INSTITUTIONS AND MACROECONOMIC PERFORMANCE: A META-REGRESSION ANALYSIS

Adnan Efendic, Geoff Pugh and Nick Adnett[1]

Abstract

This meta-regression analysis investigates the effects of institutions on (macro)economic performance. This literature reveals a positive relationship that is conditional on heterogeneities with respect to model specifications, samples, datasets, observed time-horizons, and approaches to the potential endogeneity of institutions. The partial correlations between institutional and performance variables are particularly influenced by choice of dependent variable and treatment of institutional endogeneity. Standard tests suggest that there is an authentic empirical effect and reveal no evidence of publication bias. These findings are supported by separate investigation of primary studies with, respectively, output-growth and output-level as the dependent variable. Sub-sample investigations reveal an institutional effect on output *growth* in transition economies but a larger effect on output *levels* in other countries.

Key words: institutions; economic performance; meta-regression analysis

Total words: Abstract: 119**;** Full paper (inclusive): 8,060

JEL classification: E02; O43.

First draft: 25 April 2009

[1] Authors' affiliations are, respectively: School of Economics and Business in Sarajevo, BiH, E-mail: adnan.efendic@efsa.unsa.ba; Business School, Staffordshire University, Stoke-on-Trent ST4 2DF, UK, E-mail: g.t.pugh@staffs.ac.uk; Business School, Staffordshire University, Stoke-on-Trent ST4 2DF, UK, E-mail: n.j.adnett@staffs.ac.uk.

1 Introduction

This paper reports a meta-regression analysis (MRA) of the empirical literature that investigates the link between institutions and economic performance. The conventional narrative review establishes that this literature typically reports statistically significant and positive effects of institutional improvement on economic performance. MRA is the means to move beyond such qualitative judgements. MRA is "the regression analysis of regression analysis" (Stanley and Jarrell, 1989), providing statistical tools to test for and measure the extent of publication bias in empirical literatures, to identify and quantify authentic effects in diverse econometric literatures net of publication bias, and to explain why, and quantify how, empirical estimates differ in applied research (Stanley, 2005 and 2008). MRA is a relatively new econometric tool and the econometric investigation of institutions and economic performance is a relatively new area. The only related study to the one reported in this paper is the Doucouliagos' (2005) MRA of the empirical literature on economic freedom and economic growth.

2 Meta-regression analysis and institutional empirical research

2.1. Sampling and MRA procedure

Following the methodology applied by Stanley (2001), the search process for relevant empirical studies included: the EconLit database (on-line 2007); working paper series; the internet; and references obtained from the literature. Key words used in the search were: "institutions + economic growth"; "institutions + economic development"; "institutions + economic performance". These approaches identified more than 200 papers, including 40 econometric studies together reporting 112 regressions of interest, which form the observations in the present MRA. The majority of authors report several regressions arising from testing down procedures and/or from comparative analysis of different specifications (e.g. institutions in combination with other variables). However, our selection criterion was to take authors' preferred or base specification(s) for the MRA database, although in some cases the reader has to identify these. This is common practice among MRA researchers (Stanley and Doucouliagos, 2008a). Consequently, the number of reported regressions ranges from one (as in Hall and Jones, 1999; Chousa et al., 2005; Redek and Susjan, 2005; De La Croix and Delavallade, 2006; Beck and Laeven, 2006) up to six (Moers, 1999; Aixala and Fabro, 2008), with an “average” of 3.1 regressions per study. The studies included in the MRA are noted in the reference list.[2] Variation from study to study in the number of reported regressions implies that some studies may be over-weighted in the MRA. Accordingly, the regressions reported below are weighted so as to give the same weight to every study.[3]

The dependent variable in each investigation is related to (macro)economic performance which are grouped into two categories: variables related to the level of output (GDP; GDP per capita; GNP per capita; and GDP per worker), which are represented by a new dummy variable (LEVELGDP); and variables related to growth (i.e. GDP growth; GDP per capita growth; GDP per worker growth), which are represented by another dummy (GRGDP). Accordingly, all MRA tests will be conducted on the whole sample (40 studies and 112 observations) and, separately, for the output-growth (20 studies and 52 observations) and output-level (21 studies and 60 observations) sub-samples.

The studies in this MRA sample used a range of institutional indices that include different units, scales and components. Accordingly, we use a standardized measure of the parameter of interest (“institutional variable”); i.e. a measure without dimensionality (Stanley and Jarell, 1989). For each reported regression we calculate the partial correlation coefficient (henceforth PCC) between the dependent variable and the variable of interest. Partial correlation is a standardized measure of the degree of association, controlling for the influences of other factors (Greene, 2008, p. 31; for an application in MRA, see Doucouliagos and Laroche, 2009). Hence, this standardization will enable direct comparison between different studies in the sample, as well as between different MRA subsamples (i.e. growth-output and level-output literatures).

The simplest MRA regresses the standardised effect size (i.e. PCC) on an intercept (a) and the conventional measure of precision (*SEpcc*, the standard error of PCC), as follows:

$$PCC_i = \hat{a} + \hat{b}_0 \cdot SEpcc_i + \hat{e}_i \qquad (1)$$

[2] Since institutional applied research in economics started quite recently, the oldest research reported in this sample was published in 1995 (i.e. Knack and Keefer, 1995; Mauro, 1995) while the latest studies are from 2008 (i.e. Richter and Timmons, 2008; Aixala and Fabro, 2008). Most authors use data from the period 1990 - 2000.
[3] The weights were calculated using the formula: weight = 1/(number of reported regressions in the MRA from a particular study).

where i = 1,…,N indexes regressions in the MRA database, $\hat{a}$ and $\hat{b}_0$ are estimated, and $\hat{e}_i$ is the regression error term.

