INSTITUTIONAL EFFECTS ON ECONOMIC PERFORMANCE IN POST-SOCIALIST TRANSITION: A DYNAMIC PANEL ANALYSIS*

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This article uses dynamic panel analysis to investigate the relationship between institutional improvement and economic performance in 29 transition countries. The contribution of this paper is two-fold. First, we find that per capita GDP is determined by the entire history of institutional reform under transition and that, conditional on this history, per capita GDP adjusts to recent institutional changes. Moreover, we find that the time-horizon over which we measure institutional change matters, with five-year changes showing the clearest effects on current levels of per capita GDP. Secondly, we address the pronounced methodological heterogeneity of this literature. To compensate for incomplete theoretical guidance from the institutional literature, we draw upon an institutional meta-regression analysis to inform our model specification. Our analysis covers the period 1992–2007.

Keywords: institutions, economic performance, transition countries, dynamic panel analysis, extreme bounds analysis

JEL classification indices: E11, P30, P39

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1. INTRODUCTION

Many authors agree that transition is largely a process of institutional change (Redek – Susjan 2005; Eicher – Schreiber 2010). Accordingly, institutional economics may be particularly relevant in explaining economic differences among the 29 transition countries (TCs) we analyse. However, the study of institutions in transition is still characterised by empirical gaps that remain to be investigated.

Most transition studies report that "better institutions" are supportive in achieving "better economic performance". However, while results tend to be qualitatively similar, model specifications and empirical strategies in this literature are diverse. In turn, this reflects a lack of theoretical guidance from the institutional literature. Accordingly, the point of departure for this study is the pronounced methodological heterogeneity of this literature. Our response is to use the results from a meta-regression analysis (MRA) to inform our literature review (Section 2) from which we derive theoretical and econometric reasons for our model specification (Section 3). With respect to the substantive issue, we report new findings on the timing of institutional effects on economic performance (Section 4). In Section 5, we present our conclusions. Because of lack of space, we illustrate the results of the modelling in details in our on-line *Appendix*.

2. LITERATURE REVIEW

Conventional literature review establishes a general consensus that institutions matter for achieving better economic performance in transition. Although the qualitative findings seem homogenous, a meta-regression analysis (Efendic et al. 2011a) applied on institutional studies identified five main sources of heterogeneity in this literature: the dependent variable; measurement of the variable of interest that is the proxy variable for institutions; model specification; the estimators applied; and the approach to addressing the potential endogeneity of institutions. Since these heterogeneities affect estimates of the impact of institutions on economic performance, our review will focus on these differences.

2.1 The dependent variable: output growth or levels?

The core theoretical institutional literature (North 1990) explains the effect of institutions on *economic performance;* hence, not specifying precisely the definition and measurement of the explained variable. Lack of theoretical precision has permitted substantial heterogeneity in empirical studies, which variously focus

on economic growth or the level of economic output variables. Efendic et al. (2011a) identified 20 studies using output *growth* and 21 studies using output *level*. This paper reports more robust findings of positive and statistically significant institutional effects on output levels than on output growth. Yet, in the transition sub-sample, research has been mainly focussed on output growth, leaving institutional influences on output levels relatively unexplored.

In addition to the finding that investigating output levels is more likely to reveal institutional effects, and that such investigations have been relatively neglected in the transition literature, there are also substantial theoretical reasons for focussing on output levels as the dependent variable. *Inter alia,* Basu (2008) and Easterly (2009) argue like this. The main rationale for this modelling strategy is that national differences in per capita output levels reflect entire histories of time-varying growth performance. Accordingly, analysing the determinants of differing per capita levels helps to avoid non-robust and, hence, spurious explanations that arise from potentially unrepresentative samples of impermanent growth processes (reflecting, according to Easterly 2009: 30, "the possibility that if you get a result associating high growth with a particular country … in one period, it is likely to vanish in the following period."). Moreover, focusing on per capita values enables us to take the relative country size into account (Busse – Hefeker 2007). Accordingly, our dependent variable will be defined in terms of the per capita output level – the logarithm of GDP per capita (ln *gdppc*).

2.2 The independent variable of interest: 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). A huge disparity in using institutional proxies in empirical research, without any consensus on the direction of "unification", suggests that a single variable representing institutions is not available (Keefer – Knack 1997). Consequently, the second 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 researchers rely on the European Bank for Reconstruction and Development (EBRD) structural and institutional change indicators as their proxy for institutions.[1] Redek – Susjan (2005), and Paakkonen (2009) employ the Heritage Foundation Index of Economic Freedom;

[1]   Falcetti et al. 2006; Di Tommaso et al. 2007; Efendic 2010; Eicher – Schreiber 2010.

