AMERICAN UNIVERSITY

WASHINGTON, DC

Department of Economics

Working Paper Series

Market Reform and Infrastructure Development in Transition Economies

by

Robert M. Feinberg and Mieke Meurs

No. 2005-06
June 2005

http://www.american.edu/cas/econ/workpap.htm

https://doi.org/10.17606/ffqr-8f48

Market Reform and Infrastructure Development in Transition Economies*

Robert M. Feinberg and Mieke Meurs**

Abstract

This paper presents an econometric analysis of the determinants of investments in physical infrastructure over the first decade of market reform in Central and Eastern Europe and other former Soviet economies. While our econometric specifications are quite simple – limited in part by the data requirements for a large cross-section of developing economies – they strongly suggest that market reform has had a positive impact on both traditional and newer ("high-tech") measures of infrastructure, with a stronger impact on the newer types of infrastructure more likely to be market-derived. There is also the strong suggestion that market reform is more likely to push investors to develop infrastructure when political/institutional reforms are accomplished in tandem.

Key words: Infrastructure, Transition Economies, Market Reform

JEL classification: O12, P23

* We thank Renata Kochut for excellent research assistance, and acknowledge support from the National Science Foundation (Grant INT-0330964).

** American University. Contact: Robert M. Feinberg, Department of Economics, American University, 4400 Massachusetts Avenue, NW, Washington, DC 20016-8029. Email feinber@american.edu.

I. Introduction

The role of infrastructure in promoting economic growth, both in developed and developing economies has been well-studied.[1] The issue of what determines infrastructure investment has been less-studied. In particular, little attention has been given to the impact of market reform in transition economies on the development of the infrastructure necessary to facilitate this growth. This paper presents an econometric analysis of the determinants of investments in infrastructure; we examine the physical infrastructure resulting, rather than the financial expenditures on these,[2] over the first decade of market reform in Central and Eastern Europe and other former Soviet economies.

II. Literature Review

While this paper focuses on the issue of the determinants of infrastructure development in transition economies, we briefly discuss here previous work in three related strands of the economic literature: (1) effects of infrastructure on economic growth, both generally and for developing economies; (2) patterns of infrastructure development in Central and Eastern Europe pre- and post-transition; and (3) determinants of infrastructure more generally.

[1] Another related role, noted in Feinberg and Meurs (2005), is the enhancement of competition and market-openness as physical infrastructure in an economy is improved.

[2] Definitions and measures of infrastructure in the literature vary widely, from broad definitions which include institutional and personal capacities (Jochimsen, 1966; Carlin, et.al., 2003), to broad measures of public goods including education and health care (Demurger, 2001), to very narrow definitions limited to a few representative elements of material infrastructure (transport and communications) (Zhuravskaya, 2000; Feinberg and Meurs, 2005). We will focus on determinants of investment in material infrastructure, including transport, communications, water and energy.

Under the first category, much recent interest was stimulated by the work of Aschauer (1989) who produced econometric estimates (based on macroeconomic data applied to expanded production functions including the public capital stock) showing a significant productivity impact of public capital spending. However estimates of the social rate of return to public capital spending – as large as 75 percent annually or higher -- have struck others as implausibly high, and after correcting for some perceived measurement and econometric problems Hulten and Schwab (1991) and Tatom (1991) found much lower estimates, not always statistically significant. Gramlich (1994), in surveying this literature, discusses work – originating with Eisner (1991) -- which has raised the issue of endogeneity of infrastructure with respect to economic growth and argued that without dealing with this endogeneity the productivity impact of infrastructure would be overstated.[3]

Hulten (1996), turning attention to developing economies, found evidence supporting the importance of examining *how* infrastructure (public capital spending on roads, rail, telephone and electricity infrastructure) is used. He argues that more important than the level of infrastructure for these economies is the efficiency with which it is used. Carlin et al (2003), using survey data on 26 transition economies, find evidence somewhat consistent with this argument, as organizational change, degree of competition, and willingness to innovate seem more closely related to firm growth than are measures of physical, financial, and legal infrastructure.[4]

[3] We should note that these macroeconomic studies have not considered particular types of infrastructure, rather taking public capital spending as a proxy.
[4] Warner (2002) also finds little impact of infrastructure on growth in transition economies.