However, Equation (1) is rarely estimated due to a common problem with heteroscedasticity (Stanley et al., 2008), since the standard error is the estimated standard deviation of the partial correlation coefficient. Accordingly, Stanley (2008) recommends that this bivariate regression be weighted with the standard error of the PCC to reduce heteroskedasticity and yield more efficient estimates. Hence, Equation (1) is divided by the standard error of the PCC to obtain the weighed least squares (WLS) version of Equation (1):[4]

$$TSTAT_i = \hat{a} \cdot \frac{1}{SEpcc_i} + \hat{b}_0 + \hat{e}_i \qquad (2)$$

Note, the slope and intercept terms are now reversed compared to Equation (1) and the inverse standard error becomes the key independent variable in the MRA (Stanley et al., 2008). Accordingly, in Equation (2): the t-value ($TSTAT_i$) of the estimated coefficient on the institutional variable in each regression is taken as the "effect size of institutions on economic performance" (henceforth, ESIEP); $\hat{a}$ is the same coefficient as in Equation (1) and thus still provides an estimate of the "true" or underlying effect size ***in terms of the partial correlation coefficient*** (it is thus *not* to be interpreted in terms of the *t*-statistic from the primary regressions in the literature); and $\hat{b}_0$, which is also from Equation (1), measures publication bias, as explained below. Hence, $\hat{a}$, the coefficient on the inverse of the standard error of the partial correlation coefficient, measures the model's precision *corrected for publication selection.*

The estimated bivariate MRA regression can be biased if important explanatory variables are omitted (Doucouliagos and Stanley, 2008a). Accordingly, a more developed version of Equation (2), i.e. a multivariate MRA, is standard in meta-analysis (Doucouliagos and Laroche, 2009); it enables investigation of the sources of heterogeneity in the referenced studies by adding independent (or moderator) variables to Equation (2). These additional

[4] The following formulas inform this transformation; these are derived from Fisher, 1954, p. 194: $SEpcc_i = \frac{PCC_i}{TSTAT_i}$, and $TSTAT_i = \frac{PCC_i}{SEpcc_i}$. The t-statistics come from the regressions that are used in the MRA sample while the PCC is calculated.

meta-independent variables will be also divided by the standard error of PCC. Hence, the general multivariate MRA is specified as follows:

$$TSTAT_i = \hat{a} \cdot \frac{1}{SEpcc_i} + \hat{b}_0 + \sum_{1}^{K} \hat{l}_K \cdot \frac{1}{SEpcc_i} Z_{Ki} + \hat{e}_i \quad (3)$$

In Equation (3), Z_{Ki} are k=1, … K moderator variables each weighted by $\frac{1}{SEpcc_i}$ (henceforth, SEINVpcc); $\hat{l}_k$ are k coefficients to be estimated, where each measures the impact of the corresponding moderator variables on the underlying effect of institutions on economic performance; and $\hat{e}_i$ is the meta-regression disturbance term, which has the standard characteristics.

.

In this MRA sample, the dependent MRA variable is the t-statistic on the institutional variable of interest from each study.[5] The mean t-statistic in the sample is 4.8 with standard deviation 3.8. The null hypothesis that the mean value of the t-statistic in the whole sample is zero may be rejected at any conventional level of significance (t-statistic=13.03; p-value=0.00), which indicates a typically positive relationship between institutions and economic performance. However, the range of t-statistics reported in the sample varies from 0.002 to 21.08, indicating considerable variation around the mean. Accordingly, it motivates us to do further investigation of the main reasons for such variation by applying MRA.

The “meta-independent” or “moderator” variables used in this MRA are listed and explained in Table 1. The final specification of a MRA is determined by reference to the data (Stanley and Jarell, 1989) and, in our case especially, to model diagnostics. Accordingly, the moderator variables listed in Table 1 comprise the initial set of variables that were identified as potential sources of heterogeneity in the institutional literature.[6] For reasons of space, we discuss these variables in the context of our results, which are reported in Section 4.

[5] In several studies the authors did not report t-statistics. These studies were either excluded from the analysis or, if they provide standard errors or p-values, the missing t-statistics were retrieved using (statistical) calculators. Moreover, some studies use indices/proxies that represent better institutions by a lower value. In these cases, negative coefficients and t-statistics were transformed into positive ones. The reported minimum and maximum values of the t-statistic are from the transformed data set.

[6] Identification of the full set of potential moderator variables entails, in effect, a conventional literature review.

Table 1. Potential explanatory (moderator) variables in this MRA

VARIABLES	SHORT EXPLANATION OF MODERATOR VARIABLES	Mean	St. dev.
YEARSE	The year an article is published (1995=1; 1996=2; 1996=3; …; 2007=13)	106.8	67.7
NOINDSE	The number of independent variables used in regressions	13.3	12.8
SEINVpcc	The inverse standard error of the partial correlation coefficients	10.9	4.7
LNTIMEDSE	The observed time-horizon of the dependent variable (e.g. 1, 2, 5 years change/average), logarithmic transformation	9.6	14.8
LNTIMEINSSE	The observed time-horizon of the institutional variable (e.g. 1, 2, 5 years change/average), logarithmic transformation	8.8	14.1
SAMSE	Dummy, 1 if a sample is for transition countries, 0 otherwise	2.3	4.6
LEVELGDPSE	Dummy, 1 if a study uses the level of output as dependent variable, 0 otherwise	6.8	7.3
GRGDPSE	Dummy, 1 if a study uses the growth rate of output as dependent variable, 0 otherwise	4.2	5.1
SPINSSE	Dummy, 1 if a study uses only institutional variable(s) in the regression	2.3	4.7
SPPRSE	Dummy, 1 if a study uses institutional variable(s) in the modified extended production function , 0 otherwise	3.8	5.9
SPOTHERSE	Dummy, 1 if a study uses institutional and other variables but not the standard growth factors, 0 otherwise	4.8	6.6
COMPSE	Dummy, 1 if the institutional variable is a subcomponent, 0 is for aggregated index	5.5	5.8
INITIALSE	Dummy, 1 if the initial level of output is included in the specification, 0 otherwise	1.2	3.1
MODELSE	Dummy, 1 if authors use panel data, 0 cross-section	3.4	7.2
PROPRSE	Dummy, 1 if authors use property rights as the main institutional variable, 0 otherwise	0.8	2.6
RULESE	Dummy, 1 if authors use rule of law as the main institutional variable, 0 otherwise	1.7	4.7
LAGSE	Dummy, 1 if authors use the lagged institutional variable in the regressions (one-year lag)	0.1	1.9
INSVARSE	Dummy, 1 if authors use instrumental variables (i.e. IV or 2SLS) to control for endogeneity, 0 other	6.8	7.1
SLS3SE	Dummy, 1 if authors use the 3SLS procedure to control for endogeneity, 0 otherwise	0.6	2.5
Source: Authors			

3 Initial testing for publication bias and authentic empirical effect

"Publication bias" (henceforth PB) in a literature arises when editors, reviewers, and/or researchers have a preference for results that are statistically significant (Stanley, 2005) and/or satisfy theoretical expectations (Doucoilagos, 2005). Research based on smaller samples is usually at a disadvantage in finding statistically significant results, because limited degrees of freedom are associated with larger standard errors on estimated coefficients. Hence, authors that work with smaller samples may "search" more (e.g. across specifications; estimators; techniques; data sets; proxies/indices; etc.) in order to obtain more significant results, which *per se* makes publication bias more likely. Accordingly, we may expect that publication bias can make empirical effects appear larger then they are (Stanley et al., 2008). In the context of institutional effects on economic performance, publication bias may be reflected in non-publication (or even non-submission) of results in which institutional improvement does not have a significant effect, or has a negative effect, on economic performance. Fortunately, MRA researchers have established a methodology both for detection of PB and for correction of the effect of publication selection (Stanley, 2005; 2008).