Chousa et al. (2005) base their institutional variable on the shadow economy; Beck – Laeven (2006) use the World Bank Worldwide Governance indicators, while some use specifically designed survey data (e.g. Efendic et al. 2014).

Most transition papers are based on aggregated institutional indicators. The first general critique is that the institutional variable in this case is a broad indicator usually composed of sub-indices, which measure different institutional features that might be the product of institutions rather than institutions themselves (Shirley 2008). Conversely, De Haan et al. (2006: 182) see this aggregation as an advantage of institutional indices; the authors conclude that those indices are both "reliable and useful".

Another potential shortcoming of these institutional measures is the assumption that the institutional framework among different countries has the same structure and size in relation to the economy. Shirely (2008) argues that much less effort has been directed towards measuring institutions in specific countries. Furthermore, as Havrylyshyn – Van Rooden (2003) underline, such indices are based on the judgment of outside experts, which may be subjective and contain perceptions bias. Glaeser et al. (2004) argue that potential subjectivity biased measures raise doubt over causality that goes from variables representing institutions to economic growth, since the institutional indices mainly improve with the level of economic growth (performance). This is a simple but a rather convincing criticism. However, Glaeser et al. (2004) focus on political institutions, while economic along with political institutions, including the interrelationships between them, are crucial for economic prosperity and better performance (Bjornskov et al. 2010; Sobel – Coyne 2011). Moreover, Sobel – Coyne (2011) investigate in particular the issue of the stationarity and cointegration of different institutional measures and find that indices of formal political and economic institutions are non-stationary, implying that institutional reforms indeed have permanent effects. Their finding also implies that, in non-transition countries, central parts of the (non-political) institutional framework are very persistent over time, suggesting that subjective bias is unlikely to be a main concern.[2] All in all, any strategy in measuring institutions in transition will have its advantages and disadvantages (Efendic et al. 2011b). However, transition papers are rather consistent in using (EBRD) aggregated institutional indices to proxy institutional performance.

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[2]   For this addition we thank an anonymous referee.

2.3 Model specifications in applied transition research

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. 2003). In such circumstances, empirical modelling should take into account "all" possible determinants and transition specifics, which *per se* raise a number of methodological problems.

There is a wide range of empirical specifications utilised to model institutional effects. In some studies, institution(s) is/are the only explanatory variable(s) (often augmented by the lagged dependent and/or lagged values of the institutional variable); for example, Mauro (1995) and Sachs (1996). Although there is no clear guideline about the specification that should be used in institutional research, this simple "bivariate specification" is less acceptable than a fully-specified model (Gwartney et al. 2004). Ostrom (2005) suggests that to understand and analyse the processes of structural change of any particular situation, we should include one or more of the underlying sets of variables. 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, can be found in Keefer – Knack (1997), Glaeser et al. (2004), Redek – Susjan (2005), and Paakkonen (2009). Finally, we may identify also many "other specifications" that include institutions as explanatory variables together with control variables that are not standard production factors. The seminal paper written by Rodrik et al. (2004) may be a good representative (also exploited by Sachs 2003), in which authors use institutions, trade integration, and geographical location as explanatory variables of economic development.

In transition research, there is no consensus concerning the variables to be included in these regression models. However, in studies of economic performance in transition, extended production function specifications are applied by only a minority of researchers (e.g. Falcetti et al. 2006; Redek – Susjan 2005), although all these transition studies investigate the effect of institutions on economic growth. Yet, it is quite the opposite for non-transition research, which includes a good number of extended production function specifications and output level studies.

2.4 Estimators used in transition research

Regarding the methodology employed to estimate institutional models, the existing empirical research on transition is often based on OLS cross-section analy-

sis, although some research has been based on static panels, while Falcetti et al. (2006), Paakkonen (2009) and Eicher – Schreiber (2010), for example, apply a dynamic model. We argue below that dynamic panel models are a methodological advance in comparison to the cross-section and static panel models applied; accordingly, we discuss these papers.

In their dynamic panel, Eicher – Schreiber (2010) regress GDP per capita growth on institutions for a period of 11 years. The institutional variable is constructed from the EBRD indicators. The authors find significant evidence that institutions influence economic growth per capita in transition. Moreover, by analysing the dynamic contribution of institutions on growth, they find that sustained institutional change is crucial for economic performance in transition. However, in this research, the standard model diagnostics are not reported, thereby raising doubts concerning instrument validity, while their bivariate specification may give rise to omitted variables bias. A more developed specification is applied by Paakkonen (2009) and Falcetti et al. (2006), in which the authors, in addition to the (once) lagged dependent variable and an institutional proxy, use other explanatory variables such as investment and government consumption, and include the interaction of the institutional proxy with some of these variables. These specifications might be considered as more fully specified models. Paakkonen (2009) reports a positive effect of increasing economic freedom on economic growth over the period 1998–2005. Falcetti et al. (2006) employ the same proxy for institutions as Eicher – Schreiber (2010) and find that institutions are an important determinant of economic growth in transition.

