The Impact of Economic factors on Economic growth

Introduction

Globalization is a complicated process that has boosted interdependence between countries. Since the beginning of the 21st century, most countries have been opened to investment and the government strongly encouraged most capital investment to go to inward provinces as part of the strategy to develop more agricultural sectors as well as reduce inequalities. Since then, Foreign Direct Investment (FDI) has continued to increase its share in the total of actual foreign capital inflow. Many governments have adopted free-market systems, vastly increasing their own productive potential, and creating myriad new opportunities for international trade and investment that have boosted economies worldwide. Theoretically, FDI is an important factor to economic growth through technology transfer from developed countries to developing ones and efficiency improvement. This relationship was tested in an investigation that set FDI, initial GDP per capita, and a set of other variables that affect economic growth (such as government consumption, black market, inflation rate) as the parameters influencing the rate of growth of the output. Their regressions were estimated using seemingly unrelated regression (SUR) technique on the sample consists of 69 countries. The outcome shows a relatively strong and positive relationship between FDI and economic growth, especially in developing countries. The authors reason that the host countries may offer lower costs to the foreign firms, while the firms bring advanced technology to these economies. Thus, FDI seems to benefit both sides (Borensztein, Gregorio & Lee, 1998).

However, the impact of FDI and human capital on economic growth among different income groups of countries has not been studied much recently. Thus, the aim of this project is to further examine the effect of those factors on economic growth and to understand the transition of the impact amid countries of various income levels. The data will be collected for a 7-year period, from 2011 to 2017, since this is the time when many economies started recovering from the global financial crisis and globalization has been a huge wave to the world economy (Lee et al, 2017). The observations will include countries from all continents. The countries will

be categorized into low income, lower middle income, upper middle income, and high income countries, as this paper also wants to investigate how economic explanatory variables have different impacts on developing and developed countries. The categorization is taken from World's Bank meta table. The dataset to be studied is collected from World Bank (WB) and Penn World Table (PWT) database.

Materials and Methods

For over five decades, the Penn World Table has been one of the most frequently used as a standard source of data on real GDP across economies. By using prices collected in benchmark years by the International Comparisons Program (ICP) and exchange rates, PWT converts GDP at national currency to U.S. dollars, a common currency, to make them comparable between economies. Each newer version of PWT is based on a newer ICP benchmark. This paper uses PWT 9.1 which is based on the 2011 ICP price, whereas older version such as PWT 8.1 makes use of the 2005 ICP. GDP data is collected from National Accounts (NA) statistics, The fundamental element of PWT has always been real GDP per capita, a measure of relative living standards across countries at different points in time, which can be computed by taking output-side real GDP (namely rgdpo) divided by each country's population. Furthermore, PWT introduces human capital index according to average years of schooling from Barro and Lee (Barro & Lee, 2013) and an estimated rate of return to education based on the Mincer equation (Psacharopoulos, 1994). This approach, however, ignores any variation in returns over time and across countries. Besides, it also ignores differences in cognitive skill obtained by the students, which might be more important than only measuring on years of schooling because it underestimates the quality of education labor input in more developed countries (Hanushek and Woessman, 2012). Nevertheless, measuring the cognitive skill index for each specific country can be very complicated and costly as it includes variation over time and needs much more effort.

Data on FDI flows are presented on net basis. According to World Bank, net decreases in assets or net increases in liabilities are recorded as credits, while net increases in assets or net decreases in liabilities are recorded as debits. Thus, FDI flows with a negative sign indicate that at least one of the components of FDI is negative and not offset by positive amounts of the

remaining component. These are instances of reverse investment. Data on FDI net flows are based on the sixth edition of the Balance of Payments Manual (2009) reported by the International Monetary Fund (IMF). Foreign direct investment data are supplemented by the World Bank staff estimates using data from United Nations Conference on Trade and Development (UNCTAD) and official national sources.

By making use of multiple linear regressions for each specific year, the difference in the effect of explanatory variables on GDP per capita is observed. Although 7 years are taken into account in the exploratory data analysis part, only the last three years in the dataset (2015, 2016, and 2017) will be analyzed with regression as it will be overcomplicated to model each year over a 7-year period. The response variable, GDP per capita, will be log-transformed to avoid heteroskedasticity. A stepwise approach is used to build the best model without interaction terms or data transformations of the explanatory variables. Additionally, Nested f- tests were conducted to determine if adding a variable in the model was significantly better than the original model. Using the nested f-test will help determine the most effective model by eliminating insignificant complexity.

