Institutions and economic performance: System GMM modelling of institutional effects in transition

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Abstract

In this paper we investigate the relationship between institutional improvement and economic performance in transition population of countries (TCs). Our general findings confirmed the results of other researchers that "institutions matter" in explaining economic performances in TCs. However, our models reported that institutional change in transition did not have a constant effect since the time-horizon over which institutions affect economic performance also matters. More precisely, neither the current contemporaneous effect of institutions nor the significant "long-run" response of economic output to changes in institutions was well identified. However, an improvement in institutions over a previous five-year period had a significant effect on the current GDP per capita, suggesting some kind of "peak" effect of institutions within a five-year period.

Key words: Institutions; Economic performance; Transition countries

JEL classification: E02; P30; P39

Total words (including tables): 8,000

Draft: July 2010

Revised paper presented at International Conference of Staffordshire University: *International trade: a global perspective for the 21st century,* 06th of December 2008: http://www.staffs.ac.uk/assets/Institutions%20and%20economic%20performance%20in%20transition%20-%20Adnan%20Efendic_tcm44-20631.pdf

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1. Institutions and economic performance in transition

1.1. Institutions and transition in Europe – an introduction

Transition is "the widely accepted term for the thoroughgoing political and economic changes" in ex-European communist countries in order to establish market-oriented economies (Murrell, 2006, p. 1). The process of transformation from central-planned to market economies started two decades ago (1989) and it was comprised of four major elements: macroeconomic stabilisation (control of inflation and budget deficits); liberalisation (price and market liberalisation); privatisation (restructuring and privatization of state enterprises); and institutional reforms (redefining the role of the state, market, and business sector). In spite of the initial reforms being quite similar in all these countries, the experience of TCs differed regarding policies implemented, their sequencing, the speed of the reform, and results obtained. There have been a wide range of degrees of success in the progress toward self-sustainable market economies, suggesting that for many of these countries the transition process proved to be more difficult than initially anticipated.

Many authors agree that transition is largely a process of institutional change (North, 2005; Cornia and Popov, 2001; Raiser et al., 2001; Raiser, 2001; Redek and Susjan, 2005; Murrell, 2006; Eicher and Schreiber, 2007; Berglof, 2008). Accordingly, institutional economics may be particularly relevant in explaining economic differences of TCs. However, the importance of institutions in transition is under investigation and it is still characterized with empirical gaps that need to be thoroughly investigated.

When the process of transition began many institutions collapsed, leaving "a vacuum" (Moers, 1999, p. 10). Some authors argue that the development of institutions that supported market and private enterprises in the later phase has influenced the overall economic performance of TCs (e.g., Redek and Susjan, 2005; Popov, 2006). Unfortunately, it was "extremely demanding" for TCs to establish capitalist institutions overnight on the "ruins of socialist institutions" that could not easily be used as a building block for the new capitalist system (Redek and Susjan, 2005, p. 1000). Svejnar (2002) argues that none of TCs succeeded in rapidly establishing market-oriented institutions, but some countries were better than others. However, this rapid institutional development in TCs modifies the standard assumption of institutional economics that institutional building is a slow process (Murrell, 2006); hence, providing "a unique historic experiment" (Beck and Laeven, 2006, p. 158) for empirical investigations.

There are some empirical studies that analyse the link between institutions and economic performance in transition. The majority of authors report a strong evidence that "better institutions" in transition were supportive in achieving "better economic performance"; as in research by Sachs (2001); Assane and Grammy (2003); Lane and Rohner (2004); Beck and Laeven (2006); Chousa et al. (2005); Redek and Susjan (2005); Popov (2006); Falcetti et al. (2006); Eicher and Schreiber (2007); Dreher et al. (2007) and Paakkonen (2009). We do not aim to provide an overview of these papers since they report quite similar findings, but these studies will be critically evaluated through our empirical investigations in the later sections, which is *de facto* our main interest.

The paper is structured as follows. Section 1.2 provides our discussion about the problem of measuring institutions in economics, presents our strategy to quantify institutional effects in transition, and reports initial empirical results on the link between institutions and economic performance. Since we have identified that this link exists, the following section starts with an empirical panel model that investigates the relationship of interest. In empirical modelling strategy we report our procedure in establishing preferred specification (Section 2.1), explain the obtained results (Section 2.2), and conduct sensitivity checkings (Section 2.3). Section 3 concludes our key findings.

1.2. Measuring institutional performance in transition

Institutions are a "complex" phenomenon and empirical research cannot capture all of this complexity; hence, simplified institutional indicators and proxies need to be used in applied research (Williamson, 2000; Fukuyama, 2006). A huge disparity in using institutional proxies in empirical research, without any consensus in the direction of "unification", suggests that a single variable representing institutions is not available (Keefer and Knack, 1997; Raiser et al., 2001; Zeghni and Fabry, 2008; Aidis et al., 2007; Shriley, 2008; Aidis et al., 2009). Consequently, the first methodological challenge for empirical research on institutions is to find an "adequate" quantitative proxy for the performance/quality/efficiency of institutions in transition.

Looking at previous transition research, most empirical investigations use the European Bank for Reconstruction and Development (EBRD) structural and institutional change indicators as proxy for institutions (e.g., Havrylyshyn et al., 1998; Raiser et al., 2001; Havrylyshyn and van Rooden, 2000; Sachs, 2001; Beck and Laeven, 2006; Falcetti et al., 2006; Marelli and Signorelli, 2007; Eicher and Schreiber, 2007; Di Tommaso et al., 2007; and Zeghni and Fabry, 2008). Other authors use some different proxies; for example: Redek and Susjan (2005), Aidis et al. (2007), and Paakkonen (2009) employ the Heritage Foundation Index of Economic Freedom as institutional measures; Sonin (2000) uses some risk ratings and official statistical indicators; Chousa et al. (2005) base their institutional variable on the shadow economy; Lane and Rohner (2004) and Beck and Laeven (2006) use the World Bank Worldwide Governance indicators; while Estrin et al. (2009) and Aidis et al. (2007) utilize the Corruption Perception Index obtained from the Transparency International.