However, none of these studies report the full range of model diagnostics, as recommended by Arrelano – Bond (1991) and they leave some important aspects of dynamic panel modelling unexplored. Moreover, the potential effect of time-related shocks in transition is not investigated; the authors do not include all TCs in the sample; and the authors do not investigate the timing of short-run institutional effects. All these shortcomings will be addressed in our modelling procedure.

2.5 Addressing the potential endogeneity of institutional effects on economic performance in transition

The problem of the potential endogeneity of institutions is one of the most difficult in empirical institutional work (Ahlerup et al. 2009). Although institutional economists generally recognise institutions as an endogenous factor in economics, some empirical studies do not consider the potential endogeneity problem (in the transition context, this applies to Havrylyshyn – Van Rooden 2003; Redek – Susjan 2005; Chousa et al. 2005). Yet Efendic et al. (2011a) find that the

conclusions of such studies should be treated with great caution because of their potential overestimation of the institutional effect on economic performance.

The most widely recognised strategies for addressing the potential endogeneity of institutions are those that derive instruments from historical perspectives (Acemoglu et al. 2001), the geographical environment (Rodrik et al. 2004), or linguistic characteristics (Hall – Jones 1999). Yet these instruments developed for global samples typically cannot be applied to sub-samples of countries (Eicher – Leukert 2009), in particular to TCs. More promisingly, Falcetti et al. (2006), Paakkonen (2009), and Eicher – Schreiber (2010) use internally generated instruments in the context of dynamic panel modelling. Our modelling strategy builds upon this approach.

3. EMPIRICAL MODELLING OF INSTITUTIONAL EFFECTS IN TRANSITION

From our literature review, we conclude that best practice in the investigation of institutional effects in transition is to model output levels rather than growth, to proxy institutional effects using some established index, to estimate a "fully-specified" dynamic model, and to address the potential endogeneity of institutions. In this section, we explain how our approach responds to these requirements.

3.1 Institutional proxy

In establishing our proxy variable for institutional quality, we follow the mainstream transition literature and focus on a broad aggregated indicator of institutional change, 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 industrialised market economies. 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: 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 for at least two reasons. Firstly, institutional reforms in transition include redefining the role of the state, market and business sectors, which this index is designed to capture. Secondly, observations are available annually from the beginning of transition, enabling the longest time-span and the largest number of observations.

This (unweighted) aggregated institutional EBRD index is scored from 1.0 (minimum) to 4.3 (maximum); we normalise it to a range from 0 to 1. In our

initial checking procedure we found that almost all components of the EBRD index are highly correlated with each other, which most researchers also report (Di Tommaso et al. 2007; Eicher – Schreiber 2010; Bjornskov et al. 2010). Sobel–Coyne (2011) report that in TCs even minor reforms to one institution can be reinforcing and result in subsequent reforms to other institutions, suggesting that institutional changes and reforms are simultaneously and permanently maintained.

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: 873). However, the choice of indicators that 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: 4). Moreover, multicollinearity might be a serious issue in such analysis. Fortunately, Raiser et al. (2001) have exploited the Multiple Indicator Multiple Cause methodology to control for potential measurement errors in this multidimensional variable, as well as for the problem of aggregation of different components of the EBRD index. The authors find that averaging institutional sub-indices into one composite index is an appropriate measure of institutional change in transition. As a check, we calculated Cronbach's Alpha (CA) for the eight components of the EBRD index. With complete observations for each index, CA = 0.96, which suggests that the aggregation of the EBRD indices is appropriate for the data used in the regressions below.

An additional issue in defining the institutional variable of interest, which has not been properly addressed in the literature, is the timing of the institutional influence on economic performance. The majority of researchers model contemporaneous or short-run institutional effects (Sachs 1996; Redek – Susjan 2005), although some authors argue that the institutional influence might work with lags (Gwartney et al. 2004; Raiser et al. 2001). Accordingly, the timing of institutional effects in transition should be further investigated. To this end, we do not use the current and/or lagged values of the proxy for institutions, which is the measure typically applied in previous studies. Sobel – Coyne (2011) report that institutional proxies, often being non-stationary, should not be used in levels as independent variables explaining some (non-stationary) measures of economic prosperity. Indeed, they should be investigated rather in the form of changes in the series, which is the approach that we apply. Accordingly, we use the change in institutional improvement over a five-year period ($inst5_{it}$), which we characterise as an influence over the medium-term. This approach to estimating the influence of change in institutions (Sobel – Coyne 2011) over a longer period is recommended by Gwartney et al. (2004) and applied, for example, by Raiser et al. (2001). We

follow this practice to allow for institutional influences on economic performance to take place when sustained over time. In the next section, we advance additional econometric reasons for this practice.

