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Institutions And Growth: Time Series Evidence from Natural Experiments*

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Abstract:

Documenting the long term impact of institutions on economic performance has generated tremendous interest in the development literature. Contemporary or intermediate term effects of institutions over time are difficult to establish, however, since institutions seldom change significantly in the short run. In addition, accepted instruments that control for endogeneity of institutions in cross sections are inappropriate for time series analysis. In this paper we utilize an eleven year panel of 26 countries with sufficient institutional variation to identify large and significant short and intermediate effects of institutions. To control for endogeneity, we utilize the *hierarchy of institutions* hypothesis and find that it holds strong explanatory power. A 10 percent change in institutional quality towards OECD standards is shown to raise annual growth by 3.5 percent. In discriminating between short run and intermediate term effects, we can also document that early reformers reap the greatest benefits, but that it is never too late to begin institutional reform.

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I) Introduction

A growing strand of the empirical growth literature focuses on the explanatory power of institutions to account for differences in living standards across countries. As institutions are assumed to evolve slowly, empirical studies emphasize the long-term influences of institutions on income levels (e.g., Hall and Jones 1999, and Acemoglu et al. 2001).[1] Instead of examining long-term effects of institutions in a cross section, we investigate the contemporary effects of institutional change on economic growth in a panel of countries over 11 years. By exploring the time series dimension, we can isolate the effects of institutional change on economic growth in the short and intermediate term.

While panel analysis is informative to disentangle the effects of institutions on economic performance, it has not been popular in the literature because of two serious methodological problems. The panel approach requires sufficiently large institutional variation, and relevant instruments to control for endogeneity of institutions. We resolve both issues by utilizing a different natural experiment: the destruction of the Iron Curtain. The subsequent economic performance of transition countries has been closely linked to differences in the change of institutions across countries (see e.g. Roland 2000 and Figure A1).[2] The overriding feature in our country panel is institutional change in two dimensions. First, economic institutions evolved from centrally planned towards market-based systems at varying speeds. Second, political institutions moved toward more democracy and greater constraints on the executive branch of government after the fall of one-party regimes. The transition experience may thus provide a unique sample with sufficient variation in institutional quality across time and countries to identify the short- and intermediate-term influences of institutional change on economic performance.

The endogeneity of institutions is a serious problem that has been amply documented in the previous literature. Fixed-effects panel analyses cannot utilize established cross sectional instruments (such as latitude, language, or settler mortality).

[1] For example, colonial history is shown to impact current institutions and thus current output levels.

[2] Economic performance and institutional quality in transition countries differ substantially. One group (including Poland, Hungary, and the Baltic states) improved institutions significantly, moving from weak institutions to near OECD standards. Other countries (including Turkmenistan and Uzbekistan) experienced little change, while a third group (including Belarus and Russia) showed little improvement and/or experienced institutional quality reversals.

The task is to identify new instruments that are uncorrelated with the disturbances, but vary sufficiently over time to isolate the effects of ongoing institutional change on economic performance. Here we utilize the notion of the *hierarchy of institutions* (Williamson 2000, Acemoglu et al 2004, and Roland 2004) to address endogeneity. Positing that political institutions influence the equilibrium economic institutions that subsequently determine economic outcomes, we use political institutions as instruments in our analysis of the effects of economic institutional change on economic growth.

We approach the empirics in two stages. In the tradition of the long-run institutions literature, we first report cross section results that establish the effects of initial institutional conditions on subsequent income and growth (see also Knack and Keefer 1995 and Barro 1997 among numerous studies for OLS growth regressions that include institution indices). After establishing the long-term effects of institutions, we use the 11 year panel to examine both short- and intermediate-term effects of institutions across economies, while also testing the hierarchy of institutions hypothesis.

The cross section results attribute strong explanatory power to initial institutional quality to account for subsequent income levels and growth rates. For example, a 10 percent increase in the initial level of institutional quality towards OECD standards is shown to increases income levels 11 years later by a staggering 38 percent, or 2.97 percent per annum. In addition, institutions explain a stunning 40 percent of the variation in subsequent growth in the cross section. These results replicate the long-lived impact of institutions on economic performance, as well as a great degree of path dependence that has been documented in large cross country samples by authors such as Hall and Jones 1999 and Acemoglu et al. 2001.[3]

The strong influence of the initial institutional environment in the cross section begs the question if countries that miss the early turn toward better institutions are inevitably stuck in a low growth transition path. The short- and intermediate-term effects of institutions that can only be established in the panel do not confirm this fear. Even after controlling for endogeneity, the effect of contemporaneous institutions on growth

[3] For the importance of initial conditions in transition countries see, for example, De Melo et al 1997.

may be larger than the pure cross-section estimate.[4] For example, a 10 percent improvement in institutions is shown to raise the annual growth rate by about 3.5 percent. Aside from documenting the pure institutional effects, we also uncover large differences in fixed effects across countries that are highly correlated with the proximity to the European Union. This may argue for the importance of fixed factors such as geography, climate, natural resources, etc. for the growth experience of the countries in our sample.

Finally, we examine the shape of the relationship between institutions and growth to find that *all* levels of institutional quality, no matter how weak, contribute to economic growth (although better institutions have a slightly larger marginal effect). This introduces doubts that the relationship between institutional quality and growth may be U-shaped.[5] Any argument that may support non-linearity, perhaps due to adjustment costs as mentioned by Falcetti et al. (2000), seems to be short-lived in our sample.

