The Role of Investment and Regulatory Reforms in the Development of Infrastructure across Transition Economies

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Abstract

The main aim of this paper is to assess whether investment in infrastructure and broader institutional infrastructure reforms have been reflected in better infrastructure performance indicators across transition economies. Our econometric analysis shows that at the enterprise level the reduction of utility arrears is significantly associated to lower costs in terms of interruption of power and telecom service provision. This suggests that the discipline exercised by private sector involvement is starting to have some impact. At the country level our regression results show that increased investment, tariff increases and the establishment of an independent regulator are all significantly associated to the reduction of power and telecom outages.

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1. Introduction

Transition economies are facing enormous challenges in terms of physical and institutional infrastructure. In terms of physical infrastructure, new evidence based on a major enterprise level survey implemented by EBRD and the World Bank in 2002 shows severe power outages as well as unavailable mainline telecom services.[1] The low level and restricted access to utilities services has determined very high transaction costs and weaken competition. This is reflected in considerable costs for enterprises, measured for instance by the number of working days lost due the interruption of infrastructure services. In terms of institutional reforms transition, many countries are still characterised by severe under-investment, very low tariffs (not allowing cost recovery) and the lack of independent regulators, in turn creating a vicious circle reinforcing under-investment. The development of predictable and transparent regulatory frameworks would ensure users' access to competitively priced, high quality services and would engender investment in the infrastructure sectors. The new economics of regulation, pioneered by Baron and Myerson (1982) and Laffont and Tirole (1993), analyses the optimal design of regulation to encourage efficiency in the short term. One of the main insights coming from this literature is that high powered incentive schemes (price cap) should be preferred to low powered schemes (rate of return regulation) to encourage investment. However, there is no clear consensus on the impact of different regulatory schemes on long-run investment. The results depend very much on the way different schemes are implemented. For instance, Gilbert and Newbery (1994) modelling regulation as a

[1] The Business Environment and Enterprise Performance Survey (BEEPs) was implemented by the EBRD and the World Bank in the summer of 2002 to assess the business environment and enterprise performance across transition economies. It includes 6,000 enterprises across 26 countries of eastern Europe and Former Soviet Union.

repeated game between a firm facing a stochastic demand and a regulator tempted to disregard past investments show how Useful and Used Rate of Return Regulation (with a commitment to an adequate rate of return on useful and used capital, i.e. prudently invested) support an efficient investment programme for a larger set of parameter values than price cap regulation.

The main aim of this paper is to assess whether investment in infrastructure and broader institutional reforms have been reflected in improved performance indicators of infrastructure services (e.g. lower interruption of infrastructure service provision).

Cross-country evidence generally indicates that the combination of privatisation and broader regulatory reforms is associated with significant improvements in the performance of the utilities sector, on any of a range of indicators, whereas privatisation on its own has only limited impact.[2] However, there is still limited empirical evidence on transition and developing economies, also due both to lack of adequate or reliable census data and most of the studies are based on cross-country analysis. This paper attempts to tackle similar issues considering new microeconomic evidence from survey data from a major enterprise level survey (implemented by EBRD and the World Bank in the summer of 2002).

Our econometric analysis at the enterprise level shows some interesting results. At the enterprise level, the hardening of budget constraints (leading to the reduction of utility arrears) is significantly associated to lower power and telecom outages. This suggests that the discipline exercised by infrastructure providers that have been corporatised and in many cases privatised is starting to have some impact, as non-paying enterprises get disconnected. Interestingly, business users' qualitative and quantitative assessment of the infrastructure sectors are consistent both at the enterprise and country level. That is, enterprises that identify the relevant infrastructure sector as one of the main obstacles to growth and

[2] See Ros (1999) and Boylaud and Nicoletti (2000).

expansion, relative to many other alternative obstacles creating an adverse business environment are also the ones that are more severely affected by power and telecom outages. At the country level our regression results show that increased investment, tariff increases and the establishment of an independent regulator are all significantly associated to the reduction of power and telecom outages. These results hold controlling for ownership, size and location effects. Finally, our data provides a strong evidence of power and telecom infrastructure determining a divide between urban and rural areas, due to lack of investment in infrastructure networks and lack of choice in terms of alternative providers of services.