3.2 Base model specification

We specify our base model to estimate the effect of changes in institutional quality on economic performance within a dynamic framework. We allow current economic performance to be influenced by past economic performance. In a dynamic panel specification, lagged GDP per capita is an endogenous variable by definition. 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.

To the economic reasons for specifying the institutional variable of interest as change in institutional improvement over a five-year period, we add two econometric reasons. Firstly, models in which institutional measures are from the current or lagged periods may give rise to spurious regression (Falcetti et al. 2006); conversely, our specification – as a stationary variable – should avoid this problem.[3]

Secondly, the institutional proxy is constructed in such a way as to eliminate reverse causation and from this perspective it may be treated as an exogenous variable. 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 attenuating endogeneity (Aron 2000).

However, in a dynamic panel specification, endogeneity potentially also arises from correlation of institutional quality with unobservable time-invariant influences on economic performance captured by the country-specific error terms (v_i). Because not all such unobserved variables can be identified (this depends on the state of theoretical understanding) or, even if identified, measured (this is subject to data limitations), we cannot with certainty control for all such potentially correlated variables. In this case, endogeneity may arise from omitted variables. Accordingly, although we have designed our institutional proxy to be free from simultaneity between economic performance and institutional quality as a source of endogeneity, we do not assume that $inst5_{it}$ is exogenous.

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[3]   The Im–Pesaran–Shin panel unit root test confirmed that our dependent variable *(lngdppc)* is a trended variable, integrated of order one (the null that this variable contains a unit root in all panels cannot be rejected; $p = 1.000$), and that our independent variable of interest *(inst5)* is stationary (the null being rejected; $p = 0.000$). This precludes spurious correlation via common statistical generating mechanisms.

Initial conditions in individual TCs were different. For both economic and econometric reasons we control for the potential impact of different starting positions on later economic performance.[4]

Initial conditions proxied by per capita GDP from 1989 cannot be subject to endogeneity arising from simultaneity effects. By definition, our initial conditions predate the transition period. In addition, correlation between initial conditions and unobserved time-invariant influences in the country-specific error terms (v_i) is unlikely to be sufficiently substantial to give rise to endogeneity bias. Given that the purpose of transition was to bring about a profound structural break in economic, social and cultural development, we assume the pre-transition time-invariant components of the country-specific error terms (v_i), with which initial conditions may have been correlated, to be sufficiently different from the post-transition components of the v_i for correlation between these and the initial conditions not to be a problem in practice. For example, many of the countries giving rise to pre-transition country-specific effects no longer exist. For this reason, we treat initial conditions as an exogenous variable. We follow some authors and include variables commonly used to control for stabilisation policies in transition, which may influence economic performance: inflation, budget deficit, domestic investment, and foreign direct investment. In our specification, we treat these control variables as exogenous.

Over the last 20 years TCs have been going through similar reforms, although with different sequences and speeds. Hence, it is possible that those countries suffered some universal time-related shocks. Moreover, some TCs experienced economic, financial, and political integration or disintegration (particularly the countries of former Yugoslavia), which implies possible time-related interdependencies between countries. Hence, we include in our specification time-dummy variables in order to control for potential common time-related shocks.

Hence, our model specification has the following form:

$$\ln gdppc_{it} = \hat{\alpha} + \hat{\beta} \ln gdppc_{it-1} + \hat{\lambda} inst5_{it} + X_{it}\hat{\delta} + Y_t \hat{\gamma} + u_{it} \qquad (1)$$
$$u_{it} = v_i + \varepsilon_{it}$$

where $i = 1, \ldots, 29$ indexes the TCs and $t = 1992, \ldots, 2007$ indexes the 16 years in the sample.[5] The dependent variable in (1) is the natural logarithm of

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[4]   See our on-line *Appendix 1* to this paper at www.efsa.unsa.ba/adnan.efendic

[5]   An important issue in any transition research is the observed time period, hence, sample size. Some authors, for example Falcetti et al. (2006), estimate their models starting from an earlier period of transition (1989), but not with the full sample (3 SEE countries are omitted). The supporting argument is that some countries (Central European) made significant progress in transition reforms during the initial period (1989–1992). However, the data for this initial