Results

Figure 1 illustrates a general visualization of how economies, grouping by regions, were developing during the 2011-2017 period. GDP per capita is introduced instead of the sum of all domestic products within each region due to the fact that some regions have much more countries and population than some others hence much more

Figure 1. GDP per capita of regions over 2011-2017

people to produce goods. As a result, the cumulative value might be higher although the former

was not doing as well as the latter. According to Figure 1, nearly half of the regions experienced worse economic quality in 2017 than they did in 2011, including the Middle East & North Africa, Latin America & Caribbean, and Sub-Saharan Africa, while the rest of the regions show gradual growing economies.

Figure 2. World FDI and GDP growth during 2011-2017

Figure 2 compares the world GDP growth rate and FDI during the examined period. It may be observed that GDP growth rate and FDI have opposite tendency against each other. However, when comparing the GDP growth rate with FDI of the previous year, they tend to have a positive relationship. For instance, cumulative FDI dropped in 2014, then the GDP during 2015 grew slower than the other years. In contrast, FDI rocketed during 2015 and the world economy has risen sharply since 2016. Therefore, it might be valuable to try taking FDI of the previous year as one of the explanatory variables for the regression model later. On the other hand, Figure A1 and Figure A2 show that the lower middle income is the only group undergoing the increasing trend in receiving FDI, and it is also the group with the highest GDP growth rate. Furthermore, Table A1 in Appendix indicates that there is a statistically significant relationship between GDP per capita and FDI (p-value=0.000681).
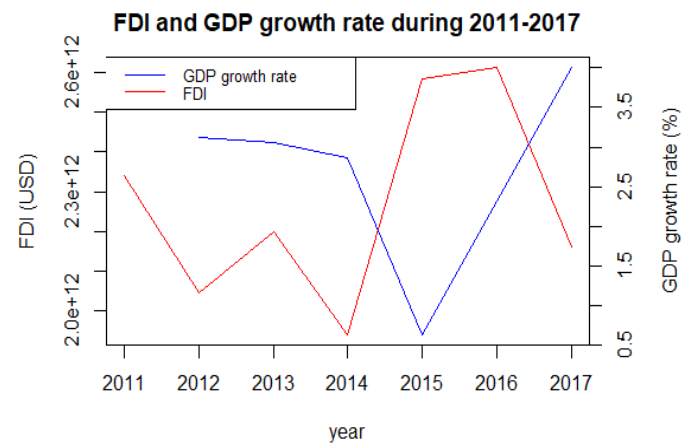
Figure 3 and Figure 4 illustrates human capital growth rate grouped by regions and by income groups, respectively. Both yield similar results that human capital in Asia, Africa, and Latin America (where most of the countries belong to the low and middle income groups) has been developing relatively faster than in Europe and North America (where most of the them are categorized as high income countries). The possible reason is that there are more rooms to advance in developing economies than in developed ones.
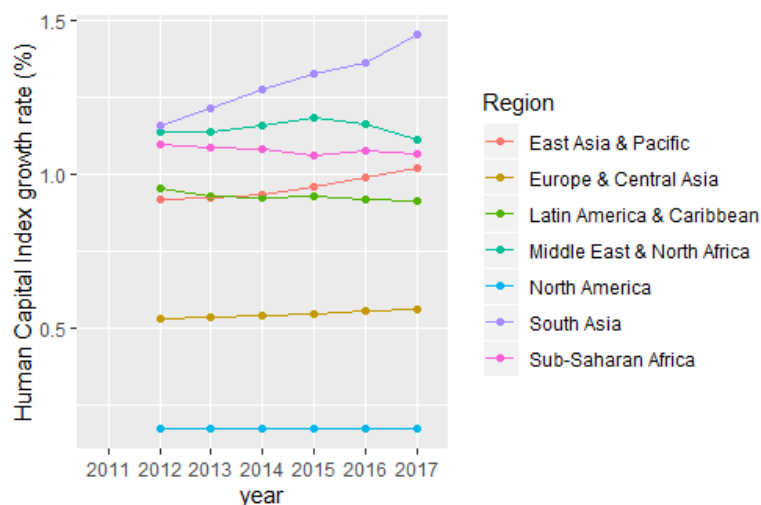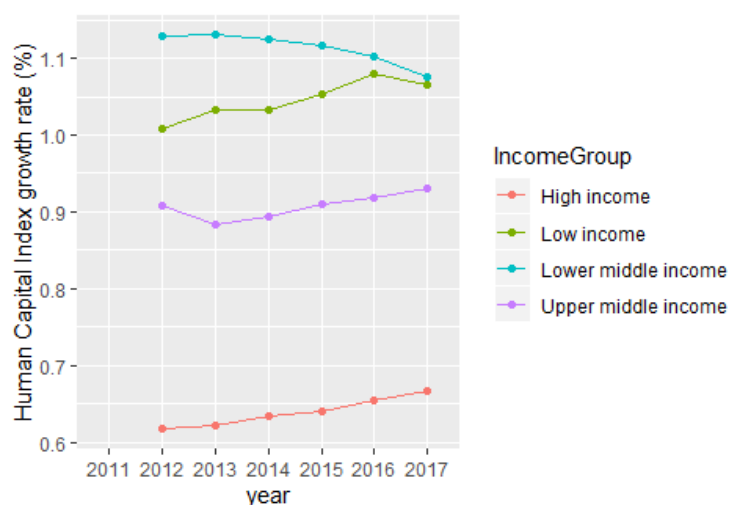
Figure 3. Human Capital growth rate by Regions