Turning to the determinants of infrastructure – the focus of this paper – there has been little previous work. Rietveld and Boonstra (1995), looking at the supply of highways and railroads in Europe, find regional and interregional demand, construction costs, and financing constraints to affect infrastructure availability. As noted above, the work on explaining economic growth has discussed the possible endogenous link between growth and infrastructure. In addition, Temu and Due (2000) and Ordover et al (2001) have pointed out that, in the short-term, privatization can raise operating costs of basic infrastructure industries such as energy, transport, and communications leading to disruptions in infrastructure supply.

The role of market reform on infrastructure development is not completely clear from a theoretical perspective. While better transmission of price signals should stimulate private-sector oriented infrastructure, infrastructure more closely tied to the public sector may be less affected. Certainly market reform is not the only – and perhaps not the most important – determinant of infrastructure. Nevertheless it is a potentially important factor which merits an empirical examination.

III. Infrastructure Development in Transition Economies

In the case of former socialist economies, infrastructure development during the socialist period was significant. But this infrastructure was geared mainly toward a centralized model of heavy industrial production, and is not adequate for an industrialized market economy. Transportation networks featured rails over roads and were highly inflexible, providing one set of links between established sets of suppliers and buyers. Telecommunications infrastructure was weakly developed. While water and energy infrastructure were relatively extensive, during the final years of socialism maintenance and updating were neglected, so much of the infrastructure stock, like that in transportation and communications, was in poor condition and technologically out-dated. Infrastructure was uniformly state-owned, and the state maintained low prices to both consumers and producers, often resulting in very inefficient patterns of use.

Infrastructure needs in post-socialist economies of the early 1990s were thus estimated to be significant. In order to reach European levels of infrastructure provision, one estimate found that transition economies would need to invest 6% of GDP annually between 1995 and 2010 in physical infrastructure development, while reaching the level of other middle income countries would require investment of about 3% of GDP annually (von Hirschhausen, 2002, 62). Necessary changes in infrastructure in transition economies would also include changes in the way it is used, through both privatization and regulatory reform.

In fact, we observe significant increases in the availability of at least some types of infrastructure post-socialism. Telecommunications infrastructure expanded extremely rapidly with the end of the state monopoly on provision and the privatization of many state telecommunications firms. Availability of main phone lines per 100 inhabitants more than doubled in the Poland, Hungary and the Czech Republic, while increasing by 25-66% in the post-Soviet cases (von Hirschhausen, 2002:95). Road and rail density grew much more slowly or even declined in some places (Romanian National Commission for Statistics, 1993; Czech Statistical Office, 1998), however, although these measures do not account for significant up-grades made to the networks. Length of motorways increased significantly, for example, in most Central and Eastern European and post-Soviet cases, even if total road network did not (von Hirschhausen, 2002, 95).

Privatization and regulatory reform in infrastructure sectors have proceeded slowly outside of telecommunications, however. On the EBRD scale of 1 (absence of reform) to 4.3 (full reform), only Estonia was rated as high as 4 across all infrastructure sectors in 2001. Only Hungary, Poland, the Czech Republic, Latvia and Slovenia averaged as high as 3, while the remaining post-Soviet cases averaged 2.5 or below (EBRD, 2001, cited in von Hirschhausen, 2002, 101).

Considering determinants of infrastructure development in transition economies, we expect that infrastructure investment should respond to both economic and political incentives, both on the supply side (government and non-government funding decisions) and the demand side (perceived "needs" based on enhanced market orientation and global

interactions). On the supply side, we expect financing constraints to play a significant role. Negative real growth rates predominated in transition economies during the first half of the 1990s, and by 2002 few countries had returned to 1989 levels of output (WDI, 2004). Combined with radical changes in tax systems, this resulted in severe declines in government revenue. Strict guidelines set by international financial institutions (IFIs) limited the use of deficit spending, and weak development of credit markets and poor international credit rating limited government borrowing in many cases. As a result, state capital investments were growing 4-6% per year by the late 1990s from low levels (von Hirschhausen, 2002, 74), and these data exclude the poorest transition economies where infrastructure investment is likely to be slowest. In some cases, these expenditures come at the expense of maintenance of existing infrastructure, resulting in offsetting declines in provision.

In transition economies, infrastructure spending is also heavily affected by IFIs and other international actors, which provide alternative sources of investment initiatives and financing. IFIs spent approximately $25 billion on infrastructure investments in transition economies during the 1990s. The vast majority of this money went into just two sectors (transportation and energy), however, and only into a few countries (Russia and Poland alone accounted for about one-third of the spending) (von Hirschhausen, 2002, 97-98).