GDP per capita denoted as ln $gdppc_{it}$. ln $gdppc_{it-1}$ is the dependent variable with a one-year lag, while $\hat{\beta}$ estimates its effect on the current value of the dependent variable. $\hat{\alpha}$ is the regression intercept; $inst5_{it}$, the variable of interest, is the difference in the institutional index over a five-year period where $\hat{\lambda}$ measures the effect of institutions on the dependent variable. X_{it} is a $1 \times k$ vector of k control variables identified as important co-determinants of economic performance in transition, which includes domestic investment proxied by the gross capital formation as a percentage of GDP $(invest_{it})$, foreign direct investment (FDI) 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 annual rate of change of the consumer price index (cpi_{it}), and, finally, initial conditions proxied by GDP per capita (Purchasing Power Parity, income per capita in 1989 US dollars in logarithmic form: lh initial$_{it}$). $\hat{\delta}$ is a $k \times 1$ vector of parameters to be estimated. Y_t is a vector of time dummies to be estimated ($t = 1993 \ldots 2007$). Finally, u_{it} is a composed error term, made up of two components: v_i, the group-level effects, which control for all unobserved influences on countries' economic performance that can be assumed constant (or, at least, slowly moving) over the sample period; and $\hat{\varepsilon}$ the observation-specific error term. The strategy of specifying independent variables as percentage changes or as ratios to GDP ensures their stationarity and thus precludes spurious regression (Redek – Susjan 2005). Further explanation of the variables, including data sources, is available in our on-line *Appendix 2*.[6]

Our dynamic model estimates the short-run effect on economic performance of the most recent medium-term changes in institutional quality conditional on the effects of the entire history of institutional reform under transition. We demonstrate this feature by simplifying our specification, while preserving essentials: in equation 2, γ_{it} is the level of per capita GDP of country i in year t, Δx_{it} is the change in institutional quality in the previous five years, and u_{it} is the usual error term. Starting with our simplified specification in equation 2, we repeatedly substitute for the lagged dependent variable.

Substitute for γ_{it-1} in (2):

$$\gamma_{it} = \hat{\lambda}\gamma_{it-1} + \hat{\beta}\Delta x_{it} + u_{it} \tag{2}$$

$$\gamma_{it-1} = \hat{\lambda}\gamma_{it-2} + \hat{\beta}\Delta x_{it-1} + u_{it-1} \tag{3}$$

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period are not reliable and not available for all transition economies. Accordingly, we follow the advice of Beck – Laeven (2006) and rely on data from a more stable period of transition (1992–2007), which entails the advantage that our model can be estimated for the full sample of transition countries (29) with correspondingly more observations (325).

[6]   www.efsa.unsa.ba/adnan.efendic

Substitute (3) into (2)

$$\gamma_{it} = \hat{\lambda}(\hat{\lambda}\gamma_{it-2} + \hat{\beta}\Delta x_{it-1} + u_{it-1}) + \hat{\beta}\Delta x_{it} + u_{it}. \tag{4}$$

Substitute for γ_{t-2} in (4):

$$\gamma_{it-2} = \hat{\lambda}\gamma_{it-3} + \hat{\beta}\Delta x_{it-2} + u_{it-2}. \tag{5}$$

Substitute (5) into (4)

$$\gamma_{it} = \hat{\lambda}(\hat{\lambda}\left[\hat{\lambda}\gamma_{it-3} + \hat{\beta}\Delta x_{it-2} + u_{it-2}\right] + \hat{\beta}\Delta x_{it-1} + u_{it-1}) + \hat{\beta}\Delta x_{it} + u_{it}.$$

Gather terms

$$\gamma_{it} = \hat{\lambda}^3\gamma_{it-3} + \hat{\lambda}^2\hat{\beta}\Delta x_{it-2} + \hat{\lambda}\hat{\beta}\Delta x_{it-1} + \hat{\beta}\Delta x_{it} + \hat{\lambda}^2 u_{it-2} + \hat{\lambda}^2 u_{it-1} + u_{it} \tag{6'}$$

… and so on.

