University of Ioannina

Department of Economics

MSc Economic Analysis

# Unlinking Causally Economic Complexity and Income Inequality

Panagiotis Kapartzanis

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Supervisor: Athanasios Lapatinas

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## Abstract

Existing studies establish a significant negative effect of economic complexity on income inequality. They support that countries producing complex products have lower levels of income inequality. We examine the impact of economic complexity on income inequality using panel data for 227 countries, for the period 1960-2016. We present fixed effects and 2SLS/IV estimates that show no evidence of a clear cut causal effect. Moreover, we show that a negative correlation may be apparent but there is no evidence of causation. Finally, even when there is evidence of a causal relationship between economic complexity and income inequality, it seems to be a positive one.



***Keywords***: economic complexity, income inequality, institutions

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# 1. Introduction

As we know from Economic Theory, production is the process by which inputs (economic resources) are combined, transformed, and turned into outputs (goods and services). The inputs used in this process are usually natural resources and capital equipment (raw materials, machines and labor). Inputs are the initial part of production and outputs are the result arising from the production process. Another important ingredient required for the creation of a product is knowledge. There are two kinds of knowledge into a society: explicit knowledge and tacit knowledge. Explicit knowledge is easy to transfer and communicate by reading a text on a book or on the web or by using visual and oral means. On the other hand, tacit knowledge is hardly transferred because it is based on an individual's emotions, experiences, observations and insights. It is also vital for growth and development process. Differences to prosperity are mainly a result of the amount of tacit knowledge a society holds and the ability to combine it. For this reason it is very important for an economy to specialize and for individuals to be used in specific occupations. (Hausmann, et al, 2013).

In Adam Smith's "Wealth of Nations" discusses that division of labor is very important for economic growth. The specialization of labor force refers to the action of breaking down large activities into tinier components. By this way, each worker becomes an expert in a specific area of production a fact that usually leads him in increasing efficiency. However, the extent of the market constitutes a limitation for the division of labor because the bigger the market is the higher the division of labor can be achieved. Wealth and development depend on the complexity that turns out from the number of combined activities an economy holds (Hidalgo & Hausmann, 2009). The division of labor is important because it allows a society to possess a huge amount of knowledge that no one could hold individually. This fact helps modern world adapt to expanding knowledge because it holds a large amount of knowledge, while each individual holds only a little part of it. Products differ by the amount of knowledge that is necessary for their production. For example natural resources require a low amount of productive knowledge in their production in contrast with highly complex products, such as

medical equipment, that require a high amount of knowledge for their production. Most products produced in our days require that the economy holds a high amount of productive knowledge and as a result the production of these products require the interaction of individuals with different capabilities. In order to mobilize the productive knowledge into an economy, people have to interact. This interaction takes place through firms and organizations which connect each other through the product/service market. Economic Complexity is a recently introduced measure of the complexity of this interaction in a society and of the amount of productive knowledge that is combined into an economy. Economic Complexity is reflected in the composition of an economy's productive structure and output and it is an indicator of the country's ability to combine productive knowledge (Hausmann et al. 2013).

In addition, complexity is related with the type of produced products. Countries producing high technology goods (aircraft) are more complex than countries producing commodities (sugar) and also need more productive knowledge. For an economy to be complex, its individuals from different sectors have to interact, communicate and combine their knowledge in order to produce more sophisticated products. Furthermore, complex economies have the ability to combine large amounts of knowledge together and as a result to produce complex products that are knowledge-intensive. Lower complexity countries, in contrast, fail to combine the required amount of productive knowledge and they produce simpler products. As a result, countries do not produce all the products they consume or are necessary for them but only the ones which they are able to produce based on the knowledge that their people and firms hold. For this reason, we can measure economic complexity by taking into account the mix of products that countries produce.

Looking into the mix of products that a country produces one can locate the level of its productive knowledge. During the measurement process of economic complexity we have to define two sizes related to the productive structure of a country: diversity and ubiquity. Diversity refers to the number of the different kinds of products an economy is able to produce and ubiquity refers to the number of

countries which have the ability to produce a product. As we have already argued, countries produce only the products for which they have the required knowledge. The diversity of an economy's exports is related to the variety of capabilities available in this economy and the ubiquity of a product is depended on the variety of capabilities required for the production of the product. The amount of capabilities a country holds is reflected in the number of products it produces, in the ubiquity of those products and the diversity of the other countries that produce these products (Hausmann et al. 2013).

Economic complexity of a country is measured by the Economic Complexity Index (ECI) which is a metric of the sophistication of a country's productive structure and is also a view of country's capabilities. ECI uses information on countries' product diversity and ubiquity. A high ECI value means that the respective country is a complex economy. Complex countries are highly diverse and export products of low ubiquity while less complex countries produce high ubiquity products. Additionally, ECI connects countries to the products in which they have Revealed Comparative Advantage (RCA) and is calculated using exports data (Hidalgo and Hausmann, 2009). The Revealed Comparative Advantage of a country c in a product p is:

$$RCA_{cp} = \frac{\frac{X_{cp}}{\Sigma_{p'} X_{cp'}}}{\frac{\Sigma_{c'} X_{c'p}}{\Sigma_{c'p'} X_{c'p'}}} \quad (1)$$

where, $X_{cp}$ is the total export of country c in product p. RCA defines a discrete matrix $M_{cp}$ with its elements equal to 1 if country c has RCA in product p and 0 otherwise. In this matrix every row represents a different country and every column a different product:

- Mcp= 1 if RCAcp ≥1
- Mcp= 0 if RCAcp <1

Using the rows and the columns of the matrix $M_{cp}$ we can calculate countries' product space diversity and ubiquity.

$$Diversity = k_{c0} = \sum_p M_{cp} \quad (2)$$

$$Ubiquity = k_{p0} = \sum_c M_{cp} \quad (3)$$

The Economic Complexity Index (ECI) is then defined as:

$$ECI = \frac{K_c - <K>}{std\ (K)} \quad (4)$$

where, $K_c$ is the eigenvector of $\widehat{M}_{cc'}$ associated with the second largest eigenvalue and < > represents an average, and std stands for the standard deviation.

Similarly, we can define the Product Complexity Index (PCI):

$$PCI = \frac{Q_p - <Q>}{std\ (Q)} \quad (5)$$

where, $Q_p$ is the eigenvector of $\widehat{M}_{pp'}$ associated with the second largest eigenvalue.

Next we give two tables depiciting the five most complex and the five less complex economies for the year 2016.

**Table 1:** The five most complex economies in Economic Complexity Ranking 2016.

| ECI Ranking | Country Code | Country | ECI Value |
|---|---|---|---|
| 1 | JPN | Japan | 2.26 |
| 2 | CHE | Switzerland | 2.18 |
| 3 | DEU | Germany | 1.99 |
| 4 | KOR | Korea (Republic of) | 1.79 |
| 5 | CZE | Czech Republic | 1.69 |

Source: http://atlas.cid.harvard.edu/rankings/2016

**Table 2:** The five less complex economies in Economic Complexity Ranking 2016.

| ECI Ranking | Country Code | Country | ECI Value |
|---|---|---|---|
| 118 | MRT | Mauritania | -1.84 |
| 119 | PNG | Papua New Guinea | -1.88 |
| 120 | CMR | Cameroon | -1.88 |
| 121 | GIN | Guinea | -2.16 |
| 122 | NGA | Nigeria | -2.25 |

Source: http://atlas.cid.harvard.edu/rankings/2016

Economic Complexity reflects the amount of productive knowledge that is combined and used into a country's productive structure. There are several reasons that make Economic Complexity Index (ECI) an important measure for economics. ECI consists a predictive measure for future economic growth. Specifically, economic complexity has a positive correlation with future economic growth and exports and also enhances long term income. Highly diversified countries produce more complex products (Hidalgo and Hausmann, 2009). The ability of ECI to predict future economic growth suggests that finally countries reach an income level that is in line with their level of productive knowledge. When countries reach a higher level of Economic Complexity they have the ability to expand their productive capabilities and produce more complex products. In addition, Economic Complexity is related to

human development and leads people to develop better quality of life (education, health, etc.) (Hausmann, et al, 2013). On the other hand, even though a positive relation is observed between economic complexity and human development there is no evidence of a causal effect (Lapatinas, 2016). Economic Complexity is very important for one more reason. Increases in Economic Complexity decrease income inequality. That means that countries producing and exporting complex products have lower income inequality (Hartmann, et al, 2017). Concluding, economic complexity is a driver for an economy because it is predictive of future economic growth, decreases income inequality, is related to human development and is vital for a country's level of prosperity. Economic complexity is hard to achieve, but economies that achieve it move forward and obtain important benefits.

Though Economic Complexity is a recently developed measure it is very important and usually better than other classic approaches. Existing literature has examined the relation between institutions, human development and growth. However, as discussed above Economic Complexity leads to better institutions, quality of life and to more educated workers. In other words, Economic Complexity includes all these terms and this is why it is a better indicator of economic growth. Also, traditional measure of growth fail to take into account the sophistication of the products and differences in productive structure something that it is well explained by Economic Complexity literature. As a result, Economic Complexity Index (ECI) is a better predictor of growth than traditional measures of governance, competitiveness and human capital (Hausmann et al. 2013).

Furthermore, It is important and valuable to study the potential causal relation between economic complexity and income inequality. Existing studies establish a link between economic diversification and income inequality supporting that ECI is a negative and significant predictor of income inequality (Hartmann et al. 2017). This means that more economic sophistication leads the economy to lower income inequality levels.

In this study, we are going to examine if a causal relationship exists between economic complexity and income inequality. In order to measure income inequality

and economic diversification, we use the Estimated Household Income Inequality Data Set (EHII) from the University of Texas as well as the values of Economic Complexity Index, available at MIT's Observatory of Economic Complexity (alternatively we also use ECI+ values). We utilize two strategies to investigate the causal effect of economic complexity on income inequality. Our first strategy is to control for country-specific factors affecting both economic diversification and income inequality by including country fixed effects. Our first finding is that once fixed effects are introduced, the negative relationship between economic complexity and income inequality disappears. In addition there is no evidence of a statistical significant effect of ECI on income inequality. Our second strategy is to use 2SLS/IV regressions to estimate the impact of economic complexity on income inequality. We find no evidence of a (negative) causal effect of economic complexity on income inequality. Instead, the 2SLS/IV estimations indicate that if causation between ECI and income inequality exists then it will probably be a positive one. Specifically, this is more evidenced when we use the ECI+ values, instead of ECI. We also reproduce the estimations using the lagged value of ECI (and ECI+) and our results remain the same. There is a negative correlation between economic complexity and income inequality but no evidence of causation. Furthermore, in some cases where a causal effect seems to be apparent (statistical significant), the sign of the effect appears to be positive and not negative as the relevant literature suggests. Finally, we check the robustness of our results following the same estimation strategy but using alternative income inequality measures finding the same results.

## 2. Literature Review

Hidalgo, Klinger, Barabási, and Hausmann (2007) map the product space and study the evolution of countries on it. They suggest that product affinity is related to the fact that a country which specializes in the production of one product, can also specialize in the production of another. In their paper, they use Robert Feenstra's international trade data from a project agreed with the National Bureau of Economic Research. Using network techniques they show that product relatedness explains the way countries change their specialization patterns over time and usually move their production to related goods. They also find that high income products are located in a solid connected core while lower income products face a weaker connection between them usually lying in the network's periphery. The structure of the product space limits a country's chances to move in a better position. Especially if we take into account the fact that poorer countries have Revealed Comparative Advantage (RCA) on peripheral goods it shows that a country's productive structure is affected by how easily those product-specific factors can be used differently. As a result, poorer countries have problem in developing more competitive exports. Finally, they argue that the choice of moving into nearby products is an effective strategy for richer countries, which are located on the core of product space, and ineffective for poorer countries located on the periphery of product space.