On the demand side, economic growth should influence infrastructure provision (Gramlich, 1994). IFIs and other external actors may also affect demand for

infrastructure if they cause governments to spend resources in ways that they would not otherwise have chosen. Of particular interest to us, patterns of market reform are also expected to influence infrastructure demand, as more market-oriented firms and consumers demand the infrastructure needed for effective adjustments. Corruption, however, may offset the impact of market reforms, by creating channels through which those likely to be hurt by rising competition can block infrastructure expansion[5].

Considering changes in the way infrastructure is used—via both privatization and regulatory reform-- economic and political constraints are again likely to play a role in development. While telecommunications has been rapidly privatized, both through the entry of new private providers and privatization of state firms, privatization of other infrastructure has proceeded slowly. Private road development, based on user charges, has failed across ECE and CIS countries due to the impact of economic downturns on road traffic and states' unwillingness to impose charges on resistant (and sometimes economically distressed) populations. Privatization has proceeded a bit further in the energy sector, with some countries allowing partial privatization of electricity. But regulatory reform has been limited again due to governments' fear of political backlash. In many cases, low incomes limit prices and thus the interest of potential private investors (von Hirschhausen, 2002, ch. 8-10).

At the same time, IFIs may provide pro-reform political pressures. When tied to resources needed to support other popular projects, these pressures may offset

[5] Both market reforms and corruption may also have indirect impacts on the supply of infrastructure, through their impact on economic growth.

countervailing pressures from populations. Overall market reforms are also likely support reforms in the infrastructure sector, both by creating a political context for infrastructure reform, and also by possibly creating a constituency of market-oriented voters interested in more efficient infrastructure sectors.

In considering factors underlying changes in infrastructure provision and use, it may also be useful to distinguish between types of infrastructure which are now predominantly provided by the private sector (mobile telephones and internet, for example), and more those types of infrastructure which continue to be predominantly supplied by the state (albeit with an increasing role for private investment). Privately supplied infrastructure is less likely to be subject to the types of financial and political constraints faced by governments, and more likely to respond to economic incentives, especially as such infrastructure in typically supplied by large global firms with access to international capital markets.

IV. Methodology and Data

Below we estimate the impact of economic and political factors on infrastructure outcomes. The following infrastructure measures are analyzed over the 1990 to 2002 period with, however, considerable missing observations for some countries and data series (data obtained from World Development Indicators): (1) electric power efficiency (100- percentage electricity transmission and distribution losses); (2) telephone mainlines per 1000 people; (3) paved road kms per 1000 people; (4) internet users per 1000 people; (5) mobile phones per 1000 people. We then group (by simple averaging) these into two

broad categories: "traditional infrastructure" (TRAD, or T) comprising the first three measures, and "high-tech infrastructure" (HITECH, or H) comprising the last two measures.

Considering factors underlying infrastructure provision, we expect good economic conditions (here measured by PPP-adjusted real GDP per capita, RGDP) to have a positive impact, through their effect on supply (through national and local budgets) and also through their impact on demand for infrastructure. We also expect to find that announcements of accession to NATO or the EU are associated with an increased infrastructure development, through impacts on both resources available for infrastructure provision as well as demand for infrastructure. We choose to focus on the announcement date of NATO accession via a dummy variable equal to one starting in that year, zero otherwise.[6]

Patterns of market reform should also influence infrastructure provision, both indirectly through effects on economic growth (a supply-side impact) and directly through their ability to free up market forces (a demand-side impact). By market reform, we mean primarily price liberalization and privatization initiatives. We expect the influence of market reform to differ between traditional (more state-supplied) and high-tech (more privately supplied) infrastructure, with market reforms having a stronger

[6] EU accession announcements for the relevant countries were made too late in our sample period to capture this impact; we did try using instead the year of the start of formal EU negotiations, with results similar to what are presented below using the NATO accession variable. NATO accession should have a similar impact; regression results using start dates of EU negotiations were quite similar to those presented here. Note that in lagging real GDP per capita we should reduce the possible problem of the endogeneity of economic growth with respect to infrastructure.

impact on the provision of high tech infrastructure. Our measure of market reform (REFORM) is the simple average of the EBRD indexes of small scale privatization, price liberalization, and trade and foreign exchange liberalization – each measured on a 1 to 4.3 scale (the latter indicating "fully liberalized"). While the EBRD indexes have been subject to some criticism, they remain the only consistent set of measures of market reform which can be used to compare the transition experience of a wide range of economies over the post-1989 period.

