Efficient Infrastructure Supply for Economic Development in Transition Countries – The Case of Ukraine

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by

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Abstract

Infrastructure restructuring is one of the major elements of structural reforms in transition economies because of its expected large economic and social impact. This paper aims at assessing the role of infrastructure policy on the economic development in transition countries in general and on Ukraine in particular. We test the relationship between infrastructure policy and economic growth, though this test is carried out at a very aggregate level due to data problems. According to our estimations the government can make an indirect contribution to economic development by enhancing competition and efficiency within the infrastructure industries. The paper also develops a framework to analyse and compare infrastructure policies across transition countries, and provides a detailed survey of infrastructure policies in Ukraine. We conclude that the major element of reforms should be tariff reform, carried out concurrently with commercialisation and deregulation of the sector.

Key Words: infrastructure, transition, economic growth

JEL-classification: O12, P21
1. Introduction

It is generally acknowledged that an efficient supply of infrastructure is conducive to economic development; some argue that it is even a condition for such a development (e.g. Rostow, 1960, Aschauer, 1989). There is much less consensus on how specific infrastructure policies should be designed to support growth, and how they should respond to specific institutional conditions, e.g. in countries undergoing systemic transition. The literature tends to favour specific infrastructure policies for transition countries (e.g. Aghion/Schankerman, 1999, Armstrong/Vickers, 1996, Meissner, 1999) whereas empirical evidence so far does not support this idea (e.g. Hirschhausen, 1999). In particular, as the countries of Central and Eastern Europe (CEE countries) approach EU-membership, they are becoming more and more integrated into the EU regulatory and institutional framework of infrastructure financing and regulation, and specific domestic infrastructure policies lose much of their importance. What remains, then, are the post-Soviet countries, such as Russia and Ukraine, where economic recovery is more recent and more fragile, and which continue to claim a special role for supporting domestic infrastructure development.

Infrastructure policy is a central element in the reform process of any transition economy. Whereas the policy debate is mainly concerned with quantitative measures, e.g. public investments, the
The ultimate objective of infrastructure reforms is to supply infrastructure services by efficient, mainly privatised companies, at tariffs close to hypothetical market levels (e.g. long-run marginal costs, complemented by a time-of-use element), and subject to an objective transparent regulatory process. Ukraine is still far away from this ideal world, just as many other CIS transition economies are.

This paper assesses the role of infrastructure policies for economic development in transition countries in general, and with particular reference to Ukraine. Our hypothesis is that the link between infrastructure and growth cannot be quantified precisely for transition countries, but that by enhancing competition and efficiency in particular infrastructure sectors, the government can make an indirect contribution to economic development. The paper is structured in the following way: Section 2 surveys the recent literature and provides a cross-sectional analysis of the relationship between competition and infrastructure policies, and economic growth in transition countries between 1993 and 1999. Section 3 develops a framework to analyse and compare infrastructure policies across transition countries, and provides a detailed survey of infrastructure policies in Ukraine, using an enhanced estimation of the EBRD infrastructure indicators. In Section 4 we discuss policy measures to improve efficiency and competition in specific qualitative aspects of infrastructure policy are at least as important.
sectors (power and railways). Conclusions and policy recommendations are given in section 5.

2. Infrastructure and growth in transition countries: A difficult relationship

2.1 Survey of the literature

The importance of infrastructure development for economic development has traditionally been acknowledged and widely used for policy advice by international financial institutions. The World Bank review of infrastructure policies provides numerous examples illustrating the influence of infrastructure development on economic growth and documenting correlations between infrastructure and income levels (World Bank, 1994). At the same time the World Bank draws attention to the differences in the rate of return estimations of individual projects in different countries and concludes that the poor performance of infrastructure projects is related to a weak climate of economic activity. The World Bank Development Report (World Bank, 1994, p. 19) concludes that infrastructure investments alone cannot be a precondition for growth and that "...the economic impact of infrastructure investments varies not only by sector but also by its design, location and timeliness".

Since the Rostow (1960) vs. Hirschman (1958) debate, infrastructure investments had not been considered as a factor of
economic growth. The interest has revived after Aschauer (1989) showed that the productivity turn down in the United States had been preceded by a turn down in infrastructure investments. This finding has attracted an unusual amount of attention.² Results of the studies summarised by Gramlich (1994) are mixed and do not provide unambiguous support for infrastructure as a factor of economic growth. Further research on the influence of infrastructure investments on economic growth has not brought any firm evidence so far either (Easterly and Rebelo, 1993, Canning, Fay, and Perotti, 1994, vs. Holtz-Eakin, 1994, Garcia-Mila, McGuire, and Porter 1996). Also, Gramlich’s view supports the World Bank’s conclusions that the reason for ambiguous infrastructure research results is due to the use of macroeconomic production function studies rather than more dis-aggregated rate of return studies and studies of the impact of different policy changes (Gramlich, 1994, p. 1194).³

² Gramlich (1994, p. 1177) puts it "...infrastructure investment was always more important than was indicated by its lack of attention up to 1989; never as important as the intense attention since 1989 would suggest".