2) Data

We examine the institutional determinants of per capita GDP growth for 26 transition economies between 1991 and 2001.[6] Purchasing power parity per capita GDP is obtained from the World Development Indicators database, while the main indicators of institutional quality are taken from the various subcomponents of the European Bank of Reconstruction and Development (EBRD 2000, 2001, 2002) Economic Reform Index. Specifically, our institutional quality indicator includes eight EBRD indices on price liberalization, foreign exchange and trade liberalization, as well as small and large scale privatization, enterprise reform, competition policy reform, banking sector reform, and reform of non-banking financial institutions.

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[4] Most studies treat institutional change in transition countries as exogenous. Exceptions are Hebey and Murrell (1998) and Wolf (1999), who allow a feedback via structural reforms, as well as Berg et al. (1999) and Ghosh (1997), who instrument stabilization policies.

[5] De Melo et al. (1997a) find non-linear effects in a shorter sample; Berg et al. (1999) instead argues that negative impacts on the state sector were offset by positive effects in the private sector growth.

[6] Albania, Armenia, Belarus, Bulgaria, Croatia, Estonia, FYR Macedonia, Georgia, Hungary, Kazakhstan, Kyrgyz Republic, Latvia, Lithuania, Moldova, Poland, Romania, Russia, Slovak Republic, Slovenia, Tajikistan, Turkmenistan, and Ukraine. Because of data availability, several countries are restricted to shorter time series, Azerbaijan (1993 – 2001), Bosnia & Herzegovina (1997 – 2001), Czech Republic (1992 – 2001), Uzbekistan (1993 – 2001).

Most of the institutional indices are highly correlated as shown in table A1; hence we follow the lead of the previous literature and concentrate on the impact of one composite institutional index on economic performance.[7] As in Hall and Jones (1999), we sum the subindices into one broad composite index of institutional quality and normalize the aggregate index to a range from zero to unity. Zero represents the complete absence of market based economic institutions, while unity indicates an institutional standard similar to OECD economies. The median value across countries and time is 0.51. The time series of the index and GDP growth is shown in Figure A1.[8]

Political institution indices are obtained from the Polity IV database and reflect regime durability and executive constraint. Regime durability tracks regime stability, and executive constraints reflect the de facto independence of a country's executive branch. Both variables are popular instruments in cross section analysis (i.e., Acemoglu 2003, Acemoglu and Johnson 2003, Acemoglu et al. 2004, and Persson 2003).[9]

3) Exploratory Cross-Country Regressions

While we are ultimately interested in the time series dimension of institutions, we commence by examining the effects of initial reform on long run economic performance. Figures 1a and 1b show the positive correlation between economic institutions and standards of living across countries. They also reflect that the speed of institutional change has not been constant across countries. Some of the initial laggards (Estonia, Lithuania, and Latvia in particular) are now among the most institutionally advanced countries. Also, institutional quality has increased in some countries starting in the late 1990s, for example, in Albania, Moldova, and the Caucasus countries (Georgia, Armenia, and Azerbaijan).

[7] Sensitivity analysis in section 7 shows that the results are robust to alternative institutional specifications.
[8] To the degree that measurement error across indices is uncorrelated, this parsimonious approach to constructing our main index of institutions reduces the potential bias of the estimates.
[9] Standard caveats on the severe data problems in transition countries apply regarding difficulties in establishing deflators; deriving balance of payments measures; and inaccurate output reports. See Kaufman and Kaliberda (1996) as well as Johnson, Kaufman, and Shleifer (1997) for analyses regarding the extent of the shadow economy in transition economies.

Effects of Initial and Contemporaneous Institutions on Economic Performance

Figure 1a

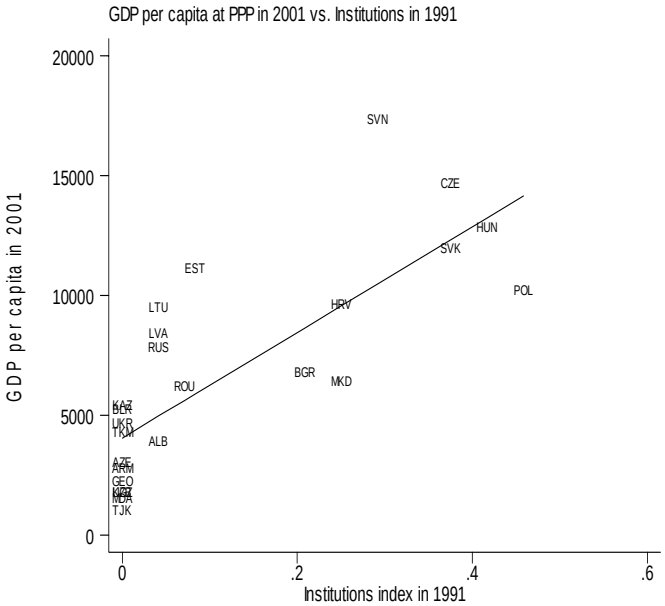
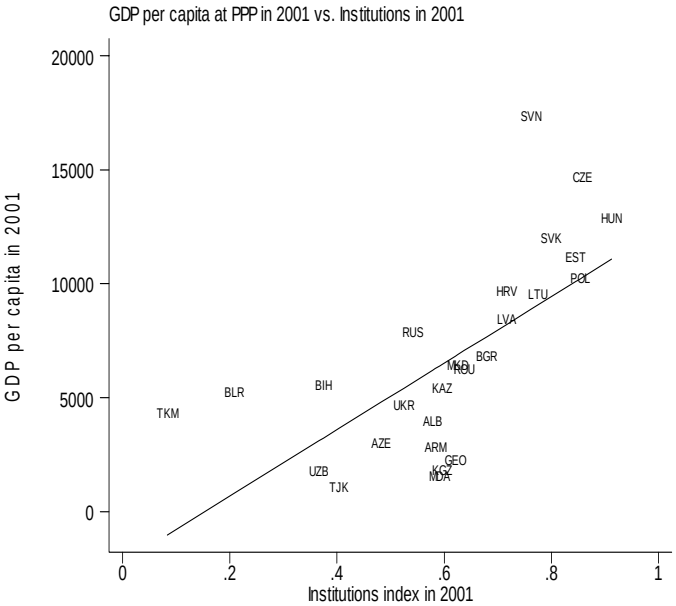