By repeated substitution, we demonstrate that dynamic specifications, through the lagged dependent variable, contain the entire history of the independent variables. In equation (6'), we find that current GDP per capita is influenced not only by the most recent institutional changes $(\hat{\beta}\Delta x_{it-1})$, but also by the cumulated effects from institutional changes one period back $(\hat{\lambda}\hat{\beta}\Delta x_{it-1})$ and two periods back $(\hat{\lambda}^2\hat{\beta}\Delta x_{it-2})$, although these persistence effects attenuate the more remote the period (shown by the increasing exponent on $\hat{\lambda}$). Further substitutions demonstrate that our dynamic specification includes the whole history of institutional reform that influences the current level of per capita GDP. By taking this history into account, we are able to identify the additional short-run effects on per capita GDP of recent – medium-term – institutional changes. In turn, these are informative about the process of adjustment of per capita GDP to institutional change. By taking account of the effects of all past institutional changes (reforms) together with estimating the effect of current adjustment to the most recent change, our dynamic model enables the level of per capita GDP to be explained by changes in institutional quality, which is consistent with our earlier discussion motivating the choice of level of per capita GDP as our measure of economic performance. To anticipate the estimates reported below, because the effects of current adjustment do not induce further rounds of effects through time (shown by the non-significance of the long-run coefficient on institutional change), the effects of institutional change on per capita GDP are fully accounted for by the history of institutional change and current adjustment.

Finally, following good practice guidelines suggested by a number of authors, in our on-line *Appendix* we explain our preference for a dynamic panel model estimated by the System General Method of Moments (SGMM), including also a discussion of the model diagnostics and how we address potential endogeneity in the model *(Appendix 3).*[7]

4. EMPIRICAL FINDINGS

The estimated model suggests that per capita GDP was strongly autoregressive in the 1992–2007 period. In other words, the main determinant of per capita GDP in the current period is per capita GDP in the previous period *(LngdppcL1).*[8] The size of the estimated persistence effect (0.913) together with its high level of statistical significance suggests that the current level of per capita GDP reflects the entire history of the process by which it is determined, which includes all previous institutional developments (Greene 2008: 469).[9] Conversely, the estimated models reported in *Table 1* suggest that the impact of current developments on current per capita GDP is limited. However, recent institutional improvement is an exception; this does have an effect on current per capita GDP.

Our variable of interest *(inst5)* is statistically significant and exerts an economically substantial influence on economic performance. We estimate a dynamic panel model in a Log-Lin form. Hence, 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. This implies that as institutions improve, increasingly large absolute improvements are needed to yield a given increase in GDP per capita. For example, very poor institutions with an index of 0.1 require an absolute improvement of only 0.01 to give a percentage improvement of 10 per cent, while excellent institutions with an index of 0.9 require an absolute improvement of 0.09 – i.e. almost to "perfection" – to give a similar percentage improvement. In other words, absolute improvements in institutional quality are subject to diminishing returns. Indeed, intuitively, this must be the

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[7]   www.efsa.unsa.ba/adnan.efendic
[8]   Deeper lags of the dependent variable proved to be insignificant.
[9]   Greene is definitive on this point (2008: 469): "Adding dynamics to a model … creates a major change in the interpretation of the equation. Without the lagged variable, the "independent variables" represent the full set of information that produce observed outcome y_{it}. With the lagged variable, we now have in the equation the entire history of the right-hand-side variables, *so that any measured influence is conditional on this history;* in this case, any impact of (the independent variables) x_{it} represents the effect of *new* information."

Table 1. Base model – SGMM dynamic panel – two-step robust estimate

The dependent variable is the natural logarithm of GDP per capita in current US$ *(Lngdppc)*	PREFERRED MODEL: *Inst5* exogenous	ALTERNATIVE MODEL: *Inst5* endogenous
variables (SHORT EXPLANATION OF VARIABLE)	COEFFICIENTS	COEFFICIENTS
constant (INTERCEPT TERM)	–0.220 (–0.59)	–0.488 (–0.89)
lngdppcL1. (LAGGED DEPENDENT VARIABLE, 1st LAG)	0.913 *** (10.88)	0.880 *** (9.69)
Inst5 (INSTITUTIONS, 5 YEAR DIFFERENCE)	0.403 ** (2.28)	0.438 ** (2.04)
cpi (INFLATION, ANNUAL AVERAGE IN %)	–0.001 (–0.78)	–0.0001 (–0.59)
budget (BUDGET DEFICIT, % GDP)	0.001 (0.14)	–0.001 (–0.14)
fdiper (FDI INFLOW, % GDP)	–0.003 (–1.57)	–0.003 (–1.61)
invest (DOMESTIC INVESTMENT, % GDP)	0.003 (1.37)	0.003 (1.12)
lninitial (INITIAL CONDITIONS, GDP PPP 1989)	0.129 (1.10)	0.193 (1.34)
Year dummies for 1996 to 2007:		
_Iyear_1996	–.253 ** (–2.61)	–0.347 ** (–2.31)
_Iyear_1997	–.351 *** (–3.84)	–0.380 *** (–3.56)
_Iyear_1998	–.331 *** (–3.22)	–0.341 ** (–2.66)
_Iyear_1999	–.420 *** (–3.90)	–0.435 *** (–3.78)
_Iyear_2000	–.290 ** (–2.69)	–0.349 *** (–2.98)
_Iyear_2001	–.225 ** (–2.31)	–0.268 *** (–2.78)
_Iyear_2002	–.196 ** (–2.15)	–0.216 ** (–2.28)
_Iyear_2003	–.115 (–1.45)	–0.131 (–1.53)
_Iyear_2004	–.087 (–1.45)	–0.109 * (–1.76)