³ In contrast Canning (2000) has found that microeconomic cost-benefit studies do not capture externalities associated with infrastructure development and regulation, in particular, tariff reform, development of regulatory institutions and investment. This suggests that the impact
Other research on the linkage between infrastructure development and growth was concentrated on regional cross-country studies of the effectiveness of infrastructure policies, for example in Latin America and Central-Eastern European transition economies. Along with traditional neo-classical arguments in favour of a positive infrastructure investment impact on total factor productivity (e.g. Neil, Jon R., 1996), arguments for the positive impact on economic structural change and on the intensity of competition through direct cost reduction and market selection effects were also developed (Aghion/Schankerman, 2000). Yet other arguments concerned the optimal speed of liberalisation related to risks of expropriation and liberalisation (Armstrong/Vickers, 1996). Jasinski/Ross (1999) point out that creating competition in infrastructure sectors is more easily said than done. Specifically, in transition countries without the proper institutional conditions competition policies may impede rather than improve social welfare. Piazolo (1999), introducing institutional reforms factor to a macroeconomic production function has found that increasing government economic policy credibility has a substantial economic growth effect in transition economies. Henisz (2000) in an extensive panel data study has also found a link between government policy credibility and of infrastructure investments can be better studied at the macroeconomic level.
infrastructure growth rates and concluded that an important component in explaining investment levels within a country is its ability to commit to a given policy environment.

Thus, we can conclude that substantial uncertainty still exists about the relationship between infrastructure and growth both in developed and in transition economies, although the institutional environment is likely to be a very important complement for translating infrastructure investments into economic growth.

2.2 Econometric analysis

In this section we shall present some early results on the relationship between infrastructure and growth in transition countries, being aware of the caveats of such an approach. Most studies of the relationship between infrastructure and growth followed a model developed by Barro (1990). In the aggregate production function it is assumed that a country's aggregate output ($Y$) is produced using capital and labour, where the capital consists of infrastructure capital ($G$) and other capital ($K$)

$$Y = A K^\alpha G^\beta L^{1-\alpha-\beta},$$  \hspace{1cm} (1)

where $A$ is total factor productivity and $\alpha$, $\beta$ and $1-\alpha-\beta$ are the elasticities of aggregate output with respect to capital $K$, infrastructure capital $G$ and labour $L$ respectively.

Since we assumed that infrastructure policy could be an important factor for economic growth, we extended the model with a
variable, which reflects changes in infrastructure policy. We estimated an aggregate production function. For transition economies this implies a strong assumption, since neither capital nor labour are employed at their optimum production levels. According to our model, the dependent variable – aggregate output – is a function of private and public investments, labour, and infrastructure policy.

To enlarge the degrees of freedom we estimated our model using panel data. Most data were sourced from the World Bank database, which included 13 transition Eastern European and FSU countries (Bulgaria, Croatia, Czech Republic, Estonia, Hungary, Latvia,

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4 This approach was applied by Piazolo (1999). To quantify the quality of economic institutions Piazolo obtained a general indicator of institutional change by summing up nine indicators developed by the European Bank of Reconstruction and Development. The indicator of institutional change was found to be a significant factor of economic growth.

5 In contrast to the research by Piazolo (1999) we did not account for an initial capital-output ratio. The major reason is the unavailability of the required data on assets value, due to the absence of a market for capital. Our approach can be justified by the fact that in exogenous growth models the GDP growth does not depend on initial conditions. Moreover, the assumptions of a constant capital-output ratio and depreciation rates for all the countries in focus are not realistic; therefore, we considered it not to be justified to apply this approach.
Lithuania, Poland, Romania, Russia, Slovakia, Slovenia and Ukraine) for the five years from 1992 to 1997. In order to estimate the quality of institutional reforms we used the EBRD indicators of institutional reforms. Our choice of proxies in the equation was determined by severe constraints on data availability for transition economies. Gross domestic product per capita ($GDP_c$) is a function of gross domestic investments per capita ($GDI_c$) (reflecting private capital investments), gross government expenditures per capita ($GGE_c$) (reflecting public or infrastructure investments), and the indicator of institutional reform (IR) (reflecting the quality of infrastructure reforms). The indicator of institutional reforms was calculated as the sum of four EBRD qualitative indicators – banking sector, non-banking financial institutions, competition policy, and enterprise reform and corporate governance. Here we followed Piazolo’s (1999) approach with the difference that he obtained a sum of nine indicators. We had to construct the IR indicator from the raw data, since the EBRD indicator of infrastructure reforms exists only for years 1998-2000 (the correlation coefficient between the infrastructure reforms indicator and the institutional reforms indicators is 0.81, which suggests a good proxy for the infrastructure reforms).