Figure 1b



A focus on early institutions follows a large body of literature which concentrates on the significance of initial conditions in the development process. Reviewing the transition process, Murrell (1996) suggests that political change and institutional change are related to initial conditions. The hypothesis is supported empirically by Balcerowicz and Gelb (1995); De Melo, Denizer, and Gelb (1997a); Fischer, Sahay, and Vegh (1996a,b); and Denizer (1997), who all include up to two initial conditions in their analyses. De Melo, Denizer, Gelb, and Tenev (1997b) extract principal components from 11 different initial conditions to again show the strong influence of initial conditions. The emphasis in this literature, however, has been on political transition, geographic, and/or industry conditions, not economic institutions as in this paper.

Beyond Figures 1a-b, table 1 documents the effects of initial reforms on subsequent income and growth.

Table 1
Effects of Initial Institutional Reform on Income and Growth

	Dependent Variables						
	OLS				IV, Instrument: Independence		
Regressors	Y_{2001}	Y_{2001}	Y_{2001}	$\hat{Y}_{1991-2001}$	Y_{2001}	Y_{2001}	$\hat{Y}_{1991-2001}$
Inst Index$_{1991}$	3.608***		2.737**	1.647***	3.813***		2.631*
	(0.629)		(0.980)	(0.304)	(1.102)		(1.352)
Inst Index$_{2001}$		2.326***	1.013			3.891***	
		(0.772)	(0.980)			(1.234)	
Y_{1991}				-0.020			-0.16
				(0.199)			(0.315)
R^2	0.49	0.34	0.52	0.39			
R^2 first stage					0.34	0.19	0.45
N	25	26	25	22	25	26	22

Superscripts */**/*** denote 10, 5, and 1 percent significance levels. White-Standard Errors in parentheses. A constant (not reported) was included in all regressions. $Y_t, \hat{Y}_t$ are the level (in logs) and growth rate of per capital output in year *t*, respectively.

The first column in table 1 reports OLS estimates of the relationship between the initial level of economic institutions in 1991 and income levels in 2001 as shown in figure 1a. It shows that about half of the variation in the dependent variable is explained by initial institutional conditions alone, the coefficient is highly significant. The simple regression predicts that a 10 percent increase in the initial institutional index increases the income level by 36 percent over the following 11 years. This attributes a massive effect to initial reform and provides support for a long run approach to institutions as in Hall and Jones (1999) and Acemoglu et al. (2001).

Column 2 reports a regression that identifies the effect of 2001 institutions on income levels in 2001. This examines the importance of contemporaneous institutional quality as shown in figure 1b. Again, institutions are highly significant at the 1 percent level. It is interesting to note, however, that 1991 institutions (column 1) explain a much larger share of 2001 output than 2001 institutions. Indeed, table 1 highlights that one could have predicted the 2001 per capita income more accurately by looking at 1991 institutions, than at the institutions in 2001. This point is further illustrated by column 3 which includes both the institutional index in 1991 and 2001, with only the former being statistically significant.

To obtain a first look at a dynamic impact of institutions we examine whether the level effect induced by initial conditions also translates into changes in subsequent

growth rates in the fourth column of table 1. This presents the best support of the significance of initial conditions in a cross section. Despite changes in institutions over the decade, our proxy for initial institutional conditions in 1991 is highly statistically significant. A 10 percent increase in the initial composite institutional quality index for a given country increases the growth rate for the next eleven years by 16 percent (or about 1.4 percent per annum). Note that the result holds up even if we add initial income in the regression, which is not significant. The early economic institutional environment thus shows a positive correlation with both the subsequent level of income and its growth rate.

To further argue for causality in this overview, in particular when the level of income is the dependent variable, it is necessary to find a suitable instrument for the institutional index in 1991. In the spirit of the variable that identifies the impact of colonial history on long term economic performance in Acemoglu et al 2001, we utilize a communist history indicator as an instrument for transition countries. The variable is a dummy that identifies whether a country was independent in 1988 or not. Previously independent countries did not have to form completely new institutions, while previously dependent countries (such as Croatia) had no choice but to start from scratch after they gained independence. Alternatively, previously independent countries (including Russia) could rely to a degree on existing economic and political institutions.

