2012). As corruption leads a reduced economic growth, lessened state income, and arise poverty. Another researcher also figured out that high corrupts countries bring a higher inflation rate (Ali & Sassi, 2016). Thus, higher corruption not only effects on public debt but also cause many other economic problems.

Table 1.1: Top 10 higher public debt countries in developed countries attached with Corruption Perception Index from the year 2013-2017.

	Public debt (GDP %) CPI (Index)				
Country/Year	2013	2014	2015	2016	2017
Japan	[232.5] (4.5)	[236.1] (4.5)	[231.3] (4.5)	[235.6] (4.5)	[237.6] (4.5)
Greece	[177.9] (2.0)	[180.2] (2.0)	[178.8] (2.5)	[185.3] (2.5)	[181.8] (2.5)
Portugal	[129] (3.5)	[130.6] (3.5)	[128.8] (4.0)	[129.9] (4.0)	[125.7] (4.0)
Italy	[129] (2.5)	[131.8] (2.5)	[131.5] (2.5)	[132] (2.5)	[131.8] (2.8)
Cyprus	[102.1] (4.0)	[107.5] (4.0)	[107.5] (4.0)	[106.6] (4.0)	[97.5] (3.7)
Belgium	[105.5] (5.0)	[107] (5.0)	[106.1] (4.5)	[106] (4.5)	[103.4] (4.5)
Unites Stated	[104.9] (3.6)	[104.6] (3.6)	[104.8] (4.5)	[106.8] (4.5)	[105.2] (4.5)
Spain	[95.5] (4.0)	[100.4] (4.0)	[99.4] (3.5)	[99] (3.5)	[98.4] (3.5)
Singapore	[101.5] (4.5)	[96.6] (4.5)	[100.5] (4.5)	[106.8] (4.5)	[111.1] (4.8)

France	[93.4] (4.1)	[94.9] (4.0)	[95.6] (4.5)	[96.6] (4.5)	[96.8] (4.2)

Notes: Public Debt showed in [ ], CPI showed in ( )

Table 1.1 shown that top 10 highest public debt countries in the developed countries. Most of the countries faced an increasing trend in public debt year by year. Based on table 1.1 and 1.2, the index of corruption indicated the control of corruption with a range of 0 (high corruption countries) to 6 (less corruption countries). According to the IMF, Japan had become the country to obtain the highest public debt in the globe in 2017 which was 237.6%. Japan was the most distinct faced an increasing trend on public debt whereas corruption perception index remains unchanged on index 4.5 from 2013-2017. As stated in Table 1.1, the decrease in public debt over the period also came with an increase in CPI in some countries such as Greece, Cyprus, and Portugal. There were also have some countries had increased the corruption perception index but the percentage of the public debt still had an increasing trend. Those countries included Italy, United States, Singapore, and France.

Table 1.2: Top 10 higher public debt countries in developing countries attached with Corruption Perception Index from year 2013-2017.

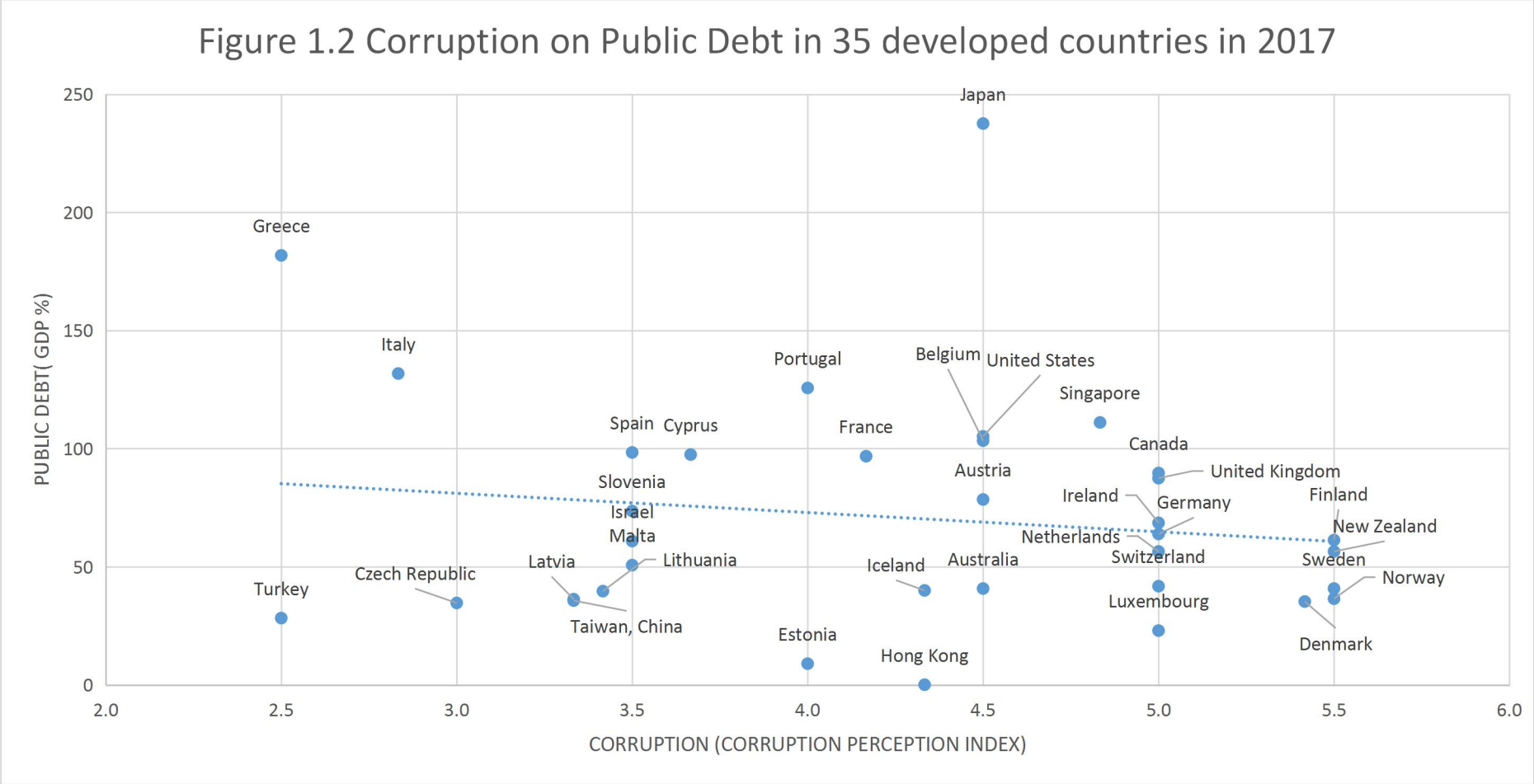
	Public debt (GDP %) CPI (Index)				
Country/Year	2013	2014	2015	2016	2017
Lebanon	[136.6] (1.5)	[137.2] (1.5)	[140.9] (1.9)	[145.5] (2.0)	[146.8] (1.7)
Sudan	[93.1] (0.5)	[83.2] (0.5)	[82.3] (0.5)	[99.5] (0.5)	[121.6] (0.5)
Jamaica	[140.5] (2.0)	[139.7] (2.0)	[121.3] (2.5)	[113.6] (2.5)	[101] (2.5)
Egypt	[84] (2.0)	[85.1] (2.0)	[88.5] (2.0)	[96.8] (2.0)	[103] (2.0)

Mozambique	[53.1] (2.0)	[62.4] (2.0)	[88.1] (2.0)	[121.6] (2.0)	[102.1] (2.0)
Jordan	[86.7] (2.5)	[89] (2.5)	[93.4] (3.0)	[95.1] (3.0)	[95.9] (3.0)
Gambia	[58.6] (2.0)	[69.4] (2.0)	[68.6] (2.0)	[82.3] (2.0)	[88] (1.7)
Brazil	[60.2] (2.7)	[62.3] (2.5)	[72.6] (2.5)	[78.4] (2.0)	[84] (2.0)
Sri Lanka	[71.8] (2.5)	[72.2] (2.5)	[78.5] (2.5)	[79.6] (2.5)	[79.1] (2.5)
Ukraine	[40.5] (1.5)	[70.3] (1.5)	[79.3] (1.5)	[81.2] (1.7)	[71] (2.0)

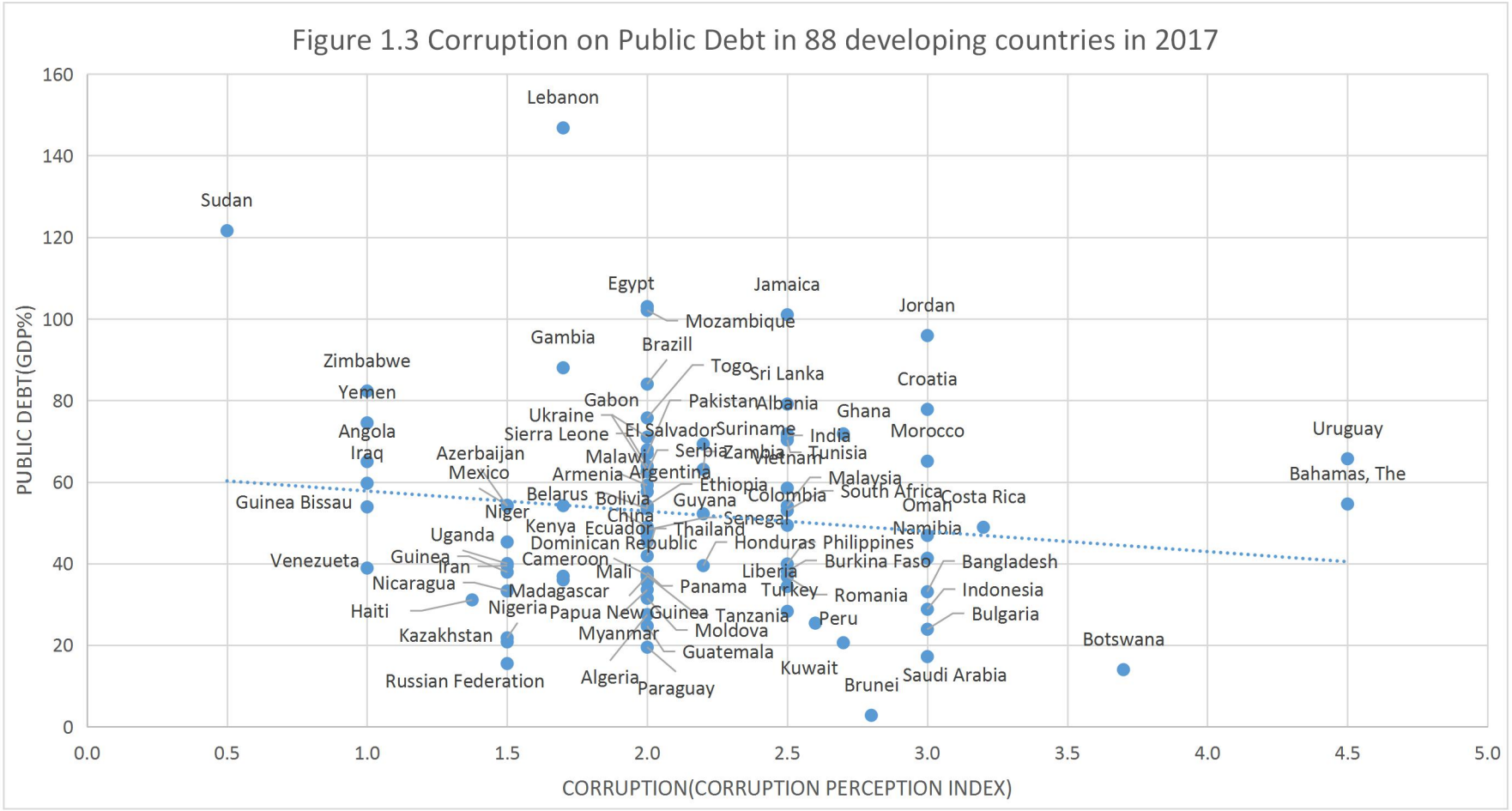
Notes: Public Debt showed in [ ], CPI showed in ( )

Table 1.2 had shown that top 10 highest public debt countries among the developing countries. Majority of countries faced an increasing trend in public debt. Based on table 1.2 figured out a serious corruption occurred in developing countries since most of the corruption perception index less than 3.0. The higher the public debt, the lower the corruption perception index and the index indicate a range of 0 (high corruption countries) to 6 (fewer corruption countries). According to the International Monetary Fund (IMF), Lebanon had been turned out to be third-highest public debt in the world and the highest debt among developing countries. As Table 1.2 figured out Lebanon obtained the highest debt and keep remaining increase from the year 2013 to 2017 with CPI less than 2.0 whereby Sudan obtained the highest corruption which corruption perception index was only 0.5.

The Figure 1.2 present corruption on public debt in 35 developed countries in 2017.



Moreover, Figure 1.3 present corruption on public debt in 88 developing countries in 2017.



1.2 Problem Statement

In the new global economy, corruption has been the main reason for a country's financial problems. Based on the previous researchers, corruption should be eradicated because it carries negative impacts on the economy (Dimant & Tosato, 2017). And, the consequences of corruption on public debt were indistinct. In addition, it brought a serious problem for the world developed and developing nations nowadays, limits a country economic freedom and unsubstantial enforcement on the rule of law (Nwabuzor, 2005).

Besides that, Global Finance (2018) stated that the main reason of an increase in public debt is the country's decision to cover the budget deficit ensure a sufficient fund able to pay back to the borrower before the due date. There was an increasing trend of public debt in some developed countries by analyzed data from the Organisation for Economic Co-operation and Development (OECD) and the International Monetary Fund (IMF). Furthermore, IMF had figured out 59 developing countries that faced a high debt crisis. The effect of the debt crisis in a country due to systemic financial instability and political problem occurred. Likewise, it led to serious economic problems such as high inflation and high-interest rate. Among the OECD area, Global Finance (2018) also stated that public debt had been significantly increasing across the period of 2008-2012, and yet their total debt was estimated rise from $43.6 trillion in 2017 to $45.0 trillion in 2018.

In the event of corruption, it may result to raise public debt (Jeng, 2018). Corruption can affect public debt in certain ways. First of all, some research has mentioned high public debt will link to rent seeking activities by the government (Yared, 2010). Second, corruption will tend to lower tax revenues. As Cooray & Schneider (2013) has argued when there was a low tax revenue, a government may have to more borrowing to finance the project. Hence, the higher corruption

of a government will leads more amount of tax revenue contribute to bribe payment which will bring more public debt. Moreover, Cooray & Schneider (2013) concluded corruption will lead to a fiscal deficit which decreased public revenues while public spending simultaneously rises and it will bring a rise of public debt.

On the other hand, a recent study done by Liu, Moldogaziev, & Mikesell (2017) reports that higher corruption may cause higher public debt. Thus, the author mentioned when the corruption in control, it would help the government reduce the borrowing cost in order to lower public debt. Next, Butler, Fauver, & Mortal (2009) analyzed that some rating agencies give lower bond rating look on as more corrupt and thus increase borrowing costs. Corruption affects public debt through expenditure and revenue (Benfratello, Del Monte, & Pennacchio, 2017). Some historians have argued that corruption has a statistically and positive impact on the public debt (Cooray & Schneider 2013; Henri, 2018; Grecheyna, 2012). Based on the study done by the previous author, showed that persistent growth in public debt has increased regard fiscal sustainability and it will bring negative impact to the country (Kim, Ha, & Kim, 2017).

Based on the previous studies, when the country faced increasing trend in corruption, it may lead to a high level of public debt in the country at the same time contribute a large amount of negative impact on country economic development. In addition, this research tried to scatter plot diagrams to observe the relationship between corruption and public debt in developed and developing countries. Surprisingly, the scatter plot showed that there was a negative effect of corruption on public debt in both developed and developing countries in Figure 1.1 and Figure 1.2 in the year 2017. This was the main reason which motivates this research to probe the impact of corruption on public debt. In addition, this research investigated the impact of corruption on public debt by separated into developed and developing countries in order to analyse the impact of corruption and public debt in two different condition countries.

1.3 Research Objectives

1.3.1 General Objective

The general objective of this paper was to investigate the impact of corruption on public debt in developed and developing countries. Besides that, this research also discriminated other control variables such as government spending, inflation, economic growth, and interest rate.

1.3.2 Specific Objectives

Specifically, the objectives of this research were as following:

1) To examine the impact of corruption on public debt in developed countries.
2) To examine the impact of corruption on public debt in developing countries.

1.4 Research Questions

1. Is there a significant impact of corruption on public debt in developed countries?
2. Is there a significant impact of corruption on public debt in developing countries?

1.5 Hypotheses of the Study

Hypothesis 1

H_0: There is no significant impact of corruption on public debt.

H_1: There is a significant impact of corruption on public debt in developed countries.

H_2: There is a significant impact of corruption on public debt in developing countries.

1.6 Significant of the study

Past studies on the public debt it only focused on one country it might be developed or developing country only and have been conducted on the country focus. Thus, there was limited knowledge and information on public debt across the world. This research aims to contribute to the existing in several ways.

Firstly, this research helps to investigate the key elements that will affect public debt. Through analysing the effect of corruption, government spending, inflation, economic growth and interest rate on public debt, a significant relationship might be found whether those variables were significant providing effects. By including those variables, this research was able to explain corruption on public debt clearly among the developed or developing country. Besides that, the findings of this research may also be of interest to the government for future economic growth and reduce the debt of the country. The government can set up the overall objective prohibited corruption try to reduce debt in the country.