Stanley (2008, p. 108) argues that Equation (2) may be used to test for both publication bias and an authentic empirical effect beyond publication bias. The Funnel Asymmetry Test (FAT) for detection of PB tests the hypothesis H_0: $\hat{b}_0 = 0$, where non-rejection is consistent with lack of publication bias. Alternatively, if the intercept term is significantly positive (or negative) then the effect size is subject to an upward (or downward) bias across its whole range, which is evidence of publication bias in the literature under investigation.[7] The Precision-effect test (PET) tests whether the slope coefficient in Equation (2) is zero: i.e. H_0: $\hat{a} = 0$ (where rejection is consistent with an authentic empirical effect). Simulations by Stanley (2008) suggest that the estimate of $\hat{a}$ serves as a test for “authentic” or “genuine” empirical effect corrected for publication bias. Results from the estimated bi-variate MRA model (2) are summarized in Table 2.

[7] This test is used for example in Stanley 2005; Douciouliagos 2005; Nijkamp and Poot 2005, in Roberts and Stanley, 2005; Rose and Stanley 2005, in Roberts and Stanley, 2005; Stanley and Douciouliagos 2006.

Table 2. Testing for publication bias and authentic empirical effect (Bivariate MRA FAT-PET model): OLS-weighted robust regression

Dependent variable: TSTAT, t-statistic on the institutional variable of interest (i.e., the "effect size of institutions on economic performance" - ESIEP)

	All studies			**Growth studies**			**Output-level studies**		
	Coeff.	**Robust SE**	**t – stat.**	**Coeff.**	**Robust SE**	**t – stat.**	**Coeff.**	**Robust SE**	**t – stat.**
CONS (the intercept)	0.11	0.99	0.11	***2.51	0.61	4.09	- 0.79	1.75	- 0.45
SEINVpcc (The inverse SE of PCC)	***0.41	0.11	3.77	0.10	0.07	1.41	***0.52	0.16	3.22

Model diagnostics

	All studies	Growth studies	Output-level studies
Number of observations	No = 112	No = 52	No = 60
R-squared	R-squared = 0.26	R-squared = 0.04	R-squared = 0.29
F-test	F(1, 110) = 14.20	F(1, 50) = 1.99	F(1, 58) = 10.35
Ho: SEINVpcc = 0	Prob > F = 0.00	Prob > F = 0.16	Prob > F = 0.00
Ramsey RESET test	F(3, 107) = 0.14	F(3, 47) = 1.43	F(3, 55) = 0.23
Ho: No omitted variables	Prob > F = 0.94	Prob > F = 0.25	Prob > F = 0.87

Note: The coefficient on SEINVpcc measures the magnitude of the effects of institutions on economic performance studies corrected for publication selection. In columns 2 and 3 it measures the same effect in the output-growth and output-level literature respectively. Recall, SEINVpcc is the inverse standard error obtained from PCC. Reported t-statistics are based on heteroskedasticity-robust standard errors.
**** denotes two-tail statistical significance at 1%; ** significant at 5%; * significant at 10%.*

The regression for the whole sample suggests that publication selection may not exist and provides strong evidence of an authentic empirical effect of institutions on macroeconomic performance; namely, a highly significant partial correlation between institutions and economic performance of 0.41. The FAT-PET tests' results for the sub-sample with output-level as the dependent variable are quite consistent with the whole sample results. Yet this is not the case for the growth sub-sample, in which there is evidence of positive publication bias as well as lack of authentic empirical effect. Similar results are obtained by Doucouliagos (2005) for the literature focused on the economic freedom and economic growth relationship. The highly significant and positive $\hat{b}_0$ indicates PB in favour of a positive effect of institutions on economic growth. Moreover, having a value $|\hat{a}_0|\rangle 2$ indicates "severe selectivity" (Doucouliagos and Stanley, 2008, p. 13). However, the F-test is unacceptable, suggesting that this sub-sample regression suffers from omitted variables and that neither the coefficient estimates nor the associated inferences are reliable.

This bivariate MRA estimate may be biased when important explanatory variables are omitted (Stanley and Doucouliagos, 2008a). Accordingly, we use a multivariate meta-regression model, in which "FAT" and "PET" tests are embedded (Stanley, 2008), to control and explore sources of heterogeneity in the literature, as well as their consequences, for the estimated effects of institutions on economic performance. To this end, the moderator variables listed in Table 1 model the impact of different specifications, samples, time-horizons observed, and methodologies for dealing with the potential endogeneity of institutions with respect to economic performance. After controlling for these influences, we are able to test for publication bias as well as for the presence of an authentic empirical effect in the literature. Moreover, if an empirical effect is identified in the literature, it is measured conditional on the sources of heterogeneity identified in the MRA as well as net of publication bias (i.e., "beyond publication bias", in the words of Stanley, 2005).

4 Multivariate MRA

We estimate model (3) where i = 1,…,112 regressions in the sample; k = 1, …,12 moderator variables. The final model was chosen by the "general to specific" approach to econometric modelling, which is common practice in MRA (Stanley, 2005, p. 332). Hence, some of our initial set of ***potential*** moderator variables are excluded from the final model. Our results for the whole sample are reported in Table 3.

In addition to the highly significant coefficient on the inverse SE, ten of the twelve moderator variables are estimated with coefficients statistically significant at the ten percent level (or, in two cases borderline). Positive and significant coefficients suggest that a certain study characteristic represented by that moderator variable typically increases the partial correlation between institutions and economic performance; while a negative and significant coefficient suggests that a particular characteristic typically reduces the partial correlation coefficient. Hence, those studies that have characteristics represented by the moderator variables with a positive sign are likely to report a more positive effect of institutions on macroeconomic performance (and ***vice-versa***).

The model ***F-statistic*** indicates that the estimated MRA coefficients are jointly significant, while the overall fit of the regression is quite high for a meta regression (R^2=0.77). Accordingly, the model has largely captured the main sources of heterogeneity in the literature as reflected in deviations from the overall empirical effect (measured by the coefficient on SEINVpcc). We report robust estimates, and the assumption of proper functional form (no omitted variables) can not be rejected at conventional levels of significance.