The last three columns in table 1 show the results of IV-regressions using independence in 1988 as an instrument. Note that the instrument is strong, as indicated by the first stage R-squared (except for the case of 2001 institutions). We take this as evidence that, although independence allowed better initial conditions for institutional change, a later catch-up was possible. Non-independent countries such as Lithuania, Latvia, Estonia, and Slovenia reformed rapidly, whereas independent countries such as Albania, Bulgaria, and Romania reformed more slowly in the first half of the 1990s. The second stage estimate of the effect of 1991 institutions on 2001 income remains similar to the OLS findings. The coefficient of institutions in 2001 increases substantially and reaches the same magnitude as the coefficient for institutions in 1991.

In summary, our cross sectional results in table 1 reveal that not only initial conditions, but also subsequent institutional change seems to contribute to long term economic performance. Even in this short time series, the effects of a better economic

institutional environment on income levels and growth are surprisingly significant, statistically and economically. The next step is to examine the significance of *ongoing and sustained* institutional improvements, as well as the importance of fixed factors (such as history and geography).

4) The Importance of Sustained Institutional Improvements: Time Series

The unique advantage of the panel dataset that cannot be obtained in cross-country studies is that we can trace the annual impact of institutional change over an eleven-year period. This allows us to extract information on how continuous institutional change affects economic performance. It would be a formidable task to conduct this analysis with any other set of countries, since institutions rarely change as dramatically and continuously as in our sample.

4a) Time Series Methodology

To estimate the impact of institutional change in our panel, we use a fixed-effects model to control for variables that do not change over time such as history, geography, etc. Such variables have been included in previous cross-country level regressions along with institutions as control variables or instruments. Due to their invariance, however, country history or geography cannot be introduced separately in fixed-effects panel analysis. We estimate fixed-effects OLS (LSDV) and system-GMM regressions for:

$$\hat{Y}_{i,t} = \alpha + \beta\, I_{i,t} + \gamma \ln Y_{i.t-1} + \eta_i + \varepsilon_{i,t} \qquad (1)$$

where $\hat{Y}_{i,t}$ is growth in country *i* at time *t*, *I* is the institutions index described above, *Y* is the income level, α is a constant, and η_i captures country specific fixed effects.

Before we report results, a discussion of the methodological issues is necessary. The LSDV estimator is biased in this dynamic panel as shown by Nickell (1981).[10] Recent simulation studies in a macroeconomic context (Judson and Owen 1999, Gaduh

[10] A Bhargava et al. (1982) test for the balanced panel indicates the presence of moderate first-order serial correlation (0.3) in the LSDV estimates. We correct for this using Baltagi and Wu (1999).

2002, Hauk and Wacziarg 2004) have demonstrated that the coefficient estimate on the lagged dependent variable is severely biased downwards, whereas the other coefficients are less affected. Kiviet (1995) derived a correction for this bias in LSDV regressions. Here we use the LSDV estimates together with OLS regressions without fixed effects to check whether the system-GMM results differ as predicted by simulation studies - the coefficient on lagged income should then lie between the LSDV and OLS estimates.

Blundell and Bond (1998) have proposed a system-GMM estimator as more appropriate for dynamic panel estimation with highly persistent yet stationary variables.[11] In a growth framework this technique has been used by Bond, Hoeffler, and Temple (2001). We conduct a Levin, Lin, and Chu (2002) test, which rejects the null hypothesis of a common unit root for both the growth rate and the institutional quality index. In addition, an Im, Pesaran, and Shin (2003) test rejects the null hypothesis of individual unit roots at the 1 percent confidence level for both growth rates and for the composite institutional quality indices.

Following Bond, Hoeffler, and Temple (2001) we express the GDP series in deviations from time means in all panel estimations. This correction eliminates a *common* time trend in GDP per capita across all countries over the eleven-year horizon. The assumption of trend-stationarity of GDP in a panel of countries is standard in the empirical growth literature (see Temple 1999).

For the OLS regression we also calculate three year growth averages, $\overline{Y}$, for 1992 to 1994, 1995 to 1997, 1998 to 2000, which we regress on the institutions index and the lagged level of GDP in the respective initial period. This is a common estimation method, see, for example, Acemoglu et al. (2003) who utilize ten-year periods, and by Burnside and Dollar (2000) who employ four-year intervals.

Below, we concentrate on the system-GMM coefficients as the most reliable estimates. Since endogeneity and measurement error are potential problems, the GMM estimation necessitates more distant lags of the dependent variables (see Bond 2002). We use 3 through 6 period lags of the dependent variables as instruments (as well as the second lag of the first differences). To avoid overfitting bias, once the number of

[11] Hauk and Wacziarg (2004) and Bond, Hoeffler, and Temple (2001), among others, show that the difference-GMM estimator (Arellano and Bond 1991) is not necessarily appropriate in the growth context. Here, highly persistent time series introduce a weak instrument bias to the estimation.

instruments increases relative to the number of observations, we restrict the instruments to one for each variable and lag. In this case, the p-values of a Sargent-overidentification test are 0.766, 0.706, and 0.638 for columns three, four, and five in table 2 respectively, suggesting that our estimation strategy is valid.

4b) Time Series Evidence

In estimating equation (1) Table 2 establishes two benchmarks: one for the effect of ongoing institutional reform on the annual growth rate, the other regarding the size of the parameter estimates.