In addition, this research may provide appropriate information for policymakers, researcher or economists on the impact of corruption on public debt and other variables that will influence the public debt. It might give the chance to those people understanding on the public debt. In short, the public debt of developed or developing countries always an important issue and often be concerned.

1.7 Chapter Layout

This research consists of five chapters which are introduction, literature review, research methodology, research results, discussion and conclusion. Firstly, chapter one gives a general review of this research. Besides that, a review of literature for independent variable and other control variable were discussed and evaluated, review of relevant theoretical models and proposed conceptual framework also discussed at the same time in chapter two. Furthermore, chapter three discussed the method applied to complete this research. Methodologies were the main focus of this chapter. Chapter four showed the result of this research from the estimated model. Lastly, chapter five summarized all the information and make a conclusion for this research.

1.8 Conclusion

In a nutshell, public debt always was an important issue that affects government, public, and individual. The research background and brief introduction to the public debt in developed or developing countries have been illustrated complying with the problem statement in our studies. Moreover, the general and specifies objectives, the significance of study and hypothesis of study have been addressed with clear direction in determining the effect of factors towards the public in

developed or developing countries. In order to know more about the key factors that affect the public debt, there will be a further discussion on the relevant studies by past researcher or scholars in the next chapter.

CHAPTER 2: LITERATURE REVIEW

2.0 Introduction

In this chapter, a literature review on the relation between the dependent variable (public debt) and independent variables, namely corruption, government spending, inflation, economic growth, interest rate is presented. Initially, this chapter will provide a layout of critical reviews on different ideas by different researchers. Relevant theory in this research was Pierre Bourdieu's Theory (De Graaf, 2007).

2.1 Pierre Bourdieu's Theory (Theory)

Nowadays, the collision of the corruption on public debt was getting serious in majority of countries. According to De Graaf (2007), the Pierre Bourdieu's Theory can be used to analyse and measure the corruption case studies. This theory was introduced by Pierre Felix Bourdieu in the year 1958. In Pierre Bourdieu's initial book, Sociologie de L'Algerie (*The Sociology of Algeria*), he had shown how the "habitus" can influence people on corruption.

There are four Bourdieu's key theoretical concepts in Pierre Bourdieu's Theory which are habitus, field, practice, and different forms of capital, for a given an example like economic, social and symbolic (Elaine, 1999). The first Bourdieu's key theoretical concept was habitus, a method of narrating the embodiment of history in individual and the social structure. In addition, it was also known as a misused, misunderstood and hotly contested of Pierre Bourdieu's ideas. In

Bourdieu's word, the related conditions with a special existence condition that produce habitus, transposable dispositions, systems of durable, this was the principle that build and arrange practices and can be expressed objectively adapt to their result without the pre-targeted aim or a convey mastery the operation necessary to achieve them (Bourdieu, 1990). In fact, habitus put a lot of effort into Bourdieu's approach. It was designed to transcend a series of deep-rooted dichotomies to build a way of thinking about the social world. Habitus was the reproducer of structures, and also the product of practices and the product of structures. The habitus will not act alone. Bourdieu was not recommended the pre-programmed automatons that can explain the impact of our growth. Practices were the answer of what it calls "an obscure and double relation" (Bourdieu & Wacquant 1992a: 126) or "an unconscious relationship" (Bourdieu, 1993a: 76) that between the field and the habitus. According to the research of Bourdieu, individual within the same habitus and having the same dispositions and predispositions were activate into corruption. De Graaf (2007) had thought the action of Bourdieu's theory was very useful for the corruption investigation that had shown in the previous section.

The second Bourdieu's key theoretical concepts were field. Subordinate positions, capital and consisting was the structured spaces planned around the specific types for field. Bourdieu had analysed some examples of fields, such as the field of science, the field of education, the field of religion and the field of law. The field represents the production area, knowledge, circulation, and with the competitive position that clasp by the actors that their scuffle to accumulate and scuffle control these different kinds of capital (Swart, 1997). The connection of condition, the field had structured the habitus, while on the other hand, it was a connection of knowledge. Habitus had subscribed to compose the field as a purposeful world (Bourdieu & Wacquant 1992). Furthermore, practice was one of Bourdieu's key theoretical concept. According to Bourdieu's theoretical framework, the result had shown the relationship of practice between a single's habitus, the field of action and the different form of capital. Habitus does not determine practice, but create and produces it. The adaptability of practice, was controlled by habitus and had

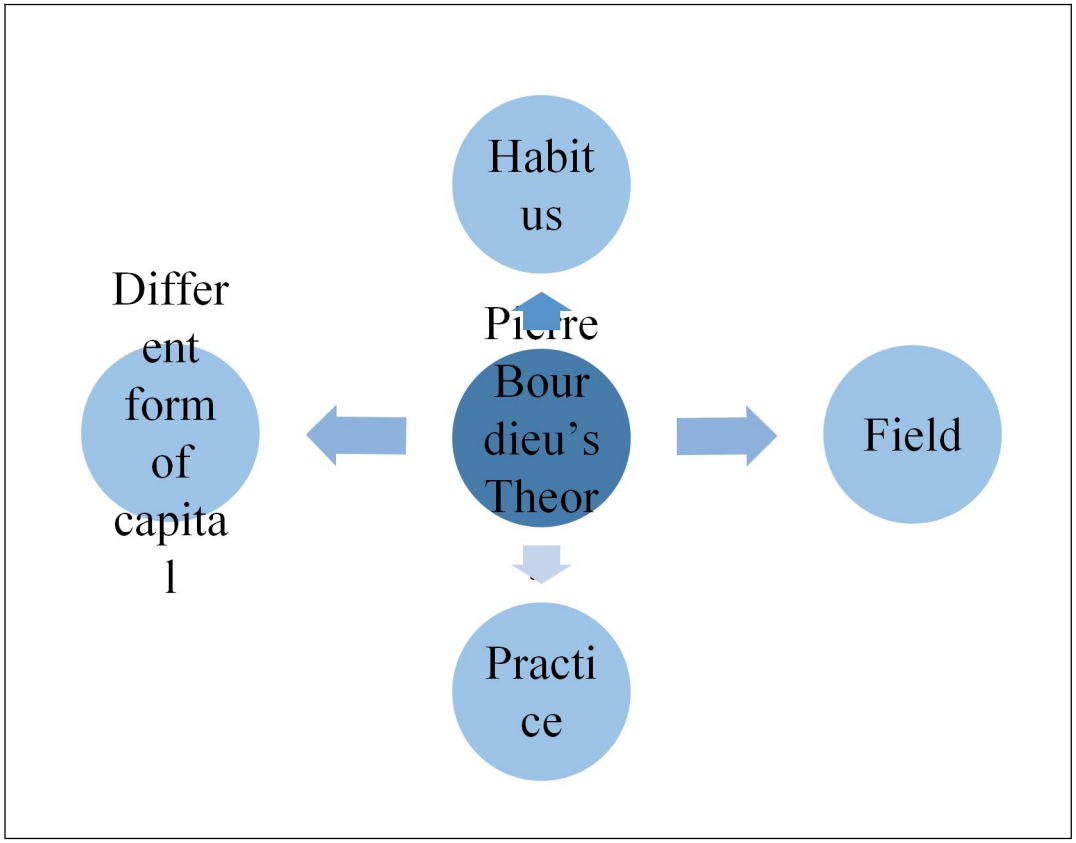
been differentiated with the musical practice of jazz musicians. Bourdieu's model of practice, practices are not decreasing to habitus and field but it will grow out of the "interrelationship" that began at the time (Swartz, 1997). There were three steps to approach any sociological study that had suggested by practice, the model of Bourdieu. The first step was the habitus negotiator bring their situation in the field and society that track of the situation. Next was the specific area related to a wider range of areas power. Then was the construction of an objective connection between the dissimilar situations within the field (Swartz, 1997).

A different form of capital was the last key theoretical concept for Bourdieu. Bourdieu had identified four main types of capital, which was symbolic, economic, cultural and social. In fact, the figurative capital was the configuration used by other kinds of capital, when its nature was an arbitrary misunderstanding. Economic capital was the greatest direct type of capital and used to the types of associated with its power. Next, the cultural capital had in the form of long last temperament of the body and the mind, and in the form of objectification resulting and last were in the configuration of cultural goods. Social capital accumulates from the networks of relationship, such as institutionalized relationships. Bourdieu had turned the field of study on the family (especially in *La Misere du Monde*, shortly it will publish in English translation as *The Poverty of Society*: *A Study in Social Suffering*).

According to Benfratello et al. (2017), studies on the relationship between corruption and public debt had shown that corruption can influence public debt in several ways. Foremost was expenditure and revenue, the public officials can exaggerate public expenditure for their own income, and they will also pay about the market price for the goods and services (Tanzi & Davoodi, 2002). In spite of the fact that the amount of public expenditure was higher than necessary, but the productivity from such expenditure was quite low, beyond the expectation (Mauro, 1998). In addition, corruption will lead to higher costs of debt by lowering the bond ratings (Depken & Lafountain, 2006). According to Grechyna (2012), the

collision of corruption on public debt had increased in majority countries, for a sample that as did by Cooray et al. (2017), it including the developed and developing countries. Furthermore, high government spending will damage the consequence of corruption on public debt in a country (Cooray et al., 2017). When the government spending was getting higher in higher-income (HICs), which may describe these countries had a stronger influence of corruption.

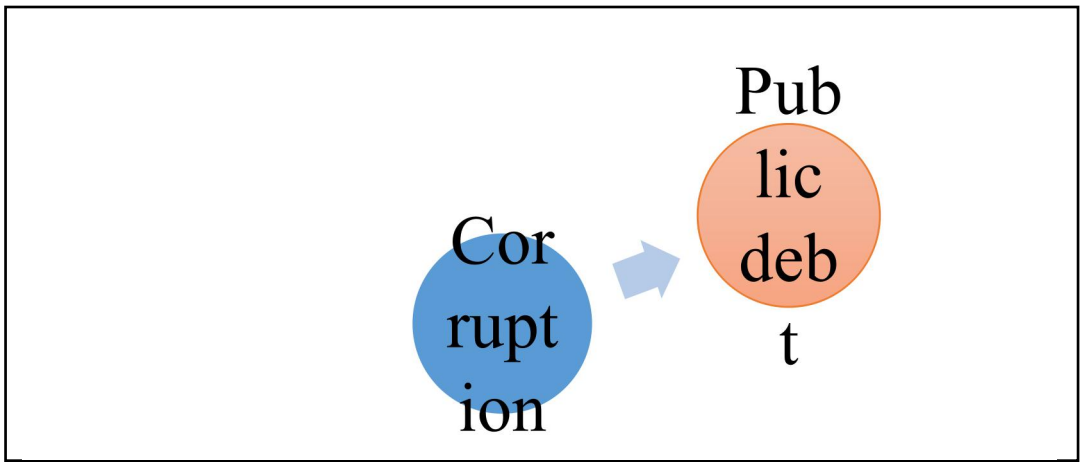
Figure 2.1: Pierre Bourdieu's Theory



Sources: De Graaf (2007), Bourdieu (1990), Swartz (1997), Benfratello, Del Monte, & Pennacchio (2017), Mauro (1995), Mo (2001), Tanzi & Davoodi (2002), Cooray, Dzhumashev, & Schneider (2017)

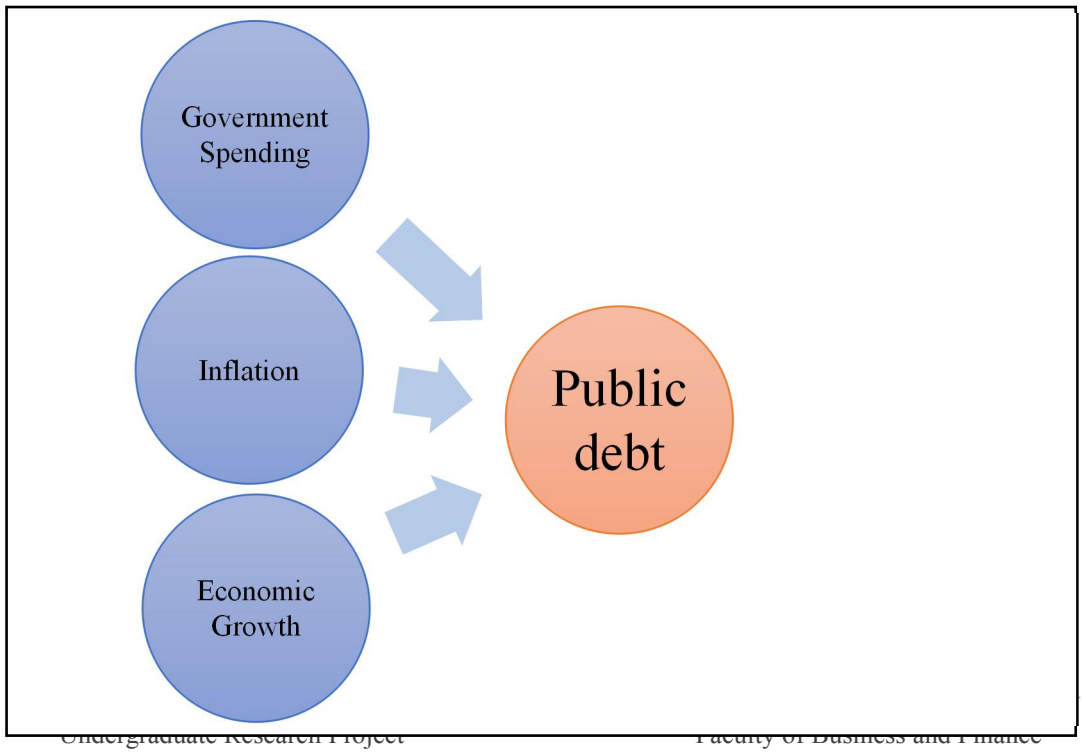
2.2 Research Framework

Figure 2.2: Independent variable and dependent variable



Sources: Kaufmann (2010)

Figure 2.3: Control variable and dependent variable



Sources: Gomez- Gonzalez (2019), Joydeb & Ritwik (2017), Robert and Dogales (2002), Pattillo, Poirson, & Ricci (2011)

This research will use habitus to explain the relationship between corruption and public debt. There was a positive expected relation between corruption and public debt. This was because Kaufmann (2010) had pinpointed out that the measure of corruption was a positive correlation between government debt levels. Therefore, the expected relationship between inflation and public debt was positive, which indicates that when an increase in inflation will increase in public debt. Moreover, when inflation was raised, produce economies will increase public debt (Gomez-Gonzalez, 2019). Next, government expenditure showed a positive relationship with the public debt. Based on the study of Joydeb & Ritwik (2017), the research pointed out the total expenditure of the country which was financed by government borrowing, from this research know that if government spending rise at the same time public debt of country also rising. On the other site, interest rate showed a negative relation with the public debt. Based on the study done by Robert & Dogales (2002), it showed that the result of the data by nine Organization for Economic Cooperation and Development (OECD) countries had concluded that expand in interest rate will influence the government taking debt at large scale on the early year 1970s. Lastly, the economic growth was expected positive relationship with the public debt also. Based on the result of Moki (2012) show that was a positive relationship between public debt and the economic growth in Africa. The result meaning that the expansion in economic growth also will lead to an expansion in public debt.

2.3 Empirical study of Corruption on Public Debt

Public debt has become a popular issue currently in research. The main focus of this research was the impact of corruption on public debt. Corruption has been a

global phenomenon (Iyanda, 2012) and the impact of corruption on economic has troubled policymakers and has affected the governance (Athanasouli, Goujard, & Sklias, 2012). Based on transparency international (2016), 69% of the total 176 countries scored below 50 in systemic corruption. According to the definition of Waite & Allen (2003), corruption is an illegal use of formal power or affected by the government to enrich themselves. Another perspective about corruption was studied by Shleifer & Vishmy (1993) and they define corruption as a personal gain by the government official. According to those definitions, corruption included all crimes which involve embezzlement, bribery, dishonesty, rent-seeking, and misconduct.

How corruption did influence public debt? Several empirical researchers demonstrated the relationship between corruption and public debt. A number of studies had found that public expenditures wasteful (Tanzi & Davoodi, 1997; Shleifer & Vishny, 1993; Tanzi 1998). Besides that, Tanzi & Davoodi (2000) pointed out corruption will raise public expenditure which would lead to a rise in public debt. The corruption will happen if the officer steals the loaned fund and other government income. This may limit the ability of government to meet the debt obligations and caused an increase in the public debt (Ng, 2006). Kaufmann (2010) pinpointed out that the measure of corruption was a positive correlation between government debt levels and corruption. Jalles (2011) demonstrated that the negative interaction of corruption on public debt and economic growth. This mean corruption will affect public debt and economic growth. Yet, the increase in corruption will cause public debt to increase and the economic growth decrease. In addition, Grechyna (2012) found that the impact of corruption on public debt for high income economic was loss, he aimed to fill up this gap, and collected data from 30 OCED countries for 1995 to 2010 and get a result from all specifications which corruption was significant and affect public debt. Moreover, Grechyna (2012) done another research about public debt and found that corruption was one of the main reason which affects the public debt. When the corruption increase, it will lead to an increase in public debt by using the sample of 23 high-income OECD countries. Cooray & Schneider (2013) found that the effect of corruption

on public debt by analyzing a sample of 106 countries. The result showed that if corruption increased, public debt will also increase.