Table 3. Multivariate model for testing the publication bias and authentic empirical effect (Multivariate MRA FAT-PET model): OLS-weighted robust regression

Dependent variable: t-statistic on the institutional variable of interest (i.e., the "effect size of institutions on economic performance" - ESIEP)				
MODERATOR VARIABLES USED IN MRA *(short description of moderator variable)*	**Coeff.**	**Robust SE**	**t –stat.**	**P>|t|**
CONS *(intercept term)*	- 0.51	0.57	- 0.89	0.375
SEINVpcc *(inverse standard error of PCC)*	0.89	0.12	7.63	0.000
SPPRSE *(modified extended production function specification)*	- 0.38	0.08	- 4.55	0.000
SPINSSE *("institutional specification")*	0.13	0.07	2.00	0.049
GRGDPSE *(dependent variable is growth of output)*	- 0.29	0.10	- 2.82	0.006
INSVARSE *(instrumental variable methodology used in research)*	- 0.24	0.04	- 5.25	0.000
SLS3SE *(three-stage-least squares methodology used in research)*	- 0.52	0.08	- 6.53	0.000
LAGSE *(institutional variable is lagged once)*	- 0.13	0.06	- 2.01	0.047
INITIALSE *(initial level of output included in specification)*	0.19	0.06	3.15	0.002
LNTIMEINSSE *(time-horizon of the institutional variable)*	- 0.04	0.02	- 1.90	0.061
LNTIMEDSE *(time-horizon of the dependent variable)*	0.04	0.02	1.63	0.107
COMPSE **(***instit. variable is focused on certain components of an index)*	0.03	0.07	0.44	0.660
SAMSE *(sample covered by research; transition=1, "non-transition"=0)*	- 0.12	0.09	- 1.30	0.198
NOINDSE *(number of independent variables in the regression)*	- 0.01	0.01	- 1.56	0.123

Model diagnostics

Number of observations	No. obs. = 112
R-squared	R-squared = 0.77
F-test	F(13, 98) = 31.51
Ho: independent variables are jointly equal to zero	Prob > F = 0.00
Ramsey RESET test	F(3, 95) = 1.96
Ho: No omitted variables	Prob > F = 0.12
Variance Inflation Factor (VIF)	Max: 5.44; Mean: 3.02

Note: The coefficient on SEINVpcc measures the magnitude of the effects of institutions on economic performance studies corrected for publication selection. SEINVpcc is the inverse standard error obtained from PCC. Reported t-statistics are based on heteroskedasticity-robust standard errors.

The multivariate-MRA results are consistent with those from the bivariate-MRA, again suggesting a lack of publication bias. These results again suggest a positive authentic empirical association between institutions and economic performance. However, in the multivariate MRA the "authentic effect" is captured by the combinations of all the moderator variables (Doucouliagos and Stanley, 2008a). Changes in the inverse of the standard error (SEINVpcc) also affect all moderator variables interacted with SEINVpcc. Consequently, the estimated effect size is not, as in the bivariate model, simply the coefficient on SEINVpcc; instead, the estimated effect size depends both on all the moderator variables interacted with SEINVpcc and on the corresponding choices of omitted (reference) categories. For example, in Table 3 the estimated coefficient on SEINVpcc is 0.89, while the coefficient on the moderator variable for those regressions with growth as the dependent variable (GRGDPSE) is -0.29. Conversely, when we estimate with the moderator variable for those regressions with output-level as the dependent variable (LEVELGDPSE), hence with GRGDPSE as the omitted category, the coefficient on SEINVpcc is 0.60 and the coefficient on LEVELGDPSE is 0.29. In the first case, the partial correlation between economic performance and the institutional variable of interest in the sub-sample of studies with economic growth as the dependent variable is 0.60 (=0.89-0.29); whereas in the sub-sample investigating output level it is 0.89 (=0.60+0.29). In both cases, the remaining coefficient estimates are unchanged.

The moderator variables reveal sources and consequences of heterogeneity in this literature. With "*other specifications*" (SPOTHERSE) as the reference category, those studies that use *institutional specifications* (institution(s) as the only independent variable; SPINSSE) are more likely to report higher correlations between institutions and economic performance. Conversely, the *extended production function specification* (SPPRSE) that combines institutional variables and some standard growth factors tends to lower the estimated effect.

Moreover, specifications in which *output growth is the dependent variable* (GRGDPSE) (with LEVELGDPSE - output level - as the reference category) typically yield lower estimated institutional effects. The obtained results also suggest that if a study has *initial level of output* in the specification (INITIALSE) it is more likely to yield a higher estimated effect of institutions on economic performance.

The *number of explanatory variables* (NOINDSE) in different specifications is a also significant determinant; namely, the more explanatory variables in the specification the less the effect of institutions on macroeconomic performance. This coincides with the findings on different specifications; recall, *institutional specification* with only one explanatory variable tended to report the highest effect on the institutions-economic performance link. A significant and negative coefficient is estimated on LAGSE, which captures the effect of the *lagged institutional variables* (one year lag) on economic performance. Accordingly, the lagged effect of institutions on economic performance tended to produce a lower institutions-economic performance correlation, on average. However, some caution is needed, since this moderator variable is estimated with only four observations in the MRA sample.

Endogeneity has been accounted for in many studies by using either an *instrumental variable methodology* (IV or 2SLS methodology; denoted INSVARSE) or in a few studies the *three-stage-least squares methodology* (SLS3SE). The base category is those studies that do not control for endogeneity. Both coefficients of interest are highly significant and negative. We expected this variable to be a significant influence, because institutional endogeneity is generally recognized in institutional research as a potential problem. This negative effect suggests that studies not controlling for potential endogeneity are likely to overestimate the effect of institutions.

The MRA results also suggest that the observed time-horizon matters. Firstly, the longer is the *observed period of the dependent variable* (LNTIMEDSE), the higher is the effect of institutions on economic performance. Secondly, the shorter is the *period of the observed independent institutional variable* (LNTIMEINSSE), the higher is the correlation between institutions and economic performance. Accordingly, if institutions are observed over a "long" period of time, their effect attenuates (because estimated with a negative sign).

Since there are 40 papers in the sample, most of which report more than one regression, it is likely that the observations (regressions) are correlated within studies. Hence, as a robustness check on the results reported in Table 3, we implemented cluster-robust estimation, which allows the error terms within each cluster to be correlated, requiring only that they are not correlated across clusters (Baum, 2006). The results are very consistent with the base-line model in terms of the model diagnostics, levels of significance, and magnitude of the moderator variables. The only variables that lost their significance are the moderator variables that control for the time-horizon of institutions, although their estimated signs remain the same.