Table 2
Dynamic Effects of Institutions on Growth

	Dependent Variables			
Regressors	LSDV $\hat{Y}_{i,1992-2001}$	OLS $\overline{Y}_{i,1992-2001}$	System-GMM $\hat{Y}_{i,1992-2001}$	System-GMM $\hat{Y}_{i,1992-2001}$
Inst. Index$_t$	0.452*** (0.045)	0.246*** (0.035)	0.350*** (0.069)	0.273*** (0.082)
Y_{t-1}	-0.301*** (0.036)	-0.016* (0.010)	-0.078*** (0.022)	-0.112** (0.043)
Inst. Index$_{1991}$ * Inst. Index$_t$				0.036 (0.024)
R^2	0.43	0.42		
N	244	73	249	249

Superscripts */**/*** denote 10, 5, and 1 percent significance levels. Standard Errors in parentheses. White standard errors for OLS regression.

Concentrating on the system-GMM coefficient first, as the most reliable, we find that a 10 percent increase in the institutional index leads raises the growth rate by 3.5 percent per annum. This magnitude of the estimate for *ongoing* institutional reform is thus about twice the size of the estimate for effect of the *initial* institution level reported in table 1 (17 percent over 11 years, or 1.4 percent per annum). Despite the importance of initial conditions that has been documented in the literature, we can now identify that ongoing institutional change is even more important when a country is in transition to OECD institutional standards.

The effect of ongoing reform changes only marginally when we examine alternative time periods or if an interaction term is included. The lack of statistical significance for the interaction term indicates that it is possible to experience excellent growth performance when a country initially starts without good institutions. Indeed, the last column in table 2 indicates that ongoing reform is the crucial determinant and it does not need to be influenced by the initial level of institutions. The interaction term is not statistically significant, whereas the institutions index, by itself, stays highly significant and also remains close to the estimates without the interaction term. This implies that there is no growth bonus in later years for countries that reform early, and on the flip side, there is also no penalty for later reformers as long as they eventually reach the appropriate institutional levels. Our results support the findings of De Melo et al. (1997a,b) and Berg et al. (1999) who argue that the quantitative impact of initial conditions is small and rapidly declining over time.

The convergence estimate is very similar to the results of Bond, Hoeffler, and Temple (2001) implying a speed of conditional convergence of about 2 percent. Given identical progress in the institutional environment, the estimate thus implies conditional convergence at speeds similar to OECD countries. It is important to note, however, that all 26 countries are "by construction" in transition; hence any suggestion of convergence to a steady-state may be premature.

In comparing the GMM results to the OLS and LSDV approaches, it can be noted that the coefficient on institutions is upwards biased in the LSDV regression if the institutions index is positively correlated with the lagged level of GDP per capita (see Nickell 1981). A positive correlation is indeed a standard result in the long run institutions literature that has been discussed above. As expected, the GMM convergence and institutions coefficients lie between the LSDV and OLS estimates. The R-squared of both the LSDV and the OLS regression are around 0.4, indicating that the large degree of growth variations that can be explained by institutional change in the panel is of similar magnitude as in the cross section above.

Unfortunately the impact of initial institutions alone cannot be included separately into the regression, as they are they are part of the country-specific fixed effects. The fixed effects associated with the LSDV regression are reported in table 3.

Table 3
Country Fixed Effects
Dependent variable: output growth 1992-2001

Country	Fixed Effect	Brussels Distance	Country	Fixed Effect	Brussels Distance	Country	Fixed Effect	Brussels Distance
Slovenia	0.30	1352	Russia	0.12	2607	Kazakhstan	0.01	6000
Czech Rep.	0.22	913	Poland	0.11	1338	Albania	-0.06	2427
Slovak Rep.	0.16	1223	Turkmenistan	0.10	6000	Azerbaijan	-0.11	4321
Croatia	0.15	1399	Lithuania	0.10	1785	Armenia	-0.19	4167
Hungary	0.15	1412	Romania	0.09	2234	Uzbekistan	-0.26	6000
Bosnia	0.14	1311	Bulgaria	0.08	2175	Georgia	-0.27	4193
Belarus	0.12	1881	Macedonia	0.08	2225	Kyrgyz Rep.	-0.31	6000
Estonia	0.12	2508	Latvia	0.06	2197	Moldova	-0.37	2233
			Ukraine	0.02	2215	Tajikistan	-0.44	6000

Although the fixed effects are likely to be slightly biased, their respective ranking can offer insights about the impact of fixed factors such as initial institutional conditions and geography on growth differences across countries. Countries farther removed from the EU border seem to exhibit lower fixed effects. The correlation between the size of the fixed effects and the distance to Brussels index obtained from Fidrmuc (2001) is surprisingly large (r = -0.68). This argues for the importance of geographic or other non-varying factors such as an EU-Accession-Country bonus. The correlation between the size of the fixed effects and initial institutional levels is of the same magnitude, (r = 0.60). The fixed effects may, of course, also reflect other factors such as ethnolinguistic fragmentation and/or resource abundance.

5) Robustness Part I: Alternative Instruments

The previous regressions clearly show that institutions and institutional change matter even in the short run. Significant growth effects can be observed not only in cross sections but also in a panel. As pointed out, however, any OLS and LSDV estimates suffer from endogeneity bias. An event that influences growth rates, such as a war, may well affect institutional change, thus leading to a correlation between the explanatory variable and the error term. Alternatively, countries with higher growth rates are eventually richer, which may make it easier to afford better institutions. No formal

model of this endogeneity exists; however, previous empirical models have clearly documented that instruments must be found to control for endogeneity.

The previous literature addressing the endogeneity of institutions (Hall and Jones 1999 and Acemoglu et al. 2001) is based on cross-sectional studies. The instruments that have been popularized by this literature do not suffice for our purposes since predicted trade shares, settler mortality, language, geography, or climate all are time invariant and cannot serve as instruments for evolving institutions in a panel of countries. In addition to using lagged values of the dependent variables as instruments as we did above, we now examine the *hierarchy of institutions* hypothesis to derive possible instruments.