Thus, the production function for country $i$ at time $t$ is of the form:

$$GDP_{cit} = A_i GDI_{cit}^{\alpha} GGE_{cit}^{\beta} e^{\gamma R_t},$$

(2)

where the aggregate production function is estimated in per capita terms, except for the IR variable. In this equation $\gamma$ measures the
impact of institutional changes on GDP. The elasticity of GDP with respect to the institutional framework is $\gamma \text{IR}$. We believe that the model should be specified in this way because GDP is sensitive both to the changes in the institutional framework and the level of its initial endowment.

If all variables are in logarithmic form and we assume that economic growth is independent of the initial conditions, such as the capital output ratio, then the following equation should be estimated:

$$\ln(\text{GDP}_{ct}) = \ln(A_i) + \alpha \ln(\text{GDI}_{ct}) + \beta \ln(\text{GGE}_{ct}) + \gamma \text{IR}_i (3)$$

In order to check the differences between countries we tested the hypothesis that the fixed coefficients are zero with an F test. The 1% critical value from the F table is about 2.50 whereas \( F (12,62) \) is 28.35, hence we cannot conclude that the differences between countries are insignificant. Having used the Hausman specification test we could not reject the null-hypothesis that the difference in coefficients is not systematic at the 1% significance level. Therefore, the model with random effects seems to be preferable. However, we estimated this function with the fixed intercept because the difference in coefficients is rather small. Coefficients in the model with the fixed coefficients are unbiased and consistent but might be inefficient; yet, coefficients in the model with the random effects might be biased and inconsistent.
After having run a regression we obtained the following results (t-statistics are presented in parentheses)\(^6\):

\[
\begin{align*}
\ln(\text{GDP}_{\text{cit}}) &= 4.25 + 0.10\ln(\text{GDI}_{\text{cit}}) + 0.45\ln(\text{GGE}_{\text{cit}}) + 0.02\text{IR}_{\text{it}} \\
R^2 &= 0.9085
\end{align*}
\]

All variables are significant. The explanatory power of the regression is also high (91%) and the signs of the obtained coefficients correspond to those predicted by theory. Thus, increases in variables reflecting private capital investments, public or infrastructure investments, and the quality of institutional reforms seem to have a positive impact on GDP.

In order to test the possible endogeneity between GDP on the one hand, and gross government expenditures or gross domestic investments on the other, we used the version of the Hausman test proposed by Davidson and MacKinnon (1989, 1993). This version carried out the test by running an auxiliary regression. As instrumental variables for gross government expenditures we used lagged value of gross government expenditures due to data constraints. For gross domestic investments we used real interest rates. In our case the coefficients for both variables (residuals in the auxiliary regressions) are not significantly different from zero, which indicates the absence of endogeneity in the model.

\(^6\) For detailed regression outputs see Appendix 2.
However, the high explanatory power of the regression might also indicate that the relationship between the variables might be non-stationary and that the regression results are spurious. Therefore, we also redesigned the model by taking the first differences. Thus, the reformulated model has a form:

\[ \ln(GDP_{cit}) = \alpha \ln(GDI_{cit}) + \beta \ln(GGE_{cit}) + \gamma IR_{it} \]  

Having run pooled least squares we have obtained the following results (z-statistics are presented in parentheses):

\[ \ln(GDP_{cit}) = 0.08 \ln(GDI_{cit}) + 0.60 \ln(GGE_{cit}) + 0.02 IR_{it} \]  

Log likelihood = 72.96

As can be seen from these results all variables are significant again and the values of coefficients are rather close to the values from the regression model above. Thus, we have to conclude that the obtained results are robust, and that infrastructure investments and institutional reforms have a positive impact on GDP growth in transition economies. However, it should be pointed out that the data set for the model might be insufficient and results should be interpreted with caution. Nevertheless, the data provide some support for the contention that institutional reforms are an important factor for economic growth in transition economies.

