* 1. *Descriptive Statistic*



1. Corruption and Growth

Figure 1 provides scatter plots of growth rate of real GDP versus CPI for 170 countries and CPI data in 2013-2017. Again, generally, corruption and growth seemly have positive correlation (the less corruption, the less growth rate) relation. Left (1994) in his research also reach the same conclusion. According to World Bank, this research separates data by three groups: high income countries, upper income countries and lower middle-income countries. Figure 1 shows that the relationship between corruption and growth is different between groups. In high income group, country has more corruption, then has more growth. In upper middle-income group, corruption seemly has no impact on growth. And in lower middle-income group, if country has more corruption, it has less growth.

Appendix 3 and Appendix 4 shows the impact of corruption on growth rate of real GDP is not clear. In the highest CPI group (7.5-9) (the least corruption nation), Singapore is the one has the highest growth rate ranking among 170 nations in Appendix 3. Denmark, which has the highest CPI, ranks in term of growth. That is much lower than Equatorial Guinea which has the least CPI and ranks in term of growth. Many countries in group of high CPIs (7.5-9) have low growth ranks (economy grow slowly), such as Finland (156), Netherland (154), Germany (153), Belgium (148). And many countries in group of low CPIs (1-2.5) have high rank, such as Turkmenistan (5), Cambodia (7), Uzbekistan (10), Tajikistan (11). But it is seeming countries rank randomly, therefore it is not enough evidences to convince that the correlation between CPI and growth is negative or the relationship between corruption and growth is positive.

Appendix 5 is correlation matrix for growth rate of real GDP, corruption, political rights and political stability. All these correlations are significant at 1 percent level. It is considered that corruption has positive relation with growth.There is negative correlation between CPI and growth (-0.323) , in other word, a clearer government lead to a decline in growth.

It is concerned that the impact of corruption on growth maybe different depended on income of country. This is supported by Michael T. Rock and Heidi Bonnett (2004). They used to divide sample into six sub-samples to investigate the impact. The groups were created based on the differences characteristics of selected countries. Their result concluded that Corruption tends to slow growth and or investment in most developing countries but increase growth in the large East Asian newly industrialized economies. To deeper study this situation, this research decides to divide data by several groups based on income. But the convention of World Bank is not used now, because the number of observations of each group are not equal each other. Sample is sorted by the initial per capita income (y2002), from highest to lowest. Then, it divided by four groups more equally. After that, in each group, sample is sorted once more time by CPI and it is also separated by four parts. Now, there is 16 parts of observations, each part has 10 or 11 countries. In each part, growth is taken average for all countries. The results are shown in Table 1.

**Table 1**

Average growth rate for each group sorted by initial per capita income and then by CPI

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | High CPI (less corruption) | 2 | 3 | Low CPI(more corruption) |
| Group 1 | 0.021317 | 0.022 | 0.028231 | 0.028737 |
| Group 2 | 0.030086 | 0.033 | 0.035864 | 0.037397 |
| Group 3 | 0.045819 | 0.049 | 0.045138 | 0.039972 |
| Group 4 | 0.057458 | 0.051 | 0.051717 | 0.048964 |
| Note: same row same group of initial per capita income, but same column not same group of CPIs. From group 1 to group 4, the initial per capita income decreases. | | | | |

Table 1 adds more evidences to convince that the relationship between corruption and growth is different depended on income. First and second row show that if CPI decreases, growth will increase. Third and last rows show that if CPI decrease, growth will decrease. It is considered that, if country has high income, the relationship between corruption and growth would be positive. And if country has low income, the relationship between corruption and growth would be negative.

But when summarizing data of initial per capita income for each group, there is a problem. Appendix 6 provides that the standard deviation of group 1 and group 2 is much larger than group 3 and group 4. It is concerned that in each part of group 1 and group 2, the differences of income between countries are too large. It can lead to in group 1 or group 2, parts with high CPI may have much higher income than other parts. And as Barro (1991), Mauro (1995) and Mo (2000) said, the initial per capita income has negative impact on growth, so the decrease of growth maybe from the effect of income inspire inspite of the effect of corruption.

Thus, to study this thinking, this research does one step more. Data from group 1 and group 2 are mixed, then sorted by CPI, and divided by five groups, from highest CPI to lowest CPI. After that, in each group, observations sorted by initial per capita income, and separated by four parts, from highest initial per capita income to lowest initial income. Now, there is 20 different parts of observations, each part has 4 or 5 countries. In each part, growth is taken average for all countries. Results is shown in Table 2.