Conflicting interests over distribution of resources imply that groups with greater political power are more likely to secure the economic institutions they prefer. To this end we define as long-term political institutions those that change infrequently but nevertheless impact economic institutions in the short run. There are a number of indices available that speak to the quality of political institutions. The Polity IV data on regime durability and constraint on the executive branch have been identified as strong, significant instruments in cross sectional analyses (see Acemoglu 2003 and Acemoglu and Johnson 2003 among numerous others).

"Durability of the regime" tracks regime stability, and "constraints on the executive" tracks the de facto independence of the executive branch of a country. We create a dummy variable that is 1 if a political regime as has been stable for 5 years or longer and is 0 otherwise. In order to implement sustained improvements in economic institutions, regime stability is certainly a necessary condition. We argue that the constraints placed on the executive are likely to have a positive effect on the quality of economic institutions (see, for example, Hellman 1998). Checks and balances, along with more democratic political constitutions, provide larger incentives for the ruling governments to implement more efficient (i.e. market-based) economic institutions. These measures are treated as exogenous in our short-run panel analysis, although they may well be endogenous in the long run. Theoretical and empirical support for our choice of instruments is also provided by a prominent strand of the literature that documents extensive links between political transition and the intensity of economic

institution reform (e.g., Balcerowicz and Gelb (1995), De Melo, Denizer, and Gelb (1997a), and Aslund, Boone, and Johnson (1996) and Shleifer (1997)).[12]

We utilize the hierarchy of institutions approach in both the LSDV regressions (to show the strength of the instrument) and the system-GMM approach (to derive the coefficients). For the first stage of the LSDV estimation we regress the economic institutions index on the lagged level of GDP per capita, the dummy variable capturing the durability of the current regime, the constraint on the executive and fixed effects. The goodness of fit in the first stage is substantial; political institutions explain 37 percent of the variation in economic institutions. This indicates sufficient strength of our instruments, which are also of the expected positive sign. The dummy for regime stability is significant at the 1 percent level, whereas the constraint on the executive is significant at the 11 percent level in the first stage. Having established that the instrument is strong enough in LSDV regressions, we present the system-GMM estimates of (1) in table 4.

Table 4
Dynamic Effects of Institutions on Growth, System-GMM

	Dependent Variables	
	Instruments: Executive Constraint; Regime Duration	Instruments: Lagged Institutions (t – 3)
Regressors	$\hat{Y}_{i,1991-2001}$	$\hat{Y}_{i,1991-2001}$
Institution Index$_t$	0.389***	0.321***
	(0.065)	(0.054)
Y_{t-1}	-0.100***	-0.073***
	(0.024)	(0.020)
R^2 first stage	.37	.66
N	263	270

Superscripts */**/*** denote 10, 5, and 1 percent significance levels.
Standard Errors in parentheses.

The hierarchy of institutions results are shown in column 1 of table 4. They are close to the GMM results in table 2 which use lagged values of the dependent variables as

[12] Since we obtain our hierarchy of institutions instruments from the Polity IV database, this identification strategy will also eliminate possible bias due to measurement error in the economic institutions index from the EBRD if measurement error is uncorrelated across the two data sources. This may explain the slightly larger coefficient estimate if hierarchy of institutions instruments are used rather than lagged values of the economic institutions index in table 4.

instruments and are reproduced in column 2 in table 4.[13] We also compute a Sargent test for overidentifying restrictions for the hierarchy of institutions estimates.[14] We do not reject the null hypothesis of correct specification at the 10 percent level. Thus table 4 provides strong evidence for the hypothesis of using political institutions as instruments for economic institutions.

Table 4 provides three encouraging lessons. First, economic institutions matter for growth in our natural experiment even in the short run. Second, the results of section 4 are robust to using different identification strategies. Finally, the hierarchical approach to institutions provides important new instruments for panel studies.

6) Robustness Part II: Identifying the Importance of Sustained Institutional Change

The previous sections documented not only that the significant effect of institutional change on growth is robust with respect to identification strategy, but also that sustained institutional change is crucial for economic performance. In this section we seek to establish if institutional thresholds exist that must be overcome in order to benefit from institutional change, or which signal higher returns to institutional change. One hypothesis to be explored is that distinct levels of institutional qualities have different effects, either in magnitude or sign, on economic growth.

We divide our institutional index into six categories of equal range and create the dummy variables: *worst institutions* (index = 0 – 0.167; 39 observations), *weak institutions* (0.168 – 0.334; 33 observations), *below average institutions* (0.335 – 0.5; 49 observations), *above average institutions* (0.501 – 0.667; 76 observations), *strong institutions* (0.668 – 0.834; 54 observations), and *best institutions* (0.835 – 1.0; 9 observations). This categorization allows us to identify the contribution of alternative institutional quality *levels* on economic performance, as countries may move from one category to another over time.

[13] The three-period lagged level of institutions alone explains 66 percent of the variation in the institutions index in the first stage and is significant at the 1 percent level. Again, this shows the high degree of path dependency of institutional reform.

[14] Note that we only use the contemporaneous political institutions as instruments for economic institutions. Thus, we have one more instrument than explanatory variables.

