Review of Economic Analysis 17 (2025) 95-114 1973-3909/2025095

Corruption, Natural Capital and Economic Development: A Dynamic GMM Analysis

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Using a dynamic panel dataset of 150 countries for the period of 2006-2018 and a two-step system GMM estimation model, this paper shows that natural resources have a positive effect on economic development while holding corruption constant. Our findings support the notion that natural resources have a positive effect on the economy of a nation. When a country has less corruption, it improves the appropriation of economic gains from natural resources which serves as natural capital that would drive further capital accumulation and further development. We also find that physical capital, human capital, and freedom from corruption show strong positive effects on economic development, controlling for other economic and institutional variables.

Keywords: Corruption; Economic Development; Dynamic Panel Study; Natural Resources; Physical Capital; Human Capital

JEL Classifications: O47; Q32

1 Introduction

Do natural resources contribute more to the economic development of a country with low levels of corruption compared to one where corruption is rampant? Natural resources can be defined as the world's stocks of natural assets which include minerals, soil, air, water, and all living organisms. These resources can be viewed as either a blessing or a curse for economic development. There are studies (Sachs & Warner, 1999; Torvik, 2001; Krugman, 1987) which state that having natural resources could have a negative spillover effect on a country's future economic growth compared to other forms of capital. This is called the Dutch disease or

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negative resource effect for the general economy. While others (Brunnschweiler, 2006; Allcott & Keniston, 2018) produce evidence against this theory, Mehlum et al. (2006) show mixed results (see Venables (2016), Havranek (2016) and van Der Ploeg (2011) for more information).

It is important to account for the impact of corruption on countries that have an abundance of natural resources because the economic gains from these resources become the natural capital for future economic development. It is therefore imperative that these countries have good institutions (Mehlum et al.,2006) for economic growth because an abundance of resources could lead to more corruption (Leite and Weidmann, 1999; Bhattacharyya and Hodler, 2009; Gallego et. al, 2020).

Aside from having human and physical capital in our growth model (Barro, 1991; Batten and Vo, 2009; Fabro and Aixala, 2012; Iqbal and Daly, 2014), we also include a variable for natural capital (Sachs and Warner, 1999; England, 2000; Brunnschweiler, 2008) to capture the country's stock of natural resources that provides it the capability to grow its economy, as well as a variable that measures the prevalence (or lack thereof) of corruption. We address the effects of natural capital and corruption on economic development with a dynamic panel data model estimated by using a two-step system GMM estimation method. This model is based on the cross-country catch-up equation by Barro and Sala-i-Martin (2003), which controls for other variables, such as institutional factors (trade freedom, labor freedom, democracy, business freedom, and property rights) and economic factors (inflation, and government spending). With this estimation, we also account for the unobservable country-specific effect, and it is efficient and robust to heteroskedasticity and autocorrelation.

Our findings offer support to the idea that natural resources have a positive effect on economic development assuming the free from corruption variable remains constant. We find that physical capital, human capital and property rights also have positive effects on economic development whereas labor freedom has a negative effect on development. However, we could not find any effect of democracy on economic development when we controlled for the free from corruption variable.

This paper is structured as follows: Section 2 provides the review of related literature. Section 3 describes the data. Section 4 discusses the empirical framework. Section 5 reports the results and Section 6 gives us the conclusion.

2 Literature Review

There have been several studies on the role that institutions play in economic growth and development. Appendix 3 provides a list of the studies discussed in this section of the paper as well as their various features (sample size, estimation method, time period covered, dependent and independent variables). Dias and Tebaldi (2012) used a panel dataset of 61 countries from

1965 to 2005 and a micro-foundations model to examine the relationship between human capital, institutions and economic growth. Using system GMM to estimate their model, they found that institutions do play a role in economic growth. They also discovered that the growth of physical and human capital helps determine long-run economic growth.

Mankiw et al. (1992) argued that differences in per capita GDP among nations can best be explained by using an augmented Solow model. Their paper had several main findings. First, they found no significant difference between the elasticity of income with respect to the stock of physical capital and the share of capital to income. Second, under the augmented Solow model, both the accumulation of physical capital and population growth have a larger effect on income per capita compared to the original Solow growth model. Lastly, the model in this paper predicts that countries with similar technologies and rates of accumulation and population growth should converge in income per capita. The paper thus argues that differences in per capita GDP are due to differences in saving, population growth and education among countries.

