

**ID 2203168**

**Data Analysis 4**

**Winter 2023**

**Central European University**

**Assignment 3**

**Link: <https://github.com/Aborubaeva/Data-analysis-4--Term-Project.git>**

### **Does Foreign Aid Help Low-Income and Lower-Middle-Income Countries Grow?**

In 2004 John Perkins published a book called “Confessions of an Economic Hitman” where he argued that foreign development aid does not help low-income countries to grow. In this research project, the author will analyze this hypothesis. The given issue is significantly important for both developing countries, and countries providing aid. Such support plays an outstanding role in the economy of developing countries. Finding the weaknesses of the current system can help the stakeholders to find critical points and develop the process for future economic development and improving the quality of life for millions of people worldwide. In addition, it can help to select countries that can use aid more effectively instead of investing in the countries abusing such financial support and do not stick to the intended use of funds. Therefore, the author will investigate the research question of whether foreign aid helps low-income countries to grow.

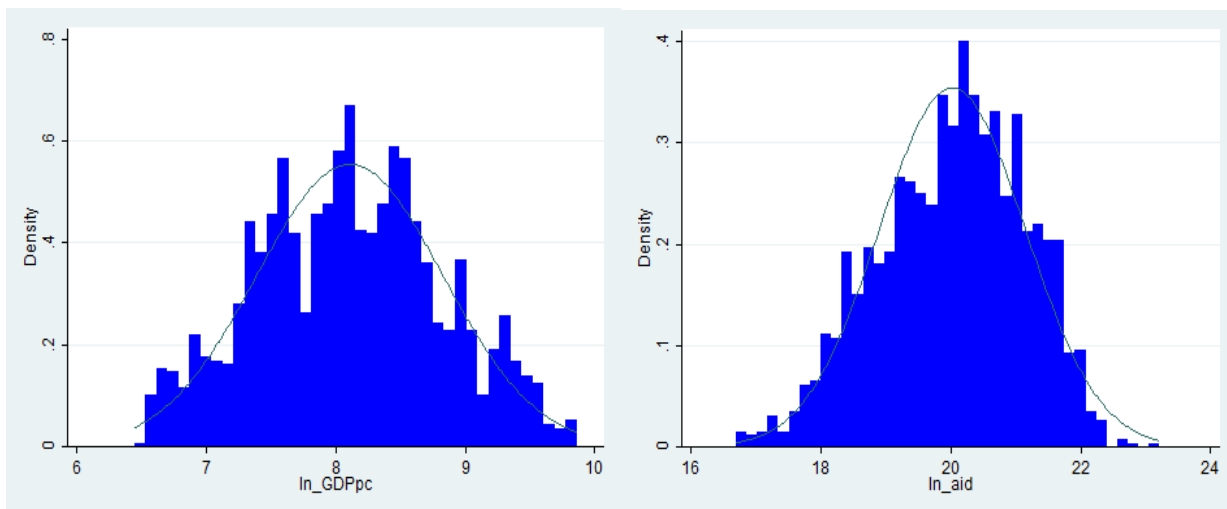
The Kyrgyz Republic is a lower-middle income country according to the World Bank classification, which has been receiving development aid since 1991. Foreign aid is an important part of the economics of the country, nevertheless, the growth of the economy is slow, while inequality and poverty are significant. This analysis is based on the dataset of the World Bank. The variable for measurement of the economic state of the country is GDP per capita, PPP (constant 2017 international) in USD, while the development aid is the Net Official Development Assistance and Official Aid Received in USD. Because there are only a few low-income countries according to the World Bank statistics, the analysis uses low-income and lower-middle-income countries to create a panel dataset with 82 countries. However, some of them have missed variables for GDP per capita, so I dropped them to get a perfectly balanced dataset. The initial timeframe is from 1991 to 2021, but the years from 1991 to 1999 are deleted because of the many missed variables for GDP per capita. Additionally, the author dropped the variables with negative aid because it means that these countries (mostly Indonesia) have not received but sent aid which is not relevant to the research.

*Table 1. Descriptive statistics*

Variable	Obs	Mean	Std. Dev.	Min	Max
year	1608	2010.516	6.354179	2000	2021
countryid	1608	37.65672	21.41149	1	74
population-h	1608	2.032209	1.028108	-2.879866	9.97197
GDPpc	1608	4325.445	3265.516	628.6933	19239.56
aid	1608	8.64e+08	9.53e+08	1.78e+07	1.22e+10
CPIA	994	2.805835	.6339077	1	4.5
HCI	226	.4438304	.0872459	.2860746	.6899645
ln_GDPpc	1608	8.116937	.7215348	6.443644	9.864724
ln_aid	1608	20.02741	1.125073	16.69358	23.22077

The descriptive statistics above show that finally there are 1,608 variables in the dataset including 74 countries and 22 years. The GDP pc varies between 628.7 and 19,239.6 USD. The mean is 4,325.4 USD. The standard deviation is 3,265.5. The ln\_GDPpc varies between 6.44 and 9.86. The mean is 8.11, the standard deviation is 0.72. The ln\_aid varies between 16.7 and 23.2 (mean=20.02, standard deviation = 1.13). The histograms of the natural logarithm of GDP per capita and the natural logarithm of aid show that these variables have a normal distribution. Population growth is calculated as a percentage of annual growth. It varies from -2.88 to 9.97 (mean=2, the standard deviation=1). CPIA varies from 1 to 4.5 and has only 226 variables (mean=2.8, standard deviation=0.63). HCI varies from 0.29 to 0.69. The mean is 0.44, the standard deviation is 0.09.