Table 5 reports the marginal contribution of each institutional category to economic growth, relative to the reference categories, which we have chosen to be the worst institutions category (index = 0 – 0.167; 39 observations).

Table 5
Dynamic Contribution of Institutions to Growth

Regressors	Dependent Variables System-GMM $\hat{Y}_{i,1991-2001}$	LSDV $\hat{Y}_{i,1991-2001}$
Weak Institutional Quality	0.088	0.045**
	(0.143)	(.022)
Below Average Institutional Quality	0.089	0.083**
	(0.086)	(.026)
Above Average Institutional Quality	0.148**	0.149***
	(0.069)	(.027)
Good Institutional Quality	0.236***	0.236***
	(0.080)	(.032)
Best Institutional Quality	0.241***	0.271***
	(0.087)	(.042)
Y_{t-1}	-0.072***	-0.275***
	(0.027)	(.038)
R^2	----	0.37
N	270	244

Superscripts */**/*** denote 10, 5, 1 percent significance levels. Standard Errors in parentheses.

The system-GMM coefficients are less precisely estimated than the (biased) LSDV ones in particular for the extreme categories. However, the magnitudes of the coefficient across methods are surprisingly similar.

The categorical dissection of the institutional quality levels in table 5 clearly documents that sustained institutional improvements contribute to growth for each institutional quality level. With the exception of the two GMM estimates for the lowest institutional categories, all categories are highly significant and the marginal contribution of each category to economic growth is just about identical. Thus, the results support not only the parsimonious linear specification of institutions throughout the paper, but also that institutional change increases growth across the entire spectrum of institutional qualities.

7) Robustness Part III: Alternative Economic Institution Indices

It remains to be shown that our results do not hinge on the specific selection of a particular index. We perform a sensitivity analysis to show that on its own, each part of our economic institutional index has a statistically significant impact on growth. We follow EBRD (2000, 2001, 2002) in subdividing our economic institutions index into four indices: Liberalization (including price as well as foreign exchange and trade liberalization), Privatization (small-scale and large-scale), Enterprise (enterprise reform and competition policy), and Financial Institutions (banking sector reform and reform of non-banking financial institutions). Again each index is normalized to lie between 0 and 1 with 0 representing completely state-planned economic institutions and 1 representing OECD market based standards of economic institutions. The system-GMM results of estimating (1) using these sub-indices of economic institutions are presented in table 6.

Table 6
Sensitivity Analysis: The Effects on Growth of Different Sub-Indices

	Dependent Variables				
Regressors	$\hat{Y}_{i,1991-2001}$	$\hat{Y}_{i,1991-2001}$	$\hat{Y}_{i,1991-2001}$	$\hat{Y}_{i,1991-2001}$	$\hat{Y}_{i,1991-2001}$
Liberalization	0.226*** (0.071)	---	---	---	-0.082 (0.139)
Privatization	---	0.213*** (0.032)	---	---	0.106 (0.191)
Enterprises	---	---	0.475*** (0.096)	---	-0.018 (0.274)
Financial Inst.	---	---	---	0.385*** (0.065)	0.298 (0.201)
Y_{t-1}	-0.045** (0.019)	-0.053*** (0.019)	-0.091*** (0.027)	-0.103*** (0.028)	-0.081** (0.037)
N	270	270	270	270	270

Superscripts */**/*** denote 10, 5, 1 percent significance levels. Standard Errors in parentheses.
Estimation Method: System-GMM.

All indices of economic institutions are individually highly significant for growth. Given the high degree of correlation among individual indices, the regression that

includes all four sub-indices generates a joint significance at the 1 percent level for all coefficients, but the coefficients are not significantly different from 0 individually. We take this as further evidence that it is economic institutions as a whole which drive growth in our sample.

8) Conclusion

The transition economies offer a unique natural experiment to assess the importance of institutional change even in the short run. We find a strong effect of the initial institutional quality among transition economies in the cross-country analysis. The quality of institutions in 1991 can explain almost 50 percent of the variation of GDP per capita in 2001 across countries. An instrumental variables regression of the growth rate on institutional reform in a pure cross-country regression shows that an increase in institutional quality 10 percent closer to OECD standards increases subsequent growth by 2.0 percent. Almost 40 percent in the difference of the growth experience among transition countries from 1991 to 2001 can be explained by the quality of 1991 economic institutions and initial income.

In a panel set-up we use a fixed-effects model to control for country-specific factors that are invariant over our eleven-year time horizon. We utilize system-GMM estimations as our main tool of panel analysis to show that the effect of institutional quality on growth remains highly significant. An increase in the institutions index of 0.1 (a move 10 percent closer to OECD standards in economic institutions) increases the growth rate by 3.5 percent per annum in our panel. Using an interaction effect between initial and subsequent institutions we can show that catching-up to early movers does not imply a growth penalty or bonus. Whenever they happen, improvements of economic institutions increase growth in our sample. We further argue that the economically big (albeit not statistically significant) differences in country fixed effects obtained from the LSDV regression can be used to show the importance of factors other than institutions in our panel. To further identify the significance of institutional factors, we perform an additional instrumental variables regression that utilizes the concept of the hierarchy of institutions. Durability of the political regime in combination with constraints on the

executive is shown to be a valid instrument, confirming the use of slower-moving institutions as instruments for economic institutions in the panel framework. The estimates obtained are similar to those of the "standard" GMM approach using lagged values of the dependent variables as instruments.