Boikos et al. (2023) tries to recreate the work of Mankiw et al. (1992). They updated the dataset using the periods 1960-2015, 1970-2015 and 1990-2015. While their results are not fully consistent with the Solow and augmented Solow models, the augmented model was shown to fit their data better. Their results also show that human capital has a stronger impact on growth compared to the results of the Mankiw et al. (1992) paper.

Gylfason (2001) identified four factors that cause natural resources to stunt economic development. These are (1) the Dutch disease, (2) rent seeking, (3) overconfidence and (4) neglect of education. He states that there is an inverse relationship between education spending and the share of natural resources in a country's wealth which leads him to conclude that natural resources crowds out human capital which leads to slower economic development. Kim and Lin (2017) used panel data on 40 developing countries during the period 1960 to 2012 as well as heterogeneous panel cointegration techniques to examine the relationship between natural resources and economic development. They found that countries abundant in natural resources develop slower than those with fewer resources thus giving more proof to the curse of natural resources.

Cavalcanti and Novo (2005) investigated how economic development is affected by institutions. Using output per worker as a proxy for development, their results showed that a one percent improvement in institutions leads to a five percent increase in output per worker. Their results also show that an improvement in institutions leads to a bigger increase in output per worker in lower income countries as opposed to those with higher incomes.

Hashim Osman et al. (2012) examined the role institutions played in the economic development of 27 Sub-Saharan African countries. Using panel data from the period 1984 to 2003 and a fixed effects model, they found that that the quality of institutions and the stability

of the government are significant factors in the economic development of these nations. However, they did not find corruption to be a significant force that affects development.

Hall et al. (2010) developed a growth model where the productivity and allocation of capital depends on the quality of a nation's institutions. Using a dataset of 96 countries that covers the period of 1980 to 2000, their results show that increases in physical and human capital can lead to a country having economic growth only if it has good institutions.

Vedia-Jerez and Chasco (2015) used a dataset of 10 South American countries over the period of 1960 to 2008 to examine the long-run determinants of economic growth in the region. Using system GMM to estimate their model, they discovered that human and physical capital accumulation are vital conditions for increasing economic growth. Also, efficient political institutions are a key component for growth as they help stimulate productivity and attract capital.

Nasreen et al. (2015) used both ordinary least squares (OLS) and panel GMM to investigate the long-term impact of institutions on investment and economic growth. Using a dataset of 94 countries for the period 1985-2009, their results showed that countries with more economic freedom have higher economic growth per unit of input as well as higher levels of spending on physical and human capital investment. Their study also points out that an independent and unbiased judicial system that protects property rights is crucial for economic growth.

Tavares and Wacziarg (2001) looked at the role of democracy in economic growth. They used a diverse dataset of 65 developed and developing countries over the period of 1970-1989. Using three-stage least squares (3SLS), they found that democracy has a negative but moderate effect on economic growth. This is because more democracy increases human capital accumulation and lowers physical investment rates. This means that democracy helps lower-income groups by expanding access to education, but it comes at the expense of accumulating physical capital. Democracy also leads to lower income inequality which can lead to higher growth. The authors of the study point out that democratic institutions provide a trade-off between economic costs and social benefits.

Dawson (1998) analyzes the empirical relationship between institutions, investment and growth. Using a dataset of 85 countries over the period of 1975-1990 and fixed effects estimation, he showed that economic freedom has a significant and positive effect on growth. This is because economic freedom has a direct effect on growth through total factor productivity and an indirect effect through investment. Thus, promoting economic freedom is important in achieving growth. The study also shows that free-market institutions as well as political and civil liberties are contributors to growth.

Fatas and Mihov's (2013) paper shows that policy volatility has a strong and negative impact on growth. They can show this by creating measures of policy volatility out of a dataset of 93 countries over the period 1960-2007. Using pooled OLS and fixed effects models, they

discover that countries that aggressively use discretionary fiscal policy when it is unnecessary tend to have lower economic growth. One of their main findings is that institutions affect economic growth through their impact on policy rather than their use as a constraint on the chief executive of a nation.