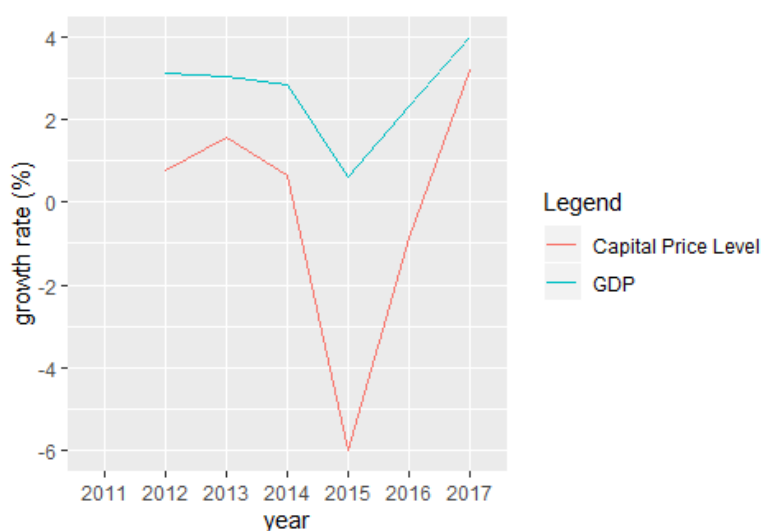
Figure 4. Human Capital growth rate by IncomeGroup

Figure 5. World GDP and Capital Price Level rate of change during 2011-2017

Since labor and capital are two of the most important factors in producing goods, it might be worth analyzing how capital price change related to GDP growth rate. Figure 5 contrasts the world GDP growth rate and the capital price level rate of change. It is clear that they both have similar trends with each other. Supported by the regression equation presented in Table A2, it can be concluded that they have a statistically significant relationship and are correlated with each other (p-value=9.46e-05).

After using stepwise approach to create the best multiple linear regression models at each year, all three final stepwise regressions result in a common model that includes human capital index, FDI, Region, and Income Group as explanatory variables. The interesting thing is that stepwise regression dropped out all the interaction terms between those variables, indicating that they are insignificant. This is also supported by the nested f-test, where nested model consists of variables in the above regression

and complex model adds in the interaction terms between those variables. The purpose is to verify whether it is essential to include at least one of the interaction terms in the regression model. All three nested f-test for each year yield p-values from 0.4 to 0.7, implying that we barely have any evidence to reject the null hypothesis and it is insignificant to have the interaction terms.

Table 1 reports the summary of the final regression model of years 2015, 2016, and 2017, respectively. The coefficients reported are exponentiated for simpler interpretation. Most of the explanatory variables are statistically significant at 10% level. The adjusted R-squared for three models are approximately 0.90, indicating that about 90% of the variation in GDP per capita is explained by human capital index, FDI, Region, and Income Group. Human capital has positive coefficients throughout the 2015-2017 period. For example, in 2015, an increase in one unit of human capital index results in 28.9% increase in GDP per capita, while an increase in one U.S dollar of FDI seems relatively small, it does not impact GDP per capita to rise nor fall, given everything else constant. However, the original coefficient of FDI is 1.216×10^{-12}, suggesting that if FDI increases by 100 billion U.S dollars, GDP per capita would likely to increase by 12.93%. According to Table 1, Low Income, Lower-Middle Income, and Upper-Middle Income countries have 91.1%, 79%, and 54.5% lower in GDP per capita than High Income countries in 2015, respectively. Moreover, compared to East Asia & Pacific region, only Middle East & North Africa region shows higher GDP per capita. Even Europe and North America, in which there are many developed countries, show lower GDP per capita than East Asia & Pacific throughout three years. Although most categories in the Region variable are not statistically significant by t-test, the nested f-test suggests including it with p-value of approximately 0.01.