Hidalgo and Hausmann (2009) promote a view of economic growth and development referring to economic complexity as a vital component. They propose a method to quantify the country's complexity which is a useful measure for the structure of the economy, due to their connection with the products they export. The data used in this paper are from 3 different sources and classifications. The first one is the Standard International Trade Classification (SITC) at the 4-digit level, the second one the COMTRADE Harmonized System at the 4-digit level and the third is the North American Industry Classification System (NAICS) at the 6-digit level. They use the Method of Reflections [1] in order to define the structure of bipartite networks

[1] With their data, they create bipartite networks in order to link the countries with the products they export. With mathematical terms they create a matrix which takes the value 1 if the country is an important exporter of a good and 0 if it is not. With the Method of Reflections they introduce variables that describe the architecture of the network which includes the matrix

which consist of countries and products. In their model, a positive relationship is observed between a country's diversity and the possession of capabilities the country has, while a negative connection is observed between the number of capabilities in the country and the level in which its products are widespread. With the term capabilities they refer to the individual activities that derive from the division of labor. Moreover, they show that countries with higher diversification produce more complex products. Their major findings indicate that economic complexity measures connect with income per capita and are strong indicators of the complexity of a country's future exports and growth.

Simoes and Hidalgo (2011) develop a new tool for controlling big data for trade, namely the Economic Complexity Observatory. Its major aim is the connection of growth theory and data. They use trade data from two different datasets. The first one is from Feenstra et al. (2005) for years 1962-2000 and the second one, for the years 2001-2009, is from the UN COMTRADE. Their results provide simple tools necessary for the investigation of the evolution of a country's productive structure. This tool is important because it provides a very simple representation of the world economy that can be easily understood by everyone.

Felipe, Kumar, Abdon and Bacate (2012) investigate the relationship between economic development and product complexity. They connect economic development with the production of higher complexity products. At their paper, economic complexity is measured using the method of reflections which was first developed by Hidalgo and Hausmann (2009). Furthermore, in order to estimate complexity measures they use trade data from the Harmonized System 6-digit level, which is composed by 5132 products for 176 countries. The main findings from the application of the method of reflections are that the most complex products are in machinery, chemicals and metals. On the other hand, the lowest complexity products are raw materials, commodities and agricultural products. In addition, they find that the more complex products are exported mainly by the richer countries

mentioned above. This method constructs a set of variables for the countries and products of this network, in order to calculate a country's diversification and the ubiquity of a product. The term diversification means the amount of products exported from a country and the term ubiquity accounts for the amount of countries that export a product.

while the less complex products are exported by the poorer countries. Additionally, they estimate cross-country regressions of each country's export share for 5107 products. The results show that exports increase with income for high complexity products, whereas for low complexity products exports decrease with income.

Cristelli, Gabrielli, Caldarelli and Pietronero (2013) introduce a new methodology aiming to end up with useful information about the complexity of products and the competitiveness of countries. In their model, they use a non-monetary measure that it is not based on income. The major utility of their measure is to discover the hidden potential for the country's growth. They present a statistical approach based on non-linear maps aiming at the connection of countries with the complexity of products. Then, they compare their method with Hidalgo and Hausmann's Method of Reflactions and argue that their main difference lies in the fact that they use a non-linear relationship between products complexity and the fitness of countries producing these products. In addition, Cristelli, Gabrielli, Caldarelli and Pietronero in their theory take into account the diversity of the export bakset, in contrast to Hidalgo and Hausmann's model, and point out that diversification has a major role for a country's competitive advantage[2]. Using trade data they observe that developed countries are at a high level of diversification, meaning that they export avariety of products and less developed countries export only the most widespread products that are exported by the most countries. However, they argue that the observation that developed countries export most of the products implies that the information on the complexity is related with the less competitive countries and this fact explains the non-linear relationship between the fitness of countries and the complexity of their products. Finally, they claim that their methodology is vital for the estimation of a country's competitiveness, potential growth and even financial markets' development through its ability to predict long term growth trends.

[2] The competitive advantage is a condition that allows a company or a country to produce goods or/and services at lower prices or in a more desirable fashion for consumers. This condition allows the productive entity to generate more sales or superior margins than its competition.

Cristelli, Tacchella, Pietronero (2015) examine in what way a non-monetary measure can be considered in an analysis related to countries growth potential. They argue that a country's productive basket provides all the information about its assets which is hard to be included in a model. They use data on exports from 1995 to 2010 for at least 200 countries and 5000 products, extracted from the BACI dataset. The Revealed Comparative Advantage (RCA) is the major criterion wherewith it is examined if a country can be recognized as a producer or not. They argue that economic systems are at any rate a subject of monetary information and it would be totally wrong the lack of attention at them because they perform a crucial role for the development and wealth of countries. In addition, they show that regression analysis is not the ideal method for making predictions, due to the great importance of heterogeneity. They recommend, instead, the use of a method similar to the method of analogues for the prediction of the heterogeneous dynamics of economic complexity.

Inoua (2016) contributes to the existing literature by showing that the logarithm of the number of products a country produces is a metric of the country's technological development. Moreover, this study points out that the standard literature on economic development does not take into account countries' economic complexity which is a vital element of their production. As defined in the paper, production complexity refers to the diversity of products a country produces which is also the diversity of productive knowledge. As mentioned above, the main goal of this paper is to suggest a simpler metric of technology through the diversification logarithm. To achieve this, Inoua uses data from UN Comtrade for 5000 products in a 6-digit coding system. His findings indicate that the logarithm of product diversification explains technological development and therefore difference in technologies challenge a gap among countries income. In addition, Economic Complexity Index (ECI) gives a reliable intuition of product diversification.

Lapatinas (2016) investigates empirically the impact of economic complexity on human development. More specifically, he examines the existence of a causal effect between economic diversification and social development. In his attempt to achieve this, he uses data on human development and economic complexity. He

uses the Human Development Index developed by Prados de la Escosura (2015) and the ECI values from MIT's Observatory of Economic Complexity. In his model, Human Development Index is presented as a function of the lagged value of Economic Complexity Index controlling also for additional factors that influence human development. Using pooled OLS with fixed effects he finds a positive relationship between economic diversification and human development. However, there is no evidence of causal effect of economic complexity on human development.

Hartmann, Guevara, Jara-Figueroa, Aristaran and Hidalgo (2017) examine whether a country's product mix predicts income inequality. They contribute to the related literature by investigating the relationship between income inequality and economic complexity. Income inequality is affected by a variety of factors, which makes difficult to pin down a set of income inequality determinants. However, indirect measures of these factors can be developed through the mix of products a country produces. This is because a country's mix of products affects all of these factors. In their study, they use data on Economic Complexity Index from MIT's Observatory of Economic Complexity, for the period 1962-2012. They use cross-section regressions for the average of years 1996-2008 and fixed effects panel regressions for years 1963-2008. Their findings indicate a strong correlation between a country's mix of products and its ability to create and distribute income. In addition, they show that economic complexity is a significant predictor of income inequality with negative correlation. This means that increases in economic diversification decrease income inequality. Moreover, countries exporting more complex products face lower levels of income inequality while countries exporting simple products are linked to higher income inequality. They also show that economic complexity is related to the distribution of income. Finally, they develop a new metric called Product Gini Index (PGI) which measures the expected level of income inequality for the country exporting a given good. This measure allows the estimation of the effect of a country's productive structure changes on income inequality.

Albeaik, Kaltenberg, Alsaleh and Hidalgo (2017) introduce a new and improved metric of economic complexity called ECI+. This index defines the complexity of an economy as a measure of the country's total exportstaking into account the level of difficulty of exporting the products. The calculation of economic complexity with this way helps to avoid the limitation of the original Economic Complexity Index (ECI) which considers as exports only the products in which a country has a Revealed Comparative Advantage (RCA)[3]. Another limitation of the original ECI which is overcomed with the ECI+ is that the former requires defining which products are exported by each country. They use data from the MIT's Observatory of Economic Complexity to compare ECI+, ECI and Fitness Complexity ability to predict future growth. For the long time series, they use the SITC-4 rev2 dataset for from the period 1962-2014 with trade information for 250 countries and 986 products. For the shorter time series, they use the BACI dataset in 4-digit level which provides data for 226 countries, 1241 products for the years 1995-2015. Using pooled OLS, fixed effects and random effects models they show that ECI+ is a better measure of economic complexity and a superior predictor of long term economic growth than ECI and Fitness Complexity. Finally, ECI+ implies that fewer countries have the ability to export knowledge-intensive products.

In conclusion, Economic Complexity Index (ECI) was recently developed from MIT Lab and for this reason the literature on Economic Complexity is scarce.

[3] Revealed Comparative Advantage (RCA) index is a measure of the relative ability of a country to produce a good in relation to its trading partners.

## 3. Data and Descriptive Statistics

We measure the countries' Economic Complexity using the values of the Economic Complexity Index (ECI) and ECI+ from MIT's Observatory of Economic Complexity (atlas.media.mit.edu). The ECI is a measure of the sophistication of a country's productive structure combining metrics of the diversity of countries and the ubiquity of its products (Hidalgo & Hausmann, 2009). In addition, ECI+ is a new metric which measures the Economic Complexity as the total exports of an economy, taking into account the difficulty of producing each product (Albeaik, Kaltenberg, Alsaleh and Hidalgo, 2017). Higher ECI and ECI+ values results to a more diverse and complex economy which produces more sophisticated products of lower ubiquity.

In order to measure income inequality we use the Estimated Household Income Inequality Data Set (EHII) from the University of Texas Inequality Project (http://utip.lbj.utexas.edu/data.html). It is a global dataset containing inequality data about 163 Countries for the period 1963-2008. However, we also use alternative inequality measures in order to examine our findings robustness. From University of Texas Inequality Project we also use the UTIP- UNIDO data set which calculates the industrial pay-inequality measures for 163 countries from 1963-2008. Furthermore, we use the Gini index values from the World Bank's Word Development Indicators about 264 countries for the period 1960-2016 as well as the Gini coefficient data from OECD for the period 1976-2015 and for 42 countries. The Gini coefficient of equivalised disposable income from European Union statistics on income and living conditions **(**EU-SILC) is the last measure of income inequality we use. Data on Gini from EU-SILC are for the period 1995-2016 and for 34 countries.

In addition, we use data on a country's GDP at Purchasing Power Parity rates (PPP) in constant 2011 international dollars[4] , School enrollment tertiary, School enrollment secondary, Government expenditure on education and population from

[4] PPP GDP is gross domestic product converted to international dollars using purchasing power parity rates. An international dollar has the same purchasing power over GDP as the U.S. dollar has in the United States

the World Bank's Word Development Indicators. Furthermore, we use institutional data from the World Bank's Worldwide Governance Indicators on Rule of Law, Corruption Control, Government Effectiveness, Political Stability, Voice and Accountability and Regulatory Quality (https://data.worldbank.org). The resulting dataset contains data from 1960-2016 for 227 countries. We also create an additional dataset, necessary for our analysis, for period 1960-2015 where each observation corresponds to five-year intervals. Table 3 contains descriptive statistics for our variables. The table shows statistics for the original dataset (annual data) as well for the five-year intervals dataset. We report means, standard deviations, the total number of countries and also the number of observations.