González-Fernández & González-Velasco (2014) constructed CPI (corruption perception index) for Spain to test the relationship between corruption and public debt for the period 2000-2012. The result demonstrated the corruption had a positive and direct impact on public debt. Benfratello et al. (2015) shown that the impact of corruption on public debt by using a panel of 166 countries for the period 1995 until 2013, and found that corruption increase public debt. Moreover, Cooray & Schneider (2013) investigated corruption led to a fiscal deficit which decreased public revenue while public spending simultaneously rises and it will bring a rise of public debt. They concluded that the higher the index level of corruption, the higher the ratio of public debt by illustrated the data from 106 countries. In addition, Ivanyna, Mourmouras, & Rangazas, (2015) applied the model to run the result and concluded a positive interaction between long-term corruption and public debt. According to the research from Cooray et al. (2017), high government expenditure increased the influence of corruption on public debt. By this mean, corruption will reduce productive investment. Besides that, Cooray et al. (2017) analysed the data from 126 countries using System GMM model (generalized method of moments) for the period 1996 to 2012 and concluded that corruption had a positive effect on public debt, by lessening tax revenues. GMM had served as one of the main methods for analysis of financial and economic data (Hall, 2007). Among this process, it included simple results on estimation. On the whole, corruption may harm an economy (Šumah, 2018).

Furthermore, Liu et al. (2017) analyzed data from United State corruption from 1977 to 2008 and use benchmark model to evaluate the effect of corruption on public debt issued by the local and state government. They tried to find out the evidence that public corruption was a significant determinant of public debt expansion. In their research found that the level of public debt caused by local and state government become higher if the level of corruption rise. Next, Kim et al.

(2017) used the pooled OLS (ordinary least squares), fixed effect model and GMM models to investigate the effect of corruption on public debt with data collected from 77 countries for 1990 to 2014 and figured out a positive moderating impact of corruption on public debt. Henri (2018) investigated the effect of corruption on public debt and illustrated a positive impact exist between public debt and corruption. Hence, they found that an increase of 1-unit in corruption will bring an increase in public debt 0.64 unit. Jeng (2018) estimated the effect of corruption on public debt and had a result which was public debt had a slim relation with corruption. Furthermore, Benfratello et al. (2017) proved the impact of corruption on public debt toward middle to high-income countries by indicating a dynamic econometric model. This research stated that the damaging effect in middle-income countries was higher than high-income, and thus corruption had a positive associated with public debt, this means when corruption increased, and public debt increased simultaneously. In short, a country with high corruption has to pay a higher interest rate which leads to a higher public debt and financial crisis (Depken & Lafountain, 2006).

2.4 Empirical study of Government Spending and Public Debt

According to the study of Anyanwu & Erhijakpor (2004), government spending which was the expenses for country government and acts as a maintenance fee for country economy and society. Moreover, government spending its impact on productivity and growth was important to maintain fiscal balance because it has a direct effect on income and collection for tax revenue (Joydeb & Ritwik, 2017). Government also considers the actual payment or the creation of an obligation to make future payment for the services received (Anyanfo, 1996).

A study of Joydeb & Ritwik (2017), on India from 1970-2016 pointed out the total spending of the country increased significantly as the government financed new projects which result in the increase of public debt. The economic growth of the country it can be increased proficient and achieved to the macroeconomic growth since the government in less developed countries may try to use public debt as an imperative tool to finance the expenditure, so the public debt increased accordingly (Matiti, 2013). Besides that, when government wish to reduce public debt in the country, the government may cut down spending for the welfare of the citizen and increasing taxes (Mah, Mukkudem-Petersen, Miruka, & Petersen, 2013) and Uguru & Leonard (2016) also mention that government spending has a significant impact on public debt the study based on Nigeria by applied ordinary least squares regression technique. Many historians (Mah et al, 2013; Idenyi, Ogonna, & Ifeyinwa, 2016; Henri, 2018; Sheikh, Faridi, & Tariq, 2010) had argued that there was a positive impact on government spending on public debt by using different type of model to run the result which was Vector Error correction Model framework and Vector Autoregression Granger causality, Generalized method of moment (GMM) estimator and OLS method to examine the result. In addition, Mah et al. (2013) has done the research in Greek from 1976-2011; Idenyi et al. (2016) in Nigeria from 1980-2015; Henri (2018) investigate 29 Sub Saharan Africa countries from 2000-2015 and Sheikh et al. (2010) conduct research based on Pakistan for the period 1972 to 2009. Furthermore, increase of well-being and income of the citizen it can boost aggregate demand for good and service, at the same national income will increased due to higher aggregate demand, then increase government spending in the country and boost economic growth at the same time reduce public debt so the result shown that public debt and economic growth has a positive relation (Lici & Dika, 2016).

However, there is also have a negative relationship between government spending and public debt. Based on the findings of Lora & Olivera (2006) for each 1% increase in the debt ratio, the total government spending would decline 0.039-0.054 percentage it has a clear negative relationship in Latin America used unbalanced panel method from 1985 to 2003 while for Ouattara (2006) the

research used OLS method in developing countries from 1980-2000 also found a negative relationship. Nevertheless, overmuch government spending it becomes a burden to the country which was the cost of government was greater than the revenue (Mitchell, 2005). Moreover, the government will borrow from external sources as government spending due to the fiscal deficit happening in the country and this scenario will lead public debt to increase accordingly (Shonchoy, 2010).

Yusuf & Said (2018) pinpointed that by using the external debt as development expenditure to develop the countries then the country may benefit because development expenditure like infrastructure may have a multiplier effect on boost economic growth. On the other hand, Ayres & Warr (2010) mention that when public debt utilized improperly, it may cause the biggest problems to the country economy and it will restrict economic growth. A study done by (Yusuf & Said, 2018; Ayres & Warr, 2010) who made a conclusion that if the government spends in an appropriate way then the public debt has an adverse relationship with government spending whereas if government spending spend inappropriate way it restricted economic growth at the same time public debt increase accordingly it shows a positive relationship. In short, the real government spending volume that increases from interest payment and public debt (Barro, 1979).

2.5 Empirical study of Inflation and Public Debt

Inflation is one of the most famous words when determinants in economics. According to the study of Cheng & Tan (2002), inflation became a challenge in macroeconomics management; which was because most of the countries need to maintain low inflation rate and stable situation. Inflation is irresistible so that every country needs to study it fundamentally. In their major study, Cheng & Tan (2002) inflationary effect was the major macroeconomic variables (excess fiscal deficit and money supply) that causes by inflation and further investigation need

to be done by the domestic economy. Investment goes downward because of inflation causes. Therefore, the research also pointed out that inflation was a factor to decline the debt ratio although inflation had been relatively mild in the past decade (Aizenman & Marion, 2011). Inflation channel may also be more important for the growth effects of debt for developing economies (Caner, Grennes, & Koehler- Geib, 2010). Based on the study of Barro (1979), he had used a theoretical model to analyse the data of U.S from the year 1916 to 1976. Government spending raises temporary, a countercyclical response of debt to temporary income moments and a one-to-one effect of expected inflation on nominal debt growth was a positive effect on the debt issue.

There was a positive relationship between inflation and public debt. According to the research of Wijnbergen & Budina (2007), the critical point that disclose by this studies is high price of postponing fiscal adjustment in such an environment of raised interest rate and small economic development, taking too much time in making fiscal adjustment, that will result an enhancement in inflation rates that lead to expeditious public debt burden. In addition, the research of Bildirici & Ersin (2007), the increases in inflation will lead to higher price level and further increase in nominal interest rates and decrease seigniorage. As a result, it is inevitable that rising public debt will result in an economy through the same channels.

The relationship between inflation and the short to long term debt ratio was expected with sign positive (Goudswaard, 1990). The higher inflation was uncertainty when higher inflation associated. High-risk premium leading to long-term nominal debt; then leading governments to stop issuing long-term debt. Public debt will increase improbability through financial repression and inflation (Cochrane, 2011). However, the study of Aizenman & Marion (2011) pointed out that inflation corrodes the debt burden was affirmed when long maturities. The research had used a statistical model to test US from the year 1946-2009. The result mentions that it was a positive relationship between inflation and public

debt. The research had concluded, when increased in inflation will increase in public debt. The researcher using the fiscal theory of the price level model (FTPL models) for the U.S in year 1970s. The fiscal shock had financed the rise of debt issue by way of delayed and had to change the price level permanently; but in the financial shock, inflation was unexpected (Sims, 2011). According to the study of Bhattarai, Lee, & Park (2014), the study had using a dynamic stochastic general equilibrium (DSGE) model for the U.S. The inflation that had a high response of public debt was response by interest rate, then it comes from a passive fiscal policy system and positive monetary policy. When the government removes the inflation that relates to the incentive with the debt load, this will importantly affect the price indexation of public debt (Calvo, 2013). According to the study of Phulpoto, Mirani, & Channa (2016), the research had used a linear regression model with time series analysis to analyse the data of Pakistan from 1995 to 2014. The result showed that inflation and public debt had a positive relationship. The research had concluded that when increased in inflation will increase in public debt. Moreover, when inflation was raised, produce economies will increase public debt. Inflation and public debt had a positive relationship, but it was losing significant (Gomez- Gonzalez, 2019).

According to the study of Woodford (1996), the result that link with monetary policy, increase in inflation only will decrease a little in the real interest rate on public debt; and the inflation will rise to a greater extent and remains high for a longer time. The unexpected high inflation came from the clear connection stems of inflation and it will decline the actual cost of servicing the debt (Reinhart & Rogoff, 2010). In 1980, inflation came the end of the automatic devaluation of public debt (Streeck, 2013). Higher inflation can let public debt decreased (Akitoby, Komatsuzaki, & Binder, 2014). Based on the study of Van Bon (2015), the research had using the estimation method of difference panel GMM Arellano-Bond for 60 developing countries in Asia, Africa and Latin America from the year 1990 to 2014. The result showed that the inflation and public debt had a significant negative effect when using GMM Arellano-Bond with the control variables of private investment, government revenue, trade openness,

infrastructure and real GDP per capita. Besides that, in the foreign currency share of debt; the study targeted the inflation had decrease led 3-6 percentage point of sovereign international debt. The coefficients across all the standard are insignificant and negative. Thus, inflation targeting had no consequent in public debt. It used a probit model to test 75 developing countries from the year 1994 to 2013 (Ogrokhina & Rodriguez, 2018).

In conclusion, most of the research concluded that there was a positive impact of the relationship between inflation on public debt. Moreover, there concluded that the inflation increased will lead to public debt increase (Aizenman & Marion, 2011; Caner et al., 2010; Barro, 1979; Goudswaard, 1990; Cochrane, 2011; Phulpoto et al., 2016; Gomez- Gonzalez, 2019). On the other hand, based on the study done by (Woodford, 1996; Reinhart & Rogoff, 2010 & Van Bon, 2015), the research had pointed out that increase inflation will cause the public debt increase. There was a negative impact of inflation on public debt. There was no relationship between inflation and public debt (Ogrokhina & Rodriguez, 2018). In short, there has been a gap between the inflation and public debt, therefore, the researcher realized its importance.

2.6 Empirical study on Economic Growth and Public Debt

Economic growth can be defined as an increase in the total output (goods or services) of an economy. It also can be defined as an increase in the capacity of an economy to produce goods and services, compared from one period of time to another (Raisova & Durcova, 2014). Based on Matiti (2013) economic growth was measured the growth in term of monetary and look there were no other aspects of development.

There were many academics and researcher verification and controversy the relationship between economic growth and public debt. Based on the research done by Pattillo, Poirson, & Ricci (2011), they used the Gaussian Mixture Model to analyse the data of 93 developing countries from year 1969 to 1998. The result shows that economic growth had a negative relationship with public debt. The result was supported by other researchers. Kumar & Woo (2010), they used the Gaussian Mixture Model to analyse the data of 38 develop and developing country from 1970 to 2007. Besides that, Fincke & Greiner (2013), they used the pooled regression model and random effect model to investigate the panel data of seven developed countries from 1970 to 2012 and Brini, Jemmali, & Ferroukh (2016), they used the Autoregressive distributed lag model (ARDL) to analyse the result of Tunisia by the data from the year 1990 to 2013.

Moreover, that is the positive relationship between economic growth and public debt. This is because the government needs to borrow the money from the international financial and capital market to fill the gap between domestic investment and saving (Saungweme & Odhiambo, 2019). Besides that, Greiner (2006) said that the economic growth increase will cause the interest rate increase and lead the public debt to increase. The result of the Moki (2012) shows that was the positive relationship between economic growth and public debt in Africa from the year 1980 to 2010 using the SPSS software. The result same with the Laine (2011) in short term, she used the Vector Auto Regression (VAR) model to analyse the data of United States from 1959 to 2010 and Abbas & Christensen (2007), they use the GMM to analyse 93 low-income countries from period 1957 to 2004. However, the researcher also found that the relationship between economic growth and public debt will turn into negative in the long-term.

On the other hand, Schclarek (2004) said that was no relationship between economic growth and private external debt. He used the GMM to analyses the sample of 24 countries from 1970 to 2002 in developing countries. The result was same as Ogunmuyiwa (2008). In this research was used the Augmented Dickey-

Fuller test and the Johansen Co-integration test to investigate the relationship between economic growth and public debt of Nigeria in the year 1970 to 2007.

Furthermore, there were some researchers found that economic growth will interact with each other. According to Owusu-Nantwi & Erickson (2016) found that the relationship between two variables was positive in Ghana from the year 1970 to 2012. In this research, they used the Johansen cointegration, vector error correction model and Granger causality test. The result of them was opposite with the Hussain, Haque, & Igwike (2015). They found that was a negative relationship between the variable by using the Dynamic Arellano-Bond panel data and Granger causality test. In this research, they use the 48 countries of sub-Saharan from the year 1995 to 2012.

In conclusion, the study done by previous researchers, they concluded that there was the positive relationship between economic growth and the public debt, the research pointed out that when the economic growth increases the public debt also will increase. (Moki, 2012; Laine, 2011; Abbas & Christensen, 2007). On the other hand, based on the study done by (Pattillo et al., 2002; Kumar & Woo, 2010; Bokemeier & Greiner, 2013; Brini et al., 2016), the researcher had pointed out that was the negative relationship between economic growth and public debt. Besides that, based on research done by (Schclarek, 2004; Ogunmuyiwa, 2008) found that was no relationship between economic growth and public debt. In addition, this research also found that economic growth and public debt will influence each other (Owusu-Nantwi & Erickson, 2016; Hussain et al., 2015). This was the reason why the researcher wants to investigate the relationship between economic growth and public debt because it had some gap between these two variables.

2.7 Empirical study of other control variables

Many of the issues can cause public debt, and one of them was the interest rate. According to the research of Patterson & Lygnerud (1999), the interest rate was elucidated as prices. The interest was the amount of price that pay for the money that borrowed in a duration of time, it is stated in a percentage form from overall undone balance left were fixed or changeable. In addition, interest was the amount that charge by the debtor to the creditor within the period of using credit provided (Mutinda, 2014).

Morley & Fishlow (1987), the problem of speedily increase the internally held of public debt and the higher domestic interest rate. According to Bohn (1988) had done the research on the high goods demand increased the interest rate, which will contemporaneous implies the higher payment on public debt. Through the result of the data by nine Organization for Economic Cooperation and Development (OECD) countries had concluded that increase in interest rate will influence the government taking debt at large scale on the early year 1970s. Faini (2004) had found that increased one percentage point in the interest rate will increase in the public debt of the euro area. Linnemann (2006) had shown the research when there was a positive steady-state stock in public debt, it will easily show to indeterminacy active the interest rate policy. According to the study of the research that done by Doi, Hoshi, & Okimoto (2011) had shown the possibility started to increase the interest rate as the public debt to the GDP ratio will increase. The research had used Lagrange multiplier to analyse the data of OECD countries and the Europe countries from the year 1990 to 2005 to get a positive relation. Higher budget deficits increased in interest rate, will crowd out the effects of increasing public debt (Claeys, Moreno, & Surinach (2012). In this research, Cavalcanti, Vereda, Doctors, Lima, & Maynard (2018) had investigated the interaction between the fiscal policies and monetary, such as an increase in interest rate will cause the public debt increased. In fact, even though the fiscal policy rule had required an endogenous response that keeping the balanced primary budget, the increasing interest rate may lead to increase the payments on public debt.

The growth rate of the public debt will reduce when the interest rate had increased the measured at par values (Barro, 1979). Based on the study of Garin, Lester, Sims, & Wolff (2019) had defined that there had a "well" period for increased in public debt if the adjacent discounted the worth of primary surpluses increased when the interest rate decreased, and there had a "worst" period to increase the public debt if the adjacent discounted worth of primary surpluses decreased when the interest rate decreased. According to both economies, it was to estimate a good period of time for increased the public debt that depends on the exogenous strength driving the interest rate fall (Garin et al., 2019).

Estimating a "transversality condition" that requires the public debt discounted at some interest rate (Wilcox, 1989). According to the research of Aizenman & Guidotti (1994) had found that there is no relation between the two variables in OECD countries in the year 1989. Furthermore, it had shown that decreasing the domestic interest rate on public debt, the sum of integrating private holdings of the domestic public debt had given the "effective" tax based of external interest income tax. According to the study of Missale (1997), there were choosing a comparative short maturity which was parallel to index the public debt to the interest rate. Based on the research of Eijffinger, Huizinga, & Lemmen (1998), increased in interest rate will well-being the domestic receptacle of public debt. The empirical facts about the public debt and interest rate were reviewed the recent econometric investigation on the interaction of federal public debt and interest rate, institute some investigation for this relationship (Engen & Hubbard, 2004). The research of Kinoshita (2006) had used the Dynamic General Equilibrium model to analyse the data of 19 industrial countries in the year 1971 to year 2004. It had shown the relation between the public debt and interest rate that keenly debated in macroeconomics. The difference of real interest rate on the public debt had shown that the government certain to reimburse its public debt the interest rate was equalized (Romer, 2006). Reinhart & Rogoff (2009) had examined the interest rate related to elongate periods of exceptionally the lofty public debt. Adam (2011) had used the Rational Expectation model to analyse the data of OECD countries from the year 2007 to 2011 to get a positive relation. Moreover, the research on the decision of the nominal interest rate will affect the

real value and price level of the outstanding public debt. Based on the research of Phulpoto et al. (2016) had found that the relation between two variables was positive in developing countries and 9 OECD countries from the year 1981 to 2006. The interest rate was such an amount that needs to pay by the government on public debt. According to the study of Coccia (2017), it is compulsory to repay the borrowers and to impose the repayment at the lenders to keep the low-interest rate on the public debt.