3. A survey of infrastructure policies in transition countries

As we saw, infrastructure policy can be considered an important complement to infrastructure investment. Since most infrastructure
industries need to be regulated to minimize drawbacks of private monopolies participation, the institutional framework can help or hinder infrastructure development. The alternative of only public infrastructure provision suffers from the significant risk of investment misallocation. Unfortunately, infrastructure regulations are difficult to monitor because their qualitative natures make them hard to estimate. In this section, the analysis is carried one level down, to the individual transition countries. After a discussion of the available infrastructure indicators a particular focus is put on infrastructure policies in Ukraine, the second most populated CIS-country where infrastructure reforms, among many others, have thus far been slow to progress. Section 3.1 provides a survey of infrastructure policies in 26 transition countries. Section 3.2 suggests a new approach to assessing reforms and explains the approach at the industries level.

3.1 A comparison of transition economies

An aggregate analysis of infrastructure sector reforms in transition countries hints at a rather slow reform pace. Table 2 in Appendix 1 presents the infrastructure reform indicators for 26 transition countries for 1998-2000 for the most important material infrastructure sectors, telecommunications, railways, power, roads, and water/wastewater, as assessed by the European Bank for Reconstruction and Development (EBRD). The scale ranges from 1 (no market economy oriented reforms at all) to 4.3 (full
implementation of the sectoral regulation of Western European market economies). The point of reference is the degree of competition-orientation of infrastructure policies in developed market economies, in this case the countries of the European Union (which themselves are far from having implemented truly market-oriented reforms in most sectors). Only three transition countries have come close to Western European standards: Estonia (4.0), Hungary (3.7), and Poland (3.7). However, most of the other countries of Eastern Europe and all CIS-countries are still far from the reference model, and some countries have carried out virtually no reforms at all (Belarus, Tajikistan, Turkmenistan). On average, the reform-orientation of infrastructure policies has not progressed much since 1998 (from a 2.3 average in 1998 to 2.4 in 2000). While some market-oriented reforms can be observed in the telecommunication (from 2.4 to 2.7) and power (from 2.1 to 2.5) sectors, reforms in railways, roads, and water seem to be stalling.

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7 The evaluation is based on three criteria:

- Tariff reform, i.e. the introduction of cost-covering and allocatively efficient price structures;

- Commercialisation, i.e. the transformation of corporate governance structures, the introduction of hard budget constraints and, eventually privatisation;

- Regulatory and institutional reform, i.e. the setting-up of independent regulatory agencies with appropriate checks and balances, the definition of a formal institutional framework, etc.
The reforms of infrastructure policies in Eastern European countries not only lag behind their objective, i.e. market-orientation; they also lag behind the overall reform process, as estimated likewise by the EBRD in the form of "transition indicators". Finally, one observes differences that have emerged between different groups of countries towards the end of transition (Figure 1). The Central/Eastern European market economies have achieved the highest degree of market-orientation, though the difference between them and the reference model is still considerable. The post-Soviet mixed economies have carried out some reforms, but these seem to be stagnating at a low level (below 2.0). Finally, the Caspian state economies have proven to be almost totally reform-resistant in infrastructure policy reform, their infrastructure indicator was even regressing, from 1.5 (1998) to 1.4 (2000). Ukraine - belonging to the group of post-Soviet mixed economies - has made substantial progress in 2000, rising from 1.9 to 2.2 and reducing the gap vis-à-vis the Central/Eastern European market economies to 0.2 points.

8 The transition indicators measure the progress of reforms towards a market economy, also on a scale ranging from 1.0 (no progress) to 4.3 (full adaptation of market economy principles), see EBRD (2000, p. 41).

9 For a definition of these ideal-type groups, see Hirschhausen/Waelde (2001).
3.2 A detailed assessment of infrastructure indicators in Ukraine

A close study of Ukrainian infrastructure industries reveals that in fact they are still characterised by a limited involvement of the private sector, by maintaining monopolistic supply, by weak regulatory institutions, and by the burden of serving distributional purposes and social insurance instead of efficiency and profitability. Though over-capacities abound in many infrastructure sectors (e.g. railway, power), the quality of infrastructure services is low. Tariffs are still severely distorted. All in all, Ukraine is but at the initial stage of infrastructure reforms, and needs extensive restructuring and market-oriented regulations in order to achieve efficiency and to support economic recovery and growth.