In establishing our base proxy variable for institutions, we follow the mainstream transition literature and focus on a broad aggregated indicator of institutional change in transition, which is constructed from the EBRD indices of structural and institutional reforms. In general, this index ranks institutions in transition relative to the standards of the industrialized market economies (Sachs, 2001; Raiser et al., 2001; Eicher and Schreiber, 2007; Di Tommaso et al., 2007; Zeghny and Fabry, 2008). Justification for this approach is that transition is in essence a process of transformation from centrally planned towards market oriented economies. Raiser et al. (2001, p. 6) see the EBRD institutional indicators as "the best available data on institutional change in transition economies". Arguably, the EBRD institutional indicators trump all other institutional indices that we have identified in the literature at least because of two reasons. Firstly, they are transition specific, i.e. specially designed for transition economies. Institutional reforms in transition includes redefining the role of the state, market and business sector,

which this index by its structure should capture (Table 1). Secondly, they are available annually from the beginning of transition enabling the longest time-span and the biggest number of observations; it is an important advantage that one should not ignore (Shirely, 2008).

Table 1 Main components of the EBRD institutional proxy

Institutional proxy; Source	**Period; Sample**	**Components of the index – first disaggregation**	**Components of the index – second disaggregation**	**References with the similar/same* institutional proxy variable**
The structural and institutional change indicators; The European Bank for Reconstruction and Development (EBRD, 2008)	1992 – 2007; 29 transition economies, i.e. all transition countries except Kosovo that has recently (2008) proclaimed its independence and for which data are not available.	Markets and trade	Price liberalization;	Havrylyshyn et al., 1998; Raiser and Di Tommaso, 2000; Havrylyshyn and van Rooden, 2000; Sachs, 2001; Raiser et al., 2001; Bevan et al., 2004; Beck and Laeven, 2006; Falcetti et al., 2006*; Eicher and Schreiber, 2007*; Di Tommaso et al., 2007; Marelli and Signorelli, 2007; Zeghni and Fabry, 2008.
			Trade and foreign exchange system;	
			Competition policy;	
		Financial sector	Banking reform and interest rate liberalization;	
			Securities markets and non-bank financial institutions;	
		Enterprises	Large-scale privatization;	
			Small-scale privatization;	
			Governance and enterprise restructuring.	
Source: EBRD (2008) and authors' interpretation.				

This (unweighted) aggregated institutional EBRD index is scored from 1.0 (minimum) to 4.3 (maximum); we normalize it to a range from 0 to 1 (for example, as in Knack and Keefer, 1995; Hall and Jones, 1999; Ali, 2003; Eicher and Schreiber, 2007; Butkiewicz and Yanikkaya, 2008). In this transformation, 0.0 indicates completely state-planned economic institutions while 1.0 represents market based standards of economic institutions in developed (OECD) economies (Eicher and Schreiber, 2007, p. 17).

In our initial checking procedure we have found that almost all components of EBRD index are highly correlated with each other, which majority researchers find and report in their analysis (e.g., Havrylyshyn et al., 1998; Ali, 2003; Butkiewicz and Yanikkaya, 2004; Lane and Rohner, 2004; Bevan et al., 2004; Eicher and Schreiber, 2007; Di Tommaso et al., 2007; Marelli and Signorelli, 2007). Since these sub-indicators may capture similar information coming from different aspects of institutional change, these high correlations are not surprising (Di Tommaso et al., 2007, p. 873). However, the choice of multiple indicators that are (usually) averaged and aggregated to one institutional proxy raises the question of "how to combine them in empirical research on institutional change as an underlying process rather than focussing on just one sub-dimension" (Raiser et al., 2001, p. 4). Moreover, multicollinearity might be a serious issue in such analysis. Fortunately, Raiser et al. (2001) have exploited the Multiple Indicator Multiple Cause methodology (MIMIC) to control for potential measurement errors in this multidimensional variable, as well as for the problem of aggregation of different components of EBRD index. The authors (Ibid, p. 21) found that averaging

institutional sub-indices into one composite index "may not be a bad approximation" of institutional change in transition. Accordingly, we will concentrate on the impact of one composite institutional index on economic performance.

We continue our analysis by investigating whether there is a relationship between the institutional index and economic performance proxied by the GDP per capita; hence, we calculate simple correlation coefficients among variables of interest.

Table 2 Pairwise correlation between institutional indices and GDP pc in TCs

INSTITUTIONAL INDEX	**GDP per capita in $ (1992-2007)**				
	ALL TCs	**EU TCs**	**SEE TCs**	**CIS TCs**	**No. of obs. for ALL, EU, SEE, and CIS respectively**
EBRD	0.64	0.59	0.65	0.32	445; 159; 80; 206
(P-value)	*(0.000)*	*(0.000)*	*(0.000)*	*(0.000)*	
Source: EBRD (2008) and authors' calculations using SPSS 16.					

Estimated correlation coefficients between institutions and economic performance suggest that correlation exists; it is positive, significant, and quite strong. The correlation coefficients also suggest some variations between different clusters of TCs. Very strong correlations are registered for the whole sample, the European Union (EU) TCs, and the South-East European (SEE) economies, while some lower coefficient is obtained for the Commonwealth and Independent States (CIS). This potential systematic difference will be more investigated through the later econometric analysis. These initial results provide intuitive conclusions that should be treated carefully and only as the first step towards a more thorough empirical analysis, which follows.

2 Empirical modelling of institutional effects in transition

2.2. Developing the base specification

Analysis of the evolution of economic performance in transition is a very complex task, especially because economic theory provides neither clear guidance nor consensus as to how the transition process should be analysed (Havrylyshyn et al., 1998). In such circumstances, empirical modelling should take into account "all" possible determinants and transition specifics, which *per se* raise a number of methodological problems.