Gwartney et al. (2006) examine the relationship between institutions and investment and how institutional quality affects growth through its impact on the productivity and level of investment. Using a dataset of 94 countries during the period 1980-2000, their findings show that countries with better quality institutions have more growth per unit of investment and attract a higher level of private investment as a share of GDP. The paper states that institutional quality has a sizeable indirect impact on private investment. Their analysis also shows that higher growth does not lead to better institutions. In fact, it goes the opposite direction as lower growth would lead to bigger improvements in institutional quality.

Issahaku et al. (2018) tried to test for two related hypotheses. The first one is the growth importation hypothesis which states that countries with weak institutions will import growth in the form of international remittances. The second one is the urgency hypothesis which states that there is a high urgency to apply remittances efficiently in countries with weak institutions because of limited alternatives. It thus implies that there is a high opportunity cost of misallocating remittance revenues. Using data for 106 countries during the period 1996-2013 and two-stage least squares (2SLS) estimation, they were able to show strong evidence for the existence of these two hypotheses. They discover that remittances foster growth in low income and lower middle-income countries but not in high income or upper middle-income countries. The authors point out that low income and lower middle-income countries have not yet benefitted from the growth dividends of institutions and that institutions and remittances are substitutes for one another.

Sidek and Asutay (2021) analyze the impact of government expenditures on economic growth while controlling for institutional factors using a dataset that included 30 developed and 91 developing countries over the period 1984-2017. Using two-step system GMM estimation, they discovered that government expenditures, whether they are government development or government consumption expenditures, have a positive effect on economic growth if good institutions are present. This implies that good governance leads to the efficient use of public funds.

3 Data

We collected data on 150 countries for 12 years (2006-2018) from different sources. We use the real per capita Gross Domestic Product (GDP) (in constant 2010 US$) with the data collected from The World Bank (WB) and smoothened with a centered moving average of a year. We also collected data on the mean years of schooling from the United Nations (UN) as

a proxy for human capital. This represents the average number of years of education received by people aged 25 and older. We use gross capital formation (% of GDP), which consists of outlays on additions to the fixed assets of the economy plus net changes in the level of inventories, as a proxy for physical capital. We also use total natural resources rents (% of GDP), where the total natural resources rents are the sum of oil rents, natural gas rents, coal rents (hard and soft), mineral rents, and forest rents, as a proxy for natural capital. Data on gross capital formation and total natural resources rents were obtained from The World Bank.

The *CorruptFree* variable is the Corruption Index collected from Transparency International's Corruption Perceptions Index that measures the level of corruption in a nation with zero as the most corrupt and 100 as the least corrupt. The *Democracy* variable comes from the Economist Intelligence Unit Democracy Index which measures the quality of democracies based on factors such as electoral pluralism, form of government, political participation, civil liberty and political culture, with zero as the least democratic and 100 as the most democratic. The data on the annual inflation rate (derived from the consumer price index) is collected from the International Monetary Fund (IMF).

We also collected data from The Heritage Foundation. This data includes the Government Spending Index that measures all levels of government expenditures, the Labor Freedom Index that measures regulations concerning labor employment, the Trade Freedom Index that measures the absence of tariff and non-tariff barriers that affect imports and exports of goods and services, the Business Freedom Index that measures the ability to have a business, the overall burden of regulation as well as the efficiency of government in the regulatory process, and Property Rights that measures the degree to which a country's laws protect private property rights and the degree to which its government enforces those laws. All the indices are measured with zero as having the least freedom and 100 as having the most freedom.