2.8 Conclusion

Literature review on an independent variable which was corruption and followed by other control variables such as government spending, inflation, and economic growth was provided in this chapter. Theoretical framework and hypotheses development were critically identified by review of relevant literature. The following chapter was discussed about research methodology.

CHAPTER 3: METHODOLOGY

3.0 Introduction

This chapter was showing clear information on the research model designed. Therefore, research design, source of data, target population, model, research framework, data processing and the estimator model which was Generalized Method of Moments (GMM) will be clearly stated in this chapter.

3.1 Research Design

The purpose of the research was to examine how corruption (CPI), government spending (GS), inflation (INF) and economic growth (GDP) that affect the public debt (PD) in the whole world. This research used the secondary data to investigate the impact of corruption on public debt. In addition, Stata software will be applied to this research.

3.2 Source of Data

Based on the study of Smith (2008), the population that is targeted was more representative by the larger samples; if offer for greater validity and more generalizable on findings. Therefore, this research was able to access the data of developed and developing countries from the International Monetary Fund (IMF), International Counter Risk Guide (ICRG) and World Development Indicators (WDI). The data period of this research was from 1970 to 2018, but there are some data was missing. Thus, in Roodman (2006) major study, the researcher showed that some of the data were unavailable, but can use the Generalized Method of Moments (GMM) model to resist the missing data. According to Zsohar (2010), the GMM was a statistical model that produces an estimate of the unknown parameters by combining the observed economic data with information from population time conditions in the economic models. Based on previous researcher corruption between public debt had a positive relationship (Kim et al., 2017; Henri, 2018; Jeng, 2018 Benfratello et al., 2017 & Depken & Lafountain, 2006). Therefore, this research expected the corruption with public debt is positive.

Table 3.1: Source of Data

Variables	Abbreviation	Definition	Expected Sign	Sources
Public Debt	PD	Percentage of Gross Domestic Product (GDP)	-	International Monetary Fund
Corruption	CPI	Corruption Perception Index	Positive	International Counter Risk Guide
Government Spending	GS	GDP per percentage	Positive	World Development Indicators

Inflation	INF	Consumer Price Index	Positive	World Development Indicators
Economic Growth	GDP	GDP per capita	Positive	World Development Indicators

Sources: Kim, Ha, & Kim (2017), Henri (2018), Jeng (2018), Bemfratello, Del Monte, & Pennacchio (2017), Depken & Lafountain (2006)

3.2.1 Public Debt

Public debt had become a common general of the financial sectors of most of the economies (Hanif, 2002). According to the Government Finance Statistics Manual (2001), gross debt consists of all liabilities that involve principal and payment by the debtor to the creditor at a date. Currency and deposits, debt securities, insurance, loan, pensions and standardized guarantee schemes and other accounts payable were included debt liabilities in the form of SDRs. Therefore, the liabilities in the GFSM 2001 system are debt. Debt can be valued at the current market, face values and nominal. The data used in this research will be the percentage of Gross Domestic Product from the year 1970 to 2018 in developing and developed countries from the International Monetary Fund.

3.2.2 Corruption

Corruption can be defined as a global phenomenon (Iyanda, 2012) and the impact of corruption on economic performance always interests the government and policymakers (Athanasouli et al., 2012). Besides that,

corruption also can define as a personal gain by the government official (Shleifer & Vishmy, 1993). The expected sign for corruption and public debt was positive. Based on the study of Jalles (2011), an increase in corruption will cause public debt to increase. The data used in this research will be the Corruption Perception Index (CPI) from the year 1970 to 2018 in developed and developing countries from the International Counter Risk Guide (ICRG).

3.2.3 Government Spending

Government spending was the expenses of country government use for country maintenance for the good of economy and society and for assistance to external bodies and other countries (Anyanwu, 1993). Based on the study of Anyafo (1996), government spending also considers as actual payment or the creation of an obligation to make future payment for the services received. The expected sign for government spending and public debt was positive. Based on the study of Joydeb & Ritwik (2017), the research had pointed out the total expenditure of the country which was financed by government borrowing. Lastly, the data used in this research will be the GDP from the year 1970 to 2018 in developed and developing countries from World Development Indicators (WDI).

3.2.4 Inflation

Inflation was defined as irresistible so that every country needs fundamentally to study. In their major study, Cheng & Tan (2002) inflationary effect was the major macroeconomic variables (excess fiscal

deficit and money supply) that causes by inflation and further investigate need to done by the domestic economy. The expected sign for inflation and public debt was positive. Based on the research of Phulpoto et al. (2016), the researchers concluded that when an increase in inflation will increase in public debt. Moreover, the data used in this research will be the Consumer Price Index from the year 1970 to 2018 in developed and developing countries from World Development Indicators (WDI).

3.2.5 Economic Growth

Economic growth was defined as an increase in the total output (goods or services) of an economy. It also can be defined as an increase in the capacity of an economy to produce goods and services, compared from one period of time to another (Raisova & Durcova, 2014). Based on Matiti (2013) economic growth was measured the growth in term of monetary and look there were no other aspects of development. The expected sign for economic growth and public debt was positive. Based on the research of Laine (2011) found that was the positive relationship between economic growth and public debt in the United States form the year 1959 to 2010. Lastly, the data used in this research will be the Gross Domestic Product (GDP) per capita from the year 1970 to 2018 in developed and developing countries from World Development Indicators (WDI).

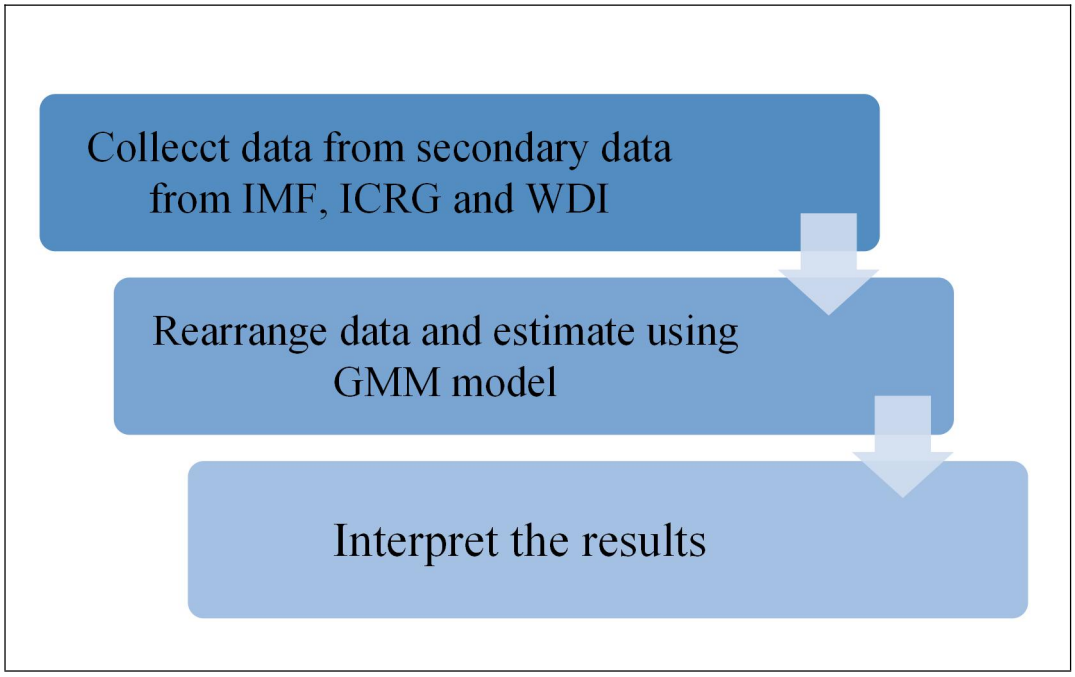
3.3 Model

$$\ln PD_{it} = \widehat{\beta}_0 + \widehat{\beta}_1 \ln PD_{it-1} + \widehat{\beta}_2 \ln CPI_{it} + \widehat{\beta}_3 \ln GS_{it} + \widehat{\beta}_4 \ln INF_{it} + \widehat{\beta}_5 \ln GDP_{it} + \varepsilon_{it}$$

where PD represents public debt, CPI represents corruption, GS represents government spending, INF represents inflation and GDP represents economic growth, index i = 1,…,N refers to countries, index t = 1,…,T refers to period of time, ε_{it} is error term and In represents nature logistic.

3.4 Data Processing

Figure 3.1: The Data processing



The data processing for this research was collecting the data from secondary data which accessed the data of developed and developing countries from the International Monetary Fund (IMF), International Counter Risk Guide (ICRG) and World Development Indicators (WDI). Next process will rearrange all the data

and run using Generalized Method of Moments (GMM) model. Lastly, those results will be fully interpreted through chapter 4.

3.5 Generalized Method of Moments (GMM)

Generalized Method of Moments (GMM) was a dynamic panel estimator used for estimating parameters in statistical models. Nowadays, GMM has become a very useful heuristic and popular tool amid empirical researchers (Baum, Schaffer & Stillman, 2003). According to the study of Roodman (2006), GMM was the general estimators intended for circumstances with small number of years and large number of observations panels, a single left hand side variable with dynamic, a linearity functional relationship, that are not biting exogenous independent variables, which means correlated current and past acknowledge of the mistake, independent effect that is fixed, autocorrelation and heteroskedasticity within individuals. According to Zsohar (2010), the GMM was a statistical model that produces an estimate of unknown parameters by combining the observed economic data with information from population time conditions in the economic models.

Zsohar (2010) stated, "the population's conditions assumed a critical role in the discussion, so it was worth returning back to the primitives to comprehend the mechanics of GMM. It was easy to compute the raw uncentered moments and they disclose important aspects of a distribution." When there have some data on the population, the inquiry has remains how to utilize the example to evaluate the parameters of interest. On the whole, inside the population have a counterpart for each sample statistics. The characteristic following step in the analysis was to use an analogy to utilize using the sample moments bases of population parameter's estimators. (Zsohar, 2010). Therefore, the sample analogue needs to replace it and be used to solve the equation for the unknown parameter.

Method of moment estimator:

Population moment condition: $\mathrm{E}[x_i] = \mu$

$\{x_i : i = 1,2,\ldots,n\}$

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

3.5.1 GMM estimator

$$\widehat{\boldsymbol{\beta}_{\boldsymbol{A}}} = (\boldsymbol{X'ZAZ'X})^{-1}\mathbf{X'ZAZ'Y}$$

The GMM estimator was implied by A. A will result in the different estimator of β. Let A be the scalar that was inefficient, intuitive and instructive. *X* was representing regressor matrix and *Z* was instrument matrix. The cross-examine in estimate the instrument of the model are hypothetically symmetrical to the error term *(E* $[z\varepsilon] = 0)$, and the corresponding vector of empirical moments $E_N[z\varepsilon] = \frac{1}{N} Z'\widehat{E}$ are trying forced, because the instruments outnumber parameters are the zero creates a systems equations more than variables. Besides, an estimator was predictable, implying if exchanges in probability to β as sample size goes to infinitude (Roodman, 2006).

3.5.2 Efficiency

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

The EGMM stands for efficient Generalized Method of Moments (EGMM). The models above were the variance matrix of the moments that the weight by the inverse for efficiency in general. EGMM would signal by high variance or covariance among the moments in the inefficiency theoretically. This will make A scaler become inexpert unless the moments $\frac{1}{N}Z'_{i}E$ have equal variance and uncorrelated, which are when it has itself scalar $Var[Z^{'}E]$ (Roodman, 2006). Therefore, their A must in effect weight moment of variances and covariances to inverse proportion. However, unless Ω was known that EGMM was not feasible.

3.5.3 Feasibility

$$\boldsymbol{\widehat{\beta_{FEGMM}} = (X'Z(Z'\widehat{\Omega}Z)^{-1}Z'X)^{-1}\ X'Z(Z'\widehat{\Omega}Z)^{-1}Z'Y}$$

The FEGMM stands for feasible efficient GMM estimator (FEGMM). According to Roodman (2006), the researcher can make the standard errors and use a kernel-based estimator, with the cluster and robust options that requested from Stata estimation commands which were “sandwich” one ordinarily. Moreover, Ω can establish a formula that itself with asymptotically convergent to a matrix $\widehat{\Omega}$, and with the characteristic that $\frac{1}{N}Z'\Omega Z$ was under the given assumptions to consistent estimator convergent to $\frac{1}{N}Z'\widehat{\Omega}Z$.

$$\widehat{\boldsymbol{\beta_1}} = (\boldsymbol{X'Z(Z'HZ)^{-1}Z'X})^{-1}\ \boldsymbol{X'Z(Z'HZ)^{-1}Z'Y}$$

$$\widehat{\boldsymbol{\beta_2}} = \widehat{\boldsymbol{\beta_{FEGMM}}} = (\boldsymbol{X'Z(Z'\widehat{\Omega}_{\widehat{\beta_1}}Z)^{-1}Z'X})^{-1}\ \boldsymbol{X'Z(Z'\widehat{\Omega}_{\widehat{\beta_1}}Z)^{-1}Z'Y}$$

In addition, A=$(Z'HZ)^{-1}$ and Ω was estimate by H based on a very few random assumptions about the errors, example of the error was homoskedasticity. One-step GMM was $\widehat{\beta_1}$, one-step GMM means it get the residuals from the estimation, and they use sandwich proxy to establish the Ω which was $\widehat{\Omega}_{\widehat{\beta_1}}$. The research rerun the GMM estimation with the setting A= $(Z'\widehat{\Omega}_{\widehat{\beta_1}}Z)^{-1}$. There are asymptotically efficient and robust to any examples that have cross-correlation and heteroskedasticity the sandwich covariance estimator model in this two-step estimator (Roodman, 2006). The researchers have regularly reported one-step result which was due to the downward bias, and it has computed standard error in second-step result. So, according to Windmeijer (2005), two-step GMM has extremely decrease this problem.

3.5.4 One-step and Two-step GMM

According to Roodman (2006), the meaning of one-step and two-step GMM was the research rerun the one-step GMM estimate parameter to become second step of estimate the parameter. The GMM estimator as below:

$$\widehat{\boldsymbol{\beta_A}} = \boldsymbol{(X'ZAZ'X)^{-1}X'ZAZ'Y}$$

$$\widehat{\boldsymbol{\beta_1}} = (\boldsymbol{X'Z(Z'HZ)^{-1}Z'X})^{-1}\ \boldsymbol{X'Z(Z'HZ)^{-1}Z'Y}$$

In the first step of the GMM, the weighting matrix is $A = (Z'HZ)^{-1}$ and Ω was estimate by H based on a very few random assumptions about the errors, for example of the error is homoskedasticity. One-step GMM was $\widehat{\beta_1}$, one-step GMM means it get the residuals from the estimation, and they use sandwich proxy to establish the Ω which was $\widehat{\Omega}_{\widehat{\beta_1}}$ (Roodman, 2006). The result of $\widehat{\beta_1}$ was consistent only.

$$\widehat{\boldsymbol{\beta_2}} = \boldsymbol{\beta}_{\widehat{\boldsymbol{FEGMM}}} = (\boldsymbol{X'Z}(\boldsymbol{Z'}\widehat{\Omega}_{\widehat{\boldsymbol{\beta_1}}}\boldsymbol{Z})^{-1}\boldsymbol{Z'X})^{-1}\ \boldsymbol{X'Z}(\boldsymbol{Z'}\widehat{\Omega}_{\widehat{\boldsymbol{\beta_1}}}\boldsymbol{Z})^{-1}\boldsymbol{Z'Y}$$

Therefore, the research rerun the GMM estimation, it means the second step GMM appears. Thus, the research minimized the effect and use the setting A= $(Z'\widehat{\Omega}_{\widehat{\beta_1}}Z)^{-1}$. There are asymptotically efficient and robust to any examples that have cross-correlation and heteroskedasticity the sandwich covariance estimator model in this two-step estimator (Roodman, 2006). The result of $\widehat{\beta_2}\ is$ consistent and asymptotically efficient.

The research had regularly reported one-step result which was due to the downward bias, and it has computed the standard error in second-step result. According to Windmeijer (2005), two-step GMM has extremely decreased this problem and the research will use the xtabond2 in the test. This was because xtabond2 comply with these estimators, which means it has some great benefit over Stata's establish into xtabond. Thus, the research will use the xtabond2 in the test.

3.5.5 Estimating Standard Errors

True variance:

$$\mathbf{Var}\ [\widehat{\boldsymbol{\beta}_A}|\mathbf{Z}] = (\boldsymbol{X'ZAZ'X})^{-1}\mathbf{X'ZAZ'}\Omega\boldsymbol{ZAZ'X}(\boldsymbol{X'ZAZ'X})^{-1}$$

In this estimation Let A = $\left(Z^{'}HZ\right)^{-1}$ as a weighting matrix for the instruments. This will not cause the inconsistent in the parameter estimates when the incorrect assumptions about the variance of the errors. The substitute H for Ω can make the estimate of their variance inconsistent. There will not robust the standard error to serial correlation or heteroskedasticity in the errors. The problem can solve by replacing Ω with a sandwich-type proxy. This will make the one step standard error be the robust estimators (Roodman, 2006).