Our qualitative investigation of different empirical specifications utilized in institutional applied work had identified the whole range of different functional forms employed to model institutional effects. We may identify number of institutional research in which institution(s) is/are the only explanatory variable, including research by Hall and Jones (1999); Acemoglu et al. (2001); Sachs (2001); Easterley (2006); Eicher and Leukert (2006); Easterley and Levine (2002); Mauro (1995); Dreher et al. (2007); and Eicher and Schreiber (2007). Although there is no clear guideline about the specification that should be used in institutional research, this bivariate specification is hardly acceptable as a fully-specified model (Gwartney et al., 2004). In line with such argumentation, Ostrom

(2007) suggests that if one wants to understand and analyse the processes of structural change of any particular situation, then it should include one or more of the underlying sets of variables, which Durham (2004, p. 486) calls "mainstream economic controls". Adding one or more standard growth-determining factors to an institutional bivariate specification leads us to some form of the "extended production function specification", which integrates growth factors, institutions, and often some other variables. Such specifications, in different forms, have been used by Mauro (1995); Knack and Keefer (1995); Keefer and Knack (1997); Vijayaraghavan and Ward (2001); Assane and Grummy (2003); Gwartney et al. (2004); Ulubasoglu and Doucouliagos (2004); Glaeser et al. (2004); Redek and Susjan (2005); Eicher et al. (2006); Gwartney et al. (2006); Baliamoune-Lutz and Ndikumana (2007); Aixala and Fabro (2008); and Paakkonen (2009). Finally, we may identify also some "other specifications" that include institutions as explanatory variables with controlled variables that are not standard production factors. The seminal paper written by Rodrik et al. (2002) may be a good representative (also exploited by Easterly and Levine, 2002; Alcala and Ciccone, 2002; Sachs, 2003; and Jacob and Osang, 2007) in which authors use institutions, trade integration, and geographical location as explanatory variables (i.e. "deep determinants") of economic performance.

Regarding the methodology employed to estimate these institutional models, existing empirical research on transition is often based on OLS cross-section analysis (e.g., Lane and Rohner, 2004; Beck and Laeven, 2006), although some research has been based on static panel models (e.g., Havrylyshyn et al., 1998; Havrylyshyn and Van Roden, 2000; Raiser et al., 2001; Chousa et al., 2005; Redek and Susjan, 2005; Zegni and Fabry, 2008), while Falcetti et al. (2006), Eicher and Schreiber (2007) and Paakkonen (2009) apply a dynamic model. Eicher and Schreiber (2007) in their dynamic panel regress GDP per capita growth on institutions (EBRD proxy), which may give rise to the problem of omitted variables bias. The standard set of GMM diagnostics is also not reported. The other dynamic panel models estimated are by Falcetti et al. (2006) and Paakkonen (2009) in which these authors utilize some form of the "extended production function" and investigate the effect of institutions on GDP growth and/or output. However, these authors do not report the full range of GMM relevant diagnostics (as recommended, for example, by Roodman 2006 and 2007) leaving some important aspects of the dynamic panel modelling as well as transition specifics unexplored (e.g., cross-section residual dependence, steady state assumption, short v.v. long-run influences of institutions in transition, etc.). All in all, a common feature of all these transition papers is that authors mainly do not report all, or even any, of the statistical diagnostics needed to ensure the statistical validity of their estimated models. Through our empirical modelling strategy we will critically assess the existing transition literature as well as report some of the key advantages and contribution of our empirical model.

Our first innovation is to estimate the effect of changing institutional on economic performance within a dynamic rather than static framework. Moers (1999) suggests that the dynamic effect of institutional change may be large in TCs even in the short-run, which should be investigated. Moreover, Sachs (2003, p. 3-4) argues, with reference to the work of Barro and Sala-i-Martin (1997), that determination of per capita income should be specified in a dynamic model, but not in the "oversimplified" static estimate. Similarly, Eicher and Schreiber (2007) conclude that by exploring the time dimension in a dynamic panel, one can analyze how continuous institutional changes influence

economic performance in transition. Consequently, in this dynamic model we allow current economic performance to be influenced by past economic performance, which is a well-known feature of economic processes.

Instead of using the current and lagged values of the proxy of institutions applied in our sample of transition papers, which might cose the problem of spurious regression (see for example Andrzej and Cizkowicz, 2003; Falcetti et al., 2006), we use the change in institutional improvement over a five-year period. We make this change to allow for institutional influences on economic performance to take place gradually, over time. This approach to estimating the influence of institutions over a longer period of time is recommended by Gwartney et al. (2004) and applied, for example by Raiser et al. (2001) and Le (2008), which is also strongly supported by the model diagnostics in the later stage.

Initial conditions in individual TCs were different and we use a proxy variable to control for the potential impact of different starting positions on later economic performance. Moreover, avoiding the modelling of different initial conditions may be problematic in estimating the dynamic panel because this information will be captured by the country-specific error term and will thus violate a fundamental assumption of the model that we apply, i.e. a dynamic panel model estimated by "system" General Method of Moments (Bond, 2002; Roodman, 2006, 2007). Hence, in our model, initial conditions (i.e. GDP per capita PPP in 1989 US$) will be controlled for, which may be found in some transition research, including: Havrylyshyn and van Rooden (2000); Raiser et al. (2001); and Chousa et al. (2005); but not in the dynamic panel context. Moreover, controlling for initial conditions is in line with growth theory where most studies found that long-run economic performance is related to initial conditions (Havrylyshyn et al., 1998).

Over the last twenty years TCs have been going through similar reforms, though with different sequences and speed, but it was likely that those countries suffered some universal time-related shocks. Moreover, some TCs experienced economic, financial, and political integration (particularly EU transition economies), which implies possible interdependencies between countries (De Hoyos and Sarafidis, 2006). Following suggestions by Roodman (2006; 2007) and De Hoyos and Sarafidis (2006) we include in our specification time-dummy variables in order to control for potential common time-related shocks, which, to our knowledge, is not found in existing empirical research applied to TCs, including the three dynamic panel studies (Falcetti et al., 2006; Eicher and Schreiber, 2007; and Paakkonen, 2009).