While the effect of FDI on economic growth does not show any tendency within the three examined years, the effect of one unit increase in human capital to GDP per capita shows an increasing trend, from 28.9% to 30.9% in 2017. This will be discussed further in the Discussion section. Additionally, other Income Groups are catching up with the High-Income countries, especially Lower-Middle Income group, where it has been narrowing the gap of GDP per capita, from 79% lower in 2015 to 77.8% lower in 2017 than the High Income.

Coefficients	Estimate	2.5%	97.5%	p-value
Year 2015				
(Intercept)	16, 370	8, 883	30, 163	<2e-16
Human capital	1.289	1.067	1.555	0.00861
FDI	1.000	1.000	1.000	0.06742
Region Europe & Central Asia	0.889	0.707	1.117	0.31004
Region Latin America & Caribbean	0.702	0.549	0.897	0.00503
Region Middle East & North Africa	1.320	1.006	1.733	0.04528
Region North America	0.801	0.410	1.566	0.51403
Region South Asia	0.859	0.588	1.257	0.43213
Region Sub-Saharan Africa	0.652	0.500	0.851	0.00187
IncomeGroup Low Income	0.089	0.064	0.123	<2e-16
IncomeGroup Lower Middle Income	0.210	0.166	0.264	<2e-16
IncomeGroup Upper Middle Income	0.455	0.375	0.553	5.9e-13
Residual standard error: 0.386 on 130 degrees of freedom Multiple R-squared: 0.9044, Adjusted R-squared: 0.8963 F-statistic: 111.8 on 11 and 130 DF, p-value: < 2.2e-16				
Year 2016				
(Intercept)	15, 567	8, 465	28, 630	<2e-16
Human capital	1.310	1.087	1.580	0.00491
FDI	1.000	1.000	1.000	0.22095
Region Europe & Central Asia	0.900	0.716	1.132	0.36751
Region Latin America & Caribbean	0.693	0.541	0.887	0.00385
Region Middle East & North Africa	1.281	0.975	1.682	0.07500
Region North America	0.900	0.465	1.742	0.75369
Region South Asia	0.850	0.580	1.246	0.40210
Region Sub-Saharan Africa	0.631	0.483	0.825	0.00087
IncomeGroup Low Income	0.093	0.067	0.129	<2e-16
IncomeGroup Lower Middle Income	0.219	0.174	0.276	<2e-16
IncomeGroup Upper Middle Income	0.464	0.382	0.564	2.16e-12
Residual standard error: 0.3886 on 130 degrees of freedom Multiple R-squared: 0.9032, Adjusted R-squared: 0.8951 F-statistic: 110.3 on 11 and 130 DF, p-value: < 2.2e-16				
Year 2017				
(Intercept)	15, 662	8, 624	28, 442	<2e-16
Human capital	1.309	1.091	1.569	0.00400
FDI	1.000	1.000	1.000	0.11251
Region Europe & Central Asia	0.928	0.734	1.165	0.51706
Region Latin America & Caribbean	0.694	0.543	0.887	0.00380
Region Middle East & North Africa	1.257	0.959	1.647	0.09653
Region North America	0.858	0.451	1.635	0.63976
Region South Asia	0.871	0.597	1.270	0.47027
Region Sub-Saharan Africa	0.629	0.483	0.812	0.00072
IncomeGroup Low Income	0.093	0.068	0.128	<2e-16
IncomeGroup Lower Middle Income	0.222	0.177	0.279	<2e-16
IncomeGroup Upper Middle Income	0.462	0.381	0.561	9.27e-13
Residual standard error: 0.3838 on 130 degrees of freedom Multiple R-squared: 0.9063, Adjusted R-squared: 0.8984 F-statistic: 114.4 on 11 and 130 DF, p-value: < 2.2e-16				

