How does corruption affect economic growth in developing countries? A machine learning approach

Literature Review

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1 Controversy over the effect of corruption

The impact of corruption on economic growth has long been discussed by academia, and there is a large and growing amount of literature focusing on it. However, answer to this topic is unclear theoretically, since scholars develop two contradicting theories and they haven't reached a consensus. One strand of the literature, represented by Leff (1964) and Leys (1965), claims that the corruptive actions like bribery are severe in countries mainly with poor quality of governance, where ill-functioning governments often promote sluggishness and officials do not have any incentive on work. Under such a scenario, corruption may provide a strong incentive for officials to fasten the decision-making process, enhance the overall efficiency and productivity, and thus improve economic performance. Such theory is also known as "grease the wheels" hypothesis, and it is echoed by Lui (1985), who argues that awards based on the scale of corruption could be provided and may attain Pareto-optimal allocation of the entire market.

The other side of the debate is called "sand the wheel" hypothesis, which argues that corruption never has positive effect on the economic growth. Many voices are direct rebuttals to "grease the wheel" hypothesis. Myrdal (1972) claims that corruption only negatively influences the efficiency of governance, and then investment and economic growth, as officials may often delay the working process to obtain time for corruptive activities. Kurer (1993) further argues that corruptive officials have incentive to make distortions in economy to sustain their illegal income. Therefore, corruption neither improves efficiency, nor it compensates for ill institutions, which makes "grease the wheel" hypothesis invalid. Moreover, Mauro (1995) points out that corruption will impede private investment, and then negatively influence economies.

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Empirical studies reveal a more intense controversy with divergent results. Given that the scholars focus on distinct regions with different data source, multiple models and estimation methods, empirical papers result in even totally opposite conclusions.

Some papers show positive effect on corruption. Biru (2010) finds that there exists a positive relationship between corruption and economic growth in Bangladesh using cross-sectional data and regression analysis. By utilizing the panel data of 69 countries (both developed and developing ones) from Penn World Table and two corruption indexes called Corruption Perception Index (CPI) and World Governance Indicator (WGI), Méon and Weill (2010) construct a Stochastic Frontier model estimated by MLE, and figure out that "grease the wheels" hypothesis is supported by their empirical evidence. Also, according to Huang (2016), who assesses 13 Asia-Pacific countries with panel data from 1997 to 2013, South Korea is one strong empirical evidence against the common perception that corruption is bad for economic growth.

However, more papers tend to conclude a negative relationship between growth and corruption. Swaleheen (2011) utilizes the data from World Development Indicator (WDI) and CPI to run GMM estimations, finding that corruption has a significant negative effect on the per-capita real GDP. Farooq et al. (2013) check the case of Pakistan under a time series framework over the period of 1987 to 2009 and find that the corruptive actions severely impede the GDP growth. Sharma and Mitra (2019) examine a sample of 103 countries around the world, further classify them by their income level (high, middle, low), and run the GMM estimation on a Dynamic Panel Data model with the data from International Country Risk Guide's (ICRG) corruption index and WDI. They suggest that the corruption control within countries has positive effect on economic growth. Moreover, a Fixed Effect model is implemented by Frimpong et al. (2019) on countries of South African communities using data from WDI, CPI and polity IV index. They find that institutions should be proactive, otherwise anti-corruption policies would not have positive impact on economies.

More conclusions are made other than just positive or negative relations. Focusing on three particular developing countries, Wedema (1997) finds that corruption doesn't affect the pace of economy. Glaeser and Saks (2006) find no significant effect of corruption on growth in the U.S. Treisman (2007) also finds no significant relations by modelling a cross-national panel data. More interestingly, Acemoglu and Verdier (1998) provide a general equilibrium approach. They find that it may be optimal to allow certain corruption to promote economies and reach an equilibrium for least developed countries. Ahmad et al. (2012) further echo this point by arguing that there exists a quadratic relation between corruption and growth in an inverse U-shape way.

2 Potential contributions of this paper

Among all the literature, one thing to notice is that while there are some papers assessing the effect of corruption in developing countries, their focuses are too specific, usually on certain regions or even just one particular country. Also, their conclusions are inconsistent, with both positive (Biru, 2010) and negative (Frimpong et al., 2019) relations. Therefore, a general picture on the effect of corruption among all developing countries is still unclear and a further comparison of corruption's effect within the group of developing countries is still not discussed.

With such motivations, this paper intends to include all the developing countries to figure out corruption - growth relations and make empirical inferences. The identification of developing countries will refer to the classifying criteria by United Nations (2019). Further comparison of corruption's effect will be done by a classification based on the income level inspired by Sharma and Mitra (2019).

This paper also argues that the controversy in empirical evidences may mainly come from two reasons, namely distinct model and estimation approaches, and the usage on different measurements of the corruption indicator. This paper will contribute to tackle these two issues and make the result of this paper more justified and convincing.

The models used in the literature are various, including but not limited to basic regression model (Biru, 2010), Stochastic Frontier model (Méon and Weill, 2010), Dynamic Panel Data model (Sharma and Mitra, 2019), etc., with their corresponding estimation strategies of OLS, MLE and GMM. This paper would like to make a comparison among different methodologies by implementing different models and estimations to test the effect of corruption, check whether the results are consistent or not, and then make final conclusions.

While the data source for macroeconomic indicators is mainly WDI provided by World Bank, the sources of corruption index are different between empirical papers. For the three most commonly-used corruption indexes (Wraith and Simpkins, 2011), namely Transparency International's Corruption Perception Index (CPI), International Country Risk Guide's (ICRG) corruption index, and World Bank's World Governance Indicator (WGI), different papers tend to pick different index(es) as the proxy of corruption in models (as mentioned in Section 1). However, these indexes take distinct factors into account during the calculation. For example, CPI focuses more on the perception of corruption by integrating various perception metrics (Transparency International, 2019), while WGI mainly evaluates the quality of governance (Kaufmann et al., 2010) by checking efficiency,

regulator quality, etc. The calculations of indexes based on different factors partially explain the different empirical conclusions. Also, Wraith and Simpkins (2011) point out that the corruption itself is hard to measure, especially in developing countries.

To solve this problem, this paper will contribute to recalculate the index of corruption through a Support Vector Machine (SVM) approach inspired by Gründler and Krieger (2016) and Lima and Delen (2020), and the new indicator will be a normalized sequence with continuous values ranging from 0 to 1. This paper will take ten factors as input to SVM to generate a new corruption index, and the selection of factors to calculate the index is inspired by Wraith and Simpkins (2011), Goel and Nelson (2011) and Frimpong et al. (2019), who consider that the measurement should also consider political institutions, government size and development of technology. Using this new indicator, this paper will figure out a robust effect of corruption on growth in developing countries.

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