**Table 3:** Descriptive statistics

| | Annual data | | | Five-year data | | |
|---|---|---|---|---|---|---|
| | Observations | Mean | Standard deviation | Observations | Mean | Standard deviation |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| EHII | 3,849 | 41.89 | 7.220 | 772 | 41.91 | 7.230 |
| ECI | 5,568 | 0.00490 | 0.994 | 1,174 | 0.00436 | 0.995 |
| ECI+ | 5,568 | 0.00466 | 0.994 | 1,174 | 0.00434 | 0.995 |
| Ln GDP | 4,936 | 24.43 | 2.386 | 1,092 | 24.42 | 2.387 |
| Ln Population | 12,206 | 14.77 | 2.430 | 2,571 | 14.75 | 2.433 |
| School enrollment tertiary | 5,260 | 23.09 | 22.72 | 1,074 | 23.75 | 23.12 |
| School enrollment secondary | 5,946 | 63.80 | 34.12 | 1,211 | 64.71 | 34.03 |
| Government expenditure on education | 3,538 | 1,059 | 62,723 | 739 | 4.326 | 1.851 |
| Rule of Law | 3,752 | -1.67e-10 | 0.998 | 834 | -9.49e-10 | 0.998 |
| Corruption Control | 3,694 | -3.90e-10 | 0.998 | 824 | -2.75e-09 | 0.998 |
| Government Effectiveness | 3,680 | 3.04e-10 | 0.998 | 820 | 1.05e-09 | 0.998 |
| Political Stability | 3,690 | 5.45e-10 | 0.998 | 820 | 2.94e-10 | 0.998 |
| Regulatory Quality | 3,680 | -3.86e-10 | 0.998 | 820 | 2.64e-11 | 0.998 |
| Voice and Accountability | 3,732 | 2.67e-10 | 0.998 | 827 | 2.21e-09 | 0.998 |
| Countries | | 227 | | | 227 | |

Notes: Columns (1), (2) and (3) refer to the annual data while columns (4), (5) and (6) refer to the five-year data. The number of countries refers to the number of countries for which we use observations

# 4. Econometric Model and Results

We estimate two equations one with lagged values of the independent variables and another one with the independent variables in levels. First, we estimate the following equation:

$$EHII_{it} = \gamma ECI_{it} + X'_{it}\,\beta + \mu_t + \delta_i + u_{it} \qquad (6)$$

where $EHII_{it}$ is the Estimated Household Income Inequality Index for country i in period t. The main variable of interest is $ECI_{it}$ (we are following the same procedure for ECI+). The parameter γ measures the effect of economic complexity on income inequality. The control variables are included in vector $X'_{it}$. The parameter $\mu_t$ denotes a full set of time effects and $\delta_i$ is a full set of country dummies. $u_{it}$ is the error term which captures any omitted factors. We run Pooled OLS , Fixed effects OLS and 2SLS/IV regressions on unbalanced panels for annual data and for data at five-year intervals. All standard errors in our regressions are fully robust against arbitrary heteroskedasticity and serial correlation at the county level (see Wooldridge 2010) and they are also clustered at the country level. Firstly, in our estimations we use the ECI values to measure economic complexity and afterwards we follow the same procedure for ECI+ values.

We begin by estimating the five-year intervals data, for the period 1960-2015. Table 4 reports results for the ECI data and Table 5 for the ECI+ data. Next, we replicate the analysis using annual data for the period 1960-2016. Columns (1) and (4) from Tables 4 and 5 give the results for Pooled OLS regressions on five-year and annual data respectively. ECI (and ECI+) has a negative correlation with income inequality and it is highly significant. These results are similar with the existing findings on literature. However, the negative correlation between economic complexity and income inequality disappears when fixed effects are included. As we observe in columns (2) and (5) in Tables 4 and 5, which present the results with fixed effects OLS regressions, there is a positive relationship between economic complexity and income inequality. This positive correlation is even greater when we use ECI+, which is an improved measure of ECI. The absence of a causal relationship between economic complexity and income inequality is clear since the positive

relationship mentioned above is not statistically significant. Columns (3) and (6) in Tables 4 and 5 present the 2SLS/IV estimations which consist an alternative estimation strategy. The instruments which we use in the 2SLS/IV estimations are the lagged first difference of ECI, second-order lagged difference of ECI, third-order lagged difference of ECI and the fourth-order lagged difference of ECI. The instruments are the same for the ECI+ estimations. In Table 4 columns (3) and (6) also depict a positive, but not statistically significant, relationship between ECI and income inequality a fact that confirms the lack of causation between economic complexity and income inequality. Nevertheless, when we use ECI+ data the estimate of γ increases dramatically in both five-year and annual estimations (7.801 for five-year data, 10.077 for annual data) and it is statistically significant. These results enhance our findings of no (negative) causation between economic complexity and income inequality and indeed they indicate that if there is a causal effect then probably it is a positive one. Finally, Tables 4 and 5 provide information about the institutional variables used in our model and Ln GDP, Ln Population, School enrollment secondary and tertiary and Government expenditures on education.

The second equation we estimate in our analysis is the following:

$$EHII_{it} = \gamma ECI_{it-1} + X'_{it-1}\beta + \mu_t + \delta_i + u_{it} \qquad (7)$$

where $EHII_{it}$ is the Estimated Household Income Inequality index for country i in period t. The main variable of interest is $ECI_{it-1}$, the lagged value of economic complexity index. We estimate the same equation using ECI+ as the main variable of interest. The parameter γ measures the effect of economic complexity on income inequality. Vector $X'_{it-1}$ includes all the control variables of our model lagged. The parameter $\mu_t$ denotes a full set of time effects and $\delta_i$ a full set of country dummies. Finally, $u_{it}$ is the error term which captures any omitted factors. We are making only annual data estimations. In addition, we use now the lag of ECI, as well as the lag of ECI+, and the lagged values of our controls. All standard errors in our regressions are fully robust against arbitrary heteroskedasticity and serial correlation at the county level (see Wooldridge 2010) and they are also clustered at the country level.

**Table 4:** Empirical results with ECI as the main variable of interest

| | Five-year data | | | Annual data | | |
|---|---|---|---|---|---|---|
| Dependent variable: | Pooled OLS | Fixed effects OLS | 2SLS/ IV | Pooled OLS | Fixed effects OLS | 2SLS/IV |
| EHII | (1) | (2) | (3) | (4) | (5) | (6) |
| ECI | -4.190*** | 2.716 | 0.518 | -4.339*** | 0.028 | 0.422 |
| | (1.300) | (8.434) | (2.657) | (1.091) | (1.314) | (1.598) |
| Ln GDP | 0.596 | -2.817 | 0.007 | 0.992 | -6.439** | -6.144*** |
| | (1.236) | (8.241) | (1.314) | (0.895) | (2.701) | (1.581) |
| Ln Population | -0.049 | 10.048 | 6.925* | -0.492 | 3.940 | 1.498 |
| | (1.357) | (22.203) | (4.125) | (0.961) | (5.598) | (3.356) |
| School enrollment tertiary | -0.065* | 0.065 | 0.021 | -0.060** | 0.003 | 0.000 |
| | (0.034) | (0.116) | (0.020) | (0.027) | (0.033) | (0.020) |
| School enrollment secondary | 0.014 | -0.070 | -0.061*** | 0.010 | 0.001 | 0.002 |
| | (0.042) | (0.096) | (0.022) | (0.025) | (0.021) | (0.014) |
| Government expenditure on education | -0.387 | -1.107 | 0.934** | -0.758** | -0.234 | -0.498 |
| | (0.492) | (1.432) | (0.368) | (0.294) | (0.225) | (0.322) |
| Rule of Law | -0.181 | -3.128 | -1.351 | 0.063 | 2.318* | 2.454*** |
| | (2.747) | (8.558) | (2.226) | (1.771) | (1.209) | (0.745) |
| Corruption Control | -0.221 | -0.635 | -1.208 | 1.436 | -0.703 | -0.437 |
| | (2.278) | (5.368) | (1.327) | (1.438) | (0.858) | (0.598) |
| Government Effectiveness | -0.011 | 3.301 | 2.319* | -0.336 | 0.339 | -0.348 |
| | (2.890) | (6.868) | (1.187) | (1.567) | (1.005) | (0.607) |
| Political Stability | -1.285 | -0.191 | 1.749*** | -1.381 | -0.523 | -0.537 |
| | (1.237) | (2.229) | (0.465) | (0.864) | (0.613) | (0.539) |
| Regulatory Quality | 0.625 | 0.605 | -0.445 | -0.608 | -0.355 | -0.371 |
| | (1.910) | (2.948) | (0.621) | (1.442) | (0.716) | (0.517) |
| Voice and Accountability | 0.056 | 7.196 | 4.995*** | -0.553 | 1.857 | 1.565 |
| | (1.722) | (4.670) | (1.498) | (1.000) | (1.386) | (0.977) |
| Constant | 33.609** | -0.804 | -54.347 | 31.435*** | 151.249* | 170.547*** |
| | (13.764) | (367.672) | (57.155) | (10.075) | (87.416) | (56.715) |
| Observations | 90 | 90 | 72 | 388 | 388 | 382 |
| R-squared | 0.655 | 0.993 | 0.998 | 0.693 | 0.961 | 0.964 |

Notes: Pooled cross-sectional OLS regression in columns (1) and (4), with robust standard errors clustered by country in parentheses. Fixed effects OLS regressions in columns (2) and (5), with country dummies and robust standard errors clustered by country in parentheses. In columns (3) and (6) the results of 2SLS/IV method are presented, with robust standard errors clustered by country in parentheses. Columns (1), (2) and (3) present the results on five-year data estimations and columns (4), (5) and (6) present the results on annual data estimations. Year dummies are included in all regressions. Dependent variable is the Estimated Household Income Inequality index (EHII) and ECI is the main variable of interest. Five-year data sample is an unbalanced panel, 1960-2015, with data at five-year intervals, while annual data is an unbalanced panel,1960-2016, with data per year. *** p<0.01, ** p<0.05, * p<0.1