During the first decade of transition Ukrainian governments have carried out relatively few infrastructure reforms, leading to low degrees of competition and a relatively distorted price structure, which still prevails today. The Ukrainian infrastructure reforms progress is expressed quantitatively in the EBRD infrastructure
indicators (EBRD, 2000, p. 42). The gap relative to Central/Eastern European market economies has become smaller in 2000 due to the adoption of new legislation for roads, a begin with railway restructuring, the adoption of changes to the power industry legislation regulating distributive accounts and increasing tariff collection ratios. However, a closer analysis reveals that the progress of reforms is somehow overestimated. Notwithstanding the adoption of progressive legislation for the roads sector, this legislation was never implemented. Instead, road financing was centralised in the state budget and was not funded at the expected level. Railway industry reforms only achieved momentum in 2001. Reforms in the power sector were directed less at the introduction of new regulations (e.g. a wholesale market, as originally planned), but at the improvement of the quality of existing regulations. The government has achieved some success in fighting the non-payment problem in the power sector by introducing distributive accounts, resulting in the strengthening of administrative control.

In order to get a more detailed and more appropriate picture of the Ukrainian infrastructure policy we developed a specific "Ukrainian Infrastructure Monitoring" approach (for details see Dodonov, et al., 2001). Following the EBRD indicators for reasons of compatibility, we extended them firstly, through indicator disaggregation, and secondly, through incorporation of measurements for the implementation of legislation and of key performance indicators, e.g. payment arrears and mutual settlements. We
introduced the following improvements with respect to the EBRD methodology:

1. A higher level of discretion in estimates to achieve more exact estimations of the progress of reforms.

2. Dis-aggregation into 21 indicators to introduce a more objective approach to estimation. The indicator established by the EBRD represents only one estimation, while the IERPC indicator is the mean of 21 estimations.

3. Incorporation of key performance and legislation implementation indicators, because the *implementation* of new legislation lags badly behind its adoption.

4. Application of universal criteria for all sectors, while the EBRD criteria are unique for each sector. Universal criteria ensure cross industry comparability of the indicators, though this implies a common ideal organisational structure for all infrastructure industries.

Figure 2 presents the infrastructure indicators of the EBRD and of the IERPC, respectively. The detailed indicators are presented in Table 3 in Appendix 1. The IERPC indicators are lower than the EBRD indicators, throughout. The higher level of discretion in the
IERPC indicators suggests that the EBRD indicators overestimate the pace of reforms.\textsuperscript{10}

**Figure 2: Infrastructure Policy Evaluation in 2000**

The following Section 4 explains how the IERPC indicator values are estimated, using the power and railway industries as examples.

4. **Case studies: The necessity to restructure and introduce competition**

4.1 *Tariff reform in the Ukrainian power sector*

The Ukrainian power sector received the highest grade for its infrastructure sector reforms, but all of the problems enumerated in Section 3 still pertain to it as well as to the other sectors. This subsection aims at explaining the procedure of the IERPC indicator estimation by describing various aspects of the sector's performance. Ukraine started to reorganise its power industry

\textsuperscript{10} We are inclined to conclude that these are problems with the EBRD indicators, which overestimate infrastructure reforms in Ukraine.
according to the British Pool model in 1994\textsuperscript{11}, but the industry's performance today is far departed from this model.

Though power generation on the one hand, and transmission, distribution and supply on the other, are now vertically separated \textsuperscript{12}, this separation took place only in a formal way because the state still owns the majority of the companies. All power generating companies remain in state ownership and only ten of the regional distribution companies had been partly or fully privatised by the end of 2000. Six more regional distribution companies were privatised in April 2001, raising the number private distribution companies to 13. This increased the indicator of 'natural monopoly ownership' from 3 to 3.3\textsuperscript{13}.

The National Electricity Regulation Commission (NERC), a formally independent organisation created by a Ukrainian presidential decree in 1994, regulates the power industry. Political

\textsuperscript{11} Presidential decree N 738/94, December 8, 1994.

\textsuperscript{12} There are seven generating companies: two using hydropower, one using nuclear power, and four based on burning fossil fuels. 27 regional distribution companies (oblenergos) buy energy on the wholesale electricity market, and transmit and deliver this electricity.

\textsuperscript{13} A score of 1.0 means that the natural monopoly is state owned. The maximum score is reached with wholly private ownership (for a description of the detailed methodology for estimating all indicators see Dodonov, et al., 2001).
interference in the NERC’s operations is still very pronounced, especially concerning the setting of tariffs for certain consumer groups and the division of revenues between generating and distribution companies. Our indicator "independence of the regulator, insulation from political influence" therefore has the value 2.7 both for 2000 and 2001.

As a result of the current low price policy in the power sector, deterioration of the equipment is very rapid, since it is impossible to upgrade the generating facilities and to modernise the sector without adjusting tariffs to meet market requirements. The level of true electricity costs in Ukraine is still being discussed. Officially the NERC uses a cost based approach\textsuperscript{14} for tariff setting. However, in practice, it sets the tariffs for industry above average cost in order to subsidise such consumers as private households and agricultural producers.