**Table 2:**

Average growth rate for each group sorted by CPI and then by initial percapita income

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | High y2002 | 2 | 3 | Low y2002 |
| Group A | 0.018083 | 0.019716 | 0.018023 | 0.034605 |
| Group B | 0.052333 | 0.019946 | 0.016304 | 0.041151 |
| Group C | 0.027345 | 0.025401 | 0.040399 | 0.034503 |
| Group D | 0.009478 | 0.034161 | 0.042597 | 0.02777 |
| Group E | 0.026954 | 0.039193 | 0.043678 | 0.043839 |
| Note: same row same group of CPIs, but same column not same group of initial per capita income. From group A to group E, CPI decreases (more corruption) | | | | |

In Group E, when initial per capita income (y2002) decreases, growth increases. In group A, although third part has the lowest growth, but growth of fourth part is the highest, and growth of second part is higher than first part. In Group B, first part has the highest growth, but it has Qatar, which has growth more than 10 percent, so it can be an outlier. If first part is excluded, fourth part has the highest growth. In Group C and Group D, first part has the lowest growth, and growth of two parts of lower y2002 is higher than two parts of higher y2002. It is evidence that the impact of initial per capita income has to be considered when studying the effect of corruption on growth. A smaller economic pie would grow quicklier than a bigger one, this phenomenon is true for both high CPI nations and low CPI nations. As we mentioned above,Michael T. Rock and Heidi Bonnett (2004)’s finding is that the impact of corruption on growth is different between countries. However, after the result of regression on Table 2, we may realize that there is a significant gap between income of selected countries. The origin of impact on growth could be income. Michael T. Rock and Heidi Bonnett (2004)’s conclusion is not correctly in this case.

So far, data set of this research provides that the relationship between corruption and growth is so complicated. In general, corruption seemly has positive impact on growth. But when going deeper, the positive impact just exists for high income countries. For low income countries, the relationship of corruption and growth is negative. Hence, when analyzing high income group, the effect of initial per capita income on growth is anxious. It may overwhelm the impact of corruption and may leads to concluding wrongly the relation between corruption and growth.

One more interesting feature of data set is the strong association between corruption, political stability and political rights. Appendix 5 provides that correlations are positive and significant at 1 percent level. Appendix 7 is a matrix that countries in data set are arranged, they are grouped by quintiles depending on their corruption and political stability indices. Appendix 8 is similar with Appendix 7 but with corruption and political rights indices.

* 1. *Empirical Estimates*

This section analyses the link between corruption and growth not only for all countries but also for individual income groups of countries. High income group includes group 1 and group 2, low income group includes group 3 and group 4. According to OLS regressions, it is found that corruption has strong negative impact on growth, even with high income group. Hence, high income group has more evidences than low income group to convince that corruption has negative effect on growth. Two Stage Least Squares (2SLS) regressions is used with instrument variables to exclude endogeneity. Number of evidences reduces, but it is still considered that the link between corruption and growth is negative, and again, even with high income group.

* + 1. *OLS regressions*

In Mo (2001), share of investment, human resource and political stability are believed plausible transmission channels that through them, corruption effect indirectly on growth. In this research, although that is not main problem to be concentrated, it is considered that the specification in Mo (2001) is appreciated. Thus, this research adopts empirical estimates of Mo (2001). To avoid perfect multicollinearity and heteroscedasticity, all regressions are robust.

The OLS regressions are reported in Appendix 9 (for all countries), Appendix 10 (for low income countries) and Appendix 11 (for high income countries). For each appendix, in column 1, there are four control variables: the initial per capita income, political rights, political rights squared and population growth. In column 2, share of investment is included. Column 3 puts in all variables excluding political stability. Column 4 puts in all variables excluding human resource. Column 5 puts in all variables excluding share of investment. And column 6 includes all variables.

For all countries, the relationship between corruption and growth is significant in column 1, column 2, column 4, column 5 and column 6. The coefficients of corrupt in these columns are all positive that means when CPI increases one point, growth will increase 0,36 percentage point (column 1) or 0,32 percentage point (column 6). So, the impact of corruption on growth is negative.

For low income countries, the association between corruption and growth is significant in column 1 and column 5. The coefficients of corrupt in these columns are all positive that means when CPI increases one point, growth will increase 0.55 percentage point (column 1) or 0.69 percentage point (column 5). It can be concluded that the effect of corruption on growth is negative.

For high income countries, the link between corruption and growth is significant in columns 1, 2, 3, 4. The coefficients of corrupt in these columns are all positive that means when CPI increases one point, growth will increase 0.31 percentage point (column 1) or 0.35 percentage point (column 4). These results show that corruption effects negatively on growth, the same result of Mauro (1995, 1996) and Mo (2001).