One-step standard errors:

$$\widehat{\boldsymbol{Var}}\ [\widehat{\boldsymbol{\beta}_1}] =$$
$$(\boldsymbol{X}^{'}\boldsymbol{Z}\left(\boldsymbol{Z}^{'}\boldsymbol{HZ}\right)^{-1}\boldsymbol{Z'X})^{-1}\mathbf{X'Z}\left(\boldsymbol{Z}^{'}\boldsymbol{HZ}\right)^{-1}\mathbf{Z}\widehat{\Omega_{\boldsymbol{\beta 1}}}\boldsymbol{Z}\left(\boldsymbol{Z}^{'}\boldsymbol{HZ}\right)^{-1}\boldsymbol{Z'X}(\boldsymbol{X'Z}\left(\boldsymbol{Z}^{'}\boldsymbol{HZ}\right)^{-1}\boldsymbol{Z'X})^{-1}$$

Two-step standard error:

$$\widehat{\boldsymbol{Var}}\ [\widehat{\boldsymbol{\beta}_2}] = (\boldsymbol{X}^{'}\boldsymbol{Z}\left(\boldsymbol{Z}^{'}\widehat{\Omega_{\boldsymbol{\beta 1}}}\boldsymbol{Z}\right)^{-1}\boldsymbol{Z'X})^{-1}$$

In this formula, the number of instruments was big this will let the standard errors are downward biased (Arellano & Bond, 1991). This will make trouble when the small samples reweighting empirical moments, which indirect with the overweighting and underweighting observations that fit the model (Roodman, 2006).

3.5.6 The Difference and System GMM estimators

In the data generation process, the difference and system GMM estimator uses more sophisticated techniques to isolate useful information. The estimator also creates fewer assumptions throughout the historical flow of econometrics (Roodman, 2006).

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

$$\boldsymbol{\varepsilon_{it}} = \boldsymbol{\mu_i} + \nu_{it}$$

$$\boldsymbol{E}[_{\mu_i}] = \boldsymbol{E}[_{\nu_{it}}] = \boldsymbol{E}[_{\mu_i \nu_{it}}] = \mathbf{0}$$

where y represents public debt, x represents corruption, government spending, inflation and economic growth, ε represents disturbance term; μ represents fixed effect and ν represents idiosyncratic shocks.

Rewrite the model as:

$$\Delta \boldsymbol{y_{it}} = (\boldsymbol{\alpha} - \mathbf{1})\boldsymbol{y_{i,t-1}} + \boldsymbol{X'_{it}\beta} + \boldsymbol{\varepsilon_{it}}$$

Data-Generating Process Assumption:

i. Some independent variable may be endogenous
ii. No correlated among the idiosyncratic error
iii. Individual-specific patterns of heteroscedasticity and serial correlation among the idiosyncratic error
iv. A dynamic process, the current predictor variable will affect by the past.
v. In the dynamic, the fixed individual effect may be randomly distributed. The predictor variable will change consistently faster than other observation units.
vi. Number of observation (N) must be larger than the number of time period (T)
vii. Some independent variable will not strictly exogenous but may be predetermined.

viii. Based on the lag instrumented variables, the data set was the only available instruments.

3.5.7 Purging Fixed Effect

The endogeneity can solve by the Difference and System GMM. The first method was using Difference GMM, remove the fixed effect by converting the data. The second method was using System GMM, instrument $y_{i,\ t-1}$ and other endogenous variables which uncorrelated with the fixed effect (Roodman, 2006).

First-Difference Transform (Difference GMM)

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

The lagged dependent variable was still endogenous even though the fixed effects are removed since the $y_{i,\ t-1}$ correlates with the $v_{i,\ t-1}$.

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

⬇ **Correlates**

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

The weakness of the First-Difference Transform has magnified the gap in the unbalance panels. For example, the Δy_{it} and $\Delta y_{i,\ t-1}$ will miss in the transformed data if some of the y_{it} was missing.

The weakness of the First-Difference Transform causes the second transform "Forward Orthogonal Deviations" appear (Arellaono & Bover,

1995). The Forward Orthogonal Deviations can determinable the observation regardless of how may the gaps except for the last number so it can minimize the data loss.

3.5.8 Instrumenting with variables orthogonal to the fixed effects

The Difference GMM will perform not well if y was close to a random walk. This was because the Difference GMM used the previous result to transmit the little information about future changes. The System GMM was different from the Difference GMM. The Difference GMM was to expunge the fixed while the System GMM was transformed the instrument to make them exogenous to the fixed effect. The System GMM assume that fixed effect was uncorrelated with any change instrument in variable w (Roodman, 2006).

$$\mathbf{E}[\Delta \boldsymbol{w_{it}} \boldsymbol{\mu_i}] = \mathbf{0} \textbf{ for all i and t}$$

w = instrument variable; μ = fixed effect

If E[$\Delta w_{it}\mu_i$] was time-invariant, then $\Delta w_{i,\ t-1}$ was a valid instrument for the variables.

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

3.5.9 Sargan / Hansen Test

The Sargan / Hansen Test was used for testing over-identifying restrictions in the model. In other words, the test was used to make sure that the model was no endogenous. The detection will invalid if the estimation was exactly identified because the estimator will make $Z'\widehat{E} = 0$ be correct by choosing $\widehat{\beta}$ when $E[_{z\varepsilon}] \neq 0$. The test statistic for the joint validity of moment conditions will fall out of the GMM framework natural when the system was over identified. The null of joint validity was $\frac{1}{N} Z'\widehat{E}$ randomly distributed around zero.

H_0 : The over-idenfication restriction are valid

H_1: The over-idenfication restriction are invalid

3.5.10 Arellano-Bond Test

Arellano-Bond Test was used to detect the correlation between disturbance term. The full disturbance was the combination of fixed effect and idiosyncratic shock. The estimators were developed to remove the trouble. The $y_{i,t-2}$ was endogenous to the $v_{i,t-1}$ in the error term in difference if the ε_{it} were serially correlated with one of themselves. AR (1) was to test

the idiosyncratic residuals in first difference are not serially correlated. AR (2) was to reject the H_0 of second-order serial correlation of the first-difference residual.

H_0 : The linear regression error term are uncorrelated

H_1: The linear regression error term are correlated

3.6 Conclusion

The research design, source of data, model, and data processing had been discussed in this chapter. The Generalized Method of Moments (GMM) was used to analyse the data and result. The following next chapter was discussed the data analysis.

CHAPTER 4: RESULTS

4.0 Introduction

This chapter applies GMM model and generates the empirical result of the impact of corruption on public debt. By full filling the assumption of the GMM model, the hypothesis testing and diagnostics checking will be done, which included one-step and two-step GMM and the difference and system GMM estimators. Moreover, those results will be fully interpreted in this chapter.

4.1 Descriptive Analysis

Table 4.1: Shown descriptive analysis for Developed Countries

Variables	Obs	Mean	Std. Dev.	Min	Max
lnPD	1032	3.836652	0.912267	-2.302585	5.473111
lnCPI	1152	-4.446639	1.117265	-6.00000	-2.00000
lnGS	1493	2.871956	0.2893475	1.646794	3.73667
lnINF	1464	2.297479	0.6595821	-0.6502854	7.159636
lnGDP	1471	0.229554	0.031686	-0.1573534	0.214633

Notes: PD represented Public Debt, CPI represented Corruption Perception Index, GS represented Government Spending, INF represented Inflation, GDP represented Economic Growth, and ln represented nature logistics.

Table 4.2: Shown descriptive analysis for Developing Countries

Variables	Obs	Mean	Std. Dev.	Min	Max
lnPD	1975	3.743693	0.7673757	-2.302585	6.243973
lnCPI	2936	-2.40454	0.9389388	-6.428571	0
lnGS	3439	2.583295	0.4349273	-0.0929549	4.333652
lnINF	3262	3.352655	0.6308001	-0.124798	9.373024
lnGDP	3699	0.0155855	0.0598672	-1.049716	0.4314175

Notes: PD represented Public Debt, CPI represented Corruption Perception Index, GS represented Government Spending, INF represented Inflation, GDP represented Economic Growth, and ln represented nature logistics and t-1 represented current year minus 1.

Table 4.1 & Table 4.2 represented the result of estimations using dynamic panel GMM all the result executed using STATA software. Based on the table, there are two types of GMM estimation, it was Different GMM and System GMM. Both Different GMM and System GMM layout for few situation when independent

variable they were correlated with past and possible current actuality of the mistaken, small T large N, a linear functional relationship, one left-hand-side variable that was dynamic, fixed individual effect and heteroskedasticity and autocorrelation within individuals but not across them (Roodman, 2009). Since this research was fulfilled several situations of GMM Model so GMM model was applied to generate the result. However, the result will interpret based on System GMM because if the series was overly tenacious, the Different GMM model will turn to bias. On the whole, Arellano & Bover (1995) and Blundell & Bond (1998) has developed System GMM to solve weakness in Different GMM.

As this research used the corruption perception index (CPI) as corruption main data resources. The CPI was used to measure the control of corruption and had been used many times in other past studies (Henri, 2018; Kim et al., 2017 & Benfratello et al., 2017). It was an index number from a range of 0 (most corrupt) to 6 (least corrupt). To indicate the level of corruption instead of control of corruption, this research used the original corruption perceptions index by multiple negative 1 to analyse the result.

According to table 4.1, the result has shown that public debt, government spending, and economic growth in developed countries have higher mean value compared with developing countries which were 3.8367, 2.8720, 0.2296 compared with 3.7437, 2.5833 and 0.01559. However, the mean for corruption perception index and inflation in developing countries was higher compared with developed countries it was -2.4045 and 3.3527 compared with -4.4466 and 2.2975. Besides that, Standard deviation used mostly to measure variability (Barde & Barde, 2012). As the higher the value of standard deviation, the more variability. According to table 4.1 and 4.2, the standard deviation of the variables for government spending and GDP in developed countries lower than developing countries as revealed by 0.2893 and 0.03169 compared with 0.4349 and 0.05987. However, the standard deviation of public debt, corruption perception index and

inflation in developed countries were higher than developing countries which were 0.9123, 1.1173 and 0.6596 compared with 0.7674, 0.9389 and 0.6308.

4.2 Correlation Analysis

Table 4.3: Analysis correlation between dependent variable and independent variable follow by other control variable in Developed Countries

	$\ln PD_{it-1}$	lnCPI	lnGS	lnINF	lnGDP
lnPD	1.0000				
lnCPI	0.0897	1.0000			
lnGS	0.3773	-0.1912	1.0000		
lnINF	-0.1214	0.1500	-0.0570	1.0000	
lnGDP	-0.1103	-0.0417	-0.0664	0.0540	1.0000

Notes: PD represented Public Debt, CPI represented Corruption Perception Index, GS represented Government Spending, INF represented Inflation, GDP represented Economic Growth, and ln represented nature logistics.

Table 4.3 shown the correlation matrix between public debt and corruption followed by the other control variable. The result shown that corruption has a weak positive correlation with public debt in developed countries which show the result 0.0897.

Table 4.4: Analysis correlation between dependent variable and independent variable follow by other control variable in Developing Countries

	$lnPD_{it-1}$	lnCPI	lnGS	lnINF	lnGDP
lnPD	1.0000				
lnCPI	-0.0723	1.0000			
lnGS	-0.1231	-0.1015	1.0000		
lnINF	0.1246	-0.1239	-0.0462	1.0000	
lnGDP	-0.1007	0.1039	-0.0283	0.0021	1.0000

Notes: PD represented Public Debt, CPI represented Corruption Perception Index, GS represented Government Spending, INF represented Inflation, GDP represented Economic Growth, and ln represented nature logistics.

Table 4.4 figured out the correlation matrix between the public debt and the main independent variable, corruption followed by other control variables in developing countries. Based on the result, public debt appears a weak negative correlation with corruption which the value of the correlation coefficient was only -0.0723.

4.3 Result from Dynamic Panel GMM Estimations

Table 4.5: Result of dynamic panel GMM estimation in Developed Countries

	One-Step Difference	Two-Step Difference	Two-Step Robust	One-Step System	Two-Step	Two-Step

	GMM	GMM	Difference GMM	GMM	System GMM	Robust System GMM
	(1)	(2)	(3)	(4)	(5)	(6)
$lnPD_{it-1}$	0.555***	0.886***	0.113	0.987***	0.961***	0.961***
	(2.44)	(17.84)	(0.20)	(47.82)	(57.44)	(39.18)
lnCPI	0.0947*	0.0127	0.160	0.0319***	0.0343***	0.0343*
	(1.67)	(0.68)	(1.55)	(2.85)	(2.64)	(1.96)
lnGS	0.423	0.416***	0.349	0.338*	0.775***	0.775**
	(1.00)	(2.60)	(0.37)	(1.71)	(4.04)	(2.35)
lnINF	0.150*	0.190***	-0.0188	0.132**	0.214***	0.214**
	(1.85)	(5.74)	(-0.07)	(2.33)	(4.20)	(2.52)
lnGDP	0.632	0.476***	0.562	0.750**	0.693***	0.693*
	(1.09)	(3.15)	(1.10)	(2.48)	(2.66)	(1.81)
Cons				-1.043*	-2.344***	-2.344**
				(-1.85)	(-4.39)	(-2.37)
Obs	535	535	535	568	568	568
AR1	-1.515	-1.851*	0.308	-8.792***	-1.871*	-1.870*
	[0.130]	[0.064]	[0.758]	[0.000]	[0.061]	[0.061]
AR2	1.929*	1.104	1.958**	1.675*	1.309	1.304
	[0.054]	[0.270]	[0.050]	[0.094]	[0.192]	[0.192]
Sargan	14.85**	21.59	14.85**	15.28**	15.28**	15.28**
	[0.011]	[0.119]	[0.011]	[0.018]	[0.018]	[0.018]
Hansen		19.90	5.469		6.876	6.876
		[0.176]	[0.361]		[0.332]	[0.332]

Notes: t statistics shown in ( ), Probability shown in [ ], *, **, *** are represent the significant level at 10%. 5%, and 1% respectively.

Table 4.5 and Table 4.6 showed two types of GMM estimations which included Difference GMM and System GMM model. However, this research selected

column 5 and column 11 as the final model which was Two-Step System GMM model to interpret the result. As mentioned before, the Difference GMM model would turn biased, and biased will be removed in System GMM model. This was the reason of two-step System GMM model more accurate compared with two-step Difference GMM model. The CPI was used to measure the control of corruption and had been used many times in other past studies. It was an index number from a range of 0 (most corrupt) to 6 (least corrupt). Besides that, this research used debt to GDP ratio as the public debt's main source and apply it into t-1 in order to obtain accurate data. This is because the effect of period t-1 would affect the period in t.

This research used public debt as dependent variable and corruption was the main independent variable followed by other control variables namely government spending, inflation and GDP on this research. Furthermore, the relationship between the variables will be shown in Table 4.5 and Table 4.6. Public debt was measured by % of GDP from 0% to 270.6%, the higher the percentage indicates the higher the public debt in the country. Based on Table 4.5 carried out that the impact of corruption on public debt had a positive coefficient and statistically significant at the significant level of 10% in 33 developed countries. The estimated of the coefficient was 0.0343% under column (5). Hence, on average, 1% rise of corruption will bring to a rise of the public debt of 0.0343%, ceteris paribus. This result supported by the past studies of Grechyana (2012) and Liu et al. (2017) that corruption was a significant determinant of public debt. Truly, Tanzi & Davoodi (2002) pointed out corruption will raise public expenditure and this will lead to a rise in public debt due to the public expenditure will cause public debt when the public revenue can't overcome it.

Besides that, among the other control variables, namely government spending, inflation and GDP also figured out an impact significantly on the public debt. For instance, result in table 4.5 shown that government spending, inflation, and GDP significantly and positively affect public debt, stated that 1% in these variables

may raise public debt by 0.775%, 0.214%, and 0.693% respectively. These results had been proved by some researchers in part studies. According to Yusuf & Said (2018) pinpointed that by using government spending as development expenditure to develop the countries then the country may benefit because development expenditure like infrastructure may have a multiplier effect on boost economic growth but if not spend in an appropriate way it restricted economic growth at the same time public debt increase accordingly. Moreover, the findings of the impact of inflation on public debt corroborate the research of Barro (2007) and Aizenman & Marion (2011). According to the research of Wijnbergen & Budina (2007), the critical point that disclose by this studies is high price of postponing fiscal adjustment in such an environment of raised interest rate and small economic development, taking too much time in making fiscal adjustment, that will result an enhancement in inflation rates that lead to expeditious public debt burden. Furthermore, the higher GDP leads to a higher public debt (Laine, 2011). The research found that the relationship between GDP and public debt had a positive significant relationship. This was because the economic growth increase will cause the interest rate increase and lead the public debt increase (Greiner, 2006).