Finally, we utilize model specification which has the following form:

$$\ln gdppc_{it} = \hat{\alpha}_i + \hat{\beta} \cdot \ln gdppc_{it-1} + \hat{\lambda} \cdot inst5_{it} + X_{it} \cdot \hat{\delta} + T_t \cdot \hat{\lambda} + \hat{u}_{it} \qquad (1)$$

The dependent variable in Specification 1 is the logarithm of GDP per capita denoted as $\ln gdppc_{it}$; $\ln gdppc_{it-1}$ is the dependent variable with a one year lag; $inst5_{it}$ is the difference in the institutional index over a five-year period, while $\hat{u}_{it}$ is the error term that

includes all unobserved influences of economic performance. X_{it} is a 1×k vector of k control variables identified as the important determinants of economic performance, which includes: domestic investment proxied by the gross capital formation as a percentage of GDP ($invest_{it}$); foreign direct investment inflow measured as a percentage of GDP ($fdiper_{it}$); budget balance measured as a percentage of GDP ($budget_{it}$); the inflation rate proxied by the rate of change of the CPI annual index (cpi_{it}); and the initial condition proxied by GDP per capita PPP in 1989 US$ in logarithmic form ($\ln initial_i$). Finally, "$\hat{\delta}$" is a k×1 vector or parameters to be estimated while "λ"is a vector of time dummies "T" included. The key information about the variables used in this empirical investigation is available in Appendix 1.

In this model specification, lagged GDP per capita is an endogenous variable while other explanatory variables are treated as exogenous. Hence, we control the endogeneity of this variable in its lagged form as a regressor by using internal instruments; namely, lagged levels and lagged differences. The institutional proxy is constructed in such a way as to eliminate potential endogeneity and reverse causation and is thus treated in the syntax as an exogenous variable. Accordingly, it is not likely that current economic performance may explain past institutional changes; moreover, using a longer period in measuring institutional performance is a good way of reducing endogeneity (Aron, 2000). Initial conditions proxied by per capita GDP from 1989 are an exogenous variable for similar reasons as institutions. We also treat the CPI index and budget balance as exogenous, because it is less probable that GDP per capita level may explain the change in CPI index or change in budget balance. The remaining explanatory variable, domestic investment proxied by gross capital formation is also treated as exogenous to the level of GDP per capita. There is a case to say that capital stock may be considered to be endogenous to GDP per capita, but that argument should not apply with any force to investment, which is a change in capital stock. Moreover, the accelerator principle, which is a demand side theory of investment, specifies a relationship between the change in national income (or change in consumption) and investment, but not between the level of national income and investment.

As an additional check of potential endogeneity problems we investigate the correlation coefficients between residuals from the base regression and independent variables. The coefficients of correlations suggest that only lagged dependent variable is highly correlated with predicted residuals which is not the case with other independent variables. In addition, those exogenous variables "ordinarily instrument themselves" in the system-GMM estimate (Roodman, 2006, p. 38); hence, all of the independent variables are instrumented as well.

The foregoing discussion has identified the main advantages of the chosen model specification as the economic model applied to TCs in comparison to the existing research. Following good practice guidelines suggested by a number of authors, notably Roodman (2006; 2007), we report the main econometric specification choices that we faced and explain why the dynamic system-GMM panel model is our preferred model over the OLS and static panel estimates.

a) Static panel estimates, as do the OLS models, omit dynamics causing the problem of dynamic panel bias (Bond, 2002; Baum, 2006) and as such do not allow us to study

the dynamics of adjustment (Baltagi, 2008). Omitted dynamics means that such models are misspecified, because they omit the entire history of the right-hand-side variables (Greene, 2008; Bond, 2002).

b) In this panel there are 29 countries (N) that are analyzed over a period of 16 years (T). Accordingly, there are more countries (N) than years (T). Many authors argue that the dynamic panel model is specially designed for a situation where "T" is smaller than "N" in order to control for dynamic panel bias (e.g. Bond, 2002; Baum, 2006; Roodman, 2006; Sarafidis et al., 2006; Roodman, 2007; and Baltagi, 2008).

c) The problem of potential endogeneity is also much easer to address in the dynamic panel models than in the static and OLS models that do not allow the use of internally generating instruments. An underlying advantage of the dynamic GMM estimation is that all variables from the regression that are not correlated with the error term (including lagged and differenced variables) can be potentially used as valid instruments (Greene, 2008); it is an unexplored dimension in transition literature.

d) Finally, the OLS and static panel estimates do not allow a separate analysis of the short and long-run effects of institutions on economic performance; hence, an additional advantage of the dynamic panel model is its ability to identify both short-run impact and long-run institutional effects (Baltagi, 2008; Pugh et al., 2008), which is particularly important for this research.

Finally, after identifying the dynamic panel model as the most appropriate econometric technique for the estimation, we had to decide which dynamic panel approach to apply. Notwithstanding that the General Method of Moments (GMM) is the method of estimation of dynamic panel models that provides consistent estimates (Baum, 2006; Roodman, 2006), one still has to decide whether to use: "difference-GMM" (henceforth DGMM) developed by Arrelano and Bond (1991); or, "system-GMM" (henceforth SGMM) estimation established by Arrelano and Bover (1995) and Blundell and Bond (1998). Without going deeply into an investigation of differences/similarities between those two GMM approaches, we identify the main advantages of SGMM over DGMM:

a) The SGMM estimate has an advantage over DGMM in variables that are "random-walk" or close to be random-walk variables (Bond, 2002; Roodman 2006; Baum, 2006; and Roodman, 2007). Since our model specification includes macroeconomic variables which are known in economics for the presence of random walk statistical generating mechanisms, the SGMM approach seems to be the more appropriate choice.

b) Since our specification includes initial conditions proxied by the level of GDP per capita PPP in 1989 as an independent variable (simply said, it is constant) this time invariant variable would disappear if we use the DGMM approach (Roodman, 2006). In other words, differencing variables within groups will remove any variable that is constant; hence, one variable from our model will be lost, but also some others used later in our sensitivity analysis.

c) The SGMM approach generally produces more efficient and precise estimates compared to DGMM by improving precision and reducing the finite sample bias (Baltagi, 2008).

d) If one works with an unbalanced panel then it is better to avoid DGMM estimation, which has a weakness of magnifying gaps (Roodman, 2006, p. 19). Our panel is close to be balanced, but again it is wise to avoid DGMM estimation. In some cases so called "orthogonal deviations" can be used to "fill" missing gaps by subtracting "the average of all future available observations of a variable" (Roodman, 2006, p. 20). The estimate of our model specification including orthogonal deviations does not provide better statistical diagnostics in comparison to SGMM. Hence, again, our preferred choice is SGMM.