4 The Model

Our baseline model is a two-step system Generalized Method of Moments (GMM) estimation model on dynamic panel data. It can be re-written from the cross-country catch-up equation of Barro and Sala-i-Martin (2003) to assess the institutional factors, with our main focus on freedom from corruption and natural resources, as:

$$\ln Y_{it} = \phi \ln Y_{it-1} + \beta_1 HumanCapital_{it} + \beta_2 PhysicalCapital_{it} + \beta_3 NaturalCapital_{it} + \beta_4 CorruptFree_{it} + \beta_5 TradeFreedom_{it} + \beta_6 Inflation_{it} + \beta_7 LaborFreedom_{it} + \beta_8 Democracy_{it} + \mu_i + d_t + \varepsilon_{it} \quad (1)$$

where $\phi = 1 + \alpha$ and α is the conditional convergence factor, Y_{it} is the real GDP per capita, Y_{it-1} is the previous year real GDP per capita, μ_i the unobservable country-specific effect, d_t is the yearly time dummy, ε_{it} is the error term, and β are the coefficients.

In Equation (1), $HumanCapital$, $PhysicalCapital$, and $NaturalCapital$ are the capital-related explanatory variables for human capital, physical capital, and natural capital respectively. For the baseline model, we have $TradeFreedom$, $Inflation$, $LaborFreedom$, and $Democracy$ as control variables for the Trade Freedom Index, the inflation rate, the Labor Freedom Index, and the Democracy Index respectively. We also include $PropertyRight$, $BusinessFreedom$, and $GovernmentSpending$ as other control variables for property rights, the Business Freedom Index, and government spending.

There exists unobserved heterogeneity in the cross-section of countries which is persistent and has higher variance than the error terms. We thus estimate the dynamic panel data using fixed effects and GMM models to control for endogeneity and unobserved heterogeneity. However, we could possibly encounter the problem of having severely weak instruments if we use the difference GMM model (Arellano and Bond, 1991). Therefore, we employ the system GMM estimator (Arellano and Bover, 1995; Blundell and Bond, 1998).

According to Roodman (2009), having a sample with the time dimension being greater than the number of countries can weaken the instruments which could lead to invalidating some asymptotic results and specification tests (Teixeira and Queiros, 2016; Iqbal and Daly, 2014). Hence, our two-step system GMM estimation is done with panel data consisting of 150 countries over a period of 12 years. We use two-step, rather than one-step system GMM, because it is more efficient and robust to heteroskedasticity and autocorrelation (Roodman, 2009). We use the collapsed instrument matrix to resolve the issue of overfitting endogenous variables.

5 Results

In this section, we present the results from the dynamic panel data analysis in Table 1 that are estimated by Blundell and Bond (1998)'s two-step system GMM estimation method using a collapsed instrument matrix that includes time dummy variables and using robust standard errors corrected for finite samples (Windmeijer-corrected standard errors).

Table 1 shows the estimation results for Equations 1 to 4 for the dependent variable which is real GDP per capita (in natural log). Arellano-Bond Tests AR (1) show that the specified dynamic model is appropriate when we reject the null hypothesis at the 1% significance level for all results. Arellano-Bond Tests AR (2) show that the GMM lag is a good instrument when we fail to reject that there exists second-order serial-correlation at the 10% significance level for all results. The Hansen tests show that the results are with valid instruments being specified because we fail to reject the null hypothesis that the instruments are invalid at the 10%

significance level. All results have a time period of 12 years that is less than the number of groups, and this ensures valid asymptotic results and specification tests, according to Roodman (2009).

The results show that the accumulation of both human and physical capital have strong positive effects with statistical significance (at either the 1% or 5% level) on economic development for all equations, similar to the findings of Batten and Vo (2009), Fabro and Aixala (2012), and Iqbal and Daly (2014). Holding everything else constant, a one-unit increase in physical capital is associated with an approximately 0.06% increase in real GDP per capita in Equations 1 to 4. Holding everything else constant, a one-unit increase in human capital is associated with a 2.17%, 2.12%, 1.62%, and 1.55% increase in real GDP per capita in Equations 1 to 4, respectively. With a population that has more educational attainment and more capital formation over time, the higher level of human capital accumulated has a greater effect of specialization in capital-intensive industries that would give rise to a greater gain on economic development.