Table 4.6: Result of dynamic panel GMM estimation in Developing Countries

	One Step Difference GMM	Two-Step Difference GMM	Two-Step Robust Difference GMM	One-Step System GMM	Two-Step System GMM	Two-Step Robust System GMM
	(7)	(8)	(9)	(10)	(11)	(12)
$\ln PD_{it-1}$	0.820***	0.917***	0.917***	0.988***	1.005***	1.005***
	(12.36)	(14.24)	(9.13)	(19.28)	(23.90)	(14.20)
lnCPI	0.108***	0.102***	0.102***	0.0411*	0.0407***	0.0407*
	(3.84)	(4.56)	(3.46)	(1.92)	(2.66)	(1.89)
lnGS	0.401*	0.486***	0.486**	0.512***	0.444***	0.444**

	(1.69)	(2.79)	(2.12)	(3.27)	(3.18)	(2.41)
lnINF	0.143***	0.121***	0.121***	0.158***	0.101***	0.101*
	(2.65)	(3.32)	(3.01)	(4.32)	(3.32)	(1.67)
lnGDP	0.580***	0.532***	0.532***	0.488**	0.550***	0.550***
	(3.09)	(4.45)	(3.01)	(2.48)	(6.58)	(3.41)
Cons				-1.702***	-1.387***	-1.387**
				(-3.02)	(-3.14)	(-2.20)
Obs	1290	1290	1290	1373	1373	1373
AR1	-5.614***	-3.239***	-3.033***	-7.170***	-3.175***	-3.091***
	[0.000]	[0.001]	[0.002]	[0.000]	[0.002]	[0.002]
AR2	-4.193***	-1.272	-1.270	-4.220***	-1.261	-1.260
	[0.000]	[0.203]	[0.204]	[0.000]	[0.207]	[0.208]
Sargan	26.87	26.87	26.87	55.92***	55.92***	55.92***
	[0.139]	[0.139]	[0.139]	[0.001]	[0.001]	[0.001]
Hansen		15.60	15.60		20.72	20.72
		[0.741]	[0.741]		[0.756]	[0.756]

Notes: t statistics shown in ( ), Probability shown in [ ], *, **, *** are represent the significant level at 10%. 5%, and 1% respectively.

Table 4.5 and Table 4.6 summarizes the relationship between public debt and those variables in 33 developed Countries and 82 Developing Countries. As shown in the table, the result indicated that the relationship of corruption and public debt was similar to Table 4.6 whereby an increase of 1% in corruption, on average, public debt will increase by 0.0407%, ceteris paribus. In other words, the effect of corruption on public debt was positive significant at the 10% significance level in column (11). The corruption will happen if the officer steals the loaned fund and other government income. This may limit the ability of government to meet the debt obligations and caused the public debt happened (Ng, 2006).

According to table 4.6, the relationship between the other control variables which included government spending, inflation, GPD and public debt in 82 developing countries had been shown as positively significant at 10% significance level. As

the result, the estimate of the coefficient between government spending and public debt was 0.444 % whereas a rise of 1% in government spending, on average, public debt led to rise by 0.444%. This was because economic growth of the country it can be increased proficient and achieved to the macroeconomic growth since the government in less developed countries may try to use public debt as an imperative tool to finance the government spending so the public debt increased accordingly (Matiti, 2013). Furthermore, Joydeb & Ritwik (2017) argues that if government spending finance by public borrowing and it fails to generate sufficient income, public debt will increase due to difficult to repay the loan and the interest on loan it bring a snowball effect. Besides that, based on the result in table 4.6, the relationship between inflation and public debt had a coefficient of 0.101%. For example, an increase of 1% of inflation, on average, public debt would increase by 0.101%, ceteris paribus. Based on Bildirici & Ersin (2007), the increases in inflation will lead to higher price level and further increase in nominal interest rates and decrease seigniorage. As a result, it is inevitable that rising public debt will result in an economic through the same channels. Furthermore, the final result of the impact of GDP on public debt was matching the expected sign which the rise of 1% GDP, on average, public debt will rise by 0.550% under Model (11). This is because the government needs to borrow the money from the international financial and capital market to fill the gap between domestic investment and saving (Saungweme & Odhiambo, 2019).

4.4 Diagnostic test

Model AR(1), AR(2) and Hansen test was applied for a diagnostic test. According to table 4.5 and 4.6 the p-value for AR(1) shown it was less than 0.10 respectively. However, AR(1) presented the first-order autoregressive. From the result, it is clearly known that first-order autoregressive was valid and happened in this research due to the effect of period t-1 would affect the period in t. Besides that, AR(2) stand for Second-order autoregressive. However, AR(2) was most important compared with AR(1) in GMM because AR(2) has taken emphasis on the error on AR(1). Based on table 4.5 and 4.6 the p-value for both AR(2) was

greater than 0.10. Hence, there was no autocorrelation available in the model. Furthermore, Hansen test was applied to justify the independent variable either it was valid or invalid for the model. The result for Hansen test from both table the p-value was greater than 0.10 which shown the result 0.332 (column 5) in table 4.5 and 0.756 (column 11) in table 4.6. This result indicated that the independent variable in this research was valid in the model.

4.5 Conclusion

In this chapter, STATA software was applied to generate the result for this research. The result of Dynamic Panel Difference GMM has been developed to explain the relationship and the level of significance between public debt and corruption followed by other control variables. From the result table 4.5 and 4.6, it clearly states that corruption has a significant and positive effect on public debt in both developed and developing the country. This similar result shown by the research of Kim et al (2018), they mention that public debt and corruption was significant and positively correlated. Hence, further discussion and conclusion will be carried out on following chapter.

CHAPTER 5: CONCLUSION

5.0 Introduction

This research was to investigate the effects of corruption on public debt in developed and developing countries. Besides corruption, this research had involved three control variables which are government spending, inflation, and economic growth among the developed and developing countries. Furthermore,

Generalized Method of Moments (GMM) had been used to examine the relationship between corruption and public debt. On the whole, this research will discuss the summary of the study, implication of study, limitation of study and recommendation for future research.

5.1 Summary of Study

Table 5.1: Summary of result for independent variable

Independent variable	**Impact on public debt**
Corruption	Positive significant

Table 5.1: Summary of result for control variables

Control variable	**Impact on public debt**
Government spending	Positive significant
Inflation	Positive significant
Economic growth	Positive significant

Based on the result in Chapter 4, the research will use a two-step system GMM's final result shows in this research. This was because the result of the one-step system GMM will downward bias. Two-step GMM has extremely decreased this problem, so the research use two-step system GMM to interpret and summary in this research. In addition, this research obtained data from World Economic Outlook (WEO), International Counter Risk Guide (ICRG) and World Development Indicators (WDI). There are involve 33 developed countries and 82 developing countries in our study. It clearly shown that corruption and public debt has a significant and positive effect on both developed and developing countries. In this research, the research intended to find out the relationship between corruption and public debt in developed countries and developing countries.

Besides of corruption as the exogenous variable, this research had also involved three control variables which are government spending, inflation and economic growth among the developed countries and developing countries. In Chapter 4, corruption as our exogenous variable has positive relationship towards public debt in developed countries and developing countries. This result supported by the past studies of Grechyana (2012) and Liu et al. (2017) that corruption was a significant determinant of public debt. Truly, Tanzi & Davoodi (2002) pointed out corruption will raise public expenditure and this will lead to a rise in public debt due to the public expenditure will cause public debt when the public revenue can't overcome it.

On the other hand, government spending, inflation and economic growth as control variable also have a positive relationship on the developed countries and developing countries. Government spending and public debt has positive significant which was because the research that had done by Yusuf & Said (2018), the researcher had pinpointed that by using government spending as development expenditure to develop the countries then the country may benefit because development expenditure like infrastructure may have a multiplier effect on boost economic growth but if not spend in an appropriate way it restricted economic growth at the same time public debt increase accordingly. Moreover, the findings of the impact of inflation on public debt corroborate the research of Barro (2007) and Aizenman & Marion (2011). As a result, the increasing debt to GDP ratios escort these countries to appropriate at higher interest rates and with lower maturity rates. Furthermore, the higher GDP leads to a higher public debt (Laine, 2011). The research found that the relationship between GDP and public debt had a positive significant relationship. This was because the economic growth increase will cause the interest rate increase and lead the public debt increase (Greiner, 2006). On the whole, through this research, the research can clearly show that was a positive relationship between corruption, government spending, inflation and economic growth on public debt.

5.2 Implication of Study

This research gives some new idea and the foresight on decision making for the future researcher and policymakers. This research was to determine the factor that affects the public debt in the development and developing the country.

In this research paper show that was a positive relationship between corruption and public debt in the developed and developing country. Based on the research Liu et al. (2017) found that the level of public debt becomes higher if the level of the corruption increases and Kaufmann (2010) pinpointed out that the measure of corruption was a positive correlation between government debt levels. First, the government can external monitoring to decrease corruption. The government can form an external auditor and anti-corruption agency for monitoring. For example, the government can launch the anti-corruption program to decrease corruption. The research done by Silva (2010) shows that Brazil government launch the anti-corruption program "naming and shaming" to overcome corruption in the country. Furthermore, transparency also was a way to decrease corruption happen. There are many evidenced shows that transparency was the beneficial effects to solve corruption (Reinikka & Svennson, 2004). The government needs to transparency the information of the project for the citizen. The government needs to open tendering all the project and open the information of the project to prevent corruption happen. For example, the Ugandan government published the funding process of education in the local newspaper to allow the citizen to monitor the government. This process will help to decrease corruption in the country.

Moreover, the government can implement the law to control corruption. The government must implement the law without political favouritism. This action can prevent those who are trying to engage the corruption (Whitton, 2001). The government can establish the inspection bodies and good judicial system to

inspect the corruption. For example, Hong Kong has the inspection bodies named “Independent Commission Against Corruption (ICAC)" to investigate the people who corrupt.

Besides that, this research shows that inflation was positive related to the public debt. Aizenman & Marion (2011) said that an increase in inflation will cause public debt to increase and Goudswaard (1990) said that the relationship between inflation and the short to long term debt ratio was expected with sign positive. Therefore, the government needs to decrease or control inflation to decrease public debt. The government can reduce inflation by used fiscal policy (Ascari, Florio, & Gobbi, 2017). For example, the government can increase tax revenue by increasing the personal tax and good and service tax. This policy will help the government to decrease the public debt because the government can use the tax revenue to repay the debt.

In addition, this research shows that was the positive relation of government spending on public debt. The research conduct by Joydeb & Ritwik (2017) and Henri (2018) show that public debt will increase when the government spending increase. The government needs to overcome this problem because it will cause budget deficit. Government can reform or terminate the irrelevant programs to decrease the spending. For example, Malaysia government reform the program named as "Bantuan Rakyat 1 Malaysia" to "Bantuan Sara Hidup" decrease the government spending.

Lastly, there was a positive relation of economic growth on public debt in this research. Laine (2011) said that was the economic was positive related with the public debt and the result of the Moki (2012) show that was the positive relationship between the economic growth and public debt in Africa from year 1980 to 2010 with using the SPSS software. The economic growth will cause inflation to happen if an increase in the long term. The national bank can solve

this problem with used the monetary policy (Dimitrijevic & Lovre, 2012). For example, national bank increases the interest rate and decrease the money supply to control economic growth.

5.3 Limitation of Study

Through the research, there was a variety of issue and limitation that need to be hone in future research to get the best and ultimate research. Thus, along the result that has procure may not fully support the relationship between public debt and corruption. The limitation that faced during the research is as below.

First and foremost, this research was not able to collect the data from every developed and developing countries. According to the world's bank group, there are 35 of developed countries, but this research was able to accumulate 33 developed countries data. In addition, there are 88 of developing countries, and this research was able to accumulate 82 developing countries data. Through the limitation of the data, this research was able to accumulate 33 developed countries data and 82 developing countries data to represent for the whole world. Go through this research, some developed country does not have the data of inflation such as Germany. Moreover, some developing country such as Taiwan does not have the data on government spending, inflation and economic growth.

Last but not least, this research was not able to get more information for this investigation in the year of 1970 to year 2008. For instance, there was some information that difficult to be found on those years, such as the corruption on public debt, government spending on public debt, economic growth on public debt and inflation on public debt. Through the research that had found by this research, more of the information for this kind of investigation was easily found in the year

of 2009 to year 2018. This limitation had caused this research difficult to get more adequate and accurate information to obtain a more valid result.

5.4 Recommendation for Future Research

To overcome the limitations of the study, there was some recommendation suggested to the future researchers to avoid a similar problem, the recommendation will be beneficial to the future researchers to acquire better and accurate result.

Foremost, this research will suggest the future researcher try to collect more data for the developed and developing countries. In addition, this may let the future researchers to get more adequate and accurate information in the generalized method of moment model (GMM). Hence, future researchers should find out more data for the developed and developing countries in order to get a more justifiable result.

On the other hand, the future researchers had been recommended to find out more information that states in the previous year. It is the way to find out whether the developed or developing counties had more affected to the public debt in the previous year. Furthermore, it can also find out more perfect and exact information for the comparative reason.

5.5 Conclusion

This chapter had explained about the summary of study, implication of study, limitation of study and recommendation for this study. Through this research, the research can clearly show that was a positive relationship between corruption, government spending, inflation and economic growth on public debt. Furthermore, there was two limitation had found in this study. Lastly, this research had provided two recommendation to solve the limitation.

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APPENDIXES

Appendix 1: Literature Review Table

Authors (Years)	Country / Data	Method of estimation and model	Findings	Variable
Abbas & Christensen (2007)	93 low-income countries	• Generalized Method of Moments • Pooled OLS regressions • Granger-causality regressions	The finding found that was the positive relation between the economic growth and domestic public debt. This mean that when the domestic public debt increase will cause the economic growth increase.	• Domestic public debt and economic growth

Adam (2011)	OECD countries	• Rational Expectation model	The research had showed that the investigate the research on the decision of nominal interest rate will affect the real value and price level of the outstanding public debt. Thus, to the extent that the monetary policy can affect the real interest rate or the price level, it will affect the government budget.	• GDP • Monetary policy • Interest rate • Fiscal policy

Aizenman & Guidotti (1994)	34 OECD countries	• Real endowment economy	According to the research had showed that decreasing the domestic interest rate on public debt, the sum of integrate private holdings of the domestic public debt had gave the "effective" tax based of external interest income tax.	• Domestic debt • Collection costs • Capital controls
Aizenman & Marion (2011)	United States	• Stylistic model • Sensitivity analysis	The temptation to inflation away some of this debt burden is similar to that at the end of World War II. The model illustrates that the optimal inflation rate is positively related to the share of the debt held by foreign creditors, the cost of tax collection, and the share of non-indexed debt.	• Inflation • Public debt • Debt overhang • Debt maturity

Akitoby, Komatsuzaki & Binder (2014)	G7 Countries	• The debt dynamics equation • Fisher effect • Robustness of assumptions	The inflation impact on debt is positively correlated with the initial share of medium and long term, non-indexed, and domestic-currency debts. In the full OECD countries case, inflation is positively correlated with output growth, and real and nominal interest rates, and negatively correlated with the debt- to GDP ratio.	• Inflation • Debt drisis • G7 • Public debt
Barro (1979)	United States – hypotheses are tested on U.S. data since World War I	• Theoretical model	The findings show a positive effect on debt issue of temporary increases in government spending, a countercyclical response of debt to temporary income movement, and a one-to-one effect of expected inflation on nominal debt growth.	• Level of debt • Federal spending • Inflation

Barro (1979)	United States	• Ricardian model	The research had showed that the growth rate of public debt will reduce when the interest rate had increased of the measured at par values.	• Debt • Federal spending • Interest rate
Benfratello, Del Monte, & Pennacchio, (2015)	166 countries	• GMM estimation	-The finding figure out corruption in the public sector increases government debt. -This research disentangle the direct and indirect effect of corruption, the former operating via increased public expenses and the latter via the negative impact on GDP.	• Public Debt

Bhattarai, Lee & Park (2014)	United States- U.S. data is used	• Dynamic stochastic general equilibrium (DSGE) model	The findings show active monetary and passive monetary fiscal policy regime, inflation moves oppositely from the inflation target and a stronger reaction of interest rates to inflation increases the response inflation to shocks. A higher level of public debt increases the response of inflation while a weaker reaction of taxes to debt decrease the response of inflation to shocks.	• Inflation target • Inflation response • Public debt • Monetary and fiscal policy

Bohn (1988)	World economy	• Stochastic monetary	According to the research, the high goods demand increased the interest rate, which will contemporaneous implies the higher payment on public debt. If the government wants to borrow more, it must offer higher interest rates to induce inter temporal substitution towards later consumption.	• Inflation • Inflation rate • Consumption • Government spending • Taxes

Calvo (2013)	United States and several other countries	• Game-theoretic model	The findings show the rate of inflation is an increasing function of nominal debt service and government spending. The relationship between the rate of stock of government bonds and inflation, incidentally, will hold true even when the equilibrium is unique.	• Debt repudiation • Money and non-indexed debt • International debt • inflation
Caner, Grennes & Koehler (2010)	75 developing countries & 26 developed countries	• Threshold Regression Model	The findings show that the coefficients on inflation are insignificant. Trade has a positive effect on the growth under the high-debt regime, possibly because more credit is available for trade. Initial GDP per capita coefficients are significant and much higher in low-debt than high-debt regimes.	• Real growth rate • Public debt • Country index • Trade openness • Inflation

Cavalcanti, Vereda, Doctors, Lima & Maynard (2018)	OECD countries	• Ricardian model	In this research had investigated that increase in interest rate will caused the public debt increased. In fact, even though the fiscal policy rule had required an endogenous response that keeping the balanced primary budget, the increased in interest rate may lead to increased the payments on debt.	• Monetary policy • Public investment • Public debt • Fiscal rules
Cheng & Tan (2002)	Malaysia	• Vector error correction model (VECM)	The financial crisis hit the ASEAN region caused the Malaysian Ringgit to depreciate to a substantial extent. The consequent increase in import prices, prices for intermediate and capital goods, has placed an extremely powerful inflationary pressure in the country. Inflation become an important issue and the focus of the government in macroeconomic	• Inflation • Financial management