**Table 5:** Empirical results with ECI+ as the main variable of interest

| | Five-year data | | | Annual data | | |
|---|---|---|---|---|---|---|
| Dependent variable: EHII | Pooled OLS | Fixed effects OLS | 2SLS/ IV | Pooled OLS | Fixed effects OLS | 2SLS/IV |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| ECI+ | -4.575*** | 8.752 | 7.801*** | -4.549*** | 4.138 | 10.077*** |
| | (1.072) | (6.968) | (2.624) | (0.820) | (2.650) | (2.656) |
| ln_GDP | 0.317 | -6.401 | -7.106*** | 0.900 | -7.951*** | -9.761*** |
| | (1.165) | (8.434) | (2.654) | (0.880) | (2.920) | (1.960) |
| ln_Population | 0.209 | 1.566 | 5.906 | -0.465 | 3.925 | 2.295 |
| | (1.295) | (17.987) | (3.683) | (0.963) | (5.588) | (3.922) |
| School enrollment tertiary | -0.063* | 0.049 | 0.001 | -0.058* | -0.004 | -0.011 |
| | (0.036) | (0.089) | (0.018) | (0.029) | (0.028) | (0.017) |
| School enrollment secondary | 0.036 | -0.030 | -0.011 | 0.019 | 0.001 | 0.003 |
| | (0.044) | (0.089) | (0.021) | (0.028) | (0.022) | (0.016) |
| Government expenditure on education | -0.662 | -0.706 | 1.661*** | -0.909*** | -0.200 | -0.302 |
| | (0.452) | (1.115) | (0.312) | (0.266) | (0.228) | (0.292) |
| Rule of Law | 0.405 | -2.270 | -2.015** | 0.716 | 2.628** | 3.280*** |
| | (3.113) | (4.701) | (0.828) | (1.942) | (1.272) | (0.831) |
| Corruption Control | -1.747 | -1.426 | -3.193*** | 0.422 | -0.396 | 0.192 |
| | (2.852) | (3.109) | (0.989) | (1.699) | (0.838) | (0.660) |
| Government Effectiveness | 1.035 | 1.906 | 2.110* | -0.349 | 0.304 | -0.144 |
| | (2.856) | (5.452) | (1.227) | (1.475) | (0.954) | (0.682) |
| Political Stability | -1.799* | 0.707 | 3.511*** | -1.895** | -0.256 | 0.053 |
| | (1.037) | (2.258) | (0.660) | (0.743) | (0.550) | (0.506) |
| Regulatory Quality | 0.579 | -0.269 | -1.515*** | 0.076 | -0.522 | -0.818 |
| | (1.807) | (2.989) | (0.513) | (1.442) | (0.636) | (0.527) |
| Voice and Accountability | 0.023 | 7.380** | 6.320*** | -1.065 | 1.573 | 0.983 |
| | (1.787) | (3.135) | (0.705) | (1.045) | (1.220) | (0.915) |
| Constant | 36.073*** | 199.615 | 123.939 | 33.073*** | 180.823* | 247.142*** |
| | (13.358) | (477.564) | (87.262) | (10.073) | (100.197) | (77.388) |
| Observations | 90 | 90 | 72 | 388 | 388 | 382 |
| R-squared | 0.634 | 0.995 | 0.998 | 0.670 | 0.963 | 0.961 |

Notes: Pooled cross-sectional OLS regression in columns (1) and (4), with robust standard errors clustered by country in parentheses. Fixed effects OLS regressions in columns (2) and (5), with country dummies and robust standard errors clustered by country in parentheses. In columns (3) and (6) the results of 2SLS/IV method are presented, with robust standard errors clustered by country in parentheses. Columns (1), (2) and (3) present the results on five-year data estimations and columns (4), (5) and (6) present the results on annual data estimations. Year dummies are included in all regressions. Dependent variable is is the Estimated Household Income Inequality index (EHII) and ECI+ is the main variable of interest. Five-year data sample is an unbalanced panel, 1960-2015, with data at five-year intervals, while annual data is an unbalanced panel,1960-2016, with data per year. *** p<0.01, ** p<0.05, * p<0.1

We begin by estimating a pooled OLS regression on an unbalanced panel for the period 1965-2005 with annual data. In Table 6 the lag of ECI is the main variable of interest and in Table 7 is the lag of ECI+. Column (1) from Tables 6 and 7 gives the results for Pooled OLS regressions on annual data. The results are consistent with existing literature as ECI and ECI+ have a negative correlation with income inequality which is highly significant. The negative correlation between economic complexity and income inequality disappears when fixed effects are included. As we observe in column (2) in Table 6 there is a positive relationship between the lag of ECI and income inequality. This is additional evidence that there is no causal effect of economic complexity on income inequality. When we use the lag of ECI+, Table 7 column (2), the positive relationship between ECI+ and income inequality is even higher and statistically significant at level 0.05 . The above results indicate that if causation exists then it will be positive. Our findings remain intact when we use the 2SLS/IV method depicted in column (3) in Tables 6 and 7. The instruments used in 2SLS/IV method are the second-order lagged difference of ECI, third-order lagged difference of ECI and the fourth-order lagged difference of ECI. The instruments follow the same philosophy at ECI+ estimations. Again when we use the lag of ECI+ the positive relationship between economic complexity and income inequality increases and the result is highly significant.

**Table 6:** Empirical results with lag of ECI as the main variable of interest

| | Annual data | | |
|---|---|---|---|
| Dependent variable: $EHII_{it}$ | Pooled OLS | Fixed effects OLS | 2SLS/IV |
| | (1) | (2) | (3) |
| ECI $_{t-1}$ | -4.550*** | 1.262 | 2.661* |
| | (1.072) | (1.221) | (1.481) |
| ln_GDP $_{t-1}$ | 0.808 | -4.739* | -5.479*** |
| | (0.901) | (2.439) | (1.453) |
| ln_Population $_{t-1}$ | -0.217 | -0.940 | -1.909 |
| | (0.949) | (6.393) | (3.912) |
| School enrollment tertiary $_{t-1}$ | -0.063** | 0.008 | 0.003 |
| | (0.028) | (0.033) | (0.017) |
| School enrollment secondary $_{t-1}$ | 0.006 | -0.002 | -0.002 |
| | (0.027) | (0.012) | (0.008) |
| Government expenditure on education $_{t-1}$ | -0.704** | -0.140 | -0.121 |
| | (0.312) | (0.180) | (0.203) |
| Rule of Law $_{t-1}$ | 0.399 | 0.302 | 0.283 |
| | (1.806) | (1.077) | (0.803) |
| Corruption Control $_{t-1}$ | 1.449 | -0.734 | -0.509 |
| | (1.523) | (0.564) | (0.534) |
| Government Effectiveness $_{t-1}$ | -0.279 | 1.082 | 1.063** |
| | (1.716) | (0.662) | (0.486) |
| Political Stability $_{t-1}$ | -1.307 | -0.943* | -0.823** |
| | (0.902) | (0.506) | (0.345) |
| Regulatory Quality $_{t-1}$ | -0.571 | 0.110 | -0.011 |
| | (1.637) | (0.567) | (0.428) |
| Voice and Accountability $_{t-1}$ | -0.771 | 2.409* | 2.224*** |
| | (0.992) | (1.399) | (0.812) |
| Constant | 31.920*** | 204.480* | 205.016*** |
| | (10.172) | (118.936) | (66.648) |
| Observations | 341 | 341 | 338 |
| R-squared | 0.709 | 0.978 | 0.978 |

Notes: Pooled cross-sectional OLS regression in column (1), with robust standard errors clustered by country in parentheses. Fixed effects OLS regression in column (2), with country dummies and robust standard errors clustered by country in parentheses. In column (3) the results of 2SLS/IV method are presented, with robust standard errors clustered by country in parentheses. Year dummies are included in all regressions. Dependent variable is the Estimated Household Income Inequality index (EHII) and the lag of ECI is the main variable of interest. *** $p<0.01$, ** $p<0.05$, * $p<0.1$

**Table 7:** Empirical results with lag of ECI+ as the main variable of interest

| | Annual data | | |
|---|---|---|---|
| Dependent variable: EHII $_{it}$ | Pooled OLS | Fixed effects OLS | 2SLS/IV |
| | (1) | (2) | (3) |
| ECI+ $_{t-1}$ | -5.132*** | 5.038** | 8.619*** |
| | (0.816) | (2.176) | (2.499) |
| ln_GDP $_{t-1}$ | 0.621 | -6.093*** | -7.584*** |
| | (0.870) | (2.247) | (1.555) |
| ln_Population $_{t-1}$ | -0.079 | -1.433 | -2.508 |
| | (0.945) | (5.743) | (3.604) |
| School enrollment tertiary $_{t-1}$ | -0.060* | 0.003 | -0.004 |
| | (0.030) | (0.029) | (0.015) |
| School enrollment secondary $_{t-1}$ | 0.021 | -0.002 | -0.004 |
| | (0.029) | (0.013) | (0.009) |
| Government expenditure on education $_{t-1}$ | -0.888*** | -0.142 | -0.112 |
| | (0.273) | (0.167) | (0.152) |
| Rule of Law $_{t-1}$ | 1.340 | 0.566 | 0.794 |
| | (1.989) | (1.075) | (0.811) |
| Corruption Control $_{t-1}$ | 0.052 | -0.396 | -0.033 |
| | (1.856) | (0.627) | (0.588) |
| Government Effectiveness $_{t-1}$ | -0.057 | 0.928 | 0.848* |
| | (1.581) | (0.586) | (0.481) |
| Political Stability $_{t-1}$ | -1.903** | -0.631 | -0.289 |
| | (0.770) | (0.483) | (0.405) |
| Regulatory Quality $_{t-1}$ | 0.292 | -0.111 | -0.418 |
| | (1.579) | (0.493) | (0.435) |
| Voice and Accountability $_{t-1}$ | -1.327 | 2.276* | 1.945** |
| | (1.048) | (1.231) | (0.757) |
| Constant | 34.299*** | 250.968** | 265.995*** |
| | (10.186) | (105.632) | (63.340) |
| Observations | 341 | 341 | 338 |
| R-squared | 0.693 | 0.980 | 0.979 |

Notes: Pooled cross-sectional OLS regression in column (1), with robust standard errors clustered by country in parentheses. Fixed effects OLS regression in column (2), with country dummies and robust standard errors clustered by country in parentheses. In column (3) the results of 2SLS/IV method are presented, with robust standard errors clustered by country in parentheses. Year dummies are included in all regressions. Dependent variable is the Estimated Household Income Inequality index (EHII) and the lag of ECI+ is the main variable of interest. *** $p<0.01$, ** $p<0.05$, * $p<0.1$

In Tables 8-23 of the Appendix we test our findings using alternative measures of income inequality. It seems that our results are robust, since all the alternative income inequality measures used confirm our initial findings.

Concluding, the above results imply that there is no (negative) causal effect of economic complexity on income inequality, as existing literature claims, but only a negative correlation between them. It also seems that a clear cut causal effect does not exist. Instead, our findings indicate that if a causal relationship exists this is probably positive.

## 5. Conclusions

The relevant literature suggests that economic complexity is a significant and negative predictor of income inequality. In other words, existing literature points out a causal effect of economic complexity on income inequality. In our study, we found no causal effect of economic complexity on income inequality, a result which is robust across a variety of income inequality measures used. We argue that, despite the fact that economic complexity and income inequality are negatively correlated, there is no evidence of causation. We used country and time fixed effects and 2SLS/IV estimations in order to establish the lack of a clear cut causal effect of economic complexity on income inequality. Our findings indicate that even in the cases where causation seems to exist, probably this is a positive one. These results shed considerable doubt on the conventional wisdom in the academic literature that economic complexity is a negative determinant of income inequality and that a general increase in ECI will bring improvement in income inequality.