Corruption, however, is expected to reduce the impact of market reforms on infrastructure provision. Unfortunately, measures of corruption are often highly correlated with reform measures, making it difficult to identify separate impacts. We use the measure "control of corruption" (CONCORRUP) – obtained from the World Bank Governance Indicators -- having a *relatively* low correlation (+0.6) with REFORM.

We anticipate that the marginal effect of market reform on infrastructure development should be diminishing, and we incorporate this into our econometric specification. The general estimating equation employed, using a random effects estimation strategy with an autocorrelation adjustment, is of the following form:

$INFRA_{T,H}$ = f (lnREFORM(-1), RGDP (-1), NATO, lnREFORM*CONCORRUP, country random effects).

We also consider a specification without the control of corruption term (which allows us to utilize a larger sample). Given the possibility that market reform may promote economic growth, our REFORM coefficient may understate the total effect on infrastructure, which would include an indirect impact via RGDP growth.[7]

In a second equation, we investigate factors underlying reform in the infrastructure sector. The advantage of this approach is that infrastructure sector reform could occur more quickly than infrastructure development, and therefore would be more likely to be picked up in the relatively short time series available. As above, we examine the impact of national economic performance, NATO membership, market reform, and corruption on infrastructure reform. To measure reform in the infrastructure sector, we use the EBRD *index of reform* (EBRDIX) of infrastructure sectors.

We examine 26 Central and Eastern European and other former Soviet countries over the period from 1990 to 2002, with data from EBRD, WDI, and other sources. The countries included and some descriptive statistics are given in Table 1.

V. Results

Table 2 presents results explaining levels of "traditional" infrastructure (as defined earlier) over time and across countries by the one-year lagged market reform index, one-year lagged real GDP per capita, a binary variable for country/year observations on and after an announcement of NATO accession, with and without an interaction term between the market reform index and an index of the control of

[7] Warner (2002) finds that faster-reforming transition economies did in fact grow faster during the 1990s.

corruption. All right-hand side variables (except the NATO announcement dummy variable) are expressed in natural logarithms. This implies that marginal impacts on infrastructure levels are diminishing. Note that while variables are expressed in levels (or log-levels) rather than changes, the estimated coefficients are interpreted as the impact of changes in market reform on changes in infrastructure (i.e., investment in infrastructure).

We find that NATO accession announcements have a large and significant positive impact on traditional infrastructure, raising this by over 20 percent. GDP per capita also has a significant positive impact, but surprisingly small (at mean values, a 5% increase in RGDP implies a one percent increase in infrastructure).

Our primary interest, however, is on the impact of market reform. In column (1), with the larger sample size and no interaction with CONCORRUP, we find a highly significant positive impact of REFORM. As noted previously, the specification chosen (levels on logs) implies that the effect diminishes as market reform advances: when REFORM = 2 (on the 1-4.3 scale), a one-unit increase raises TRAD by about 6 percent, when REFORM = 3 the increase is about 4 percent, when REFORM = 4 the increase is about 3 percent. When we add the interaction with CONCORRUP in columns (2) and (3) the signs are as expected – an increasing impact of REFORM as control of corruption improves.

Table 3 presents comparable results explaining high-tech infrastructure. While the overall pattern of results, especially the signs of estimated coefficients, remains the

same there are some notable differences from the Table 3 results. First of all, NATO accession announcements have a very large and significant impact in column (1), but this goes away once control of corruption is included; this latter effect could be explained by traditional infrastructure (electricity, telephones, roads) being much more likely to be directly provided or controlled by governments, who in turn may feel pressure from NATO to modernize. In contrast high-tech infrastructure (cell phones, internet usage) is more likely to be privately-owned and driven by market determinants not political pressures (both from inside and outside the country).

As expected, economic growth has a stronger impact than on traditional infrastructure, and market reform has a much larger impact as well – a one-unit increase in the market reform index increasing high-tech infrastructure by about 40 percent, 25 percent, and 18 percent respectively at REFORM = 2, 3, and 4. Also interesting is that the interaction term between REFORM and CONCORRUP is now highly significant suggesting that private infrastructure investment is more sensitive to corruption than is government infrastructure investment.

As noted earlier, the lags in investment decisions and time required for major infrastructure improvements to be seen may limit the relatively short term causal link examined here between economic and political change and infrastructure provision. However, there may be a quicker and perhaps more direct linkage between political and economic change and reform (in terms of tariffs, regulation, and privatization) of infrastructure sectors. We therefore replicate the regression analyses of Tables 2 and 3,

replacing the indexes of *actual* infrastructure with the EBRD index of infrastructure sector *reform*. The results, presented in Table 4, are interesting and for the most part consistent with the impacts on actual infrastructure investment.