The natural capital variable shows a positive effect on growth (similar to Brunnschweiler, 2006; Allcott and Keniston, 2018) with statistical significance at either the 5% or 10% level. Holding everything else constant, every one-percentage point increase in natural resources as a percent of GDP is associated with a 0.26%, 0.28%, 0.3%, and 0.29% increase in the level of economic development in Equations 1 to 4, respectively. We also find that being less corrupt has a strong positive effect, which is statistically significant at the 5% or 10% level, on economic development. Holding everything else constant, every one-unit increase in the free from corruption variable is associated with a 0.33%, 0.32%, 0.23%, and 0.24% increase in the level of economic development in Equations 1 to 4 respectively. This is consistent with Mehlum et al. (2006), which finds a positive natural resources effect when a country endowed with natural resources has good institutions. When a country has an abundance of natural resources, corruption causes an uneven appropriation on the gains from these resources that would otherwise serve as the natural capital to allow more people to be better off from accumulating other forms of capital to achieve higher economic development. We did find an interesting note on democracy. We failed to find its connection with economic development when we controlled for freedom from corruption. We also found that trade freedom has a moderate positive effect on development in equation 4. Our results reaffirm the findings of Leite and Weidmann (1999) which said that the establishment of strong, corruption-free institutions that secure property rights plays an important role in promoting economic development when a country is endowed with natural resources.

Table 1. Dynamic panel data estimation results on the relationship among economic development, natural capital and freedom from corruption; 12 years, 2006-2018.

Variable	Proxy	(1)	(2)	(3)	(4)
		All countries	All countries	Developing countries	Developing countries
		Two-step system GMM	Two-step system GMM	Two-step system GMM	Two-step system GMM
GDP Per Capita (lagged)	Real Gross Domestic Product Per Capita (ln, one-year lagged)	0.9047*** (0.0351)	0.9031*** (0.0343)	0.9113*** (0.0218)	0.9100*** (0.0227)
Physical Capital	Gross capital formation (% of GDP)	0.0006*** (0.0002)	0.0006*** (0.0002)	0.0007** (0.0003)	0.0006** (0.0003)
Human Capital	Number of years of schooling of the population aged 25 or more	0.0217** (0.0091)	0.0212** (0.0087)	0.0162*** (0.0046)	0.0155*** (0.0044)
Natural Capital	Natural Resources Rents (% of GDP)	0.0026* (0.0014)	0.0028** (0.0013)	0.0030** (0.0015)	0.0029** (0.0012)
Freedom from Corruption	Corruption Index (1: the highest level, 7: the lowest)	0.0033** (0.0013)	0.0032** (0.0013)	0.0023** (0.0011)	0.0024* (0.0012)
Interaction between Natural Capital and Freedom from Corruption	Corruption Index × Natural Capital	-0.0001** (0.0000)	-0.0001** (0.0000)	-0.0001* (0.0001)	-0.0001** (0.0000)
Institutions	Property Rights	0.0007 (0.0006)	0.0007 (0.0006)	0.0005 (0.0006)	0.0007 (0.0007)
	Democracy Index	-0.0006 (0.0005)	-0.0006 (0.0006)	-0.0002 (0.0006)	-0.0005 (0.0006)
Other Economic Control Variable	Trade Freedom		0.0009 (0.0007)		0.0009* (0.0005)
	Labor Freedom		-0.0003 (0.0004)		-0.0002 (0.0004)
Goodness of fit	No. of Observation	1497	1496	797	796
	No. of Countries/Group	157	156	84	83
	No. of Instruments	27	27	29	29
	Year Fixed Effect	Yes	Yes	Yes	Yes
	Country Fixed Effect	Yes	Yes	Yes	Yes
	AR(1) p-value	0.194	0.025	0.182	0.027
	AR(2) p-value	0.107	0.179	0.146	0.191
	Hansen test p-value	0.115	0.121	0.214	0.435

*p**<0.1, *p***<0.05, *p****<0.01, standard errors in parentheses.

6 Robustness Check for Non-Linearities

We added polynomial variables to the second and third power for natural capital and an interaction term between natural capital and freedom from corruption to our two-step system GMM model. All four specifications have the interaction term and the polynomial value of natural capital to the second power while the polynomial variable for natural capital in the third power is in specifications (2) and (4). The estimation results are shown in Table 2. These additions are meant to explore the possibility that non-linearities exist in our model. The results show that the natural capital polynomial variables are not statistically significant in all our specifications. This then implies that there is a linear relationship between natural capital and real GDP per capita and non-linearities are not present in the model. The interaction term between natural capital and freedom from corruption is significant at the 0.1 level in all specifications which states that the impact of natural resources on economic development depends on the quality of institutions in a particular country. The values for the natural capital and freedom from corruption variables and the interaction term between natural capital and freedom from corruption in each specification in Table 1 are somewhat similar to their respective counterparts in Table 2.