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# Appendix

**Table 8:** Empirical results with ECI as the main variable of interest

| Dependent variable: UTIP-UNIDO | Five-year data | | | Annual data | | |
|---|---|---|---|---|---|---|
| | Pooled OLS | Fixed effects OLS | 2SL/IV | Pooled OLS | Fixed effects OLS | 2SLS/IV |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| ECI | -0.025** | 0.053 | 0.176*** | -0.028** | -0.006 | 0.015 |
| | (0.012) | (0.100) | (0.059) | (0.011) | (0.026) | (0.023) |
| Ln GDP | 0.019 | -0.051 | -0.071*** | 0.036** | -0.039 | -0.046** |
| | (0.019) | (0.118) | (0.027) | (0.018) | (0.031) | (0.021) |
| Ln Population | -0.016 | 0.019 | -0.028 | -0.034* | 0.046 | 0.021 |
| | (0.021) | (0.241) | (0.088) | (0.020) | (0.079) | (0.063) |
| School enrollment tertiary | -0.001** | 0.000 | -0.000 | -0.001*** | -0.000 | -0.000 |
| | (0.000) | (0.001) | (0.000) | (0.000) | (0.000) | (0.000) |
| School enrollment secondary | 0.001 | 0.001 | -0.000 | 0.001* | 0.001 | 0.001** |
| | (0.000) | (0.001) | (0.000) | (0.000) | (0.000) | (0.000) |
| Government expenditure on education | -0.005 | -0.002 | 0.027*** | -0.006* | -0.005 | -0.007** |
| | (0.004) | (0.014) | (0.007) | (0.003) | (0.003) | (0.004) |
| Rule of Law | 0.023 | -0.056 | -0.172*** | 0.013 | 0.026 | 0.030 |
| | (0.037) | (0.089) | (0.056) | (0.027) | (0.026) | (0.019) |
| Corruption Control | 0.000 | -0.030 | 0.051* | 0.026 | 0.008 | 0.013 |
| | (0.032) | (0.053) | (0.028) | (0.027) | (0.024) | (0.015) |
| Government Effectiveness | -0.041 | 0.053 | 0.109*** | -0.058 | -0.024 | -0.030 |
| | (0.053) | (0.081) | (0.029) | (0.039) | (0.030) | (0.023) |
| Political Stability | 0.003 | 0.024 | 0.037*** | -0.002 | 0.003 | 0.004 |
| | (0.014) | (0.023) | (0.007) | (0.011) | (0.005) | (0.005) |
| Regulatory Quality | 0.033 | -0.012 | -0.036*** | 0.015 | -0.016 | -0.016* |
| | (0.033) | (0.037) | (0.011) | (0.032) | (0.013) | (0.008) |
| Voice and Accountability | -0.040 | 0.063 | 0.122*** | -0.030 | 0.014 | 0.010 |
| | (0.026) | (0.038) | (0.034) | (0.019) | (0.027) | (0.019) |
| Constant | -0.126 | 1.342 | 2.117 | -0.292* | 0.273 | 0.781 |
| | (0.159) | (4.792) | (1.500) | (0.160) | (1.532) | (1.102) |
| Observations | 92 | 92 | 74 | 394 | 394 | 388 |
| R-squared | 0.332 | 0.992 | 0.994 | 0.382 | 0.912 | 0.914 |

Notes: Pooled cross-sectional OLS regression in columns (1) and (4), with robust standard errors clustered by country in parentheses. Fixed effects OLS regressions in columns (2) and (5), with country dummies and robust standard errors clustered by country in parentheses. In columns (3) and (6) the results of 2SLS/IV method are presented, with robust standard errors clustered by country in parentheses. Columns (1), (2) and (3) present the results on five-year data estimations and columns (4), (5) and (6) present the results on annual data estimations. Year dummies are included in all regressions. Dependent variable is the UTIP-UNIDO index and ECI is the main variable of interest. Five-year data sample is an unbalanced panel, 1960-2015, with data at five-year intervals, while annual data is an unbalanced panel,1960-2016, with data per year. *** p<0.01, ** p<0.05, * p<0.1

**Table 9:** Empirical results with ECI+ as the main variable of interest

| Dependent variable: UTIP-UNIDO | Five-year data | | | Annual data | | |
|---|---|---|---|---|---|---|
| | Pooled OLS | Fixed effects OLS | 2SLS/IV | Pooled OLS | Fixed effects OLS | 2SLS/IV |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| ECI+ | -0.038** | 0.081 | 0.045 | -0.042*** | 0.050 | 0.136*** |
| | (0.014) | (0.080) | (0.039) | (0.015) | (0.033) | (0.039) |
| Ln GDP | 0.020 | -0.077 | -0.055 | 0.038** | -0.061* | -0.091*** |
| | (0.018) | (0.125) | (0.040) | (0.017) | (0.032) | (0.023) |
| Ln Population | -0.016 | -0.019 | -0.018 | -0.035* | 0.046 | 0.036 |
| | (0.020) | (0.213) | (0.048) | (0.018) | (0.082) | (0.069) |
| School enrollment tertiary | -0.001** | 0.000 | 0.000 | -0.001** | -0.000 | -0.000 |
| | (0.000) | (0.001) | (0.000) | (0.000) | (0.000) | (0.000) |
| School enrollment secondary | 0.001 | 0.001 | 0.000 | 0.001* | 0.001 | 0.001** |
| | (0.001) | (0.001) | (0.000) | (0.000) | (0.000) | (0.000) |
| Government expenditure on education | -0.007 | -0.002 | 0.009** | -0.007** | -0.004 | -0.005 |
| | (0.004) | (0.014) | (0.004) | (0.003) | (0.003) | (0.003) |
| Rule of Law | 0.030 | -0.020 | -0.034*** | 0.020 | 0.031 | 0.042** |
| | (0.036) | (0.065) | (0.010) | (0.026) | (0.027) | (0.021) |
| Corruption Control | -0.017 | -0.040 | -0.009 | 0.009 | 0.013 | 0.021 |
| | (0.031) | (0.046) | (0.014) | (0.023) | (0.023) | (0.015) |
| Government Effectiveness | -0.029 | 0.018 | 0.016 | -0.051 | -0.024 | -0.027 |
| | (0.050) | (0.073) | (0.019) | (0.036) | (0.030) | (0.022) |
| Political Stability | -0.001 | 0.031 | 0.040*** | -0.005 | 0.007 | 0.012** |
| | (0.014) | (0.029) | (0.009) | (0.011) | (0.005) | (0.006) |
| Regulatory Quality | 0.034 | -0.014 | -0.019** | 0.022 | -0.018 | -0.022*** |
| | (0.032) | (0.034) | (0.008) | (0.031) | (0.012) | (0.009) |
| Voice and Accountability | -0.037 | 0.057 | 0.058*** | -0.031* | 0.010 | 0.003 |
| | (0.024) | (0.038) | (0.012) | (0.018) | (0.026) | (0.018) |
| Constant | -0.160 | 2.505 | 1.553 | -0.341** | 0.791 | 1.680 |
| | (0.153) | (4.731) | (1.138) | (0.167) | (1.630) | (1.210) |
| Observations | 92 | 92 | 74 | 394 | 394 | 388 |
| R-squared | 0.355 | 0.992 | 0.997 | 0.407 | 0.914 | 0.910 |

Notes: Pooled cross-sectional OLS regression in columns (1) and (4), with robust standard errors clustered by country in parentheses. Fixed effects OLS regressions in columns (2) and (5), with country dummies and robust standard errors clustered by country in parentheses. In columns (3) and (6) the results of 2SLS/IV method are presented, with robust standard errors clustered by country in parentheses. Columns (1), (2) and (3) present the results on five-year data estimations and columns (4), (5) and (6) present the results on annual data estimations. Year dummies are included in all regressions. Dependent variable is UTIP-UNIDO index and ECI+ is the main variable of interest. Five-year data sample is an unbalanced panel, 1960-2015, with data at five-year intervals, while annual data is an unbalanced panel,1960-2016, with data per year. *** p<0.01, ** p<0.05, * p<0.1

**Table 10:** Empirical results with lag of ECI as the main variable of interest

| | Annual data | | |
|---|---|---|---|
| Dependent variable: UTIP-UNIDO $_{it}$ | Pooled OLS (1) | Fixed effects OLS (2) | 2SLS/IV (3) |
| ECI $_{t-1}$ | -0.032*** | 0.004 | 0.023 |
| | (0.012) | (0.012) | (0.018) |
| Ln GDP $_{t-1}$ | 0.038* | -0.028 | -0.039** |
| | (0.019) | (0.023) | (0.018) |
| Ln Population $_{t-1}$ | -0.034 | -0.064 | -0.078 |
| | (0.021) | (0.060) | (0.072) |
| School enrollment tertiary $_{t-1}$ | -0.001*** | 0.000 | 0.000 |
| | (0.000) | (0.000) | (0.000) |
| School enrollment secondary $_{t-1}$ | 0.001 | 0.000 | 0.000 |
| | (0.000) | (0.000) | (0.000) |
| Government expenditure on education $_{t-1}$ | -0.005 | -0.000 | 0.000 |
| | (0.004) | (0.001) | (0.001) |
| Rule of Law $_{t-1}$ | 0.006 | 0.006 | 0.006 |
| | (0.031) | (0.016) | (0.010) |
| Corruption Control $_{t-1}$ | 0.031 | -0.002 | 0.001 |
| | (0.032) | (0.009) | (0.007) |
| Government Effectiveness $_{t-1}$ | -0.067 | 0.004 | 0.004 |
| | (0.042) | (0.007) | (0.005) |
| Political Stability $_{t-1}$ | -0.006 | -0.007 | -0.005 |
| | (0.012) | (0.009) | (0.005) |
| Regulatory Quality $_{t-1}$ | 0.033 | -0.004 | -0.006 |
| | (0.042) | (0.006) | (0.005) |
| Voice and Accountability $_{t-1}$ | -0.031 | 0.008 | 0.006 |
| | (0.019) | (0.014) | (0.009) |
| Constant | -0.355** | 1.919* | 2.128 |
| | (0.171) | (0.977) | (1.294) |
| Observations | 344 | 344 | 341 |
| R-squared | 0.382 | 0.974 | 0.974 |

Notes: Pooled cross-sectional OLS regression in column (1), with robust standard errors clustered by country in parentheses. Fixed effects OLS regression in column (2), with country dummies and robust standard errors clustered by country in parentheses. In column (3) the results of 2SLS/IV method are presented, with robust standard errors clustered by country in parentheses. Year dummies are included in all regressions. Dependent variable is UTIP-UNIDO index and the lag of ECI is the main variable of interest. *** p<0.01, ** p<0.05, * p<0.1

**Table 11:** Empirical results with lag of ECI+ as main variable of interest

| | Annual data | | |
|---|---|---|---|
| Dependent variable: UTIP-UNIDO $_{it}$ | Pooled OLS (1) | Fixed effects OLS (2) | 2SLS/IV (3) |
| ECI+ $_{t-1}$ | -0.054*** | 0.016 | -0.012 |
| | (0.019) | (0.023) | (0.045) |
| Ln GDP $_{t-1}$ | 0.040** | -0.033 | -0.022 |
| | (0.018) | (0.024) | (0.020) |
| Ln Population $_{t-1}$ | -0.034* | -0.066 | -0.060 |
| | (0.019) | (0.060) | (0.068) |
| School enrollment tertiary $_{t-1}$ | -0.001** | 0.000 | 0.000 |
| | (0.000) | (0.000) | (0.000) |
| School enrollment secondary $_{t-1}$ | 0.001* | 0.000 | 0.000 |
| | (0.001) | (0.000) | (0.000) |
| Government expenditure on education $_{t-1}$ | -0.006* | -0.000 | 0.000 |
| | (0.003) | (0.001) | (0.001) |
| Rule of Law $_{t-1}$ | 0.017 | 0.007 | 0.007 |
| | (0.029) | (0.016) | (0.009) |
| Corruption Control $_{t-1}$ | 0.009 | -0.001 | -0.004 |
| | (0.026) | (0.010) | (0.007) |
| Government Effectiveness $_{t-1}$ | -0.056 | 0.004 | 0.005 |
| | (0.037) | (0.007) | (0.005) |
| Political Stability $_{t-1}$ | -0.011 | -0.006 | -0.007 |
| | (0.012) | (0.010) | (0.008) |
| Regulatory Quality $_{t-1}$ | 0.041 | -0.005 | -0.004 |
| | (0.041) | (0.006) | (0.005) |
| Voice and Accountability $_{t-1}$ | -0.032* | 0.008 | 0.007 |
| | (0.017) | (0.014) | (0.009) |
| Constant | -0.410** | 1.898* | 1.449 |
| | (0.177) | (1.022) | (1.059) |
| Observations | 344 | 344 | 341 |
| R-squared | 0.427 | 0.974 | 0.974 |