5 Are there differences between output-growth and output-level studies?

A further investigation is to divide the sample into the output-growth and output-level studies in order to take into account the dependent variable heterogeneity in the analysed MRA sample.[8] Recall, in the bivariate MRA specification the results on the publication bias (FAT) and authentic empirical effect (PET) are different between those two subsamples, with the growth literature affected by positive publication bias and revealing no authentic empirical effect. Accordingly, we investigate whether or not these sub-sample findings are robust to a full MRA specification.

Some study characteristics are not presents in both samples (e.g. SLS3SE and INITIALSE in the output-level literature) and those moderator variables cannot be estimated in both samples. In addition, some variables are omitted because they prove incompatible with satisfactory statistical specification of the sub-sample model(s) (SPPRSE in the output-level sample and LNTIMEDSE, LNTIMEINSSE in both subsamples). The estimates are presented in Table 4.

[8] Being cautious about potential differences in the literature as a consequence of the dependent variable heterogeneity, we estimated an exogenous "switching regression" using maximum likelihood estimation and the GDP growth dummy as the sample separator variable. The results suggested that we can reject the null of homogeneity. This indicates that over-dispersion and heterogeneity may be present (Alfonso, 2004).

Table 4. Comparative multivariate MRA FAT-PET estimates for the output-growth and output-level studies – OLS-weighted robust regression

Dependent variable: TSTAT, t-statistic on the institutional variable of interest (i.e., the "effect size of institutions on economic performance" - ESIEP)						
MODERATOR VARIABLES USED IN MRA *(short description of moderator variable)*	**Output-growth studies**			**Output-level studies**		
	Coeff.	**Robust SE**	**t – stat.**	**Coeff.**	**Robust SE**	**t – stat.**
CONS *(intercept term)*	- 1.07	0.95	- 1.13	- 1.99	1.26	- 1.58
SEINVpcc *(inverse SE of the partial correlation coeff.)*	** 0.27	0.13	2.12	*** 0.67	0.14	4.86
SPPRSE *(modified extended production function specification)*	0.03	0.10	0.27	-	-	-
SPINSSE *("institutional specification")*	*** 0.39	0.09	4.19	*** 0.31	0.08	3.96
INSVARSE *(IV methodology used in research)*	* - 0.13	0.07	- 1.85	*** - 0.23	0.06	- 3.66
SLS3SE *(three-stage-least squares used in research)*	** - 0.37	0.14	- 2.64	-	-	-
LAGSE (institutional variable is lagged once)	- 0.11	0.08	- 1.47	-	-	-
INITIALSE *(initial level of output included in specification)*	** 0.17	0.07	2.60	-	-	-
COMPSE (Inst. variable is component of an index)	**0.16	0.07	2.24	*** 0.22	0.07	2.95
SAMSE *(sample covered; transition=1, "non-transition"=0)*	*** 0.19	0.07	2.79	** - 0.26	0.11	- 2.27

Model diagnostics

	Output-growth studies	Output-level studies
Number of observations	No = 52	No = 60
R-squared	R-squared = 0.50	R-squared = 0.58
F-test	F(9, 42) = 4.37	F(5, 54) = 34.46
Ho: independent variables are jointly = 0	Prob > F = 0.00	Prob > F = 0.00
Ramsey RESET test	F(3, 39) = 1.51	F(3, 51) = 0.47
Ho: No omitted variables	Prob > F = 0.23	Prob > F = 0.71
Variance Inflation Factor (VIF)	Max: 7.45; Mean: 3.61	Max: 3.11; Mean: 1.91

Note: The coefficient on SEINVpcc measures the magnitude of the effects of institutions on output-growth (the first column) and on output- level studies (the second column) corrected for publication selection. Reported t-statistics are based on heteroskedasticity-robust standard errors.
**** denotes two-tail statistical significance at 1%; ** significant at 5%; * significant at 10%.*

The most interesting result is that in the growth literature there is no longer acceptable evidence of publication bias (insignificant intercept term), while there is evidence of a positive authentic empirical effect (significant coefficient on SEINVpcc). Moreover, the model diagnostics are much improved; in the bivariate MRA specification (Table 2), the growth sub-sample suggested no-authentic empirical effect and the presence of publication bias with an extremely low R^2 (i.e. 4%) that was not significant (F-test obtained the p-value of 0.16). Accordingly, after taking into account the source of heterogeneity in this literature, we are able to identify a "genuine" positive link between institutions and economic growth (Stanley, 2005).

If we compare these sub-sample results with the baseline model, we see that the moderator variable COMPSE (disaggregated institutional index components) is now statistically significant (previously insignificant) with positive coefficients for both strands of the literature. This suggests that both growth and level studies that do not use aggregated indices as proxies for institutions but, instead, use particular components (like executive constraints, property rights, rule of law, efficiency of bureaucracy, etc.), are more likely to report higher and positive correlations between institutions and output-growth/output-level. Also, for both sub-samples, the moderator variable(s) capturing the treatment of endogeneity are highly significant and negative, as in the base model. In addition, we note the consistency of these results with the base model with respect to the estimated coefficient on the institutional specification (SPINSSE).

Another difference between the output-growth and the output-level literature is that studies focused on the transition economies (SAMSE) tend to report higher partial correlations between institutions and output level, but a lower partial correlation between institutions and output growth, holding all other factors constant. Recall, in the base model this variable is negative but statistically insignificant; in the light of these sub-sample results, we may conclude that these effects (positive for the growth literature and negative for the output-level studies) cancel each other in the joint sample.

The OLS weighted and cluster-robust model of these two subsamples is also estimated (Appendix 2). While the output-level literature is fully consistent with the presented OLS weighted-robust results, the growth literature seems more sensitive to this change in estimation methodology. Statistical significance is now lost for authentic effect while still being positive and close to the ten percent borderline (i.e. $p=0.13$); however, publication bias is not present. Although the variable INSVARSE that controls for endogeneity lost its significance (with no change in the estimated sign), other variables are more-less the same. Of course, both sub-samples are much smaller compared to the base estimate. Hence, some caution is needed here regarding the statistical performances of those sub-samples in comparison the baseline model reported in Table 3.