7 Conclusion

The paper investigates the nexus of corruption and three different types of capital on economic development using a two-step system GMM estimation model. We present a dynamic panel data analysis for 150 countries over the period 2006–2018. The findings show that countries with more natural resources and less corruption tend to achieve higher levels of economic development. The accumulation of human, natural and physical capital are important in promoting economic development. Most importantly, institutions that ensure a clean government are vital for the equitable distribution and use of natural resources across a country. These institutions would enable more people to benefit from a nation's natural capital which then leads to further capital accumulation and higher economic development. Our results suggest that the focus of policy on economic development should not only be on capital accumulation, but also on investing in building institutions that promote property rights and fight corruption.

The results of this paper show that there is a need for governments and international organizations such as The World Bank to engage in capacity building activities on institutions in the developing world. Institutions such as the judiciary and the civil service are vital for the

Table 2. Dynamic panel estimation with polynomial variables to test for non-linearities

Variable	Proxy	(1)	(2)	(3)	(4)
		All countries	All countries	Developing countries	Developing countries
		Two-step system GMM	Two-step system GMM	Two-step system GMM	Two-step system GMM
GDP Per Capita (lagged)	Real Gross Domestic Product Per Capita (ln, one-year lagged)	0.899***	0.911***	0.913***	0.907***
		(0.0284)	(0.0288)	(0.0231)	(0.0240)
Physical Capital	Gross capital formation (% of GDP)	0.000764**	0.000793**	0.000636*	0.000673*
		(0.000292)	(0.000303)	(0.000290)	(0.000265)
Human Capital	Number of years of schooling of the population aged 25 or more	0.0220**	0.0189*	0.0145**	0.0150**
		(0.00752)	(0.00762)	(0.00428)	(0.00445)
Natural Capital	Natural Resources Rents (% of GDP)	0.00337	-0.000111	0.00499	0.00764
		(0.00705)	(0.00835)	(0.00395)	(0.00996)
Natural Capital^2		-0.00000602	0.0000912	-0.0000261	-0.000114
		(0.000119)	(0.000285)	(0.0000465)	(0.000427)
Natural Capital^3			-0.000000730		0.000000986
			(0.00000320)		(0.00000518)
Freedom from Corruption	Corruption Index (1: the highest level, 7: the lowest)	0.00325**	0.00297**	0.00248	0.00293*
		(0.000998)	(0.00102)	(0.00130)	(0.00136)
Interaction between Natural Capital and Freedom from Corruption	Corruption Index × Natural Capital	-0.0000934*	-0.0000916*	-0.000126*	-0.000147*
		(0.0000384)	(0.0000426)	(0.0000593)	(0.0000635)
Institutions	Property Rights	0.000791	0.000628	0.000721	0.000785
		(0.000651)	(0.000652)	(0.000684)	(0.000686)
	Democracy Index	-0.000604	-0.000728	-0.000241	-0.000273
		(0.000865)	(0.000751)	(0.000756)	(0.000721)
Other Economic Control Variable	Trade Freedom	0.00118	0.000747	0.00102	0.00119
		(0.000945)	(0.000942)	(0.000574)	(0.000674)
	Labor Freedom	-0.000344	-0.000169	-0.000308	-0.000368
		(0.000532)	(0.000536)	(0.000438)	(0.000530)
Goodness of fit	No. of Observation	1496	1496	796	796
	No. of Countries/Group	156	156	83	83
	Year Fixed Effect	Yes	Yes	Yes	Yes
	Country Fixed Effect	Yes	Yes	Yes	Yes
	AR(1) p-value	0.197	0.177	0.034	0.073
	AR(2) p-value	0.168	0.157	0.172	0.174
	Hansen test p-value	0.354	0.201	0.361	0.272

p<0.1, *p*<0.05, *p*<0.01, standard errors in parentheses.

protection of property rights and the enforcement of the rule of law which are both important ingredients for businesses and livelihoods to thrive. It is imperative that these institutions are

relatively free of corruption to ensure that economic development reaches as many people as possible and that rents are not illegally appropriated or distorted. Interventions should be aimed at increasing the quality, effectiveness and accountability of the bureaucracy. In short, institutional reforms can be the spark that leads to sustainable economic development especially in the developing world.