Notes: Pooled cross-sectional OLS regression in column (1), with robust standard errors clustered by country in parentheses. Fixed effects OLS regression in column (2), with country dummies and robust standard errors clustered by country in parentheses. In column (3) the results of 2SLS/IV method are presented, with robust standard errors clustered by country in parentheses. Year dummies are included in all regressions. Dependent variable is UTIP-UNIDO index and the lag of ECI+ is the main variable of interest. *** p<0.01, ** p<0.05, * p<0.1

**Table 12:** Empirical results with ECI as the main variable of interest

| | Annual data | | |
|---|---|---|---|
| Dependent variable: | Pooled OLS | Fixed effects OLS | 2SLS/IV |
| Gini (OECD) | (1) | (2) | (3) |
| ECI | -0.043*** | 0.003 | 0.015 |
| | (0.011) | (0.012) | (0.020) |
| Ln GDP | -0.046 | 0.015 | 0.010 |
| | (0.029) | (0.028) | (0.020) |
| Ln Population | 0.054* | 0.064 | 0.092 |
| | (0.030) | (0.061) | (0.059) |
| School enrollment tertiary | -0.001 | -0.000 | -0.000* |
| | (0.000) | (0.000) | (0.000) |
| School enrollment secondary | -0.001 | 0.000 | 0.000 |
| | (0.000) | (0.000) | (0.000) |
| Government expenditure on education | 0.003 | -0.002 | -0.002 |
| | (0.007) | (0.002) | (0.002) |
| Rule of Law Estimate | 0.018 | 0.010 | 0.010 |
| | (0.038) | (0.018) | (0.013) |
| Corruption Control | 0.040* | -0.029** | -0.029*** |
| | (0.022) | (0.012) | (0.008) |
| Government Effectiveness | -0.060** | 0.002 | 0.004 |
| | (0.025) | (0.013) | (0.008) |
| Political Stability | -0.035*** | -0.006 | -0.005 |
| | (0.012) | (0.013) | (0.008) |
| Regulatory Quality | 0.030 | 0.002 | 0.001 |
| | (0.025) | (0.012) | (0.008) |
| Voice and Accountability | -0.007 | 0.003 | 0.002 |
| | (0.041) | (0.025) | (0.014) |
| Constant | 0.754** | -0.876 | -1.478 |
| | (0.287) | (1.065) | (0.970) |
| Observations | 203 | 203 | 203 |
| R-squared | 0.736 | 0.984 | 0.984 |

Notes: Pooled cross-sectional OLS regression in column (1) with robust standard errors clustered by country in parentheses. Fixed effects OLS regressions in column (2) with country dummies and robust standard errors clustered by country in parentheses. In columns (3) the results of 2SLS/IV method are presented, with robust standard errors clustered by country in parentheses.. Year dummies are included in all regressions. Dependent variable is Gini index from OECD and ECI is the main variable of interest.*** $p<0.01$, ** $p<0.05$, * $p<0.1$

**Table 13:** Empirical results with ECI+ as the main variable of interest

| | Annual data | | |
|---|---|---|---|
| Dependent variable: Gini (OECD) | Pooled OLS (1) | Fixed effects OLS (2) | 2SLS/IV (3) |
| ECI+ | -0.079*** | -0.005 | 0.034 |
| | (0.021) | (0.020) | (0.031) |
| Ln GDP | -0.033 | 0.018 | 0.003 |
| | (0.030) | (0.028) | (0.020) |
| Ln Population | 0.044 | 0.054 | 0.086* |
| | (0.030) | (0.068) | (0.049) |
| School enrollment tertiary | -0.001 | -0.000 | -0.000* |
| | (0.001) | (0.000) | (0.000) |
| School enrollment secondary | -0.000 | 0.000 | -0.000 |
| | (0.000) | (0.000) | (0.000) |
| Government expenditure on education | 0.001 | -0.002 | -0.001 |
| | (0.007) | (0.003) | (0.002) |
| Rule of Law | 0.023 | 0.010 | 0.007 |
| | (0.038) | (0.019) | (0.013) |
| Corruption Control | 0.031 | -0.030** | -0.027*** |
| | (0.022) | (0.012) | (0.008) |
| Government Effectiveness | -0.058** | 0.001 | 0.005 |
| | (0.024) | (0.013) | (0.007) |
| Political Stability | -0.033*** | -0.006 | -0.006 |
| | (0.012) | (0.013) | (0.007) |
| Regulatory Quality | 0.025 | 0.001 | 0.005 |
| | (0.023) | (0.012) | (0.008) |
| Voice and Accountability | -0.014 | 0.003 | 0.001 |
| | (0.037) | (0.024) | (0.014) |
| Constant | 0.589** | -0.792 | -1.196 |
| | (0.283) | (1.140) | (0.825) |
| Observations | 203 | 203 | 203 |
| R-squared | 0.756 | 0.984 | 0.984 |

Notes: Pooled cross-sectional OLS regression in column (1) with robust standard errors clustered by country in parentheses. Fixed effects OLS regressions in column (2) with country dummies and robust standard errors clustered by country in parentheses. In columns (3) the results of 2SLS/IV method are presented, with robust standard errors clustered by country in parentheses.. Year dummies are included in all regressions. Dependent variable is Gini index from OECD and ECI+ is the main variable of interest.*** $p<0.01$, ** $p<0.05$, * $p<0.1$

**Table 14:** Empirical results with lag of ECI as the main variable of interest

| | Annual data | | |
|---|---|---|---|
| Dependent variable: Gini $_{it}$ (OECD) | Pooled OLS (1) | Fixed effects OLS (2) | 2SLS/IV (3) |
| ECI $_{t-1}$ | -0.045*** | 0.006 | 0.047* |
| | (0.011) | (0.013) | (0.026) |
| Ln GDP $_{t-1}$ | -0.043 | 0.017 | 0.000 |
| | (0.027) | (0.033) | (0.024) |
| Ln Population $_{t-1}$ | 0.053* | 0.058 | 0.171* |
| | (0.028) | (0.064) | (0.091) |
| School enrollment tertiary $_{t-1}$ | -0.001 | -0.000 | -0.000** |
| | (0.000) | (0.000) | (0.000) |
| School enrollment secondary $_{t-1}$ | -0.000 | 0.000 | 0.000 |
| | (0.000) | (0.000) | (0.000) |
| Government expenditure on education $_{t-1}$ | -0.000 | -0.004 | -0.003 |
| | (0.007) | (0.004) | (0.002) |
| Rule of Law $_{t-1}$ | 0.014 | 0.015 | 0.020 |
| | (0.041) | (0.016) | (0.013) |
| Corruption Control $_{t-1}$ | 0.043* | -0.025** | -0.028*** |
| | (0.023) | (0.010) | (0.007) |
| Government Effectiveness $_{t-1}$ | -0.046* | -0.002 | 0.003 |
| | (0.026) | (0.014) | (0.009) |
| Political Stability $_{t-1}$ | -0.021* | 0.001 | 0.005 |
| | (0.012) | (0.011) | (0.006) |
| Regulatory Quality $_{t-1}$ | 0.022 | 0.001 | -0.001 |
| | (0.025) | (0.016) | (0.011) |
| Voice and Accountability $_{t-1}$ | -0.037 | -0.002 | -0.005 |
| | (0.044) | (0.023) | (0.016) |
| Constant | 0.711** | -0.833 | -2.515* |
| | (0.276) | (0.947) | (1.284) |
| Observations | 214 | 214 | 214 |
| R-squared | 0.730 | 0.983 | 0.982 |

Notes: Pooled cross-sectional OLS regression in column (1), with robust standard errors clustered by country in parentheses. Fixed effects OLS regression in column (2), with country dummies and robust standard errors clustered by country in parentheses. In column (3) the results of 2SLS/IV method are presented, with robust standard errors clustered by country in parentheses. Year dummies are included in all regressions. Dependent variable is the Gini index from OECD and the lag of ECI is the main variable of interest. *** p<0.01, ** p<0.05, * p<0.1

**Table 15:** Empirical results with lag of ECI+ as the main variable of interest

| | Annual data | | |
|---|---|---|---|
| Dependent variable: Gini $_{it}$ (OECD) | Pooled OLS (1) | Fixed effects OLS (2) | 2SLS/IV (3) |
| ECI+ $_{t-1}$ | -0.082*** | -0.033 | 0.002 |
| | (0.020) | (0.021) | (0.030) |
| Ln GDP $_{t-1}$ | -0.031 | 0.034 | 0.019 |
| | (0.028) | (0.037) | (0.023) |
| Ln Population $_{t-1}$ | 0.045 | 0.004 | 0.043 |
| | (0.028) | (0.093) | (0.058) |
| School enrollment tertiary $_{t-1}$ | -0.001* | -0.000 | -0.000** |
| | (0.001) | (0.000) | (0.000) |
| School enrollment secondary $_{t-1}$ | -0.000 | 0.000 | 0.000 |
| | (0.000) | (0.000) | (0.000) |
| Government expenditure on education $_{t-1}$ | -0.000 | -0.006 | -0.005* |
| | (0.007) | (0.004) | (0.002) |
| Rule of Law $_{t-1}$ | 0.019 | 0.015 | 0.014 |
| | (0.040) | (0.016) | (0.012) |
| Corruption Control $_{t-1}$ | 0.033 | -0.026** | -0.024*** |
| | (0.024) | (0.010) | (0.007) |
| Government Effectiveness $_{t-1}$ | -0.047* | -0.005 | -0.002 |
| | (0.026) | (0.014) | (0.008) |
| Political Stability $_{t-1}$ | -0.020* | -0.000 | 0.000 |
| | (0.012) | (0.010) | (0.006) |
| Regulatory Quality $_{t-1}$ | 0.021 | -0.001 | 0.002 |
| | (0.023) | (0.016) | (0.011) |
| Voice and Accountability $_{t-1}$ | -0.042 | -0.003 | -0.001 |
| | (0.041) | (0.022) | (0.015) |
| Constant | 0.580** | -0.457 | -0.876 |
| | (0.272) | (1.156) | (0.912) |
| Observations | 214 | 214 | 214 |
| R-squared | 0.747 | 0.983 | 0.983 |

Notes: Pooled cross-sectional OLS regression in column (1), with robust standard errors clustered by country in parentheses. Fixed effects OLS regression in column (2), with country dummies and robust standard errors clustered by country in parentheses. In column (3) the results of 2SLS/IV method are presented, with robust standard errors clustered by country in parentheses. Year dummies are included in all regressions. Dependent variable is the Gini index from OECD and the lag of ECI+ is the main variable of interest. *** p<0.01, ** p<0.05, * p<0.1