Table 1. continued

| _Iyear_2005 | −.086 **
(−2.13) | −0.111 **
(−2.66) |
| _Iyear_2006 | −.067 **
(−2.51) | −0.089 ***
(−3.22) |

Notes: *; **; *** denotes test statistic significance at the 10%, 5% and 1% levels, respectively. T-statistics (in parentheses) computed from cluster-robust SEs.

Source: Authors' calculations using STATA 12.

Model diagnostics

Number of observations	325	325
Number of groups (countries)	29	29
Number of Instruments	41	56
F-test of joint significance: Ho: The estimated coefficients on the independent variables are jointly equal to zero	$F_{(18, 28)} = 2,310$ Prob > F = 0.000	$F_{(18, 28)} = 2,775$ 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	z = −2.48 Pr > z = 0.013
Arellano-Bond test for AR(2) in first differences: H_0: There is no second-order serial correlation in residuals	z = −1.78 Pr > z = 0.075	z = −1.72 Pr > z = 0.085
Hansen J-test of overidentifying restrictions (a check that the overall model specification is valid): H_0: all overidentifying restrictions (all overidentified Instruments) are valid (exogenous)	chi2 (22) = 14.44 Prob > chi2 = 0.885	chi2 (37) = 14.57 Prob > chi2 = 1.000

Difference-in-Hansen tests of exogeneity of GMM Instrument subsets:

Hansen test excluding the differenced Instruments on the levels equation – a test of the validity of the Instruments on the differenced equation: H_0: Instruments on the differenced equation are exogenous (valid)	chi^2 (10) = 12.32 Prob > chi2 = 0.265	chi^2 (26) = 10.80 Prob > chi2 = 0.996
Hansen test excluding SGMM Instruments (the differenced Instruments on the levels equation); in effect, a test of system versus difference GMM: H_0: GMM differenced-Instruments on the levels equation are exogenous	chi^2 (12) = 2.12 Prob > chi2 = 0.999	chi^2 (11) = 3.77 Prob > chi2 = 0.976

Table 1. continued

Hansen test excluding the Instruments on the lagged dependent variable: H_0: All other Instruments –*Inst5* and the exogenous variables – are exogenous (valid)	Not applicable	chi2 (36) = 16.51 Prob > chi2 = 0.998

Difference-in-Hansen tests of exogeneity of standard IV Instrument subsets:

Test of the joint validity of all GMM Instruments: H_0: GMM Instruments without "IV" Instruments are exogenous	chi2 (4) = 4.21 Prob > chi^2 = 0.378	chi2 (20) = 14.54 Prob > chi^2 = 0.802
H_0: Standard 'IV' Instruments are exogenous and they increase the Hansen J-test	chi2 (18) = 10.22 Prob > chi^2 = 0.924	chi2 (17) = 0.03 Prob > chi^2 = 1.000

Source: Authors' calculations using STATA 12.

case; for as institutional quality approaches the ceiling of one, so the potential for institutional improvement to raise economic performance is reduced.

It is instructive to compare the estimated short-run impact effect reported in *Table 1* and the long-run cumulated impact reported in *Table 2*. The former is statistically significant, whereas the latter is not. This suggests that recent institutional improvement sustained over the medium term (five years) adds to current per capita GDP, but that this is a current impact effect only, hence does not cumulate thereafter into a larger long-term effect. After five years, the effects of institutional improvement are discernable – in our sample – in a higher level of per capita GDP and thus a higher platform for all future economic activity. In that sense, the benefits of institutional improvement are long-run (indeed, permanent). However, the combination of a statistically significant short-run (impact) coefficient and an insignificant long-run coefficient suggests a once-and-for-all economic performance effect from institutional improvement over the medium term. In sum, institutional change previously sustained over the medium term changes the current level of GDP per capita and thus sets a new starting level for the future evolution of GDP per capita.

The coefficient on the lagged dependent variable captures the entire historical process, including institutional development, culminating in the current level of per capita GDP. The coefficient on the institutional change variable measures the

Table 2. Long-run effect of changes in institutions on economic performance

Variable	Long-run coefficient	SE	t-statistic	P>|t|
Inst5	4.64	5.80	0.80	0.431

Source: Authors' calculations in Stata 12.

additional impact of recent medium-term changes in institutional quality on current GDP. Accordingly, our model encompasses *both* the effects of institutional reform on per capita GDP during the history of transition *and* the additional effects of the most recent changes.

