1. Introduction

Starting from Douglas North's seminal contribution (1990), economists have generally claimed that the quality of a country's institutions is positively related to its level of development (Acemoglu and Johnson, 2012; Acemoglu et al., 2014; Rodrik, 2000, 2007; Rodriguez-Pose, 2013). Better institutions might be an outcome of a country accumulating more resources (Rodriguez-Pose and Di Cataldo, 2015), however, or institutions might struggle in poor countries lacking in government effectiveness or reliable regulatory systems (Tebaldi and Mohan, 2010). A recent study found that the causality runs from institutional quality to economic growth, and not vice versa (Corradini, 2021), but this applied to the regions of a single country, Italy, considered only in the short run, and as regards a single aggregate indicator of institutional quality.

The present paper provides three novel contributions to the literature on institutions and development. First, we consider the level of GDP per capita (our poxy for a country's level of development and standard of living), instead of the economic growth rate, because the former is characterized by a stochastic trend, while the latter tends to follow a stationary, mean-reverting process. This choice enables us to analyze the relationship between institutions and standard of living in the longer run. Second, we use a panel cointegration approach to ensure that such a relationship is not spurious. Using a panel vector error correction model (PVECM) also enables us to estimate the direction of the causality between the quality of institutions and a country's GDP per capita in the short and long run, while controlling for time-invariant omitted variables. Third, we widen the analysis (by comparison with previous studies) to span 162 countries and 21 years and consider six dimensions of institutional quality.

Our results show that there is a non-spurious, mutual, long-run causal relationship between each element of institutional quality and a country's level of GDP per capita. In the short run, on the other hand, the level of standard of living is Granger-caused only by regulatory quality, and by voice and accountability.

This paper is structured as follows. Section 2 offers a short presentation of the data and our empirical model. Section 3 presents the empirical findings. Section 4 concludes.

2. Data and empirical strategy

Our data come from two main sources: the Worldwide Governance Indicators (WGI)[1]; and the World Bank's World Development Indicators (WDI). The WGI was developed by Kaufmann et al. (2010) for the World Bank. It provides year-by-year information on six dimensions of institutional quality: voice and accountability (VA); political stability and absence of violence (PS); government effectiveness (GE); regulatory quality (RQ); rule of law (RL); and control of corruption (CC). The WDI provides data on the level of GDP per capita (GDPPC), at constant prices in US dollars in 2010. Our final balance panel consists of 162 countries and covers the years 1996-2016.

To analyze the long-run relationship between institutional quality (IQ) and GDP per capita (GDPPC) as a proxy for the average standard of living, we proceed as follows: first, we apply

[1] Data and methodological notes are available here: https://info.worldbank.org/governance/wgi/

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Quality of institutions and standard of living: a panel cointegration analysis

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Abstract

Does the quality of its institutions affect the average standard of living in a country? We aim to answer this question by conducting a panel cointegration analysis on a sample of 162 countries and 21 years, from 1996 to 2016. In the long run, the estimates show a mutual (Granger) causal effect between all six constitutive elements of institutional quality considered and GDP per capita, our proxy of a country's standard of living. In the short run, however, GDP per capita is only influenced by voice and accountability, and regulatory quality.

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the logarithmic transformation for all our variables, so that all the estimated coefficients correspond to elasticities[2]. The baseline equation is:

$$\ln(GDPPC)_{it} = \alpha_i + \beta ln(IQ)_{it} + \gamma f_t + \varepsilon_{it} \quad (1)$$

where i is the country, t is the year, the term α_i captures country fixed effects, f_t captures time-specific unobserved common shocks, ε_{it} is the stochastic error term, and β represents the elasticity of GDPPC with respect to the single measure of *IQ*. Since the six *IQ* items are highly correlated, to avoid the risk of double counting and multicollinearity, we include them one at a time in Equation 1.

Second, we test for their non-stationarity using the Pesaran (2007) panel unit root test (or cross-sectional Im, Pesaran and Shin (CIPS) test), which enables us to account for cross-sectional dependence across countries. The test consists in extending the individual augmented Dickey-Fuller regressions with the cross-sectional means of the lagged levels and first differences of the individual regressor, which are then used as a proxy for the unobserved common factors.

Third, we assess whether GDPPC and our six institutional quality variables are cointegrated, using the panel cointegration developed by Westerlund (2005) with a linear trend, and subtracting the cross-sectional mean from all the variables. We estimate the long-run relationship between institutional quality and GDP per capita using a dynamic OLS (DOLS) estimator (Kang and Chang, 2000), and a common correlated effects mean-group (CCE-MG) estimator (Pesaran, 2006), which accounts for the heterogeneous effects of common shocks by adding the averages of the dependent variables, and of the regressors for each period *t*.

Finally, we assess the short- and long-run Granger causality between IQ and GDPPC using the PVECM. We use the pooled mean-group (PMG) estimator developed by Pesaran, Shin and Smith (1999), which allows for the error correction (EC) by maximum likelihood to be estimated, while controlling for country fixed effects.