Table 1. Summary of regression model for year 2015, 2016, and 2017

Discussion

This study tested the effects of human capital, FDI, and categorized factors such as region and income level on GDP per capita, one of the common indicators to examine a country's economic strength, of 179 countries around the world by using multiple linear regression between 2015-2017 period. The primary finding of this study was verifying that human capital and FDI have a positive effect on the economy, which matches the results in Kilic (2015), Titalessly (2018), and Pelinescu (2015) research. Additionally, this paper improves on the previous studies by investigating the magnitude effect of those factors over time. As stated in the Results section, the impact of human capital on gross domestic product per capita has been revealed to have an increasing trend, which strengthens the argument that human capital is one of the most important factors on economic growth (Riley, 2012 De la Fuente and Doménech, 2006). Its impact comes from labor productivity and contribution to advancing innovation technology. With an increasing impact, it is suggested that countries and governments should focus on educational development policies to improve productivity and to make use of resources more effectively. Returns from investment in skills are as great as investment in capital. On the other hand, the lower-income countries, especially the lower-middle income group, are those who have the fastest increasing rate which can be explained by the globalization wave in recent years. Openness is the best approach for low-income countries to have access to new technology that will motivate agriculture, which is the main contribution in low-income economies, and manufacturing activities. An implication of this study is the need for open-minded and concentrated education policy to successfully integrate in a more competitive modern world. Further study could make use of this paper as one of the bases to analyze the impact of political and social factors on economic growth, combining with some economic and geographic features in this study.

In regards to linear regression assessment, GDP per capita of a country might not be independence to other countries because a large economy can have significant effect on its surroundings but should not be an issue in this study. Since the dataset is collected from most countries, it ensures randomness and is representative globally. Constant variance is also

guaranteed as shown in the residuals vs fitted plot. As none of the 179 countries exceed the magnitude of 2 in normal Q-Q plot, it can be concluded that the data is normally distributed.

References

1. "Foreign Direct Investment, net inflows" conducted by World Bank data. Downloaded from https://data.worldbank.org/indicator/BX.KLT.DINV.CD.WD?end=2019&start=2011.

2. "Penn World Table version 9.1," University of Groningen. Downloaded from https://www.rug.nl/ggdc/productivity/pwt/?lang=en.

3. Barro, Robert J. & Lee, Jong Wha, 2013. "A new data set of educational attainment in the world, 1950-2010," *Journal of Development Economics*, Elsevier, vol. 104(C), pages 184-198.

4. Cuneyt Kilic, "Effects of Globalization on Economic Growth: Panel Data Analysis for Developing Countries," *Economic Insights – Trends and Challenges* 4, no. 1 (2015): 1-11.

5. De La Fuente Á, Domenéch A., 2000, A Human capital in growth regressions: "How much difference does data quality make?,*" Economic Department Working Paper*, No.262, Paris: OECD, 2000 (ECO / WKP (2000) 35).

6. Dong-Hyeon Kim, Yu-Bo Suen, Shu-Chin Linc and Joyce Hsieh, "Government size, government debt and globalization," *Applied Economics* 50, no. 25 (2018): 2792-2803.

7. Eric A. Hanushek & Ludger Woessmann, 2012. "Schooling, educational achievement, and the Latin American growth puzzle," *Journal of Development Economics*, Elsevier, vol. 99(2), pages 497-512.

8. George Psacharopoulos, 1994, "Returns to investment in education: A global update," *World Development*, vol. 22, issue 9, pages 1325-1343.

9. Pisi Bethania Titalessy, "The Impact of Globalisation on Economic Growth in Asia-Pacific," *Asia Pacific Journal of Advanced Business and Social Studies* 4, no. 2 (2018): 79-85.

10. Pistorius, C., 2004, "The Competitiveness and innovation," *Elektron*, Vol. 21, No.3

11. Riley G, 2012, "Economic Growth - The Role of Human & Social Capital, Competition & Innovation," http://www.tutor2u.net/economics/revisionnotes/a2-macro-economic-growth-capital.html.

12. Stannia Cahaya Suci, Alla Asmara, and Sri Mulatsih, "The Impact of Globalization on Economic Growth in ASEAN," *International Journal of Administrative Science and Organization* 22, no. 2 (May 2015): 79-87.

13. Wai Choi Lee, Tsun Se Cheong, and Yanrui Wu, "The Impacts of Financial Development, Urbanization, and Globalization on Income Inequality: A Regression-based Decomposition Approach," *Asian Development Bank Institute*, no. 651 (January 2017).