2.2. Interpretation of the obtained results

Specification 1 is estimated in SGMM dynamic panel developed by Arellano and Bover (1995) and Blundell and Bond (1998) and implemented the *xtabond2* user written command in STATA 10 (Roodman, 2006). The estimated model is for the period 1992-2007 and covers the full set of TCs.

Table 3 Base model - SGMM dynamic panel – two-step robust estimate

The dependent variable is logarithm of GDP per capita in current US$ (Lngdppc)			
Variables *(SHORT EXPLANATION OF VARIABLE)*	**COEFFICIENTS**	**T- STATISTIC**	**P-VALUE**
Constant *(INTERCPET TERM)*	-0.220	-0.59	0.563
LngdppcL1. *(LAGGED DEPENDENT VARIABLE, 1st LAGG)*	0.913	10.88	0.000
Inst5 *(INSTITUTIONS 5 YEAR DIFFERENCE)*	0.403	2.28	0.031
Cpi *(INFLATION, ANNUAL AVERAGE IN %)*	-0.001	-0.78	0.440
Budget *(BUDGET DEFICIT, % GDP)*	0.001	0.14	0.890
Fdiper *(FDI INFLOW, % GDP)*	-0.003	-1.57	0.129
Invest *(DOMESTIC INVESTMENT, % GDP)*	0.003	1.37	0.180
Lninitial (INITIAL CONDITION, GDP PPP 1989)	0.129	1.10	0.280
Set of time dummy variables included			
_Iyear_1996	-.253	-2.61	0.015
_Iyear_1997	-.351	-3.84	0.001
_Iyear_1998	-.331	-3.22	0.003
_Iyear_1999	-.420	-3.90	0.001
_Iyear_2000	-.290	-2.69	0.012
_Iyear_2001	-.225	-2.31	0.029
_Iyear_2002	-.196	-2.15	0.040
_Iyear_2003	-.115	-1.45	0.159
_Iyear_2004	-.087	-1.45	0.158
_Iyear_2005	-.086	-2.13	0.042
_Iyear_2006	-.067	-2.51	0.018
Model diagnostics			
Number of observations			325
Number of groups (i.e. countries)			29
Number of instruments			41
F- test of joint significance *Ho: Independent variables are jointly equal to zero*			F (18, 28) =2310.460 Prob > F = 0.000
Arellano-Bond test for AR(1) in first differences *H_0: There is no first-order serial correlation in residuals*			z = -2.67 Pr > z = 0.008
Arellano-Bond test for AR(2) in first differences *Ho: There is no second-order serial correlation in residuals*			z = -1.78 Pr > z = 0.075
Hansen J-test of overidentifying restrictions *H_0: Model specification is correct and all overidentifying restrictions (all overidentified instruments) are correct (exogenous)*			chi2 (22) = 14.440 Prob > chi2 = 0.885
Difference-in-Hansen tests of exogeneity of GMM instrument subsets: Hansen test excluding SGMM instruments (i.e. the differenced instruments) *H_0: GMM differenced- instruments are exogenous*			chi2 (10) = 12.320 Prob > chi2 = 0.265
Difference-in-Hansen tests of exogeneity of GMM instrument subsets: *H_0: system-GMM instruments are exogenous and they increase Hansen J-test*			chi2 (12) = 2.120 Prob > chi2 = 0.999
Difference-in-Hansen tests of exogeneity of standard "IV" instrument subsets: *H_0: GMM instruments without "IV" instruments are exogenous*			Chi2 (4) = 4.21 Prob > chi2 = 0.378
Difference-in-Hansen tests of exogeneity of standard "IV" instrument subsets: *H_0: Standard "IV" instruments are exogenous and they increase Hansen J-test*			chi2 (18) = 10.220 Prob > chi2 = 0.924
Source: Authors' calculations using STATA 10.			

The validity of the obtained results in SGMM depends on the statistical diagnostics; hence, we will start our interpretation with the model diagnostics. Compared to the OLS model, SGMM does not assume normality and it allows for heteroskedasticity in the data. Dynamic panel models are known for having common problem with the heteroskedasticity of data, which fortunately they can control (Baltagi, 2008). Accordingly, we report two-step estimates that yield theoretically robust results (Roodman, 2006). Moreover, we apply the two-step estimator wanted to obtain the robust *Sargan test*, i.e., the (robust) *Hansen J-test*, which are not available in one-step estimation.

A small panel sample may produce "downward bias of the estimated asymptotic standard errors" in the two-step procedure (Baltagi, 2008, p. 154). As a remedy we report corrected results using the Stata command "*small"* that will produce a more accurate estimate by implementing the "Windmeijer correction" (Windmeijer, 2005, cited in Baltagi, 2008, p. 154). However, the SGMM approach assumes linearity and that the disturbance terms are not autocorrelated, or in other words that the applied instruments in the model are exogenous. Consequently, an important procedure in testing the statistical properties of this model is testing for the validity of instruments, which requires testing for the presence of first- and, in particular, second-order autocorrelation in the error term. Moreover, the SGMM requires "the steady state" assumption throughout the analyzed period (Roodman, 2006), which also needs to be investigated. All in all, the results of relevant statistical tests and checks for SGMM estimated follows:

a) The SGMM assumes that the twice-lagged residuals are not autocorrelated; hence we need to test for autocorrelation in the error terms, which is also a test for the validity of instruments. The m_1 and m_2 procedure tests directly for, respectively, first- and second-order residual autocorrelation. According to Arrelano and Bond (1991), the GMM estimator requires that there is first-order serial correlation *(m_1 test)* but that there is no second-order serial correlation *(m_2 test)* in the residuals. Since the null hypotheses are that there is no first-order (m_1 test) / second-order serial correlation (m_2 test), it means that one needs to reject the null hypothesis in the m_1 test but *not* to reject it in the m_2 test to get appropriate diagnostics. As we may see from Table 3, those tests support the validity of the model specification (Basu, 2008).