Graph 1&2. Histogram of ln GDP per capita distribution and histogram of ln aid distribution



The model is log-log because in the given case the percentage is more relevant than absolute numbers. Such a model will capture non-linear relationships, ensure heteroscedasticity and provide elasticity interpretations, which will lead to more accurate and reliable estimates. The author used the following panel fixed effect model. The model is  $\Delta \ln(\text{GDP per capita})_{it} = \alpha + \beta_0 \Delta \ln(\text{aid})_{it}$ , where ln\_GDPpc is the dependent variable and ln\_aid is the independent variable. By the estimation of this model, the author obtains an estimate of the effect of foreign development aid on economic growth, controlling for other factors that may also influence growth.

Table 2. Fixed Effect regression

```

Fixed-effects (within) regression
Group variable: countryid

Number of obs      =    1608
Number of groups   =     74

R-sq:  within = 0.5591
       between = 0.0010
       overall  = 0.0387

Obs per group: min =     9
               avg  =    21.7
               max  =    22

F(22, 73)          =    11.72
Prob > F           =    0.0000

corr(u_i, Xb)      = -0.0070

```

(Std. Err. adjusted for 74 clusters in countryid)

ln_GDPpc	Coef.	Robust Std. Err.	t	P> t	[95% Conf. Interval]	
year						
2001	.0152097	.0061193	2.49	0.015	.0030138	.0274055
2002	.028318	.0094513	3.00	0.004	.0094817	.0471544
2003	.0478143	.0122359	3.91	0.000	.0234283	.0722004
2004	.0833258	.0149196	5.58	0.000	.0535911	.1130605
2005	.1147361	.0171398	6.69	0.000	.0805765	.1488957
2006	.1462472	.0191741	7.63	0.000	.1080334	.1844611
2007	.180739	.0219295	8.24	0.000	.1370336	.2244444
2008	.207936	.0244599	8.50	0.000	.1591875	.2566846
2009	.2220901	.0242169	9.17	0.000	.1738259	.2703544
2010	.2573507	.0252245	10.20	0.000	.2070783	.307623
2011	.2868865	.0269208	10.66	0.000	.2332334	.3405395
2012	.313547	.0280556	11.18	0.000	.2576322	.3694617
2013	.3294628	.0298226	11.05	0.000	.2700265	.3888991
2014	.3535062	.0313149	11.29	0.000	.2910957	.4159167
2015	.3671781	.0321577	11.42	0.000	.3030879	.4312682
2016	.386383	.0335667	11.51	0.000	.3194846	.4532815
2017	.40746	.0350059	11.64	0.000	.3376933	.4772268
2018	.4221226	.0365565	11.55	0.000	.3492656	.4949795
2019	.4395166	.0388072	11.33	0.000	.362174	.5168592
2020	.4009252	.0409003	9.80	0.000	.3194112	.4824393
2021	.4178978	.0419737	9.96	0.000	.3342444	.5015511
ln_aid	.0037773	.0255827	0.15	0.883	-.047209	.0547636
_cons	7.794254	.512021	15.22	0.000	6.773797	8.81471
sigma_u	.69809606					
sigma_e	.13396385					
rho	.96448275	(fraction of variance due to u_i)				

The coefficient estimate in the table above shows when the foreign aid is higher by 1 percentage point, GDP per capita is expected to be, on average, 0.004 percentage points higher. The result is not significant at any level (p-value=0.883). The intercept shows the ln\_GDPpc in countries which have not received any aid.

The confounders can help improve the validity and reliability of the results by controlling for their potential impact on the relationship between foreign aid and economic growth. The author used such potential confounders as Population growth, CPIA and HCI. Population growth in this case can affect economic growth through an increase in the amount of labour or a shortage of resources caused by overpopulation. The transparency, accountability, and corruption in the public sector (CPIA) can also have a significant impact because in such cases when corruption in the public sector is high, the financial support will go to the wrong destination. The Human Capital Index (HCI) may influence the relationship, as countries with higher HCI on average tend to have more productive economies, and controlling for this variable can help account for this effect.

The model is  $\Delta \ln(\text{GDP per capita})_{it} = \alpha + \beta_0 \Delta \ln(\text{aid})_{it} + \beta_1 \Delta \text{population growth}_{it} + \beta_2 \Delta \text{CPIA}_{it} + \beta_3 \Delta \text{HCI}_{it}$ , where ln\_GDPpc – dependent variable, ln\_aid is the independent variable, population growth, CPIA and HCI are confounders. By the estimation of this model, the author obtains an

estimate of the effect of foreign development aid on economic growth, controlling for other factors that may also influence growth.