As infrastructure reform is a governmentally-directed activity it is not surprising that NATO accession announcements again have a strong positive impact (as in Table 2 explaining traditional infrastructure). Economic growth seems to be a stimulant to infrastructure sector reform as well. The impact of one-year-lagged overall market reform on infrastructure sector reform, with or without the interaction with control of corruption, is positive and highly significant, implying a 16 percent, 12 percent, and 8 percent increase, respectively for REFORM = 2, 3, and 4. Control of corruption appears to push infrastructure reform still further.

Finally, it might be argued that reform in the infrastructure sector might predict changes in infrastructure investment better than overall market reform,. When we tried replacing the market reform index by the infrastructure sector reform index in Tables 2 and 3 we did obtain qualitatively similar results (not surprising as the correlation –across time and countries – between the two reform indexes is 0.68), somewhat stronger for high-tech infrastructure, somewhat weaker for traditional.

VI. Conclusions

While our econometric specifications are quite simple – limited in part by the data requirements for a large cross section of developing economies -- they strongly suggest

that market reform has had a positive impact on both traditional and newer ("high-tech") measures of infrastructure. Not surprisingly, market reform seems to have a stronger impact on the newer types of infrastructure more likely to be market-derived. There is also the strong suggestion that market reform is more likely to push investors to develop infrastructure when political/institutional reforms are accomplished in tandem.

Clearly, the relationships between market and political reform and infrastructure development are likely to be more complex than we have been able to determine in our pooled cross-country analysis. Turning to more intensive analysis of infrastructure investment decisions, at the micro level, may prove fruitful as an avenue for further research.

References

Aschauer, David A., "Is Public Expenditure Productive?" *Journal of Monetary Economics*, March 1989, pp. 177-200.

Carlin, Wendy, Mark Schaffer, and Paul Seabright, "Infrastructure, Competition and Innovation: New Survey Evidence from Transition," working paper draft, December 2003.

Czech Statistical Office, Statistical Yearbook of the Czech Republic, 1998 (Prague: Czech Statistical Office, 1998).

Demurger, Sylvie, "Infrastructure Development and Economic Growth: An Empirical Investigation," *Journal of Comparative Economics* 29 (1) 2001.

Eisner, Robert, "Infrastructure and Regional Economic Performance," *New England Economic Review*, September/October 1991, pp. 47-58.

Feinberg, Robert M. and Mieke Meurs, "Market Reform, Infrastructure and Exchange Rate Passthrough in Central and Eastern Europe" (with Mieke Meurs), *Post-Communist Economies*, forthcoming 2005.

Gramlich, Edward M., "Infrastructure Investment: A Review Essay," *Journal of Economic Literature*, September 1994, pp. 1176-1196.

Hulten, Charles R., "Infrastructure Capital and Economic Growth: How Well You Use It May Be More Important Than How Much You Have," NBER Working Paper 5847, December 1996.

Hulten, Charles R. and Schwab, Robert M., "Is There Too Little Public Capital? Infrastructure and Economic Growth," American Enterprise Institute Discussion Paper, February, 1991.

Ordover, J., Pittman, R. W., and Clyde P. S., "Competition Policy for Natural Monopolies in a Developing Market Economy. Antimonopoly Law Handbook", http://netec.wustl.edu/WoPEc/data/Papers//wpawuwpio0111004.html, 2001

Rietveld, P. and Boonstra, J., "On the supply of network infrastructures. Highways and railways in European regions,"Annals of Regional Science, 29, pp. 207-220, 1995
Romanian National Commission for Statistics, Romanian Statistical Yearbook, 1993 (Bucharest: Romanian National Commission for Statistics, 1993).

Tatom, John A., "Public Capital and Private Sector Performance," *Federal Reserve Bank of St. Louis Review*, May/June 1991, pp. 3-15.

Temu, Andrew E. and Due, Jean M., "The business environment in Tanzania after socialism: challenges of reforming banks, parastatals, taxation and the civil service", The Journal of Modern African Studies, 38, 4, pp. 683-712, 2000

Warner, Andrew, "Twenty Growth Engines for European Transition Countries," in Warner, ed., *The European Competitiveness and Transition Report 2001-2002*, Oxford University Press, 2002.