Appendix 1: Variable Descriptions and Statistics, 150 countries, Year 2006-2018

Variable	Proxy	Source	Mean	Std. Dev.
Dependent variable				
Real GDP per Capita	Economic Development	World Bank	8.517945	1.499191
Explanatory variables				
Gross capital formation (% of GDP)	Physical Capital	World Bank	24.74013	8.24717
Year Schooling	Human Capital	United Nation	8.076222	3.252179
Natural Resources Rents (% of GDP)	Natural Capital	World Bank	9.228351	12.75219
Free from Corruption	Institution	The Heritage Foundation	40.8155	20.9302
Democracy	Institution	The Economist - Intelligence Unit	55.15741	22.10073
Trade Freedom	Other Economic	The Heritage Foundation	61.72039	27.61029
Business Freedom	Other Economic	The Heritage Foundation	63.42762	17.73797
Property Rights	Institution	The Heritage Foundation	44.81415	24.25345
Labor Freedom	Other Economic	The Heritage Foundation	59.64843	16.44702
Inflation Rate	Other Economic	International Monetary Fund	5.389074	8.896485
Government Spending	Other Economic	The Heritage Foundation	64.43065	23.40606

Appendix 2. List of the 150 Countries Used in This Study

Afghanistan	Congo Brazzaville	Iceland	Mexico	Sierra Leone
Albania	Costa Rica	India	Moldova	Singapore
Algeria	Côte d'Ivoire	Indonesia	Mongolia	Slovakia
Angola	Croatia	Iran	Montenegro	Slovenia
Armenia	Cyprus	Ireland	Morocco	South Africa
Australia	Czech Republic	Israel	Mozambique	South Korea
Austria	Denmark	Italy	Myanmar	Spain
Azerbaijan	Dominican Republic	Jamaica	Namibia	Sri Lanka
Bahrain	DRC	Japan	Nepal	Sudan
Bangladesh	Ecuador	Jordan	Netherlands	Suriname
Belarus	Egypt	Kazakhstan	New Zealand	Swaziland
Belgium	El Salvador	Kenya	Nicaragua	Sweden
Benin	Equatorial Guinea	Kuwait	Niger	Switzerland
Bhutan	Estonia	Kyrgyzstan	Nigeria	Tajikistan
Bolivia	Ethiopia	Laos	Norway	Tanzania
Bosnia and Hercegovina	Finland	Latvia	Oman	Thailand
Botswana	France	Lebanon	Pakistan	Timor-Leste
Brazil	Gabon	Lesotho	Panama	Togo
Bulgaria	Gambia	Liberia	Paraguay	Tunisia
Burkina Faso	Germany	Libya	Peru	Turkey
Burundi	Ghana	Lithuania	Philippines	Uganda
Cambodia	Greece	Luxembourg	Poland	Ukraine
Cameroon	Guatemala	Macedonia	Portugal	United Arab Emirates
Canada	Guinea	Madagascar	Qatar	United Kingdom
Cape Verde	Guinea-Bissau	Malawi	Romania	Uruguay
Chad	Guyana	Malaysia	Russia	USA
Chile	Haiti	Mali	Rwanda	Venezuela
China	Honduras	Malta	Saudi Arabia	Vietnam
Colombia	Hong Kong	Mauritania	Senegal	Zambia
Comoros	Hungary	Mauritius	Serbia	Zimbabwe