6 Conclusion

In this MRA we started our analysis by conducting the standard tests to investigate possible publication bias in the institutional literature and whether or not there exists an authentic empirical association between institutions and economic performance. The results obtained from the bivariate MRA, which encompasses Stanley's (2005) FAT and PAT tests, suggest significant rejection of publication bias and the presence of an authentic empirical effect of institutions on macroeconomic performance. Since those tests may have a low power in small samples and when conducted separately as bivariate regressions (Stanley, 2008), and also because they omit sources of heterogeneity in the reported results, the preferred approach is to embed these tests in a full multivariate meta-analytic models (Stanley, 2005). Such models, of the type reported in Table 3, not only enable more powerful tests for publication bias and so better "filter" - i.e., "correct" the influence of - publication bias in the estimation of the empirical effect identified by an empirical literature but also enable unbiased estimates of the moderator variables and the identification of corresponding sources of heterogeneous results in empirical literatures (Stanley, 2005 and 2008). The full MRA regression reported in Table 3, as well as an additional regression estimated to check the robustness of the results, confirms both the absence of publication bias and the presence of an authentic positive effect of institutions on economic performance.

The sources of heterogeneity in this literature include different specifications (differences between dependent variables; and different explanatory variables), samples, observed time-horizons, and approaches to endogeneity. Accordingly, we may predict at least some features of studies that are likely to report the largest effect of institutions on economic performance, and *vice-versa*. Typically, and holding all other factors constant, *if a particular study analyses the link between an institutional variable observed over short periods and national output observed over long periods, and includes institutions and initial income as explanatory exogenous variables, it is likely to report a relatively large effect of institutions on economic performance.* Conversely, *if a study analyses the link between institutions and economic growth by estimating some form of the extended production function that takes into account the potential endogeneity of the institutional variable, it is likely to report a lower effect of institutions on economic performance.*

The estimated effects of methodologies for dealing with institutional endogeneity are particularly significant and substantial. Specifically, studies that account for endogeneity tend to report a smaller relationship between institutions and economic performance than do other studies. Since theory recognises institutions as potentially endogenous, and MRA suggests that studies ignoring this guidance may overestimate the association between institutions and economic performance, we conclude that the results from studies not addressing this issue should be treated with great caution.

We address the heterogeneity of the dependent variable by partitioning the sample into studies of, respectively, output-growth and output-level. In our bivariate MRA, we find that the growth studies are affected with publication selection problem and do not identify an authentic empirical effect; yet in the multivariate MRA model the publication bias disappears and we do identify an authentic empirical effect. This suggests that authentic empirical effect in the growth literature is highly conditional on study characteristics like specification, sample, and approach to dealing with the potential endogeneity of institutions. Accordingly, more primary institutions-growth research needs to be conducted before we may identify with confidence the authentic empirical effect. Conversely, both bivariate and multivariate output-level studies suggest the absence of publication bias as well as a highly significant positive institutional effect on output performance. In comparison with the growth literature, the output level literature is more homogenous and its identified institutional effect is less conditional.

In our combined sample results, we report similar institutional effects for transition and non-transition countries. However, this conclusion is overturned by comparison of our sub-sample results. Growth studies focused on transition economies tend to report a higher correlation between institutions and growth than do those focussed on non-transition economies. In contrast, MRA results from the output-level sub-sample suggest higher correlations for non-transition economies than for transition countries. MRA thus suggests that institutional effects on economic performance may be different in transition and non-transition economies.

References

*Note: * (i.e., asterisk) means that a study is included in the MRA.*

*Acemoglu, D. and Johnson, S. (2003) Unbundling Institutions, *NBER Working Papers 9934.*

*Acemoglu, D., Johnson, S. and Robinson, J. A. (2001) The Colonial Origins of Comparative Development: An Empirical Investigation, *The American Economic Review*, Vol. 91, No. 5, pp. 1369-1401.

*Acemoglu, D., Johnson, S. and Robinson, J. A. (2002) Reversal of Fortune: Geography and Institutions in the Making of the Modern World Income Distribution, *The Quarterly Journal of Economics*, November 2002, pp. 1231-1294.

*Aixala, J. and Fabro, G. (2008) Does the impact of institutional quality on economic growth depend on initial income level?, *Economic Affairs,* Vol. 28, No. 3, pp. 45-49.

*Alcala, F. and Ciccone, A. (2002) Trade and Productivity, *Universitat Pompeu Fabra, Department of Economics and Business, Economics Working Papers No. 580.*

Alfonso, M. (2004) FIML estimation of an endogenous switching model for count data, *The Stata Journal,* Vol. 4, No. 1, pp. 40-99.

*Ali, A. M. (2003) Institutional Differences as Sources of Growth Differences, *Atlantic Economic Journal,* Vol. 31, No. 4, pp. 348-362.

*Assane, D. and Grammy, A. (2003) Institutional framework and economic development: international evidence, *Applied Economics*, Vol. 35, pp. 1811-1817.

*Baliamoune-Lutz, M. and Ndikumana, L. (2007) The Growth Effects of Openness to Trade and the Role of Institutions: New Evidence form African Countries, *University of Massachusetts Working Paper No. 2007-05.*

Baum, F. C. (2006) *An Introduction to Modern Econometrics Using Stata*, Texas: Stata Press.

*Beck, T. and Laeven, L. (2005) Institution building and Growth in Transition Economies, *WB Policy Research Working Paper Series No. 3657.*

*Beck, T. and Laeven, L. (2006) Institution building and Growth in Transition Economies, *Journal of Economic Growth,* Vol. 11, pp. 157-186.

Card, D. and Krueger, A. B. (2001) Time-Series Minimum-Wage Studies: A Meta-analysis, *AEA Papers and Proceedings*, Vol. 85, No. 2, pp. 238-243.

*Chousa, J. P., Khan, H. A., Melikyan, D. and Tamazian, A. (2005) Assessing institutional efficiency, growth and integration, *Emerging Markets Review*, Vol. 6, pp. 69-84.

*De La Croix, D. and Delavallade, C. (2006) Growth, Public Investment and Corruption with Failing Institutions, *CORE Discussion Paper 2006/101.*

*Dollar, D. and Kraay, A. (2002) Institutions, Trade, and Growth, The World Bank paper available on-line: http://www.carnegie-rochester.rochester.edu/April02-pdfs/ITG2.pdf.

Doucouliagos, C. (2005) Publication bias in the economic freedom and economic growth literature, *Journal of Economic Survey*, Vol. 19, No. 3, pp. 367-387.

Doucouliagos, C. and Stanley, T. D. (2008) Theory Competition and Selectivity, *Deakin University Australia, Economic Working Paper Series No. 2008-06.*

Doucouliagos, C. and Stanley, T. D. (2008a) Publication Selection Bias in Minimum-Wage Research? A Meta-Regression Analysis, *Deakin University Australia, Economic Working Paper Series No. 2008-14.*

Doucouliagos, C. and Laroche, P. (2009) Unions and Profits: A Meta-Regression Analysis, *Industrial Relations,* Vol. 48, No. 1, pp. 146-184.