Claeys, Moreno & Surinach (2012)	OECD countries and Europe countries	• Lagrange Multiplier (LM)	The research showed that higher budget deficits increased in interest rate, will crowding out the effects of increasing public debt. The typical empirical test for crowding out regresses a domestic interest rate on domestic public debt, and controls for spill lover including proxy measures of capital mobility, such as aggregate capital flows or a composite measure of foreign debt or foreign interest rates.	• Inflation • Interest rate • Fiscal policy

Cochrane (2011)	Federal Reserve	• Keynesian	The findings show that the Fed wants to slow down inflation by raising interest rate, the Treasury must raise the additional revenue needed to pay off the consequently larger payments on government debt. It desires to avoid a dangerous inflation should point us in the same direction as just about every other economic indicator and concern. It should point us toward finally bringing our deficits and debt under control and spurring long-term growth.	• Inflation • Government debt • Unemployment • Interest rate • Money supply

Engen & Hubbard (2004)	United States	• Ricardian equivalence	Based on the research that had done, the empirical facts about the public debt and interest rate was review the recent econometric investigation on the interaction of federal public debt and interest rate, institute some investigation for this relationship.	• Interest rate • Consumption expenditure • Investment • Wealth • GDP
Faini (2004)	Industrial countries	• Ricardian model	Found that increased one percentage point in the interest rate will increased in the public debt of the euro area. In a general model where initial public debt holdings are positive and taxes are distortionary, the increased in interest rate will negatively affect the budgetary situation in the country.	• GDP • Interest rate • Public debt

Fincke & Greiner (2013)	Austria, France, Germany, Italy, Netherlands, Portugal and USA	• Pooled regressions model • Random effect model	We find strong evidence for a significantly negative relation between debt and growth. Further, for most specifications this relationship does not seem to be characterized by non-linearity.	• Public debt and economic growth
Garin, Lester, Sims & Wolff (2019)	Miami	• Real business cycle model (RBC)	Based on the research, there had a "well" period for increased in public debt if the present discounted the value of primary surpluses increased when the interest rate decreased, and there had a "worst" period to increased the public debt if the present discounted value of primary surpluses decreased when the interest rate decreased. According to both economies, it was to estimate good period of time for increased the public debt that depends on the exogenous force driving the interest rate	• Interest rate • Fiscal sustainability

Kaufmann (2010)	European Union	• Ordinary Least Square regression	fall. The finding show that was the positive relationship between the corruption and the government debt. Moreover, the increase in corruption will lead to increase government debt.	• Corruption • Government debt
Kim, Ha & Kim (2017)	77 Countries	• Ordinary Least Squares • Fixed Effect • System GMM	The empirical results show that the interaction term between public debt and corruption is statistically significant. This confirms the hypothesis that the effect of public debt on economic growth is a function of corruption.	• Debt, Corruption, GDP per capita, Human Capital, Inflation, Government Size

Kinoshita (2006)	19 industrial countries	• Dynamic general equilibrium model	The study had showed that the relationship between the public debt and interest rate that keenly debated in macroeconomics. The effect of government debt on interest rates depend on the assumed structure of the economy. The interest rate effects of government debt alone tend to be small, an increase in government consumption and debt leads to a considerably larger effect.	• Government debt • Long-term interest rate • Consumption
Kumar & Woo (2010)	38 develop and developing country	• Generalized Method of Moments • Pooled OLS regressions	The result show that was inverse relationship between the economic growth and debt. This mean that when the economic growth decrease will lead to the debt decrease.	• Government debt • economic growth • Inflation rate, government size trade openness

Laine (2011)	United States	• VAR model • Granger causality	The finding in this study show that the economic growth and public debt will in the same direction.	• Total debt and economic growth
Linnemann & Schabert (2006)	Euro area	• Business cycle model	The research had showed that when there was a positive steady-state stock in public debt, it will easily show to indeterminacy active the interest rate policy.	• Private consumption • Real wages • Employment
Liu, Moldogaziev, & Mikesell (2017)	America	• GMM model	This study evaluate the direct link between corruption and public debt issued by state and local governments.	• Corruption, Public Debt
Missale (1997)	OECD countries	• Neoclassical model	The research had showed that there were choosing a comparative short maturity which was parallel to index the public debt to the interest rate. Discretionary debt management which aims at reducing the cost of debt servicing points to the possible failure of the expectations theory of the term structure of interest rates.	• Debt denomination • Maturity structure • Optimal tax • Price indexation • Public debt

Moki (2012)	Africa	• SPSS	The finding in this study show that was the significant positive relationship between economic growth and public debt.	• National debt and economic growth • Investment, trade openness and foreign direct investment
Morley & Fishlow (1987)	Latin American countries	• Seignorage models	The research had showed that the problem of speedily increase the internally held of public debt and the higher domestic interest rate. For countries with large amounts of public debt outstanding, the sharp rise in interest rates created a drain on the treasury which cannot easily be covered by tax increases, thereby provoking new bond issues.	• Money balances • Wealth • Government bonds • Stock • Inflation •

Mutinda (2014)	Kenya	• Ordinary Least Square (OLS)	The research showed that the interest was the amount that charge by the debtor to the creditor within the time of using credit provided. Following interest rate liberalization, interest rates have fluctuate to respond to changes in demand and supply of loanable funds in the financial market.	• GDP • Inflation • Gross investment • Budget deficit • FX rate • Lending rates
Ng (2006)	133 countries	• Ordinary Least Square regression	The result show that the corruption was positive significant to the public debt. Furthermore, when increase in the corruption will cause the public debt increase.	• Corruption • Public debt

Ogrokhina & Rodriguez (2018)	Developing countries	• Probit model	The findings not only contribute to the literature on the benefits of adopting inflation targeting in developing countries, but also emphasize the importance of policy-oriented solutions in reducing developing countries' reliance on foreign currency debt.	• Inflation targeting • International debt • Currency composition
Ogunmuyiwa (2008)	Nigeria	• Augmented Dickey-Fuller test • Johansen Co-integration test • Vector Error Correction Method (VECM)	The result show that was insignificant relationship between the economic growth and public debt. Furthermore, the result show reveal that causality does not exist between external debt and economic growth.	• Public debt • Economic growth

Owusu-Nantwi & Erickson (2016)	Ghana	• Johansen cointegration, • vector error correction model • Granger causality test	The findings from the study reveal a positive and statistically significant long-run relationship between public debt and economic growth.	• Economic growth and public debt • Inflation, population growth and investment spending
Patterson & Lygnerud (1999)	Euro area, US and Japan – from national data	• Economic model	According to this research, interest rate was defined as prices. Interest were the amount of price that pay for the money that borrowed in a duration of time, it is stated in a percentage form from overall undone balance left where were fixed or changeable.	• Interest • Discount • Rent • Profit

Pattillo, Poirson & Ricci (2002)	93 developing countries	• Gaussian Mixture Model	The finding show that was the negative relationship between the economic growth and public debt.	• Economic growth and public debt • Population and investment
Phulpoto, Mirani & Channa (2016)	Pakistan Developing countries	• Linear regression model	The findings show there is a positive relationship between inflation and public debt. Thus, the insignificant negative effect of inflation and negative significant effect of BOT on public debt in Pakistan was observed.	• Public debt • Inflation • Balance of trade • Exchange rate • Interest rate

Phulpoto, Mirani & Channa (2016)	Developing countries and 9 OECD countries	• Linear Regression model	According to the research that had done, interest rate was such an amount that need to pay by government on public debt. The impact of interest rate can be credited on the basis of fiscal deficit and governmental debt, the results of the research show that fiscal shortage as well as governmental debt show-off a significant and positive effect on interest rates.	• Public debt • Inflation • Balance of trade • Exchange rate • Interest rate
Reinhart & Rogoff (2009)	Developed and developing countries	_	Based on the research that had done, to examine the interest rate related with elongate periods of exceptionally the lofty public debt. Economists were convinced that high commodity prices, low interest rates and reinvested oil profits would prop up the economy forever.	• GDP • Inflation • Interest rate

Reinhart & Rogoff (2010)	44 countries	• World economy	The findings show that in emerging market countries, high public debt levels coincide with higher inflation. As for inflation, an obvious connection stems from the fact that unanticipated high inflation can reduce the real cost of servicing the debt.	• Public debt • Real GDP growth • Inflation
Romer (2006)	World economy	• Solow growth model	According to the research that had done, the difference of real interest rate on the public debt had showed that the government certain to reimburse its public debt the interest rate are equalized.	• Consumption • Investment • Inflation • Monetary policy • Unemployment
Schclarek (2004)	24 develop countries.	• Gaussian Mixture Model	The finding of this research found that was no relationship between the two variable (economic growth and public debt)	• Economic growth and total public debt

Sims (2011)	United States	• Fiscal theory of the price level (FTPL) models	A central bank is seriously considering the full range of impacts of its actions and the actions of fiscal authorities on future output growth and inflation should be using a quantitative model that treats explicitly and realistically the potential impacts of fiscal policy on the price level.	• Monetary • Fiscal • Inflation • Government debt
Streeck (2013)	OECD countries	• Keynesian	As growth rates declined and unemployment became endemic in the OECD world after the end of inflation, the wage and income spread increased, and so did public spending.	• Democracy • Capitalism • Neoliberalism • Fiscal crisis • Privatization • Consolidation

VanBon (2015)	60 developing countries	• Generalized Method of Moments (GMM)	The study confirmed that public debt and inflation have negative effects on the economy although in some cases their interaction can foster the growth. Highly growing public debt not only makes inflation high but leads to economic crisis and social instability as well.	• Public debt • Inflation
Wilcox (1989)	United States	• Autoregressive integrated moving average (ARIMA)	The research had estimating a "transversality condition" that require the public debt discounted at some interest rate. Flavin implement this test by first verifying the stationarity of the undiscounted surplus and then testing the stationarity of the undiscounted debt.	• Real interest rate • Government debt

Woodford (1996)	European Union	• General Equilibrium Model	The capital loss on existing nominal government liabilities due to increased inflation is not sufficient to prevent an increase in the real value of outstanding government debt. The findings show unexpected inflation causes on nominal government debt, and to the reduced debt.	• Public debt • Inflation • Interest rate • Price stability • Monetary policy

Appendix 2: Countries covered

Economy type	Countries
Developed economy (35)	Australia; Austria; Belgium; Canada; Cyprus; Czech Republic; Denmark; Estonia; Finland; France; Germany; Greece; Hong Kong SAR,China; Iceland; Ireland; Israel; Italy; Japan; Latvia; Lithuania; Luxembourg; Malta; Netherlands; New Zealand; Norway, Portugal, Singapore, Slovenia, Spain, Sweden, Switzerland; Taiwan, China; Turkey; United Kingdom; United States
Developing economy (88)	Albania; Algeria; Angola; Argentina; Armenia; Azerbaijan; Bahamas,The; Bangladesh; Belarus; Bolivia; Botswana; Brazil; Brunei; Bulgaria; Burkina Faso; Cameroon; China; Colombia; Costa Rica; Croatia; Dominican Republic; Ecuador; Egypt; EI Salvador; Ethiopia; Gabon; Gambia; Ghana; Guatemala; Guinea; Guinea Bissau; Guyana; Haiti; Honduras; India; Indonesia; Iran; Iraq; Jamaica; Jordan; Kazakhstan; Kenya; Kuwait; Lebanon; Liberia; Madagascar; Malawi; Malaysia; Mali; Mexico; Moldova; Morocco; Mozambique; Myanmar; Namibia; Nicaragua; Niger; Nigeria; Oman; Pakistan; Panama; Papua New Guinea; Paraguay; Peru; Philippines; Romania; Russian; Saudi Arabia; Senegal; Serbia; Sierra Leone; South Africa; Sri Lanka; Sudan; Suriname; Tanzania; Thailand; Togo; Tunisia; Turkey; Uganda; Ukraine; Uruguay; Venezueta; Yemen; Zambia; Zimbabwe

Appendixe 3: Descriptive Analysis for Developed Countries						
	.sum	lnPD	lnCPI	lnGS	lnINF	lnGDP
	Variable	Obs	Mean	Std.Dev	Min	Max
	lnPD	1032	3.836652	0.912267	-2.30259	5.473111
	lnCPI	1152	-4.44664	1.117265	-6	-2
	lnGS	1493	2.871956	0.289348	1.646794	3.73667
	lnINF	1464	2.297479	0.659582	-0.65029	7.159636
	lnGDP	1437	0.022955	0.031689	-0.15735	0.21463

Appendixes 4: Correlation Analysis for dDeveloped Countries.						
	corr	lnPD	lnCPI	lnGS	lnINF	lnGDP
	(obs=880)					
	lnPD	1				
	lnCPI	0.0897	1			
	lnGS	0.3373	-0.1912	1		
	lnINF	-0.1214	0.15	-0.057	1	
	lnGDP	-0.1103	-0.0417	-0.0664	0.054	1

Appendixes 5: Model 1 for Developed Countries

Dynamic panel-data estimation, one-step difference GMM

Group variable: code Number of obs = 535

Time variable : year Number of groups = 33

Number of instruments = 10 Obs per group: min = 5

Wald chi2(5) = 60.40 avg = 16.21

Prob > chi2 = 0.000 max = 19

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ly		Coef.	Std.Err	z	P>|z|	[95% Conf	Interval]
lnPD		0.555272	0.227886	2.44	0.015	0.108624	1.00192
lnCPI		0.094736	0.05665	1.67	0.094	-0.0163	0.205768
lnGS		0.422724	0.422827	1	0.317	-0.406	1.25145
lnINF		0.150117	0.081276	1.85	0.065	-0.00918	0.309415
lnGDP		0.631794	0.580025	1.09	0.276	-0.50503	1.768622

Instruments for first differences equation

GMM-type (missing=0, separate instruments for each period unless collapsed)

L(4/5).(ly lx1n lx3 lx4 lx5g) collapsed

Arellano-Bond test for AR(1) in first differences: z = -1.52 Pr > z = 0.130

Arellano-Bond test for AR(2) in first differences: z = 1.93 Pr > z = 0.054

Sargan test of overid. restrictions: chi2(5) = 14.85 Prob > chi2 = 0.011

(Not robust, but not weakened by many instruments.)

Appendixes 6: Model 2 for Developed Countries

Dynamic panel-data estimation, two-step difference GMM

Group variable: code Number of obs = 535

Time variable : year Number of groups = 33

Number of instruments = 20 Obs per group: min = 5

Wald chi2(5) = 539.03 avg = 16.21

Prob > chi2 = 0.000 max = 19

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ly	Coef.	Std.Err	z	P>|z|	[95% Conf	Interval]
lnPD	0.886156	0.049676	17.84	0.000	0.788794	0.983518
lnCPI	0.012678	0.018682	0.68	0.497	-0.02394	0.049293
lnGS	0.415831	0.159938	2.6	0.009	0.102358	0.729304
lnINF	0.190383	0.033166	5.74	0.000	0.12538	0.255387
lnGDP	0.476044	0.151096	3.15	0.002	0.179901	0.772187

Warning: Uncorrected two-step standard errors are unreliable.

Instruments for first differences equation

GMM-type (missing=0, separate instruments for each period unless collapsed)

L(4/7).(ly lx1n lx3 lx4 lx5g) collapsed

Arellano-Bond test for AR(1) in first differences: z = -1.85 Pr > z = 0.064

Arellano-Bond test for AR(2) in first differences: z = 1.10 Pr > z = 0.270

Sargan test of overid. restrictions: chi2(15) = 21.59 Prob > chi2 = 0.119

(Not robust, but not weakened by many instruments.)

Hansen test of overid. restrictions: chi2(15) = 19.90 Prob > chi2 = 0.176

(Robust, but can be weakened by many instruments.)

Appendixes 7: Model 3 for Developed Countries

Dynamic panel-data estimation, two-step difference GMM

Group variable: code Number of obs = 535

Time variable : year Number of groups = 33

Number of instruments = 10 Obs per group: min = 5

Wald chi2(5) = 19.25 avg = 16.21

Prob > chi2 = 0.002 max = 19

---

ly	Coef.	Corrected Std.Err	z	P>|z|	[95% Conf	Interval]
lnPD	0.113321	0.559161	0.2	0.839	-0.98261	1.209257
lnCPI	0.159505	0.102621	1.55	0.12	-0.04163	0.360638
lnGS	0.348897	0.95438	0.37	0.715	-1.52165	2.219447
lnINF	-0.01883	0.266967	-0.07	0.944	-0.54207	0.50442
lnGDP	0.562379	0.509601	1.1	0.27	-0.43642	1.561179

Instruments for first differences equation

GMM-type (missing=0, separate instruments for each period unless collapsed)

L(4/5).(ly lx1n lx3 lx4 lx5g) collapsed

Arellano-Bond test for AR(1) in first differences: z = 0.31 Pr > z = 0.758

Arellano-Bond test for AR(2) in first differences: z = 1.96 Pr > z = 0.050

Sargan test of overid. restrictions: chi2(5) = 14.85 Prob > chi2 = 0.011

(Not robust, but not weakened by many instruments.)

Hansen test of overid. restrictions: chi2(5) = 5.47 Prob > chi2 = 0.361

(Robust, but can be weakened by many instruments.)

Appendixes 8: Model 4 for Developed Countries.