Following Hall and Milne (1994), the short- and long-run causality between IQ and GDPPC can be assessed by means of two equations: in the first, ΔlnGDPPC is the dependent variable, and ΔlnIQ is the main regressor; in the second, ΔlnIQ is the dependent variable, and ΔlnGDPPC is the main regressor. Then, we look at the estimated coefficient of the lagged EC terms in each equation. If it is not statistically different from zero, the regressor is weakly exogenous in the equation concerned, and there is no long-run Granger causality between the two variables. If the coefficient is statistically different from zero, there is a long-run Granger causality between the two variables in the direction suggested by the regression. If the coefficient differs from zero in both equations, then the long-run Granger causality runs in both directions. We can also perform a short-run causality test by looking at the estimated coefficient of the lagged explanatory variable in each equation: if this coefficient is zero, the explanatory variable does not Granger cause the dependent variable in the short run.

3. Results

Table 1 shows the results of the CIPS panel unit root test: the null hypothesis of non-stationarity is never rejected when the variables are taken in levels, but it is strongly rejected

[2] The six variables of institutional quality (x) were first standardized as follows: [x-min(x)/max(x)-min(x)], then transformed into a natural logarithm.

when they are taken in first differences. This means that all variables are non-stationary, or I(1)[3].

Table 1. Panel unit root test

	lnGDP	lnVA	lnPS	lnGE	lnRQ	lnRL	lnCC
CIPS	-1.980	-2.004	-2.177	-2.244	-2.054	-2.120	-2.068
	ΔlnGDP	ΔlnVA	ΔlnPS	ΔlnGE	ΔlnRQ	ΔlnRL	ΔlnCC
CIPS	-3.469***	-3.679***	-3.878***	-4.324***	-4.035***	-3.659***	-3.832***

Notes: all the tests include a linear trend and an intercept. The number of lags is set to 1. The relevant 10%, 5%, and 1% critical values are, respectively: -2.59, -2.65 and -2.77 with an intercept and a linear trend, and -2.63, -2.7 and -2.85 with an intercept only. *** significant at 1% level; ** significant at 5% level.

Then, we test whether GDPPC and our six institutional quality variables are cointegrated. Table 2 shows the results of the panel cointegration test. For each of the six variables, the test rejects the null hypothesis of no cointegration at the 1% level. We conclude that equation 1 represents a non-spurious, long-run relationship between institutional quality and GDP per capita. This cointegration also implies that no relevant non-stationary variables are omitted.

Table 2. Panel cointegration test (Westerlund, 2005)

Variance ratio	H_0: at least one panel	H_0: all panels
lnVA→lnGDPPC	11.673***	8.671***
lnPS→lnGDPPC	8.943***	7.433***
lnGE→lnGDPPC	7.688***	5.021***
lnRQ→lnGDPPC	8.487***	7.172***
lnRL→lnGDPPC	9.599***	7.982***
lnCC→lnGDPPC	9.709***	6.854***

Notes: Number of panels: 162; number of periods 21. The test statistic for panel cointegration be computed using, first, the alternative hypothesis that at least one panel is cointegrated, and second, that all the panels are cointegrated. A panel-specific linear trend is included, and the cross-sectional means have been subtracted to all variables.

We now turn to the panel DOLS estimates. To test for the presence of cross-sectional dependence, we use demeaned data, but we also compute the Pesaran (2004) CD test. Under the null hypothesis of no cross-sectional dependence, the CD test takes the residuals of the DOLS regression and their pairwise correlation is estimated. The statistic is normally distributed: rejection of the null hypothesis is an indication of the presence of cross-sectional dependence across panels. In this case, the DOLS-estimated coefficients may be biased, so we apply the common correlated effects mean group (CCE-MG) estimator proposed by Pesaran (2006). Table 3 shows the results of the DOLS estimates. We find that the estimated coefficient for each institutional quality variable is positive and significant at the 1% level. The CD test always strongly rejects the null hypothesis of no cross-sectional dependence, however, meaning that the DOLS coefficients can be biased by omitted variables.

[3] This result does not change if we use all the variables before the logarithmic transformation.

Table 3. Dynamic OLS estimates

DepVar: lnGDP	(1) lnVA	(2) lnPS	(3) lnGE	(4) lnRQ	(5) lnRL	(6) lnCC
Coeff.	0.699***	2.100***	2.366***	1.786***	2.169***	1.665***
	(0.012)	(0.036)	(0.048)	(0.038)	(0.030)	(0.028)
Demeaned data	Yes	Yes	Yes	Yes	Yes	Yes
CD test	288.54***	167.02***	154.12***	192.24***	157.60***	175.63***
N. countries	162	162	162	162	162	162
N. obs.	2916	2916	2916	2916	2916	2916

Notes: pooled DOLS estimator developed by Kao and Chiang (2000). All regressions include panel-specific intercepts (i.e., fixed effects), one lag and one lead. CD is the cross-sectional dependence test proposed by Pesaran (2004). *** significant at 1% level; ** significant at 5% level.