*Dreher, A., Meon, Pierre-Guillaume, Shneider, F. (2007) The Devil is in the Shadow. Do institutions Affect Income and Productivity of Only Official Income and Official Productivity, *KOF Working Papers No. 179.*

*Easterly, W. (2006) Social Cohesion, Institutions, and Growth, *Center for Global Development, Working Paper No. 94.*

*Easterly, W. and Levine, R. (2002) Tropics, Germs, and Crops: How Endowments Influence Economic Development, *NBER Working Paper 9106.*

Egger, M., Smith, D. G., Schneider, M., and Minder, C. (1997), Bias in meta-analysis detected by a simple, graphical test, *BMJ*, Vol. 315, pp. 629-634.

*Eicher, T. and Leukert, A. (2006) Institutions and Economic Performance: Endogeneity and Parameter Heterogeneity, *Munich Economics, Discussion Paper No. 2006-05.*

*Eicher, T. and Schreiber, T. (2007) Institutions and Growth: Time Series Evidence from Natural Experiments, *University of Washington, Department of Economics, Working Paper UWEC-2007-15.*

*Eicher, T. S., Garcia-Penalosa, C. and Teksoz, U. (2006) How Do Institutions Lead Some Countries to Produce So Much More Output per Worker than Other in Eicher, S. T. and Garcia-Penalosa, C. (eds) (2006) *Institutions, Development, and Economic Growth*, Cambridge, Massachusetts: The MIT Press.

Fisher, R. (1954; 12th Ed.). *Statistical Methods for Research Workers*. New York: Hafner Publishing Company.

*Glaeser, E. L., La Porta, R, Lopez-de-Silanes, F. and Shleifer, A. (2004) Do Institutions Cause Growth, *NBER Working Paper No. 10568.*

Greene, W. (2008) *Econometric Analysis*, New Jersey: Prentice Hall.

*Gwartney, J. D., Holcombe, R. G. and Lawson, R. A. (2004) Economic Freedom, Institutional Quality, and Cross-Country Differences in Income and Growth, *Cato Journal*, Vol. 24, No. 3, pp. 205-233.

*Gwartney, J. D., Holcombe, R. G. And Lawson, R. A. (2006) Institutions and the Impact of Investment on Growth, *KYKLOS*, Vol. 59, No. 2, pp. 255-273.

*Hall, R. E. and Jones C. I. (1999) Why Do Some Countries Produce So Much More Output per Worker than Others, *Quarterly Journal of Economics*, February 1999, pp. 83-116.

*Havrylyshyn, O. and van Rooden, R. (2000) Institutions Matter in Transition, but so do Policies, *IMF Working Paper, WP/00/70.*

*Havrylyshyn, O., Izvorski, I, and van Rooden, R. (1998) Recovery and Growth in Transition Economies 1990-1997: A Stylized Regression Analysis, *IMF Working Paper, WP/98/141.*

*Jacob, J. and Osang, T. (2007) Institutions, Geography and Trade: A Panel Study, *Southern Methodist University, Departmental Working Paper No. 0706.*

*Keefer, P. and Knack, S. (1997) Why don't poor countries catch up? A cross-national test of an institutional explanation, *Economic Inquiry*, Vol. XXXV, pp. 590-602.

*Knack, S. and Keefer, P. (1995) Institutions and Economic Performance: Cross-Country Tests Using Alternative Institutional Measures, *Economics and Politics*, Volume 7, No. 3, pp. 207-227.

*Lane, Jan-Erik and Rohner, D. (2004) Institution Building and Spillovers, *Swiss Political Science Review*, Issue 10, No. 1, pp. 77-90.

Longhi, S., Nijkamp, P. and Poot, J. (2005) A meta-analytic assessment of the effect of immigration on wages, in Roberts, C. J. and Stanley, T. D. (eds) (2005) *Meta-Regression Analysis: Issues of Publication Bias in Economics*, Blackwell Publishing.

*Mauro, P. (1995) Corruption and growth, *The Quarterly Journal of Economics*, August 1995, pp. 681-712.

Nijkamp, P, and Poot, J. (2005) The last word on the wage curve, in Roberts, C. J. and Stanley, T. D. (eds) (2005) *Meta-Regression Analysis: Issues of Publication Bias in Economics*, Blackwell Publishing.

*Moers, L. (1999). How important are institutions for growth in transition countries?, *Tinbergen Institute Discussion Papers No. 99-004/2.*

*Norton, S. W. (2003) Economic institutions and human well-being: A cross-national analysis, *Eastern Economic Journal*, Vol. 29, No. 1, pp. 23-40.

*Redek, T. and Susjan, A. (2005) The Impact of Institutions on Economic Growth: The Case of Transition Economies, *Journal of Economic Issues*, Vol. XXXIX, No. 4, pp. 995-1027.

*Richter, B. K. and Timmons, J. F. (2008) Why Not Adopt Better Institutions?, *SSRN Working Paper Series No. 1213138.*

Robberts, C. J. (2005) Issues in meta-regression analysis: an overview, in Roberts, C. J. and Stanley, T. D. (eds) (2005) *Meta-Regression Analysis: Issues of Publication Bias in Economics*, Blackwell Publishing.

Roberts, C. J. (2005) Issues in meta-regression analysis: an overview, *Journal of Economic Surveys*, Vol. 19, No. 3, pp. 295-298.

*Rodrik, D., Subramanian A. and Trebbi F. (2002) Institutions Rule: The Primacy of Institutions over Integration and Geography in Economic Development, *IMF working paper WP/02/189.*

Rose, A. K. and Stanley, T. D. (2005) A meta-analysis of the effect of common currencies on international trade, in Roberts, C. J. and Stanley, T. D. (eds) (2005) *Meta-Regression Analysis: Issues of Publication Bias in Economics*, Blackwell Publishing.

*Sachs, J. D. (2001) The Transition at Mid Decade, *Economic Transition in Central and Eastern Europe*, Vol. 86, No. 2, pp. 128-133.

*Sachs, J. D. (2003) Institutions Don't rule: Direct Effects of Geography on Per Capita Income, *NBER Working Paper No. 9490.*

*Sonin, C (2000) Inequality, Property Rights, and Economic Growth in Transition Economies, Theory and Russian Evidence, *Economic Education and Research Consortium 2000, Working Paper No. 2K/02.*

Stanley, T. D. (2001) What From Chaff: Meta-Analysis As Quantitative Literature Review, *Journal of Economic Perspectives*, Vol. 15, No. 3, pp. 131-150.

Stanley, T. D. (2005) Beyond publication bias, *Journal of Economic Surveys*, Vol. 19, No. 3, pp. 309-345.