*Table 3. Fixed Effect regression with confounders*

Fixed-effects (within) regression		Number of obs	=	170	
Group variable: countryid		Number of groups	=	55	
R-sq: within	= 0.3539	Obs per group: min	=	1	
between	= 0.0633	avg	=	3.1	
overall	= 0.0282	max	=	4	
corr(u_i, Xb) = 0.0340		F(7,54)	=	10.23	
		Prob > F	=	0.0000	
(Std. Err. adjusted for 55 clusters in countryid)					
ln_GDPpc	Coef.	Robust Std. Err.	t	P> t	[95% Conf. Interval]
year					
2017	.0566183	.0333167	1.70	0.095	-.0101777 .1234143
2018	.0786094	.0366095	2.15	0.036	.0052117 .152007
2020	.0605049	.0432873	1.40	0.168	-.0262809 .1472907
ln_aid	.0184421	.0299965	0.61	0.541	-.0416973 .0785816
population_growth	.0900596	.02706	3.33	0.002	.0358075 .1443117
CPIA	.0648305	.0315941	2.05	0.045	.0014882 .1281728
HCI	.8204856	.7153376	1.15	0.256	-.6136799 2.254651
_cons	6.795376	.615997	11.03	0.000	5.560377 8.030376
sigma_u	.58937975				
sigma_e	.06402315				
rho	.98833757	(fraction of variance due to u_i)			

The coefficient estimate in the table above shows that when foreign aid is higher by 1 percentage point, GDP per capita tends to be 0.018 percentage points higher. The result is not significant at any level (p-value=0.541). The intercept shows the ln\_GDPpc in countries which have not received any aid. When the population growth is 1% higher, the GDPpc is expected to be, on average, 9% higher with a 1% significance level. At the same time, countries with CPIA higher by 1 point are expected to have approximately 6.5 percent higher GDP per capita, on average (significant at the 5% level). The countries with 1-point higher HCI are expected to have approximately 82% higher GDP per capita, on average. The result is not significant at any standard significance level. The result does not show the causal effect because the p-value is not significant at any standard level, so the null hypothesis can not be rejected. An additional investigation with more confounders is needed in this case. Now we can say that there is no effect of foreign aid on economic growth.

The Robustness check to prevent heteroscedasticity problems is usually used in the OLS model using the “robust” command. However, there is no such need for the fixed effect model because this model has already included the robustness check. Additionally, a few additional checks, such as changing the size and composition of the sample can be made.

To check if the result may be different for different countries the researcher divided the countries into two groups: low-income countries and low-middle-income countries. The results for low-

income countries were not significant at any level, so it is not included in the research. However, the result for lower-middle-income countries is interesting.

*Table 4. Lower-middle income countries*

Fixed-effects (within) regression		Number of obs	=	104		
Group variable: countryid		Number of groups	=	35		
R-sq: within	= 0.4449	Obs per group: min	=	1		
between	= 0.0000	avg	=	3.0		
overall	= 0.0145	max	=	4		
corr(u_i, Xb) = -0.1776		F(7,34)	=	28.40		
		Prob > F	=	0.0000		
(Std. Err. adjusted for 35 clusters in countryid)						
ln_GDPpc	Coef.	Robust Std. Err.	t	P> t	[95% Conf. Interval]	
ln_aid	.063504	.022728	2.79	0.008	.0173152	.1096928
population_growth	.0786214	.0446428	1.76	0.087	-.0121037	.1693466
CPIA	.0866296	.0406954	2.13	0.041	.0039266	.1693326
HCI	-.3464011	.6179323	-0.56	0.579	-1.602191	.9093884
year						
2017	.1194832	.0248214	4.81	0.000	.0690401	.1699263
2018	.1501219	.0285663	5.26	0.000	.0920683	.2081756
2020	.1215533	.0384786	3.16	0.003	.0433553	.1997513
_cons	6.630147	.4615963	14.36	0.000	5.69207	7.568223
sigma_u	.42271613					
sigma_e	.06743278					
rho	.97518404	(fraction of variance due to u_i)				

The coefficient estimator in this case shows that lower-middle income countries which receive 1 percentage point higher aid are expected to have, on average, 0.06 percentage points higher GDP per capita. The result is significant at a 1% level. Additionally, the countries with 1% population growth are expected to have 7.8% higher GDPpc (10% significance level), countries with 1-point higher CPIA are expected to have 8.7% higher GDPpc (5% significance level) and the result for HCI is not significant at any level.

Finally, the author can conclude that there is no causality between foreign aid and economic growth for low-income countries, however, the answer is not a straightforward one. However, there is a statistically significant result for lower-middle-income countries, which shows the positive relationship between foreign aid and GDP per capita. Because the Kyrgyz Republic is a lower-middle-income country, the author can argue that development aid should help the case of this country according to the result of the analysis. Therefore, the country should make efforts to get as much foreign development aid as possible to grow faster. However, the Kyrgyz Republic should also concentrate on its population growth and CPIA to make the aid more efficient. Additionally, the author would recommend continuing this investigation for the case of the Kyrgyz Republic including more confounders to find the best policy for the country.