An additional robustness check examines the marginal contribution of each institutional level to economic growth. We find a significant growth benefit for all levels of institutions in our panel conditional on a country's fixed effect and level of GDP. Finally, a sensitivity analysis shows that all subcomponents of our joint economic institutions index contribute individually to economic growth. Future work should focus on the relative importance of different parts of the institutional environment.

Our results show more than the importance of institution for a specific set of countries. We replicate the results that institutions matter in the long run, but more importantly we are able to document the contemporaneous effect of institutional change on economic growth. Our use of multiple estimation techniques, which all generate largely comparable results not only in terms of significance but also in terms of magnitudes, highlights the power of a natural experiment to track institutional change across a sizeable number of countries.

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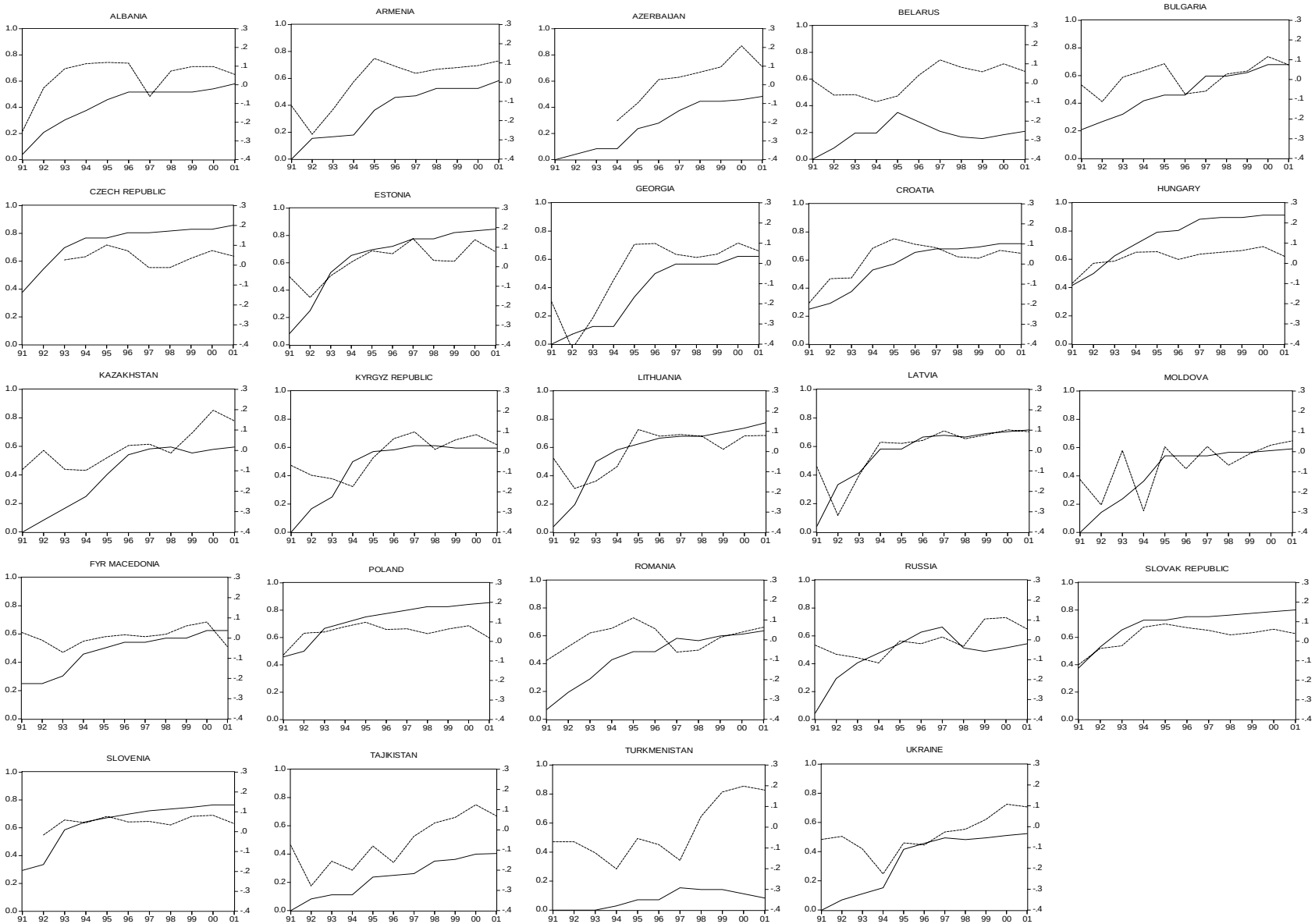
Appendix:
Table A1
Correlations between subindices of the composite economic institutions index across countries and time

	Price-Liberalization	Forex & Trade Liberalization	Small Scale Privatization	Large Scale Privatization	Enterprise Reform	Competition Policy	Banking Reform
Price-Liberalization							
Forex and Trade Liberalization	0.715						
Small Scale Privatization	0.596	0.788					
Large Scale Privatization	0.597	0.755	0.787				
Enterprise Reform	0.582	0.779	0.772	0.827			
Competition Policy	0.420	0.527	0.578	0.692	0.726		
Banking Reform	0.624	0.827	0.780	0.802	0.901	0.641	
Reform of non-banking financial institutions	0.407	0.585	0.639	0.703	0.773	0.773	0.741

Figure A1: Per Capita GDP Growth and Composite Economic Institutions Index

—— INSTITUTIONS (LEFT AXIS) – – – GROWTH (RIGHT AXIS)