High income group shows more evidences of negative relationship between corruption and growth than low income group. It leads to the positive association positive signs are uncertain among models. Hence, the negative effect of the initial per capita income is strong significant in all models. Thus, arguments which concern the bias of the impact of initial per capital income is reliable.

* + 1. *Two stage least squares regressions*

As said in Mauro (1995), not only corruption impact on growth but also growth impact on corruption. In a country which has high growth rate, the quality of institution can be improved, so corruption maybe reduced. That leads to endogeneity problem, the coefficients maybe bias and inconsistent. In order to avoid this problem, this research uses Two stage least squares regressions (2SLS) with several instrument variables. They are dummy variables of area of countries in sample as Latin America, South Asia, Sub-Saharan Africa, East Asia Pacific, OECD, and fractionalization variable (Mauro, 1996; Mo, 2001). For excluding perfect multicollinearity and heteroscedasticity, all regressions are robust. The 2SLS regressions are reported in Appendix 12 (for all countries), Appendix 13 (for low income countries) and Appendix 14 (for high income countries).

There are some problems concerned when using instrument variables. Firstly, whether instrument variables is strong enough to exclude endogeneity bias. Secondly, instrument variables may not only effect on independent variable but also dependent variable, it can lead to structural model is specified incorrectly. Wooldridge’s score test is used for tests these two problems. Appendix 15 shows the result.

For all countries, the relationship between corruption and growth is significant in columns 3 and 5. When using Wooldridge’s score test, with null hypothesis that variables are exogenous, p-value of these columns is larger than 10 percent level, that means the regressions are not endogenous. But with the null hypothesis that all instruments are a valid and structural model is specified correctly, the p-value of column 3 is less than 10 percent level and p-value of column 5 is less than 5 percent level, that means either one or more of instruments are weak or that structural model is specified incorrectly at 10 percent level. However, at the 1 percent level, instruments are acceptable. So, for all countries, when CPI increases one more point, growth will increase 0.98 percentage point (column 3) or 0.79 percentage point (column 5). That means corruption has negative impact on growth.

For low income countries, the link between corruption and growth is significant in columns 2, 5. Column 2 reported the coefficient is positive, but when using Wooldridge’s score test, with null hypothesis that variables are exogenous, p-value is less than 1 percent level, that means column 2 still has endogeneity, so it can be ignored. But with column 5, two null hypotheses are not refused, so the result is acceptable. When CPI increases one more point, growth will increase 1.1 percentage point. Corruption has negative effect on growth.

For high income countries, the association between corruption and growth is significant in columns 1. Two null hypotheses are not refused, so the result is suitable. When CPI increases one more point, growth will increase 0.47 percentage point. Corruption has negative effect on growth.

Although the number of evidences reduces, but with acceptable results, again, the relationship between corruption and growth is negative, even when endogeneity is concern and even with high income countries. And once more time, the negative impact of the initial per capita income on growth is reported in regression. After using 2SLS, once again, our finding still supports for the idea of Mauro (1995, 1996) and Park Hung Mo (2001) that corruption has negative impact on growth.

1. Concluding Remarks

From descriptive statistic outcomes, the correlation between corruption and growth seem to be positive in general. But when data set is grouped by income according to convention of World Bank, the relationship between corruption and growth is probably complicated. While this relation in high income group is positive, but in low income group is negative.

This research decides to divide data by four groups with more equal observations, and again, it is showed that in two lower income groups, the impact of corruption on growth is negative and it is positive in two higher groups. However, data descriptive provides that the standard deviation of higher income groups is much larger than lower groups. So the effect of corruption on growth maybe bias and not consistent. Observations of higher income groups is separated by corruption by five groups, and it is considered that in the same group of corruption, higher initial income probably leads to lower growth rate.

Empirical regression results give more evidences convincing the impact of corruption on growth is negative with high statistically significant. Even in high income countries, the relation between corruption and growth is negative. To avoid endogeneity, this research uses some instrument variables such as fractionalization and area. And the results show that both high income countries and lower income countries, corruption has negative effect on growth. It leads to some suggestions.

First, with low countries, reducing corruption properly leads to higher growth. The correlation between corruption and political rights and political stability are negative. It means if countries improve quality of institution, corruption might go down and it effects positively on growth. Secondly, with high income countries, higher corruption countries may have higher growth, but it does not mean corruption has positive impact on growth. It maybe the low corruption country is also the high initial income country, and the negative impact of initial income properly leads to low growth.

However, this research still has some limitations. The data set has many omissions, especially control variables, it is considered that results of some models is less reliable. Besides that, this research uses only cross-sectional data, it can lead to the improvement in quality of institution of some countries can be missed. In addition, the indirect impacts of corruption through various channels such as investment, political stability and human capital are not clarified in this assignment.