b) *The Hansen J-statistic* tests the null hypothesis of correct model specification and valid overidentifying restrictions, i.e. validity of instruments (Baum, 2006). The rejection of the null hypothesis means that either or both assumptions are questionable. Buam (2006, p. 201) argues that the *Hansen J- test* is the most commonly used diagnostic in GMM estimation for assessment of the suitability of the model. T*he Hansen test* of overidentifying restrictions does not reject the null at any conventional level of significance (p=0.88); hence, it is an indication that the model has valid instrumentation.

c) *The Hansen J-test* evaluates the entire set of overidentfying restrictions/instruments. It is also important to test the validity of subsets of instruments (i.e. levels, differenced, and standard IV instruments). For this purpose, one can use a *difference-in-Sargan/Hansen test*, also known as the *C-test* (Baum, 2006; Roodman, 2006). It estimates the SGMM with and without a subset of suspect instruments enabling investigation of the validity (i.e. exogeneity) of any subset of instruments, as well as

their contribution to "the increase in *J-test*" (Roodman, 2007, p. 11). The null hypothesis of the *C-test* is that the specified variables are proper instruments, i.e. that the set of examined instruments is exogenous. As we may see from Table 3, we do not have enough evidence to reject the null hypothesis of exogeneity of any GMM-instruments used, i.e. levels and differenced instruments, as well as the validity of standard IV instruments.

d) Sarafidis et al. (2006, p. 12) utilize a combination of *the m_2 and difference-in-Hansen test* for testing cross-section dependence, i.e., this "approach examines whether error cross section dependence is left after including time dummy variables" in the model. The null hypothesis of this test is that the cross section dependence is homogenous across pairs of cross section units (Sarafidis et al., 2006, p. 5). Looking back to the model diagnostics, we do not have enough evidence to reject the null of homogenous cross-section dependence in these two tests. Contrary, if we run the same regression without time dummies the model diagnostics are much worse, suggesting evidence of potential heterogenous cross-section dependence (Sarafidis et al., 2006). Hence, inclusion of time-dummies in our specification have improved the statistical diagnostics and removed universal time-related shocks from the error term.

e) The check for the "steady state" assumption suggested by Roodman (2006) can be also used to investigate the validity of instruments in SGMM. This assumption requires a kind of steady-state in the sense that deviations from long-term values are not systematically related to the fixed effects (Roodman, 2006, p. 43). More simply said, the estimated coefficient on the lagged dependent variable in the model should indicate convergence by having a value less than (absolute) unity (Roodman, 2007, p. 12), otherwise SGMM is invalid. The estimated coefficient on the lagged dependent variable is 0.9, which means that the steady-state assumption holds. The second condition that Roodman (2006, p. 31) suggests is that the convergence process "must not be correlated with the fixed effects (i.e. the $\hat{u}_{it}$)", which has been taken into account by including the initial conditions of the dependent variable as recognition of the importance of this assumption.

f) Bond (2002) suggests additional detection of the dynamic panel estimate's validity by checking if the estimated coefficient on the lagged dependent variable lies between the values obtained from OLS and FE estimators, which is confirmed in our model (i.e., the following values are obtained: OLS=0.98 > GMM=0.91 > FE=0.60).

g) Roodman (2007) strongly suggests that one should report the number of instruments used in the dynamic panel, since those models can generate an enormous number of potentially "weak" instruments that can cause biased estimates. There are no clear rules concerning how many instruments is "too many" (Roodman, 2006; 2007), but some rules of thumb and telltale signs may be used. First of all, the number of instruments should not exceed the number of observations, which is the case here (41 instruments < 325 observations). Second, a telltale sign is a perfect *Hansen J-statistic* with the p-value equal to 1.00. At the same time, the p-value should have a higher value than the conventional 0.05 or 0.10 levels, at least 0.25 is suggested by Roodman (2007, p. 10). In our model, *the Hansen J-test* reports a p-value of 0.88, which satisfies both rules. Finally, Roodman (2006; 2007) suggests reporting how one has obtained the "optimal" number of instruments. In our case, 41 instruments came from the restriction to use two lags for levels and two for differences in the data (i.e., the

restriction is set to (2 2) in *xtabond2*). We have estimated a number of other regressions by increasing or decreasing the number of instruments, using a special user written command *collapse* for decreasing instruments, but any other limits worsen the diagnostics. Especially important in this procedure is that further instrument count reductions resulted in a lower *Hansen p-value*, indicating that this number of instruments is, say, "optimal".

h) *The F-test* of joint significance reports that we may reject the null hypothesis that independent variables are jointly equal to zero (p=0.000) at any conventional level of significance.

Considering together the various statistical tests that have been conducted, we may say that there is enough evidence to conclude that the examined statistical tests satisfy the key assumptions of SGMM estimation and that this model is an appropriate statistical generating mechanism.

Now, we move on to economic interpretation of the results reported in Table 3. Our variable of interest (**Inst5**) is statistically significant and exerts an economically substantial influence on economic performance. This dynamic panel is a Log-Lin model (i.e. one with a dependent variable in logarithmic form and a linear independent variable). Hence, a one unit (which is the same as one percentage because the index is scaled from 0 to 1) improvement in the institutional index over a period of five years causes GDP per capita to increase by (0.01*0.403*100) = 0.4 percent, on average and other variables being equal. Or, a ten percent improvement in institutions over the period of five years is associated, on average, with a 4.03 percent increase in the current GDP per capita level.

In comparison to some other transition panel models (e.g., Redek and Susjan, 2005; Falcetti et al., 2006; Eicher and Schreiber, 2007), in our model the institutional variable in the current or previous period does not appear as significant, suggesting that if institutions do influence economic performance then they do so over a longer period (5 years). In other words, the time-horizon over which institutions act in transition does matter. Hence, an improvement of institutions in transition would not come as a stimulus to economic performance overnight. Similar findings are presented by Gwartney et al. (2004, p. 231) in their non-transition research, according to whom "a time period of 5 to 10 years is necessary for the effects of an improvement in the quality of a country's institutions to be registered fully".