WDI (World Development Indicators) (2004), CD Rom (Washington, DC: The World Bank).

Table 1. Mean Values by Country

Country	*Reform Index*	*Traditional Infrastructure*	*High-Tech Infrastructure*	*Real GDP per capita (1996 $)*
Albania	3.276667	40.61	42.15	2771.028
Armenia	2.786667	83.40	14.52	2398.102
Azerbaijan	2.226667	71.21	30.81	2366.436
Belarus	1.736667	110.39	31.16	7165.33
Bosnia and Herzegovina	2.555556	70.07	45.89	--
Bulgaria	3.01	117.22	88.31	6161.523
Croatia	3.56	129.50	162.68	7853.338
Czech Republic	3.7	128.71	260.44	12966.17
Estonia	3.326667	129.58	307.22	7942.396
Georgia	2.743333	76.17	27.03	4969.448
Hungary	3.596667	119.46	172.98	9072.377
Kazakhstan	2.763333	99.04	15.28	6197.713
Kyrgyz Republic	3.1	68.54	25.26	2787.356
Latvia	3.263333	134.11	182.94	7024.839
Lithuania	3.253333	187.69	179.27	6752.911
Macedonia, FYR	3.466667	--	67.54	4688.557
Moldova	2.763333	72.25	27.06	2210.434
Poland	3.696667	107.27	135.47	7459.208
Romania	2.966667	87.20	75.19	4453.041
Russian Federation	2.943333	89.28	29.63	7777.483
Slovak Republic	3.69	112.03	170.59	10211.98
Slovenia	3.673333	146.62	367.29	13188.44
Tajikistan	2.18	62.66	1.17	1197.917
Turkmenistan	1.403333	77.18	2.74	4533.328
Ukraine	2.296667	88.10	17.47	6069.173
Uzbekistan	2.07	68.61	5.91	2651.65

Table 2. Regression Results – Explaining Traditional Infrastructure

Random Effects, GLS, Controlling for Autocorrelation

	(1)	(2)	(3)
Constant	- 83.07*** (2.78)	-214.77*** (4.26)	-217.66*** (4.34)
lnREFORM (-1)	11.90*** (4.78)	7.86 (0.84)	--
lnRGDP (-1)	20.46*** (5.96)	37.43*** (6.02)	38.93*** (6.55)
NATO	21.65*** (5.42)	20.55*** (5.46)	20.91*** (5.59)
lnREFORM*CONCORRUP	--	5.84* (1.64)	4.97 (1.46)
n	193	114	114
estimated rho	0.91	0.79	0.79
R^2	.56	0.61	0.61

Note: z-statistics are in parentheses below estimated coefficients; *** = significance at 1%, **=significance at 5%, *=significance at 10%.

Table 3. Regression Results – Explaining High-tech Infrastructure

Random Effects, GLS, Controlling for Autocorrelation

	(1)	(2)	(3)
Constant	-1199.14*** (4.94)	-548.18** (1.99)	-542.58** (1.95)
lnREFORM (-1)	77.67** (2.04)	148.88* (1.82)	--
lnRGDP (-1)	146.75*** (5.08)	60.27* (1.77)	81.97*** (2.52)
NATO	145.71*** (6.03)	32.56 (0.75)	41.76 (0.96)
lnREFORM*CONCORRUP	--	97.07*** (3.09)	90.32*** (2.85)
n	215	145	145
estimated rho	0.86	0.76	0.76
R^2	.37	0.44	0.43

Note: z-statistics are in parentheses below estimated coefficients; *** = significance at 1%, **=significance at 5%, *=significance at 10%.

Table 4. Regression Results – Explaining EBRD Infrastructure Reform Index

Random Effects, GLS, Controlling for Autocorrelation

	(1)	(2)	(3)
Constant	-2.77*** (4.51)	-1.77** (2.31)	-2.20** (2.30)
lnREFORM (-1)	0.67*** (5.40)	1.26*** (5.57)	--
lnRGDP (-1)	0.47*** (6.12)	0.27*** (2.80)	0.51*** (4.52)
NATO	0.15** (2.17)	0.30** (2.14)	0.32** (2.14)
lnREFORM*CONCORRUP	--	0.21** (2.29)	0.12 (1.15)
n	233	153	153
estimated rho	0.74	0.59	0.62
R^2	.63	0.69	0.53

Note: z-statistics are in parentheses below estimated coefficients; *** = significance at 1%, **=significance at 5%, *=significance at 10%.