Table 4 shows the results of the CCE-MG estimates, which still confirm the positive and statistically significant relation between institutional quality and GDP per capita, but all six estimated coefficients are smaller than in Table 3. The lnRQ variable shows the greatest elasticity: a 10% increase in the index of regulatory quality corresponds to an average 2% increase in GDP per capita.

Table 4. Common correlated effects mean-group regression

DepVar: lnGDP	(1) lnVA	(2) lnPS	(3) lnGE	(4) lnRQ	(5) lnRL	(6) lnCC
Coeff.	0.094***	0.068**	0.133***	0.196***	0.070*	0.547**
	(0.034)	(0.023)	(0.027)	(0.035)	(0.036)	(0.025)
Demeaned data	Yes	Yes	Yes	Yes	Yes	Yes
CD test	-0.70	-0.29	0.70	1.88	-0.81	0.21
N. countries	162	162	162	162	162	162
N. obs.	3402	3402	3402	3402	3402	3402

Notes: CCE-GM: common correlated effects mean-group estimator developed by Pesaran (2006). All regressions include panel-specific intercepts, and a time trend. The CCE-GM regression is obtained using the *robust* option. CD is the cross-sectional dependence test proposed by Pesaran (2004). *** significant at 1% level; ** significant at 5% level.

To control for long-run causality, both from IQ to GDPPC and vice versa, we use a PVECM model that adopts the long-run cointegration regression (DOLS) coefficient to compute the lagged EC term. Table 5 shows the results of the PMG estimates and the corresponding short- and long-run exogeneity tests.

Table 5. Causality tests from PMG estimates

	(1)	(2)	(3)	(4)	(5)	(6)
lnIQ → lnGDP	lnVA	lnPS	lnGE	lnRQ	lnRL	lnCC
β	2.089***	0.536***	0.618***	0.293***	1.860***	0.479***
	(0.126)	(0.033)	(0.047)	(0.029)	(0.112)	(0.034)
EC	-0.042***	-0.064***	-0.072***	-0.080***	-0.041***	-0.068***
	(0.005)	(0.009)	(0.011)	(0.011)	(0.006)	(0.009)
Demeaned data	Yes	Yes	Yes	Yes	Yes	Yes
N. countries	162	162	162	162	162	162
N. obs.	3240	3240	3240	3240	3240	3240
Weak exogeneity test	64.63***	43.89***	46.79***	43.36***	40.32***	49.62***
Short-run Granger causality test	3.92**	2.17	0.01	16.75***	0.31	0.62
lnGDPPC → lnIQ	(7)	(8)	(9)	(10)	(11)	(12)
β	0.017**	0.039***	0.101***	0.099***	0.273***	0.046**
	(0.006)	(0.008)	(0.012)	(0.008)	(0.011)	(0.015)
EC	-0.261***	-0.297***	-0.267***	-0.268***	-0.214***	-0.254***
	(0.014)	(0.017)	(0.016)	(0.015)	(0.019)	(0.017)
Demeaned data	Yes	Yes	Yes	Yes	Yes	Yes
N. countries	162	162	162	162	162	162
N. obs.	3240	3240	3240	3240	3240	3240
Weak exogeneity test	337.88***	282.36***	270.03***	310.53***	129.04***	222.59***
Short-run Granger causality test	1.61	6.83**	14.30***	3.24*	5.36**	0.96

Notes*** significant at 1% level; ** significant at 5% level.

Comparing the estimated coefficients in Columns 1-6 with those in Columns (7-12), we find them all statistically significant at the 1% level, but their magnitude is higher when the direction of causality runs from IQ to GDPPC. Intriguingly, the weak exogeneity test always rejects the null hypothesis of no long-run Granger causality, meaning that institutional quality and the standard of living are linked by a mutual, non-spurious, long-run relationship. In the short run, on the other hand, we find that GDPPC is Granger caused only by voice and accountability, and by regulatory quality, while greater GDPPC Granger causes higher levels of political stability, government effectiveness, regulatory quality, and rule of law. We find no association between standard of living and control of corruption in the short run.

4. Conclusions

Using panel cointegration analysis, this paper shows that higher institutional quality improved the average standard of living in a sample of 162 countries during the years 1996-2016. Our results show that institutional quality and standard of living are linked by a long-run two-way (Granger) causal relationship involving all six quality dimensions in the Worldwide Governance Indicators. In the long run, it is impossible to distinguish a single direction of causality, as the level of a country's development and the quality of its institutions are interwoven in a virtuous circular dynamic. The results are different in the short run: on average, higher ratings for voice and accountability, and a more efficient market regulation can contribute to improving the level of a country's GDP per capita. This latter, in turn, helps raising the average level of political stability, government effectiveness, and rule of law. This means that national policies aiming to promote economic development in the short run should focus on strengthening democratic rules and developing the private sector.

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