The time-dummy variables used to capture universal time related shocks in transition over the observed period are mainly significant. We do not attempt to explain the reasons for such results, since this is not a primary interest. However, mainly significant time dummies do suggest the presence of universal time related shocks in transition, or using econometric vocabulary, cross-sectional dependence in the residuals.

Since the other variables in the model are not our primary interest we will just briefly explain that the level of GDP per capita from the previous year (**LngdppcL1**) has a positive and significant effect on the GDP per capita in the current period. Note, deeper lags of the dependent variable proved to be insignificant; hence, the model is left with one lag of the dependent variable. Although other variables do not enter as significant at conventional level of significance we will comment on the signs of the estimated coefficients. Accordingly, a higher budget deficit (**budget**) is associated with higher GDP per capita in the current period while higher inflation (**cpi**) is associated with lower GDP

per capita. Going further, foreign direct investment inflow as a percentage of GDP in per capita terms (**fdiper**) has negative effect on GDP per capita in the current year, while domestic investment (**invest**) proxied by gross fixed capital formation appears as a positive influence on GDP. However, if we allow FDI or domestic investment to influence economic performance with two lags, it appears as significant and positively influence economic performance, but statistical diagnostics worsen. However, the institutional variable remains statistically significant with almost the same magnitude. Since, those variables are not our main interest, we report the base specification with better model diagnostics. Finally, better initial conditions (**Lninitial**) in 1989 have a positive sign suggesting a potential advantage for those TCs with higher GDP per capita in 1989. Our findings on the non-significance of budget balance, inflation and inward FDI are similar to those of Redek and Susjan (2005); the finding on FDI inflow is also consistent with Carkovic and Levine (2002).

The estimated coefficient on the institutional variable reported in Table 3 measures the short-term impact of ongoing institutional changes in transition on economic performance. Papke and Wooldridge (2004) provide an explanation of how to obtain both the coefficient and the standard error for the long-run effect in a dynamic panel data model; it can be calculated by STATA 10 using the command "*nlcom*"; the results are reported in Table 4.

Table 4 Long-run effect of changes in institutions on economic performance

Variable	Long-run coefficient	Standard error	t-statistics	P>|t|	[95% Conf. Interval]	
Inst5	4.64	5.80	0.80	0.431	- 7.249	16.537
Source: Authors' calculations using command "*nlcom*" in Stata 10.						

The obtained coefficient in Table 4 is a measure of the responsiveness of the dependent variable in the long-run (Greene, 2008); in our case it is the level of GDP per capita, to changes in variable of interest, which is improvement in institutions towards the standards of developed economies. The long-run coefficient is positive (suggesting a positive effect of improvements in institutions to the level of GDP per capita in a long-run), but it is highly insignificant (p-value=0.431). However, this estimate assumes that other factors are "*ceteris paribus*" and that the system is stable, which are fairly strong assumptions for the long-run. Moreover, how "long is the long-run" in economics can be a moot issue. Nevertheless, these results are indicative. Mathematically, the long-run coefficient is the value after an infinite number of periods. However, given that over time the value of the long-run coefficient asymptotes towards its final value, the economically important massage of the long-run coefficient is more qualitative than quantitative; namely, the effect of institutional improvements on macroeconomic performance builds over time.

2.3. Sensitivity analysis of the main findings

We have conducted a whole range of robustness checking of the kind becoming routine in applied economics. These checks investigate the sensitivity of our results to: different time-horizons over which institutions influence economic performance; the inclusion of informal institutions into our specification; the inclusion of dummy variable for EU integration and different groups of TCs; and the use of "external" instruments for institutional influence. Since we are limited with the space to discuss all these checking's, we will briefly report the main findings that we have obtained[1].

If we use four-year difference of institutions as the explanatory variable the results are quite consistent, but the model diagnostics are weaker. If we further decrease the difference of institutions to three years, the variable of interest becomes insignificant while the statistical diagnostics remain weak. From the other side, increasing further the difference of institutions on six or seven years resulted in unacceptable statistical diagnostics, while the institutional proxy proves to be insignificant. All in all, the best model diagnostics are obtained in the preferred model (Table 3) confirming that the time-horizon over which institutions influence economic performance in transition is important.

Empirical research in the institutional literature is primarily focused on formal institutions despite the fact that in the theoretical foundations of institutional economics informal institutions are treated as an important segment of the institutional environment as well (North, 1990). Following some authors (e.g., Moers, 1999; Knowles and Weatherston, 2006), we extend our regression by adding proxy variables for informal institutions, which is an index of civil society. However, because the dataset was reduced to 43 observations, we had a corresponding problem with poor statistical diagnostics.

Countries' status with respect to the process of EU integration may be also an important explanatory variable in explaining economic performance and institutional effects in transition (Chousa et al., 2005; Di Tommaso et al., 2007). After including an (exogenous) EU dummy variable (the base category is non-EU TCs) the statistical diagnostics were a bit worse than those of the base model, while other variables remain quite the same regarding the sign, magnitude, and significance. The EU dummy has a positive sign but was not significant at conventional levels of significance.

Those TCs that entered the EU have mainly the best economic and institutional performance, this dummy variable may potentially suffer from an endogeneity problem. We take into account potential endogeneity by treating the EU dummy as a predetermined variable. As instruments we use already identified GMM instruments in the base specifications (i.e. GMM levels and differences). Moreover, following Di Tommaso et al. (2007, p. 875) we instrument the EU dummy using additionally the geographical distance from Brussels as an external instrument. However, even after treating this variable as endogenous, it is still insignificant, while model diagnostics become even weaker.

If we control in our model specification different clusters of countries (i.e. EU, SEE, and CIS transition economies) statistical diagnostics are worse than those of the base-line

[1] The regression printouts will be presented by the authors upon any request.

model while these dummy variables do not prove to be significant. Hence, we do not identify significant differences in the model between different clusters of TCs.

We estimated a number of other regressions using the institutional variable from the current period as well as with lags, treating them as predetermined and endogenous variables and instrumented them with external instruments found in the literature (i.e. years under communism; war; distance; EU dummy; and fractionalisation by religion). However, in all cases the model diagnostics were inappropriate, while the institutional variable did not appear as significant. Accordingly, we could not identify preciselly the current or lagged influence of the institutional variable on economic performance, which again confirms the key findings of the importance of timing effects of institutions in transition.