Appendix 3 Summary of Empirical Studies on Institutions and Growth/Development

Reference	Period	Sample	Estimation method	Proxy of the dependent variable (economic growth)	Proxies of independent variables
Mankiw et al. (1992)	1960-1985	121 countries	OLS	ln GDP per working-age person in 1985	Human capital: fraction of the eligible population (aged 12 to 17) enrolled in secondary school, which was obtained from the UNESCO yearbook
Dawson (1998)	1975-1990	85 countries	fixed effects	real GDP per worker	Human capital: percentage of the working-age population enrolled in secondary school Physical capital: investment to GDP ratio Human capital: political freedom, civil liberties and economic freedom index
Tavares and Wacziarg (2001)	1970-1989	65 countries	3SLS	Growth rate of Purchasing Power Parity (PPP) adjusted Real Gross Domestic Product per capita.	Human capital: Average years of secondary and higher education in the population over age 25 Physical capital: Rate of physical capital investment. Institutions: Democracy index
Gwartney et al. (2006)	1980-2000	94 countries	OLS	average annual growth rate of GDP per capita, change in Economic Freedom of the World rating	Human capital: years of schooling per worker Physical capital: private investment/GDP ratio and public investment/GDP ratio Institutions: Economic Freedom of the world index

Hall et al. (2010)	1980-2000	96 countries	OLS	growth of output per worker	Human Capital: average years of schooling per worker from Baier, Dwyer, and Tamura (2006) Physical Capital: perpetual inventory method used to calculate the physical capital stock per worker using annual investment data from Heston et al. (2000) Institutions: data on "risk of expropriation" from the International Country Risk Guide (ICRG)
Dias and Tebaldi (2012)	1965-2005	61 countries	one-step system GMM with robust covariance matrix	GDP growth rate per capita	Human Capital: rate of return from education Psacharopoulos (1994) Physical Capital: perpetual inventory system (Easterly and Levine (2001) Institutions: ratio of people with post-secondary education to people with no schooling, Polity-IV measure of democracy and autocracy
Hashim Osman et al. (2012)	1984-2003	27 countries	Fixed effects	Growth rate of real per capita GDP	Institutional quality: (a) socioeconomic conditions, (b) corruption, (c) government stability and (d) ethnic tensions, data comes from International Country Risk Guide
Fatas and Mihov (2013)	1960-2007	93 countries	pooled OLS and fixed effects	growth rate of output per capita	Human capital: primary school enrollment Physical capital: investment price Institutions: political volatility

Nasreen et al. (2015)	1985-2009	94 countries	OLS and panel GMM	growth rate of real GDP per capita	Human capital: adult literacy rate Physical capital: investment as share of GDP Institutions: political liberty, civil liberty and economic freedom indices taken form Freedom House
Vedia-Jerez and Chasco (2015)	1960-2008	10 countries	system GMM	Growth: inter-quadrennial growth of log GDP per capita, FDI: log foreign direct investment as a percentage of GDP	Human Capital: Average percentage of the log of working age population with secondary education Physical capital: Log gross fixed capital formation Institutions: institutional quality index form Norris (2009), institutional constraints on chief executives index from Polity IV, contract-intensive money from IFS
Kim and Lin (2017)	1990-2012	40 countries	Multi-factor regression	Log of real GDP per capita	Natural resources: (a) share of primary exports in GDP and (b) revenues from natural resources (including energy, minerals, and forestry) as a share of GDP
Issahaku et al (2018)	1996-2013	106 countries	2SLS	growth in per capita GDP	Human capital: labor force participation rate Physical capital: gross fixed capital formation Institutions: composite measure of institutional quality derived from the six governance indicators development by Kaufmann, Kraay and Mastruzzi (2011)

Sidek and Asutay (2021)	1984-2017	121 countries	system GMM	GDP growth rate	Human capital: annual change in population, Physical capital: investment Institutions: 12 variables (government stability, socio economic conditions, investment profile, internal conflict, external conflict, corruption, military in politics, religious tensions, law and order, ethnic tensions, democratic accountability, bureaucracy) from ICRG
Boikos et al. (2023)	1960-2015	139 countries	OLS	ln GDP per working-age person in 2015	Human capital: (a) the secondary educational attainment as a % of the population aged 15-64 (total) from the Barro-Lee dataset (Barro and Lee 2013) and (b) the human capital index, based on years of schooling and returns to education from the Penn Table

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