Furthermore, a comparison of the levels and structures of the Ukrainian power tariffs with western ones clearly shows that the NERC significantly underestimates them. Especially for households they are substantially below western levels. Electricity

\textsuperscript{14} In April 2001 the NERC enacted a new methodology that envisages rate-of-return tariffs, to meet the requirements of the new private owners. This will lead to tariff increases. However, the NERC has not enforced these changes because of resistance by the regional state administrations.
transmission losses are much higher in Ukraine than in developed countries. The density of the electrical network in Ukraine is quite high, but electricity consumption by private households is very low compared to western levels.\(^\text{15}\) In sum, we should expect higher transmission and distribution power costs per kWh for Ukrainian households than for western ones. In spite of this the NERC estimates the cost-covering transmission and distribution costs at no more than 1.5 US cent/kWh. \(^\text{16}\)

It can be expected that total electricity costs in Ukraine are higher than assessed by the NERC and might even reach the average OECD level. In Ukraine, the ratio of electricity prices for private households versus industry is below 1.0, whereas in developed countries this ratio is generally above two (see Table 1). This fact

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\(^\text{15}\) Per capita electricity consumption by Ukrainian private households was 2825 KWh in 1998; the respective figure for the OECD at the same time was 7751 kWh/per capita. Source: Ministry of Fuel and Energy of Ukraine, our calculation and IEA/OECD, Key World Energy Statistics 2000.

\(^\text{16}\) Haupt and Pfaffenberger (2000, p. 11) report average distribution costs of 3.6 EUR cent/kWh in Great Britain, which is about twice as high as the NERC estimates for Ukraine. Thus, the NERC’s estimation of cost-covering tariffs looks very unrealistic, taking into account the high fixed cost of energy distribution and the low consumption by the residential sector.
simultaneously points to two problems: cost-coverage and cross-subsidisation.

Table 1: Electricity tariffs in selected countries in 1999

As mentioned above, cost-based tariffs are not applied to all consumer groups. A significant number of Ukrainian consumers is subsidised by paying reduced tariffs for electricity (private households, closing coal mines, and agricultural producers). These subsidies are not financed out of state coffers but by the average wholesale price for electricity generated. As a result, the official cross-subsidies in the energy sector alone were nearly 1.32 bn UAH (242.59 m USD) in 2000. Even if the NERC calculations for cost-covering tariffs were used, private household tariffs should be increased by 15.08% to 55.56%, depending on the region.\textsuperscript{17} If however, the average OECD level were taken as the basis for the LRMC, the price would need to be raised about 300% percent.

The State also partially compensates the poorest private households for electricity expenditures. However, these compensations are paid

\textsuperscript{17} The transmission and distribution costs of different oblenergos vary due to differences in the customer structure and in the distribution net.
out to regional distribution companies, which is not as effective as would be direct income compensations to these households.

Thus, the common features of the pricing policy in the power sector are: tariffs at below cost-covering levels, cross-subsidisation of one consumer group by another, indirect subsidies instead of income compensation, and non-payments combined with non-monetary settlements.

Non-payments and non-monetary settlements have the most negative impacts on the sector's performance. Non-payment for the electricity consumed leads to serious cash shortages in the sector and hence to fuel supply shortages and frequent interruptions of the electricity supply. Electricity is generated at those power stations that have fuel on hand, instead of at those that can produce it at the lowest cost. However, the government has achieved some success in solving this problem, especially after July 2000. It also substantially increased the payment discipline of the budget organisations that were among the major debtors for consumed electricity, and it prohibited most of the non-monetary mutual settlements within the sector.

Taking into account all of the above noted peculiarities of tariff setting in 2001, the various indicators reflecting tariff reform were increased as follows: "final consumers collection ratios" from 2.0 to 3.3, "intra-industry payment ratio" from 2.0 to 3.0, and "budget indebtedness" from 1.7 to 3.3. The other five indicators aimed at reflecting tariff reforms remained unchanged. As a result the "tariff
reform" indicator, which is the average of all eight indicators, increased from 2.2 in 2000 to 2.6 in 2001.

4.2 Railways in Ukraine

Having inherited large infrastructure and rolling stock capacities from the USSR, but not having invested enough in maintenance and development, the Ukrainian Railways have ended up with 49% of their equipment being outmoded in 1998, compared to 39% in 1992\(^\text{18}\). The railway industry is in fact a monopoly serving distributional and social insurance purposes by subsidising other industries and the population at large. As a result it is constantly incurring losses and its assets suffer sharp deterioration. The impact of reforms on the railways could be very significant, however the industry remains among the slowest reformers.