Stanley, T. D. (2008) Meta-Regression Methods for Detecting and Estimating Empirical Effects in the Presence of Publication Selection, *Oxford bulleting of economics and statistic*, Volume 70, Issue 1, pp. 103-127.

Stanley, T. D., Doucouliagos, C., and Jarell, S. B. (2008) Meta-regression analysis as the socio-economics of economic research, *The Journal of Socio-Economics*, Vol. 37, pp. 276-292.

Stanley, T. D. and Doucouliagos, C. (2006) Identifying and Correcting Publication Selection Bias in the Efficiency-Wage Literature: Heckman Meta-Regression, *Deakin University, Economics Working Paper Series No. 29.*

Stanley, T. D. and Jarrell, S. B. (1989) Meta-regression analysis: A quantitative method of literature surveys, *Journal of Economic Surveys*, Vol. 3, No. 2, pp. 161-170.

*Ulubasoglu, M. A. and Doucouliagos, C. (2004) Institutions and Economic Growth: A Systems Approach, *Econometric Society 2004 Australasian Meetings Paper No. 63.*

*Vijayaraghavan, M. and Ward, W. A. (2001) Institutions and Economic Growth: Empirical Evidence from a Cross-National Analysis, *Clemson University, Working Paper No. 0001302.*

Appendix 1

Multivariate model for testing the publication bias and authentic empirical effect (Multivariate MRA FAT-PET model) - OLS clustered-robust weighted estimate

Dependent variable: t-statistic on the institutional variable of interest (i.e., the "effect size of institutions on economic performance" - ESIEP)

MODERATOR VARIABLES USED IN MRA *(short description of moderator variable)*	**Coeff.**	**Robust SE**	**t –stat.**	**P>|t|**
CONS *(intercept term)*	- 0.51	0.70	- 0.72	0.475
SEINVpcc *(the inverse standard error of the partial correlation coefficients)*	0.89	0.15	6.11	0.000
SPPRSE *(modified extended production function specification)*	- 0.38	0.12	- 3.24	0.002
SPINSSE *("institutional specification")*	0.13	0.08	1.64	0.110
GRGDPSE *(dependent variable is growth of output)*	- 0.29	0.14	- 2.08	0.044
INSVARSE *(instrumental variable methodology used in research)*	- 0.24	0.07	- 3.55	0.001
SLS3SE *(three-stage-least squares methodology used in research)*	- 0.52	0.11	- 4.74	0.000
LAGSE (institutional variable is lagged once)	- 0.13	0.07	- 1.88	0.067
INITIALSE *(initial level of output included in specification)*	0.19	0.09	2.17	0.036
LNTIMEINSSE *(the time-horizon of the institutional variable)*	- 0.04	0.03	- 1.38	0.175
LNTIMEDSE *(time-horizon of the dependent variable)*	0.04	0.03	1.17	0.250
COMPSE **(**institutional variable is focused on certain components of an index)	0.03	0.09	0.33	0.741
SAMSE *(sample covered by research; transition=1, "non-transition"=0)*	- 0.12	0.11	- 1.09	0.284
NOINDSE *(number of independent variables in the regression)*	- 0.01	0.01	- 1.61	0.116

Model diagnostics

Number of observations	No. obs. = 112
Number of clusters (studies)	No. of clusters = 40
R-squared	R-squared = 0.77
F-test	F(13, 39) = 15.41
Ho: independent variables are jointly equal to zero	Prob > F = 0.00
Ramsey RESET test	F(3, 95) = 1.96
Ho: No omitted variables	Prob > F = 0.12
Variance Inflation Factor (VIF)	Max: 5.44; Mean: 3.02

Note: The coefficient on SEINVpcc measures the magnitude of the effects of institutions on economic performance studies corrected for publication selection. Recall, SEINVpcc is the inverse standard error obtained from PCC. Reported t-statistics are heteroskedasticity clustered-robust standard errors.

Appendix 2

Comparative multivariate MRA FAT-PET estimates for the output-growth and output-level literature –OLS clustered-robust weighted estimate

Dependent variable: TSTAT, which is t-statistic on the institutional variable of interest (i.e., the "effect size of institutions on economic performance" - ESIEP)						
MODERATOR VARIABLES USED IN MRA *(short description of moderator variable)*	**Output-growth studies**			**Output-level studies**		
	Coeff.	**Robust SE**	**t – stat.**	**Coeff.**	**Robust SE**	**t – stat.**
CONS *(intercept term)*	- 1.06	1.13	- 0.94	- 1.99	1.48	- 1.34
SEINVpcc *(inverse SE of the partial correlation coeff.)*	0.27	0.17	1.55	*0.67	0.17	4.06
SPPRSE *(modified extended production function specification)*	0.03	0.12	0.21	-	-	-
SPINSSE *("institutional specification")*	*0.39	0.12	3.31	*0.31	0.08	3.65
INSVARSE *(IV methodology used in research)*	- 0.13	0.09	- 1.44	*- 0.23	0.08	- 2.96
SLS3SE *(three-stage-least squares used in research)*	***-0.37	0.19	- 2.02	-	-	
LAGSE (institutional variable is lagged once)	- 0.11	0.08	- 1.36	-	-	-
INITIALSE *(initial level of output included in specification)*	***0.17	0.09	2.05	-	-	-
COMPSE (Inst. variable is component of an index)	***0.16	0.10	1.72	*** 0.22	0.11	1.91
SAMSE *(sample covered; transition=1, "non-transition"=0)*	**0.19	0.09	2.20	** - 0.26	0.11	- 2.36
NOINDSE *(No. of independent variables in the regression)*	-	-	-	-	-	

Model diagnostics

Number of observations	No = 52	No = 60
Number of clusters (studies)	No. of clusters = 20	No. of clusters = 21
R-squared	R-squared = 0.50	R-squared = 0.58
F-test	F(9, 19) = 3.62	F(5, 20) = 34.40
Ho: independent variables are jointly = 0	Prob > F = 0.00	Prob > F = 0.00
Ramsey RESET test	F(3, 39) = 1.51	F(3, 51) = 0.47
Ho: No omitted variables	Prob > F = 0.23	Prob > F = 0.71
Variance Inflation Factor (VIF)	Max: 7.45; Mean: 3.61	Max: 3.11; Mean: 1.91

Note: The coefficient on SEINVpcc measures the magnitude of the effects of institutions on output-growth (the first column) and on output- level (the second column) studies corrected for publication selection. Reported t-statistics are based on heteroskedasticity clustered--robust standard errors.
**** denotes two-tail statistical significance at 1%; ** significant at 5%; * significant at 10%.*