In comparison to some other transition panel models (Redek – Susjan 2005; Falcetti et al. 2006; Eicher – Schreiber 2010), in our model the institutional variable in the current or previous period does not appear as significant, suggesting that if institutional change does influence economic performance, then it does so only when sustained over a longer – but medium-term – period. 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: 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 time-related cross-country shocks – although these may not be specific to transition – which otherwise would induce cross-sectional dependence in the residuals. (This is why panel models should be specified with time dummies.)

Since the other variables in the model are not our primary interest and are not estimated with conventionally acceptable levels of precision, we will just briefly comment on them. FDI inflow as a percentage of GDP in per capita terms *(fdiper)* has a 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, they appear as significant and positive influences on economic performance. In these models, the institutional variable remains statistically significant with almost the same magnitude, although the model diagnostics substantially worsen (most likely reflecting degrees of freedom lost by lagging these variables). Since these variables are not of primary interest, we report only the base specification with better model diagnostics. Finally, better initial conditions *(lninitial)* in 1989 have a positive sign, suggesting an 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 – Susjan (2005); the finding on FDI inflow is also consistent with Carkovic – Levine (2005).

We conducted a range of robustness checks. These checks investigate the sensitivity of our results to different time-horizons over which recent institutional changes influence economic performance, the inclusion of dummy variables for EU integration and different groups of TCs, the use of "external" instruments for institutional influence, and different endogeneity assumptions, including a systematic robustness analysis of the chosen specification implemented through a simple variant of extreme abound analysis. Since we are limited with respect to space, we report the main findings in our on-line *Appendix 4*.[10]

5. CONCLUSIONS

Our study confirms the economic importance of institutions in post-socialist transition and adds some new findings.

Firstly, we find that per capita GDP is determined by the entire history of institutional reform and that, conditional on this history, per capita GDP adjusts in addition to recent or medium-term institutional changes. Moreover, we find that the time-horizon over which we measure institutional performance matters. We could identify neither a statistically significant contemporaneous influence of improving institutions on economic output, nor a significant effect arising from institutional changes measured over periods longer than five years. Instead, we were able to identify positive and significant effects most robustly when these arose from five-year differences in our measure of institutional quality. This relationship is quite strong: a 10% increase in the quality of institutions over the previous five years increases GDP per capita in transition countries by 4%, on average. We also find that absolute improvements in institutional quality are subject to diminishing returns. As institutional quality approaches the ceiling of index equal to one, so the potential for institutional improvement to raise economic performance is reduced.

Our model takes into account the long term. Our estimated institutional effects are conditional on the entire history of institutional improvement (and, indeed, of all of the independent variables). However, we find that the response of economic performance to institutional improvement is a medium-term effect. Institutional change previously sustained over the medium term changes the current level of GDP per capita and thus sets a new starting level for the future evolution of GDP per capita. Moreover, this institutional effect is realised once and for all, because it does not cumulate into a larger effect over time. In sum, our model estimates the current effect of recent medium-term institutional improvement on economic

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[10]   www.efsa.unsa.ba/adnan.efendic

performance over and above the effects of the previous history of institutional improvement.

Secondly, our findings suggest that the 29 transition countries as a whole suffered from universal time related shocks captured by period (year) dummy variables. An implication of this finding is that models omitting period dummies are misspecified.

We set out some features of good practice in the study of institutional effects on economic performance. We advanced three ways to increase the validity of reported results: (1) in the absence of precise guidance from institutional theory on model specification, we consult meta-analysis of the literature for guidance on the implications of competing specification choices; (2) we endorse dynamic panel modelling as the preferred approach to identifying institutional effects on economic performance, and a SGMM approach to estimation, while insisting more than previous studies do on the importance of model diagnostic tests and checks; and (3) a further corollary of lack of guidance from theory on model specification is the requirement to conduct systematic checking of the robustness of reported results by comparison with results from competing specifications, to which end we propose a variant of extreme bounds analysis designed to check the robustness of dynamic panel estimates. (These features of good practice are all reported and discussed in the on-line *Appendix 4* accompanying this article: www.efsa.unsa.ba/adnan.efendic.)

Finally, from the perspective of political decision-makers, the preferred results are probably not very "encouraging", because the effects of institutional improvement appear to work over longer time-horizons than the typical electoral cycle. This may point to an inconsistency between policy-makers' short-run priorities and sound policies for the medium and/or long run. This adds to the better understanding of lagging institutional reforms and improvements in some TCs, and so may help to inform potential strategies for maintaining and/or renewing impetus to institutional reform.

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