The Ukrainian Railways are operated as a government department with a strongly integrated infrastructure, freight and passenger operations, construction and maintenance services, and quite an extensive social infrastructure. Restructuring of the industry was initiated only in July 2000 starting with the separation of the social infrastructure, services, railway construction, rolling stock repair, and maintenance from the railway infrastructure and rolling stock. Major achievements of the reforms in the industry in 2000 were the reduction of payment arrears and barter payments, leading to an

improvement in the financial situation in the industry. In 2000 the State Administration of Railways Transport of Ukraine reported profits for the first time in its history. In April 2001 corporatisation of the ancillary businesses of Ukrainian Railways was started.

These changes were reflected in our indicators provided in Table 3 in Appendix 1. The IERPC indicator for institutional development of the railways industry is a mean of the reforms achieved in commercialisation and privatisation, tariffs reform, regulatory and institutional reform. The overall progress of reforms achieved in 2001 due to commercialisation and separation of ancillary businesses, and the fighting of barter payments did not significantly influence the final grade of the IERPC indicator.

The indicator "commercialisation and privatisation" reflects changes in the ownership structure of the industry, the extent of participation of the private sector in service contracts, and the separation of the railway infrastructure and of potentially competitive businesses. Ukrainian Railways remain a state monopoly for infrastructure, transportation services and most construction and maintenance services. Infrastructure and transportation services are strongly integrated. The industry is still managed as a government department. The development planning and investment policies are subordinated to the production volume and to social security purposes instead of profitability and cost minimisation. Therefore, the progress achieved with construction, maintenance and service companies separation and corporatisation
improved the grade for the category only by 0.2 points compared to 2000.

The "tariffs reform" category reflects correct cost accounting and attribution of costs to the services provided, which is probably one of the major problems with railway regulation. In 2000, Ukrainian Railways has reported a gross profit of about UAH 500 m, although this was accompanied by a continuing rapid deterioration of the rolling stock and of infrastructure. Obviously not all costs were taken into account. The cost coverage problem could be solved through tariff adjustments, accompanied by railway capacity adjustments. Almost no measures were taken to reduce the costs and adjust tariffs to achieve a cost-covering level. The railway transportation volume has substantially declined during the 1990s, down to 29% of the 1980 volume, while the length of the rail lines has remained the same. At the same time, the increase in freight transportation tariffs during the 1990s was much less than the inflation rate.

Another problem with Ukrainian Railways is cross-subsidisation. The UAH 1.8 bn deficit generated by passenger transportation in 2000 was covered by freight transportation. The problem of cross-subsidisation in the Ukrainian railway industry is made worse by a poor compensation payment discipline by the state. A significant part of the deficit generated in passengers transportation is attributed to failure of the government to compensate for the
transportation of privileged passengers. Ukrzaliznytsia estimates the uncompensated deficit as UAH 500 m in 2000 19.

Although we took the success of fighting non-monetary payments and the improvement of payment collection ratios into account, the lack of reforms in other tariffs regulation areas in 2001 resulted only in a 0.1 improvement of the grade for the category compared to 2000.

Concerning introduction of an independent regulatory body and transparency of regulations, including regulations of access and service quality, no measurements were undertaken in 2001. Even after we have taken into account the fact that tariff adjustments were openly debated within the government, the final grade for the category remained unchanged.

Evidently, the categories of ownership and tariff reform remain the slowest reformers. The core businesses of railway infrastructure and passengers and freight transportation still were not touched by reforms. The reforms to ancillary business corporatisation can only be regarded as accessory. Partial deregulation in transition countries creates favourable conditions for corruption and rent-seeking (Aslund, 2000). To continue with accessory reforms in the

19 According to Ukrainian legislation, the costs born by the Ukrainian Railways have to be compensated out of state or local funds, depending on which authority granted the privileges. Law “On Railways Transportation”, (04.02.1996), #0237, article 9.
railway industry will lead to further substantial rent-seeking and outflow of capital through ancillary business enterprises if their owners are affiliated with the management of the core businesses and contracts are not traded in a transparent way.

5. Conclusions and policy recommendations

Infrastructure restructuring is one of major elements of structural reforms in transition economies because of its expected large economic and social impact. As can be inferred from the studies by other researchers, infrastructure investments alone do not have a significant influence on economic growth. The institutional environment is a very important complement, allowing infrastructure investments to be translated into economic growth. By enhancing the competition between and the efficiency in infrastructure industries, the government can make an indirect contribution to economic development.