**Table 16:** Empirical results with ECI as the main variable of interest

| | Annual data | | |
|---|---|---|---|
| Dependent variable: Gini (EU-SILC) | Pooled OLS (1) | Fixed effects OLS (2) | 2SLS/IV (3) |
| ECI | -4.865** | -3.374** | 0.522 |
| | (1.783) | (1.583) | (2.283) |
| ln_GDP | -1.004 | -0.326 | -3.123 |
| | (3.246) | (3.171) | (2.232) |
| ln_Population | 1.621 | -15.329** | -9.220** |
| | (3.442) | (6.550) | (4.503) |
| School enrollment tertiary | 0.015 | 0.030 | 0.023 |
| | (0.038) | (0.026) | (0.018) |
| School enrollment secondary | -0.061* | -0.009 | -0.007 |
| | (0.036) | (0.014) | (0.010) |
| Government expenditure on education | -0.838 | -0.019 | 0.110 |
| | (0.532) | (0.314) | (0.299) |
| Rule of Law | 2.486 | -1.517 | -1.556 |
| | (2.905) | (2.139) | (1.472) |
| Corruption Control | 1.058 | -0.573 | -0.559 |
| | (2.188) | (1.266) | (0.825) |
| Government Effectiveness | -2.147 | -1.487 | -1.367* |
| | (1.722) | (1.141) | (0.820) |
| Political Stability | -2.625* | 1.167 | 1.305** |
| | (1.317) | (0.885) | (0.624) |
| Regulatory Quality | 3.965* | 1.598 | 1.462* |
| | (2.146) | (1.384) | (0.826) |
| Voice and Accountability | -4.251* | -1.089 | -0.029 |
| | (2.429) | (2.111) | (1.504) |
| Constant | 47.519 | 261.945*** | 255.449*** |
| | (30.363) | (75.446) | (63.716) |
| Observations | 291 | 291 | 291 |
| R-squared | 0.626 | 0.914 | 0.910 |

Notes: Pooled cross-sectional OLS regression in column (1) with robust standard errors clustered by country in parentheses. Fixed effects OLS regressions in column (2) with country dummies and robust standard errors clustered by country in parentheses. In columns (3) the results of 2SLS/IV method are presented, with robust standard errors clustered by country in parentheses.. Year dummies are included in all regressions. Dependent variable is Gini index from EU-SILC and ECI is the main variable of interest.*** p<0.01, ** p<0.05, * p<0.1

**Table 17:** Empirical results with ECI+ as the main variable of interest

| | Annual data | | |
|---|---|---|---|
| Dependent variable: | Pooled OLS | Fixed effects OLS | 2SLS/IV |
| Gini (EU-SILC) | (1) | (2) | (3) |
| ECI+ | -6.076* | -0.995 | 8.204* |
| | (3.123) | (3.688) | (4.868) |
| Ln GDP | -0.536 | -2.334 | -6.161** |
| | (3.379) | (3.410) | (2.417) |
| Ln Population | 1.004 | -10.657 | -4.941 |
| | (3.610) | (6.462) | (4.474) |
| School enrollment tertiary | -0.002 | 0.026 | 0.011 |
| | (0.044) | (0.026) | (0.020) |
| School enrollment secondary | -0.022 | -0.007 | -0.012 |
| | (0.032) | (0.014) | (0.011) |
| Government expenditure on education | -0.797 | 0.069 | 0.292 |
| | (0.495) | (0.341) | (0.335) |
| Rule of Law | 2.017 | -1.535 | -1.678 |
| | (2.987) | (2.116) | (1.536) |
| Corruption Control | 0.787 | -0.594 | -0.287 |
| | (2.390) | (1.192) | (0.879) |
| Government Effectiveness | -3.198 | -1.415 | -1.119 |
| | (2.054) | (1.237) | (0.912) |
| Political Stability | -3.384** | 1.286 | 1.288** |
| | (1.294) | (0.917) | (0.651) |
| Regulatory Quality | 3.998 | 1.475 | 1.523* |
| | (2.551) | (1.389) | (0.789) |
| Voice and Accountability | -2.894 | -0.228 | 0.298 |
| | (3.158) | (1.893) | (1.395) |
| Constant | 43.378 | 241.255*** | 256.584*** |
| | (31.778) | (83.972) | (68.569) |
| Observations | 291 | 291 | 291 |
| R-squared | 0.576 | 0.911 | 0.906 |

Notes: Pooled cross-sectional OLS regression in column (1) with robust standard errors clustered by country in parentheses. Fixed effects OLS regressions in column (2) with country dummies and robust standard errors clustered by country in parentheses. In columns (3) the results of 2SLS/IV method are presented, with robust standard errors clustered by country in parentheses.. Year dummies are included in all regressions. Dependent variable is Gini index from EU-SILC and ECI+ is the main variable of interest.*** $p<0.01$, ** $p<0.05$, * $p<0.1$

**Table 18:** Empirical results with lag of ECI as the main variable of interest

| | Annual data | | |
|---|---|---|---|
| Dependent variable: Gini $_{it}$ (EU-SILC) | Pooled OLS (1) | Fixed effects OLS (2) | 2SLS/IV (3) |
| ECI $_{t-1}$ | -4.484** | -2.523* | 1.587 |
| | (1.646) | (1.471) | (2.480) |
| Ln GDP $_{t-1}$ | -2.460 | -3.952 | -7.010*** |
| | (3.046) | (3.289) | (2.600) |
| Ln Population $_{t-1}$ | 3.027 | -10.091** | -2.090 |
| | (3.252) | (4.923) | (5.880) |
| School enrollment tertiary $_{t-1}$ | 0.010 | 0.026 | 0.024 |
| | (0.038) | (0.025) | (0.015) |
| School enrollment secondary $_{t-1}$ | -0.046 | -0.008 | -0.011 |
| | (0.032) | (0.008) | (0.009) |
| Government expenditure on education $_{t-1}$ | -1.032* | -0.244 | -0.119 |
| | (0.512) | (0.265) | (0.234) |
| Rule of Law $_{t-1}$ | 2.638 | -0.003 | -0.123 |
| | (3.193) | (2.046) | (1.219) |
| Corruption Control $_{t-1}$ | 1.324 | -0.522 | -0.119 |
| | (2.251) | (1.500) | (0.897) |
| Government Effectiveness $_{t-1}$ | -2.391 | -1.401 | -1.215 |
| | (1.774) | (1.300) | (0.798) |
| Political Stability $_{t-1}$ | -2.667** | 0.607 | 0.705 |
| | (1.215) | (0.781) | (0.554) |
| Regulatory Quality $_{t-1}$ | 2.813 | 1.304 | 1.293 |
| | (2.107) | (1.123) | (0.793) |
| Voice and Accountability $_{t-1}$ | -1.986 | 0.830 | 1.521 |
| | (2.424) | (1.667) | (1.434) |
| Constant | 60.358** | 270.575*** | 238.052*** |
| | (27.627) | (86.501) | (78.491) |
| Observations | 311 | 311 | 311 |
| R-squared | 0.629 | 0.921 | 0.916 |

Notes: Pooled cross-sectional OLS regression in column (1), with robust standard errors clustered by country in parentheses. Fixed effects OLS regression in column (2), with country dummies and robust standard errors clustered by country in parentheses. In column (3) the results of 2SLS/IV method are presented, with robust standard errors clustered by country in parentheses. Year dummies are included in all regressions. Dependent variable is the Gini index from EU-SILC and the lag of ECI is the main variable of interest. *** p<0.01, ** p<0.05, * p<0.1

**Table 19:** Empirical results with lag of ECI+ as the main variable of interest

| | Annual data | | |
|---|---|---|---|
| Dependent variable: Gini $_{it}$ (EU-SILC) | Pooled OLS (1) | Fixed effects OLS (2) | 2SLS/IV (3) |
| ECI+ $_{t-1}$ | -6.029* | 0.220 | 6.751* |
| | (2.989) | (3.521) | (4.056) |
| Ln GDP $_{t-1}$ | -1.963 | -5.917 | -8.518*** |
| | (3.192) | (3.644) | (2.484) |
| Ln Population $_{t-1}$ | 2.458 | -5.010 | -0.015 |
| | (3.435) | (4.375) | (4.517) |
| School enrollment tertiary $_{t-1}$ | 0.002 | 0.025 | 0.019 |
| | (0.043) | (0.024) | (0.016) |
| School enrollment secondary $_{t-1}$ | -0.019 | -0.010 | -0.015* |
| | (0.029) | (0.008) | (0.009) |
| Government expenditure on education $_{t-1}$ | -1.051** | -0.162 | -0.014 |
| | (0.473) | (0.296) | (0.244) |
| Rule of Law $_{t-1}$ | 2.245 | -0.086 | -0.350 |
| | (3.294) | (2.008) | (1.253) |
| Corruption Control $_{t-1}$ | 1.014 | -0.263 | 0.066 |
| | (2.416) | (1.485) | (0.865) |
| Government Effectiveness $_{t-1}$ | -3.475 | -1.281 | -1.101 |
| | (2.131) | (1.333) | (0.811) |
| Political Stability $_{t-1}$ | -3.292*** | 0.666 | 0.639 |
| | (1.151) | (0.830) | (0.560) |
| Regulatory Quality $_{t-1}$ | 3.192 | 1.307 | 1.607* |
| | (2.357) | (1.186) | (0.835) |
| Voice and Accountability $_{t-1}$ | -0.506 | 1.260 | 1.426 |
| | (3.130) | (1.799) | (1.337) |
| Constant | 55.484* | 243.006** | 238.809*** |
| | (28.782) | (90.075) | (73.361) |
| Observations | 311 | 311 | 311 |
| R-squared | 0.587 | 0.919 | 0.916 |

Notes: Pooled cross-sectional OLS regression in column (1), with robust standard errors clustered by country in parentheses. Fixed effects OLS regression in column (2), with country dummies and robust standard errors clustered by country in parentheses. In column (3) the results of 2SLS/IV method are presented, with robust standard errors clustered by country in parentheses. Year dummies are included in all regressions. Dependent variable is the Gini index from EU-SILC and the lag of ECI+ is the main variable of interest. *** p<0.01, ** p<0.05, * p<0.1

**Table 20:** Empirical results with ECI as the main variable of interest

| | Five-year data | | | Annual data | | |
|---|---|---|---|---|---|---|
| Dependent variable: | Pooled OLS | Fixed effects OLS | 2SLS/IV | Pooled OLS | Fixed effects OLS | 2SLS/IV |
| Gini (World Bank) | (1) | (2) | (3) | (4) | (5) | (6) |
| ECI | -5.440*** | -4.669 | -12.678* | -6.094*** | -0.912 | -1.461 |
| | (1.359) | (3.824) | (7.269) | (1.360) | (1.168) | (1.248) |
| Ln GDP | 5.241** | -9.890* | -5.325 | 4.387** | 0.012 | -0.295 |
| | (2.192) | (5.250) | (4.286) | (2.108) | (3.468) | (1.631) |
| Ln Population | -4.735* | -2.202 | -17.615 | -3.403 | -6.053 | -5.057* |
| | (2.599) | (13.587) | (11.794) | (2.470) | (4.593) | (2.958) |
| School enrollment tertiary | -0.028 | 0.099 | 0.050 | -0.095* | 0.007 | 0.004 |
| | (0.057) | (0.071) | (0.045) | (0.052) | (0.025) | (0.015) |
| School enrollment secondary | -0.069 | -0.103 | 0.053 | -0.020 | 0.004 | 0.004 |
| | (0.072) | (0.104) | (0.124) | (0.063) | (0.018) | (0.011) |
| Government expenditure on education | 1.614** | 0.048 | -0.245 | 0.502 | -0.263 | -0.276* |
| | (0.722) | (0.551) | (0.763) | (0.535) | (0.309) | (0.162) |
| Rule of Law | -13.328*** | 4.357 | 1.634 | -9.869*** | 1.139 | 0.422 |
| | (4.472) | (2.984) | (1.791) | (2.713) | (1.321) | (0.919) |
| Corruption Control | 5.016* | -0.753 | -4.156** | 2.268 | -0.743 | -0.832 |
| | (2.610) | (3.456) | (1.638) | (1.881) | (1.160) | (0.669) |
| Government Effectiveness | -3.041 | -2.863 | -4.963*** | 0.103 | -1.738 | -1.710** |
| | (4.506) | (3.390) | (0.981) | (3.102) | (1.127) | (0.684) |
| Political Stability | -4.476*** | 1.833 | 1.385 | -2.424 | -0.020 | -0.041 |
| | (1.594) | (2.624) | (1.090) | (1.656) | (0.655) | (0.373) |
| Regulatory Quality | 8.494** | 1.205 | 2.567*** | 5.241** | 1.067 | 1.435** |
| | (3.217) | (2.018) | (0.917) | (2.294) | (1.103) | (0.628) |
| Voice and Accountability | 4.290 | -1.249 | -1.296 | 4.054** | -1.628 | -1.453** |
| | (2.644) | (2.855) | (2.462) | (1.848) | (1.050) | (0.689) |
| Constant | -14.885 | 343.266* | 409.166*** | -20.850 | 162.947 | 110.188** |
| | (16.482) | (178.535) | (128.587) | (17.034) | (122.164) | (46.628) |
| Observations | 102 | 102 | 79 | 491 | 491 | 483 |
| R-squared | 0.633 | 0.994 | 0.994 | 0.555 | 0.978 | 0.977 |