Dynamic panel-data estimation, one-step system GMM

Group variable: code Number of obs = 568

Time variable : year Number of groups = 33

Number of instruments = 12 Obs per group: min = 6

Wald chi2(5) = 7027.20 avg = 17.21

Prob > chi2 = 0.000 max = 20

---

ly	Coef.	Corrected Std.Err	z	P>|z|	[95% Conf	Interval]
lnPD	0.986641	0.020633	47.82	0	0.946202	1.027081
lnCPI	0.03187	0.011193	2.85	0.004	0.009933	0.053807
lnGS	0.33769	0.196907	1.71	0.086	-0.04824	0.72362
lnINF	0.132453	0.056951	2.33	0.02	0.020831	0.244074
lnGDP	0.750047	0.302175	2.48	0.013	0.157795	1.3423
_cons	-1.04284	0.563608	-1.85	0.064	-2.14749	0.061809

Instruments for first differences equation

GMM-type (missing=0, separate instruments for each period unless collapsed)

L4.(ly lx1n lx3 lx4 lx5g) collapsed

Instruments for levels equation

Standard

_cons

year

GMM-type (missing=0, separate instruments for each period unless collapsed)

DL3.(ly lx1n lx3 lx4 lx5g) collapsed

Arellano-Bond test for AR(1) in first differences: z = -8.79 Pr > z = 0.000

Arellano-Bond test for AR(2) in first differences: z = 1.67 Pr > z = 0.094

Sargan test of overid. restrictions: chi2(6) = 15.28 Prob > chi2 = 0.018

(Not robust, but not weakened by many instruments.)

Difference-in-Sargan tests of exogeneity of instrument subsets:

GMM instruments for levels

Sargan test excluding group: chi2(1) = 1.95 Prob > chi2 = 0.163

Difference (null H = exogenous): chi2(5) = 13.33 Prob > chi2 = 0.020

iv(year, eq(level))

Sargan test excluding group: chi2(5) = 15.28 Prob > chi2 = 0.009

Difference (null H = exogenous): chi2(1) = 0.00 Prob > chi2 = 0.997

Appendixes 9: Model 5 for Developed Countries.

Dynamic panel-data estimation, two-step system GMM

Group variable: code — Number of obs = 568

Time variable : year — Number of groups = 33

Number of instruments = 12 — Obs per group: min = 6

Wald chi2(5) = 17840.52 — avg = 17.21

Prob > chi2 = 0.000 — max = 20

---

ly	Corrected Coef.	Std.Err	z	P>|z|	[95% Conf	Interval]
lnPD	0.961122	0.016733	57.44	0.000	0.928326	0.993918
lnCPI	0.034285	0.012984	2.64	0.008	0.008838	0.059732
lnGS	0.774545	0.191875	4.04	0.000	0.398477	1.150613
lnINF	0.213748	0.050924	4.2	0.000	0.113939	0.313558
lnGDP	0.692992	0.260769	2.66	0.008	0.181895	1.204089
_cons	-2.34404	0.534197	-4.39	0.000	-3.39105	-1.29703

Warning: Uncorrected two-step standard errors are unreliable.

Instruments for first differences equation

GMM-type (missing=0, separate instruments for each period unless collapsed)

L4.(ly lx1n lx3 lx4 lx5g) collapsed

Instruments for levels equation

Standard

_cons

year

GMM-type (missing=0, separate instruments for each period unless collapsed)

DL3.(ly lx1n lx3 lx4 lx5g) collapsed

Arellano-Bond test for AR(1) in first differences: z = -1.87 Pr > z = 0.061

Arellano-Bond test for AR(2) in first differences: z = 1.31 Pr > z = 0.190

Sargan test of overid. restrictions: chi2(6) = 15.28 Prob > chi2 = 0.018

(Not robust, but not weakened by many instruments.)

Hansen test of overid. restrictions: chi2(6) = 6.88 Prob > chi2 = 0.332

(Robust, but can be weakened by many instruments.)

Difference-in-Hansen tests of exogeneity of instrument subsets:

GMM instruments for levels

Hansen test excluding group: chi2(1) = 1.56 Prob > chi2 = 0.212

Difference (null H = exogenous): chi2(5) = 5.32 Prob > chi2 = 0.378

iv(year, eq(level))

Hansen test excluding group: chi2(5) = 6.66 Prob > chi2 = 0.247

Difference (null H = exogenous): chi2(1) = 0.22 Prob > chi2 = 0.640

Appendixes 10: Model 6 for Developed Countries

Dynamic panel-data estimation, two-step system GMM

Group variable: code Number of obs = 568

Time variable : year Number of groups = 33

Number of instruments = 12 Obs per group: min = 6

Wald chi2(5) = 3975.35 avg = 17.21

Prob > chi2 = 0.000 max = 20

---

ly	Coef.	Corrected Std.Err	z	P>|z|	[95% Conf	.Interval]
lnPD	0.961122	0.024528	39.18	0.000	0.9130474	1.009196
lnCPI	0.034285	0.017524	1.96	0.05	-0.0000614	0.0686308
lnGS	0.774545	0.32994	2.35	0.019	0.1278755	1.421214
lnINF	0.213748	0.084655	2.52	0.012	0.0478284	0.3796681
lnGDP	0.692992	0.382048	1.81	0.07	-0.0558084	1.441792
_cons	-2.34404	0.989824	-2.37	0.018	-4.284059	-0.4040196

Instruments for first differences equation

GMM-type (missing=0, separate instruments for each period unless collapsed)

L4.(ly lx1n lx3 lx4 lx5g) collapsed

Instruments for levels equation

Standard

_cons

year

GMM-type (missing=0, separate instruments for each period unless collapsed)

DL3.(ly lx1n lx3 lx4 lx5g) collapsed

Arellano-Bond test for AR(1) in first differences: z = -1.87 Pr > z = 0.061

Arellano-Bond test for AR(2) in first differences: z = 1.30 Pr > z = 0.192

Sargan test of overid. restrictions: chi2(6) = 15.28 Prob > chi2 = 0.018

(Not robust, but not weakened by many instruments.)

Hansen test of overid. restrictions: chi2(6) = 6.88 Prob > chi2 = 0.332

(Robust, but can be weakened by many instruments.)

Difference-in-Hansen tests of exogeneity of instrument subsets:

GMM instruments for levels

Hansen test excluding group: chi2(1) = 1.56 Prob > chi2 = 0.212

Difference (null H = exogenous): chi2(5) = 5.32 Prob > chi2 = 0.378

iv(year, eq(level))

Hansen test excluding group: chi2(5) = 6.66 Prob > chi2 = 0.247

Difference (null H = exogenous): chi2(1) = 0.22 Prob > chi2 = 0.640

Appendixes 11: Descriptive analysis for Developing Countries.						
	sum	PB	CPI	GS	INF	GDP
	Variable	Obs	Mean	Std.Dev.	Min	Max
	lnPB	1975	3.743693	0.767376	-2.30259	6.243973
	lnCPI	2936	-2.40454	0.938939	-6.42857	0
	lnGS	3439	2.583295	0.434927	-0.09295	4.333652
	lnINF	3262	3.352655	0.6308	-0.1248	9.373024
	lnGDP	3699	0.015586	0.059867	-1.04972	0.431418

Appendixes 12: Correlation analysis for Developing Countries.						
	corr	PB	CPI	GS	INF	GDP
	(obs=1373)					
	lnPB	1				
	lnCPI	-0.0723	1			
	lnGS	-0.1231	-0.1015	1		
	lnINF	0.1246	-0.1239	-0.0462	1	
	lnGDP	-0.1007	0.1039	-0.0283	0.0021	1

Appendixes 13: Model 1 for Developing Countries.

Dynamic panel-data estimation, one-step difference GMM

Group variable: code Number of obs = 1290
Time variable : year Number of groups = 81
Number of instruments = 25 Obs per group: min = 0
Wald chi2(5) = 227.70 avg = 15.93
Prob > chi2 = 0.000 max = 24

---

ly	Coef.	Std. Err.	z	P>|z|	[95% Conf. Interval]	
ly |						
lnPD	0.819595	0.06629	12.36	0.000	0.68967	0.94952
lnCPI	0.108261	0.028183	3.84	0.000	0.053024	0.163498
lnGS	0.401317	0.238151	1.69	0.092	-0.06545	0.868085
lnINF	0.14305	0.053905	2.65	0.008	0.037399	0.248702
lnGDP	0.579948	0.187963	3.09	0.002	0.211548	0.948348

Instruments for first differences equation
GMM-type (missing=0, separate instruments for each period unless collapsed)
L(3/7).(ly lx1n lx3 lx4 lx5g) collapsed

Arellano-Bond test for AR(1) in first differences: z = -5.61 Pr > z = 0.000
Arellano-Bond test for AR(2) in first differences: z = -4.19 Pr > z = 0.000

Sargan test of overid. restrictions: chi2(20) = 26.87 Prob > chi2 = 0.139
(Not robust, but not weakened by many instruments.)

Appendixes 14: Model 2 for Developing Countries.

Dynamic panel-data estimation, two-step difference GMM

Group variable: code — Number of obs = 1290
Time variable : year — Number of groups = 81
Number of instruments = 25 — Obs per group: min = 0
Wald chi2(5) = 235.39 — avg = 15.93
Prob > chi2 = 0.000 — max = 24

---

ly	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
lnPD	0.916687	0.064373	14.24	0.000	0.790519	1.042855
lnCPI	0.102009	0.02237	4.56	0.000	0.058165	0.145852
lnGS	0.486245	0.174394	2.79	0.005	0.144438	0.828051
lnINF	0.12136	0.036543	3.32	0.001	0.049736	0.192984
lnGDP	0.531989	0.119452	4.45	0.000	0.297867	0.766111

Warning: Uncorrected two-step standard errors are unreliable.

Instruments for first differences equation
GMM-type (missing=0, separate instruments for each period unless collapsed)
L(3/7).(ly lx1n lx3 lx4 lx5g) collapsed

Arellano-Bond test for AR(1) in first differences: z = -3.24 Pr > z = 0.001
Arellano-Bond test for AR(2) in first differences: z = -1.27 Pr > z = 0.203

Sargan test of overid. restrictions: chi2(20) = 26.87 Prob > chi2 = 0.139
(Not robust, but not weakened by many instruments.)
Hansen test of overid. restrictions: chi2(20) = 15.60 Prob > chi2 = 0.741
(Robust, but can be weakened by many instruments.)

Appendixes 15: Model 3 for Developing Countries.

Dynamic panel-data estimation, two-step difference GMM

Group variable: code Number of obs = 1290
Time variable : year Number of groups = 81
Number of instruments = 25 Obs per group: min = 0
Wald chi2(5) = 120.96 avg = 15.93
Prob > chi2 = 0.000 max = 24

| Corrected

ly	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
lnPD	0.916687	0.100432	9.13	0.000	0.719844	1.113529
lnCPI	0.102009	0.029494	3.46	0.001	0.044201	0.159816
lnGS	0.486245	0.229083	2.12	0.034	0.03725	0.93524
lnINF	0.12136	0.040273	3.01	0.003	0.042427	0.200293
lnGDP	0.531989	0.176989	3.01	0.003	0.185098	0.87888

Instruments for first differences equation
GMM-type (missing=0, separate instruments for each period unless collapsed)
L(3/7).(ly lx1n lx3 lx4 lx5g) collapsed

Arellano-Bond test for AR(1) in first differences: z = -3.03 Pr > z = 0.002
Arellano-Bond test for AR(2) in first differences: z = -1.27 Pr > z = 0.204

Sargan test of overid. restrictions: chi2(20) = 26.87 Prob > chi2 = 0.139
(Not robust, but not weakened by many instruments.)
Hansen test of overid. restrictions: chi2(20) = 15.60 Prob > chi2 = 0.741
(Robust, but can be weakened by many instruments.)

Appendixes 16: Model 4 for Developing Countries.

Dynamic panel-data estimation, one-step system GMM

Group variable: code — Number of obs = 1373

Time variable : year — Number of groups = 82

Number of instruments = 32 — Obs per group: min = 1

Wald chi2(5) = 1212.16 — avg = 16.74

Prob > chi2 = 0.000 — max = 25

ly	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
lnPD	0.988111	0.051255	19.28	0.000	0.887653	1.088568
lnCPI	0.041133	0.021449	1.92	0.055	-0.00091	0.083173
lnGS	0.512276	0.156743	3.27	0.001	0.205065	0.819487
lnINF	0.15807	0.03663	4.32	0.000	0.086277	0.229864
lnGDP	0.488029	0.19641	2.48	0.013	0.103073	0.872984
_cons	-1.70206	0.563975	-3.02	0.003	-2.80743	-0.59669

Instruments for first differences equation

GMM-type (missing=0, separate instruments for each period unless collapsed)

L(3/7).(ly lx1n lx3 lx4 lx5g) collapsed

Instruments for levels equation

Standard

_cons

year

GMM-type (missing=0, separate instruments for each period unless collapsed)

DL2.(ly lx1n lx3 lx4 lx5g) collapsed

Arellano-Bond test for AR(1) in first differences: z = -7.17 Pr > z = 0.000

Arellano-Bond test for AR(2) in first differences: z = -4.22 Pr > z = 0.000

Sargan test of overid. restrictions: chi2(26) = 55.92 Prob > chi2 = 0.001

(Not robust, but not weakened by many instruments.)

Difference-in-Sargan tests of exogeneity of instrument subsets:

GMM instruments for levels

Sargan test excluding group: chi2(21) = 32.70 Prob > chi2 = 0.050

Difference (null H = exogenous): chi2(5) = 23.23 Prob > chi2 = 0.000

iv(year, eq(level))

Sargan test excluding group: chi2(25) = 55.54 Prob > chi2 = 0.000

Difference (null H = exogenous): chi2(1) = 0.38 Prob > chi2 = 0.536

Appendixes 17: Model 5 for Developing Countries.

Dynamic panel-data estimation, two-step system GMM

Group variable: code — Number of obs = 1373
Time variable : year — Number of groups = 82
Number of instruments = 32 — Obs per group: min = 1
Wald chi2(5) = 1261.95 — avg = 16.74
Prob > chi2 = 0.000 — max = 25

---

ly	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
lnPD	1.004572	0.042029	23.9	0.000	0.922198	1.086947
lnCPI	0.040689	0.015275	2.66	0.008	0.010752	0.070627
lnGS	0.444389	0.139927	3.18	0.001	0.170138	0.718641
lnINF	0.101231	0.030446	3.32	0.001	0.041558	0.160904
lnGDP	0.549682	0.083534	6.58	0.000	0.385958	0.713407
_cons	-1.38695	0.441841	-3.14	0.002	-2.25294	-0.52095

Warning: Uncorrected two-step standard errors are unreliable.

Instruments for first differences equation
GMM-type (missing=0, separate instruments for each period unless collapsed)
L(3/7).(ly lx1n lx3 lx4 lx5g) collapsed
Instruments for levels equation
Standard
_cons
year
GMM-type (missing=0, separate instruments for each period unless collapsed)
DL2.(ly lx1n lx3 lx4 lx5g) collapsed

Arellano-Bond test for AR(1) in first differences: z = -3.17 Pr > z = 0.002
Arellano-Bond test for AR(2) in first differences: z = -1.26 Pr > z = 0.207

Sargan test of overid. restrictions: chi2(26) = 55.92 Prob > chi2 = 0.001
(Not robust, but not weakened by many instruments.)
Hansen test of overid. restrictions: chi2(26) = 20.72 Prob > chi2 = 0.756
(Robust, but can be weakened by many instruments.)

Difference-in-Hansen tests of exogeneity of instrument subsets:
GMM instruments for levels
Hansen test excluding group: chi2(21) = 15.54 Prob > chi2 = 0.795
Difference (null H = exogenous): chi2(5) = 5.18 Prob > chi2 = 0.394
iv(year, eq(level))
Hansen test excluding group: chi2(25) = 20.12 Prob > chi2 = 0.741
Difference (null H = exogenous): chi2(1) = 0.60 Prob > chi2 = 0.439

Appendixes 18: Model 6 for Developing Countries.

Dynamic panel-data estimation, two-step system GMM

Group variable: code — Number of obs = 1373
Time variable : year — Number of groups = 82
Number of instruments = 32 — Obs per group: min = 1
Wald chi2(5) = 347.23 — avg = 16.74
Prob > chi2 = 0.000 — max = 25

| Corrected

ly	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
lnPD	1.004572	0.071	14.2	0.000	0.865903	1.143242
lnCPI	0.040689	0.021509	1.89	0.059	-0.00147	0.082846
lnGS	0.444389	0.184074	2.41	0.016	0.08361	0.805168
lnINF	0.101231	0.060797	1.67	0.096	-0.01793	0.22039
lnGDP	0.549682	0.161328	3.41	0.001	0.233485	0.86588
_cons	-1.38695	0.629128	-2.2	0.027	-2.62001	-0.15388

Instruments for first differences equation
GMM-type (missing=0, separate instruments for each period unless collapsed)
L(3/7).(ly lx1n lx3 lx4 lx5g) collapsed
Instruments for levels equation
Standard
_cons
year
GMM-type (missing=0, separate instruments for each period unless collapsed)
DL2.(ly lx1n lx3 lx4 lx5g) collapsed

Arellano-Bond test for AR(1) in first differences: z = -3.09 Pr > z = 0.002
Arellano-Bond test for AR(2) in first differences: z = -1.26 Pr > z = 0.208

Sargan test of overid. restrictions: chi2(26) = 55.92 Prob > chi2 = 0.001
(Not robust, but not weakened by many instruments.)
Hansen test of overid. restrictions: chi2(26) = 20.72 Prob > chi2 = 0.756
(Robust, but can be weakened by many instruments.)

Difference-in-Hansen tests of exogeneity of instrument subsets:
GMM instruments for levels
Hansen test excluding group: chi2(21) = 15.54 Prob > chi2 = 0.795
Difference (null H = exogenous): chi2(5) = 5.18 Prob > chi2 = 0.394
iv(year, eq(level))
Hansen test excluding group: chi2(25) = 20.12 Prob > chi2 = 0.741
Difference (null H = exogenous): chi2(1) = 0.60 Prob > chi2 = 0.439