For a number of reasons the link between infrastructure and growth cannot be precisely quantified for transition countries. One problem with assessing the linkage is the limited statistical data availability and comparability. It is possible to produce estimations only at a very aggregate level or with very indirect measures. Therefore, one should be very careful when interpreting the results. Nevertheless, according to our estimations, infrastructure policy is an important factor for translating infrastructure investments into economic growth. This suggests that, as much attention should be paid to the
creation of an institutional framework and of regulations as to infrastructure investments themselves. The development of infrastructure reform indicators is an important step in studying the linkage between infrastructure investments and growth.

The major lesson drawn from the case studies presented above is that tariff policy should play a crucial role in solving the problem of financial sustainability of most infrastructure industries. In this field, Ukraine must substantially change its approach. The current Ukrainian tariff policy is characterised by cross-subsidisation, levying tariffs below cost-covering levels, and indirect instead of direct subsidisation. Instead, a policy of commercialisation and of cost reflective tariffs should be pursued. Incentives for cost reductions should accompany the new steps towards tariff adjustments to cost-covering levels. These incentives should be supported by built-in tariff adjustment mechanisms, the separation of infrastructure and major potentially competitive businesses, as well as by the reduction of the amount of government subsidies and an improvement in the state-support payments discipline.

Deregulation should be carried out in parallel with commercialisation and tariff reform. Both developed market economies and developing countries provide evidence that deregulation along with the enforcement of competition lead to price declines and improvements in the quality of the services provided. However, deregulation accompanied by a slow pace of
core reforms could potentially lead to rent-seeking related to incentive structure distortions.
References


### Table 1: Electricity tariffs in selected countries in 1999

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<th>Household price USD/kWh</th>
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* Ukraine – NERC data
Figure 1: Infrastructure indicators by group of countries

Figure 2: Infrastructure Policy Evaluation in 2000

Source: EBRD (2000, p. 42) and own estimates
## Appendix 1

### Table 2. EBRD infrastructure reform indicators, 1998-2000

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Table 3. Infrastructure indicators for Ukraine

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### Appendix 2

#### Table 4. Fixed-effects (within) regression

|                | Coef.  | Std. Err. | t      | P>|t|  | [95% Conf. Interval] |
|----------------|--------|-----------|--------|-------|---------------------|
| ln_gdp         |        |           |        |       |                     |
| ln_gge         | .4460795 | .04859 | 9.181  | 0.000 | .34895 .54321       |
| ln_gdi         | .1005943 | .02646 | 3.802  | 0.000 | .04770 .15349       |
| ir             | .0170026 | .00368 | 4.619  | 0.000 | .00964 .02436       |
| _cons          | 4.244854 | .29179 | 14.548 | 0.000 | 3.6616 .4.8281      |

F test that all u_i=0:  F(12,62) = 28.35  Prob > F = 0.0000

#### Table 5 Random-effects GLS regression

|                | Coef.  | Std. Err. | z      | P>|z|  | [95% Conf. Interval] |
|----------------|--------|-----------|--------|-------|---------------------|
| ln_gdp         |        |           |        |       |                     |
| ln_gge         | .5131739 | .04604 | 11.147 | 0.000 | .42295 .60340       |
| ln_gdi         | .0930553 | .02720 | 3.409  | 0.001 | .03955 .14656       |
| ir             | .0184887 | .0038  | 4.820  | 0.000 | .01097 .02601       |
| _cons          | 3.768472 | .27139 | 13.886 | 0.000 | 3.237 .4.3004       |

Wald chi^2(3) = 378.58  Prob > chi^2 = 0.0000

#### Table 6 Hausman specification test

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Test:  H0: difference in coefficients not systematic  
\[ \chi^2(3) = (b-B)'[S^{-1}](b-B) \]  
\( \chi^2(3) = 18.63 \)  
Prob>\( \chi^2 \) = 0.0003

#### Table 7. Reformulated model in first differences.

|                | Coef.  | Std. Err. | z      | P>|z|  | [95% Conf. Interval] |
|----------------|--------|-----------|--------|-------|---------------------|
| dln_gdp        |        |           |        |       |                     |
| dln_gdi        | .0820674 | .0330917 | 2.480  | 0.013 | .01721 .1.469       |
| dln_gge        | .5971309 | .0441087 | 13.538 | 0.000 | .51068 .6836        |
| dir            | .0228068 | .0048629 | 4.690  | 0.000 | .01328 .0323        |

Cross-sectional time-series FGLS regression  
Number of obs = 77  
Number of groups = 13  
Obs per group:  min = 5  
max = 6  
Wald chi^2(3) = 343.74  
Log likelihood = 72.96242  
Pr > chi^2 = 0.0000