3. Conclusion

The relationship between institutions and economic performance in transition has attracted significant attention among applied economists in recent years. The majority of findings suggest that improving institutions in transition do influence significantly and positively economic performance. However, we have identified many shortcomings in the existing empirical work starting from the observations that no research covers the whole population of TCs, almost no researcher consider their models' diagnostics fully, some research is conducted with less than twenty degrees of freedom, and the majority of authors do not consider at all potential endogeneity problems. Indeed, our own findings from this paper, whilst broadly consistent with those of existing research, suggest that previous empirical studies report statistically non-robust/fragile/misspecified findings. The results presented above address many of these weaknesses by conducting a more systematic investigation of the link between institutions and economic performance in transition.

Our findings confirm the importance of institutions for economic performance in transition, but not on *a priori* ground. First of all, we found that the time-horizon in which institutions act does matter. More precisely, we could not identify a statistically significant contemporary influence of improving institutions on economic performance even after treating institutions as endogenous or predetermined economic variable instrumented with internally generated as well as externally "identified" and available instruments. Interestingly enough, we were able to identify a positive and significant effect of institutions on economic performance but most robustly when these effects arose from five-year differences of the institutional proxy. The results obtained suggest that the improvement of institutions in transition over the period of five years by ten percent towards the standards of developed market economies resulted in an increase of GDP per capita by four percent, on average, other variables being equal. The long-run effect of changes in institutions in transition appears to be substantially larger but is not precisely measured (the derived long-run coefficient lacks statistical significance).

We have conducted several robustness checks in order to further challenge our preferred results. If we use more or fewer years of differences of institutions (the base is five-year difference) the model diagnostics appeared not to be appropriate. Taken together, these

results provide some, albeit weak, suggestion of a "peak" effect of institutions on economic performance over a five-year period.

Our findings also suggest that TCs as a whole sample suffered some universal time related shocks that were captured by mainly significant time-dummy variables. Overall, this is an indication that TCs, on average, still share some common related specifics, in spite of the evident heterogeneity. A related finding is that our empirical results do not differ significantly for EU and non-EU TCs, or between different clusters of countries (SEE, CIS, and EU).

All in all, we find that institutions in transition do matter. Yet, from the perspective of political decision-makers, the preferred results are probably not very "encouraging" having in mind that improvement in institutions appear to work over time-horizons "longer" than the typical electoral cycle. This may point to an inconsistency between policy-makers' short-run priorities and sound policies for the intermediate and/or long run.

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Appendix 1

VARIABLES	DEFINITIONS AND SOURCES
Gdppc	The level of GDP per capita in $. Source: EBRD (2008), official web page; www.ebrd.com
Inst	The EBRD index of structural and institutional reforms, published annually, and includes the following areas: Governance and enterprise restructuring; Price liberalization; Trade and foreign exchange system; Competition policy; Banking reform and interest rate liberalization; Securities markets and non-bank financial institutions; Large-scale privatization; Small-scale privatization. Since the EBRD indices range from 1 to 4 + (where 4 + is approximation of an advanced market economy) we have linearized the scores assigning the value of 0.33 to a "+" indicator (e.g. Eicher and Schreiber, 2007). Hence, all indices are divided by 4.33 in order to get rank from 0 to 1, where 1 is the maximum value of the index. Source: EBRD (2008).
Cpi	Consumer price index, annual change in percentages. Source: EBRD (2008), official web page; www.ebrd.com
Budget	General government budget balance in percentages of GDP. Source: EBRD (2008), official web page; www.ebrd.com
Fdiper	Foreign direct investment, net inflow as percentage of GDP recorded in the balance of payment. Source: WB (2008a) for data 1992-2006, for 2007 data are taken from EBRD (2008), and for Montengro missing data for 2006 is taken from EBRD (2008) as well. In 1992 Armenia recorded 348.19% of FDI inlow as percentage of GDP. Since this year was obvious outlier in the transition sample, this observation is removed.
Invest	Gross capital formation as % of GDP. Source: WB (2008a).
Initial	Purchasing Power Parity Income per Capita in US Dollars in 1989. Source: IMF (2000). Missing data for Bosnia and Herzegovina, Serbia, and Montenegro were caclulated by the author from Savezni zavod za statistiku (1991).
Eu	Dummy variable that takes a value of one if a country joined the European Union over the period 1992-2007, 0 otherwise. Source: Author's calclulations.
See	Dummy variable that takes a value of one if a country belongs to the South East Europe, 0 otherwise. Source: Author's calclulations.
Cis	Dummy variable that takes a value of one if a country belongs to the CIS group of countries, 0 otherwise. Source: Authors' calclulations.
Commun	Number of years in which a particular transition country was under the communism. Source: IMF (2000). Author's estimate for Bosnia and Herzegovina which was missing in the sample.
War	Continuous variable that measures number of years in which a particular transition country was involved in any kind of military conflict. The months are also calculated as part of year. Source: www.en.wikipedia.org (2008) and authors' calculations.
Distance	Distance in thousands of kilometers between capital city of a transition country and Brussels. "Distance calculations are based on the WGS84 ellipsoid using *geod* (a part of the PROJ.4 Cartographic Projections library originally written by Gerald Evenden then of the USGS). The computation is for the great circle distance between points, and do not account for differences in elevation." Source: http://www.infoplease.com/atlas/calculate-distance.html, visited in January 2008.
Chrprob	The variable that measure the probability that a random chosen citizen is a Roman or Ortodox Catholic. Author's calculations using data from Wikipedia (2008) available on line: www.en.wikipedia.org and authors' calculations.
Civil	The ratings of the Freedom House based on a scale of 1 to 7, with 1 representing the highest level of progress and 7 the lowest. It „Assesses the growth of nongovernmental organizations (NGOs), their organizational capacity and financial sustainability, and the legal and political environment in which they function; the development of free trade unions; and interest group participation in the policy process". Source: The Freedom House (2008)
Source: Authors	