Notes: Pooled cross-sectional OLS regression in columns (1) and (4), with robust standard errors clustered by country in parentheses. Fixed effects OLS regressions in columns (2) and (5), with country dummies and robust standard errors clustered by country in parentheses. In columns (3) and (6) the results of 2SLS/IV method are presented, with robust standard errors clustered by country in parentheses. Columns (1), (2) and (3) present the results on five-year data estimations and columns (4), (5) and (6) present the results on annual data estimations. Year dummies are included in all regressions. Dependent variable is the Gini index from World Bank and ECI is the main variable of interest. *** p<0.01, ** p<0.05, * p<0.1

**Table 21:** Empirical results with ECI+ as the main variable of interest

| | Five-year data | | | Annual data | | |
|---|---|---|---|---|---|---|
| Dependent variable: | Pooled OLS | Fixed effects OLS | 2SLS/IV | Pooled OLS | Fixed effects OLS | 2SLS/IV |
| Gini (World Bank) | (1) | (2) | (3) | (4) | (5) | (6) |
| ECI+ | -4.812*** | -3.151 | 4.894 | -5.314*** | -1.296 | -1.902 |
| | (1.609) | (5.949) | (4.546) | (1.751) | (1.691) | (1.414) |
| Ln GDP | 5.366** | -9.823* | -13.565** | 4.285** | 0.094 | -0.146 |
| | (2.320) | (5.691) | (5.719) | (2.048) | (3.539) | (1.632) |
| Ln Population | -4.957* | 4.495 | 10.921 | -3.339 | -5.476 | -4.230 |
| | (2.755) | (14.658) | (11.232) | (2.451) | (4.296) | (2.634) |
| School enrollment tertiary | -0.039 | 0.120* | 0.119*** | -0.106* | 0.008 | 0.006 |
| | (0.062) | (0.067) | (0.038) | (0.057) | (0.025) | (0.015) |
| School enrollment secondary | -0.046 | -0.155* | -0.178*** | 0.004 | 0.004 | 0.003 |
| | (0.071) | (0.093) | (0.042) | (0.062) | (0.018) | (0.010) |
| Government expenditure on education | 1.466** | -0.036 | 0.714 | 0.371 | -0.286 | -0.306* |
| | (0.724) | (0.931) | (0.735) | (0.543) | (0.300) | (0.177) |
| Rule of Law | -13.017*** | 5.075* | 3.075** | -9.426*** | 1.391 | 0.851 |
| | (4.640) | (2.878) | (1.206) | (2.797) | (1.355) | (0.831) |
| Corruption Control | 4.739* | 0.029 | -1.018 | 1.684 | -0.749 | -0.827 |
| | (2.763) | (3.522) | (1.456) | (2.061) | (1.169) | (0.670) |
| Government Effectiveness | -3.670 | -2.928 | -4.896*** | -0.126 | -1.764 | -1.755*** |
| | (4.743) | (3.197) | (0.789) | (3.287) | (1.119) | (0.672) |
| Political Stability | -5.024*** | 1.613 | 2.598* | -3.302** | -0.034 | -0.053 |
| | (1.628) | (3.272) | (1.382) | (1.614) | (0.645) | (0.373) |
| Regulatory Quality | 8.702** | 1.513 | 1.833* | 4.687* | 1.013 | 1.315** |
| | (3.596) | (2.541) | (1.004) | (2.545) | (1.116) | (0.607) |
| Voice and Accountability | 3.794 | -0.625 | 2.951** | 4.113** | -1.681 | -1.544** |
| | (2.992) | (2.763) | (1.221) | (2.025) | (1.069) | (0.694) |
| Constant | -14.425 | 202.839 | 200.866*** | -19.765 | 147.924 | 94.532** |
| | (17.683) | (145.751) | (69.131) | (17.769) | (123.285) | (46.131) |
| Observations | 102 | 102 | 79 | 491 | 491 | 483 |
| R-squared | 0.599 | 0.994 | 0.995 | 0.516 | 0.978 | 0.977 |

Notes: Pooled cross-sectional OLS regression in columns (1) and (4), with robust standard errors clustered by country in parentheses. Fixed effects OLS regressions in columns (2) and (5), with country dummies and robust standard errors clustered by country in parentheses. In columns (3) and (6) the results of 2SLS/IV method are presented, with robust standard errors clustered by country in parentheses. Columns (1), (2) and (3) present the results on five-year data estimations and columns (4), (5) and (6) present the results on annual data estimations. Year dummies are included in all regressions. Dependent variable is the Gini index from World Bank and ECI+ is the main variable of interest. *** p<0.01, ** p<0.05, * p<0.1

**Table 22:** Empirical results with lag of ECI as the main variable of interest

| Dependent variable: Gini $_{it}$ (World Bank) | Annual data | | |
|---|---|---|---|
| | Pooled OLS | Fixed effects OLS | 2SLS/IV |
| | (1) | (2) | (3) |
| ECI $_{t-1}$ | -6.067*** | -0.338 | -0.170 |
| | (1.347) | (1.374) | (1.442) |
| Ln GDP $_{t-1}$ | 4.799** | -4.362 | -4.465** |
| | (1.962) | (3.610) | (1.811) |
| Ln Population $_{t-1}$ | -4.076* | 4.053 | 4.171 |
| | (2.275) | (5.283) | (3.372) |
| School enrollment tertiary $_{t-1}$ | -0.084* | 0.008 | 0.008 |
| | (0.050) | (0.029) | (0.015) |
| School enrollment secondary $_{t-1}$ | -0.040 | -0.001 | -0.001 |
| | (0.057) | (0.017) | (0.012) |
| Government expenditure on education $_{t-1}$ | 0.445 | -0.360 | -0.350** |
| | (0.507) | (0.248) | (0.160) |
| Rule of Law $_{t-1}$ | -10.092*** | 2.797* | 2.845*** |
| | (2.617) | (1.416) | (0.965) |
| Corruption Control $_{t-1}$ | 2.835 | -0.459 | -0.451 |
| | (1.826) | (1.193) | (0.734) |
| Government Effectiveness $_{t-1}$ | 0.066 | -1.268 | -1.290** |
| | (2.966) | (0.999) | (0.602) |
| Political Stability $_{t-1}$ | -2.946** | -0.366 | -0.354 |
| | (1.330) | (0.600) | (0.399) |
| Regulatory Quality $_{t-1}$ | 5.393** | 1.320 | 1.310** |
| | (2.201) | (0.969) | (0.648) |
| Voice and Accountability $_{t-1}$ | 3.632* | -1.901** | -1.942*** |
| | (1.923) | (0.910) | (0.699) |
| Constant | -7.884 | 82.978 | 78.377 |
| | (15.436) | (123.628) | (50.115) |
| Observations | 488 | 488 | 484 |
| R-squared | 0.586 | 0.978 | 0.978 |

Notes: Pooled cross-sectional OLS regression in column (1), with robust standard errors clustered by country in parentheses. Fixed effects OLS regression in column (2), with country dummies and robust standard errors clustered by country in parentheses. In column (3) the results of 2SLS/IV method are presented, with robust standard errors clustered by country in parentheses. Year dummies are included in all regressions. Dependent variable is Gini index from World Bank and the lag of ECI is the main variable of interest. *** p<0.01, ** p<0.05, * p<0.1

**Table 23:** Empirical results with lag of ECI+ as the main variable of interest

| | Annual data | | |
|---|---|---|---|
| Dependent variable: | Pooled OLS | Fixed effects OLS | 2SLS/IV |
| $Gini_{it}$ (World Bank) | (1) | (2) | (3) |
| $ECI+_{t-1}$ | -5.245*** | -1.422 | -2.491 |
| | (1.584) | (1.992) | (2.388) |
| Ln $GDP_{t-1}$ | 4.437** | -4.243 | -4.043** |
| | (1.867) | (3.544) | (1.655) |
| Ln $Population_{t-1}$ | -3.756* | 3.960 | 3.764 |
| | (2.215) | (5.146) | (3.302) |
| School enrollment tertiary $_{t-1}$ | -0.097* | 0.011 | 0.013 |
| | (0.054) | (0.028) | (0.017) |
| School enrollment secondary $_{t-1}$ | -0.010 | -0.000 | 0.001 |
| | (0.056) | (0.018) | (0.012) |
| Government expenditure on education $_{t-1}$ | 0.253 | -0.391 | -0.423** |
| | (0.504) | (0.242) | (0.170) |
| Rule of Law $_{t-1}$ | -9.787*** | 2.808* | 2.793*** |
| | (2.651) | (1.416) | (0.910) |
| Corruption Control $_{t-1}$ | 2.621 | -0.471 | -0.495 |
| | (2.070) | (1.193) | (0.726) |
| Government Effectiveness $_{t-1}$ | -0.522 | -1.256 | -1.255** |
| | (3.213) | (0.986) | (0.594) |
| Political Stability $_{t-1}$ | -3.620*** | -0.431 | -0.519 |
| | (1.319) | (0.588) | (0.412) |
| Regulatory Quality $_{t-1}$ | 5.006** | 1.343 | 1.349** |
| | (2.394) | (1.015) | (0.664) |
| Voice and Accountability $_{t-1}$ | 3.584 | -1.824** | -1.722** |
| | (2.158) | (0.904) | (0.670) |
| Constant | -4.288 | 82.534 | 74.074 |
| | (15.856) | (122.884) | (50.844) |
| Observations | 488 | 488 | 484 |
| R-squared | 0.547 | 0.978 | 0.978 |

Notes: Pooled cross-sectional OLS regression in column (1), with robust standard errors clustered by country in parentheses. Fixed effects OLS regression in column (2), with country dummies and robust standard errors clustered by country in parentheses. In column (3) the results of 2SLS/IV method are presented, with robust standard errors clustered by country in parentheses. Year dummies are included in all regressions. Dependent variable is Gini index from World Bank and the lag of ECI+ is the main variable of interest. *** $p<0.01$, ** $p<0.05$, * $p<0.1$