The structure of the paper is organised as follows. Section 2 introduces the key hypotheses on the expected links between some infrastructure performance indicators and country and enterprise level explanatory variables. Section 3 reports the distribution of the key variables by ownership, size and geographical location. Section 4 reports the results of the empirical analysis. Section 5 concludes and draws some policy implications.

2. Explanatory Variables of the Reliability of Infrastructure

This section describes the key hypotheses regarding the expected links between investment in infrastructure and broader institutional reforms and improved performance indicators of infrastructure services (e.g. lower outages times).

The enterprise-level variables are based on the Business Environment and Enterprise Performance Survey (BEEPS), a microeconomic survey implemented by EBRD and the World Bank in the summer of 2002. The main aim of the survey was to shed light on enterprise behaviour and performance and their relation to competitive pressures, the business environment and the relationship between enterprises and the State. The full sample included over 6,000 enterprises in 26 countries of the region. The survey sample was designed to be broadly representative of the population of the firms according to their economic

significance, sector, size and geographical location within each country, subject to minimum quotas for the total sample in each country.[3]

Let us start by discussing the dependent variables that we use in our empirical model. As an indicator of lack of quality and reliability of infrastructure services we adopted an indicator of the average number of days in 2001 when the enterprise experienced outages, in terms of power outages and unavailable mainline telecom services.

In the power sector, regional differences are very significant, with outages amounting to less than 3 days in the Central Eastern Europe and the Baltics (CEB) region, versus values close to 14 and 23 days respectively in South and Eastern Europe (SEE) and Commonwealth of Independent States (CIS) countries, as illustrated in Fig. 1.[4] For the telecom sector, outages range from slightly more than one day in the CEB region, to values close to 6 and 12 days respectively in the SEE and CIS region.

<<Insert Fig 1 about here>>

Also within region, the cross-country variation is significant. This reflects the various stage of development of the infrastructure. Georgia, Azerbaijan and Albania are the outliers, displaying the greatest disruption in terms of power outages. This reflects severe problems, leading to electricity crisis, as confirmed

[3] See Appendix 1 for more details on the survey sample.

[4] The CEE region includes Croatia, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Slovak Republic and Slovenia. SEE includes Albania, Bosnia and Herzegovina, Bulgaria, Serbia and Montenegro, FYR Macedonia and Romania. CIS includes Armenia, Azerbajian, Belarus, Georgia, Kazakhstan, Kyrgyz Republic, Moldova, Russia, Tajikistan, Ukraine and Uzbekistan.

by the evidence. In particular, Albania has been facing a severe electricity crisis since the summer of 2000, as a result of the chronic failure to curb illegal use of electricity and the severe extent of arrears (coming from non-payment bills) as well as deteriorating hydrological conditions on the predominantly hydropower based system. The dominant energy provider (KESH)'s power transmission and distribution losses were 43.4% of electricity supplied to the grid, of which about 20% were due to theft and collection ratio was as low as 61.5%. Electricity was sold at an average price per kWh that was less than the import price (including tax). In 2000 KESH received a subsidy of US$ 25 million from the Government for the purchase of imported electricity. In 2001 with steeply increased electricity imports and a proportionally lower import subsidy, KESH incurred substantial losses. A two-year energy sector action plan put in place in with tariff collection and reduction of distribution losses targets.

The list of explanatory variables of infrastructure outages is reported in Table 1. It consists of both enterprise-level variable as well as country level variables. A key variable that we use in the analysis is a measure of the extent to which utility-related soft budget constraints are not yet overcome. The presence of utility arrears is expected significantly associated to the higher power and telecom outages. The scale of losses and non-collection across transition economies in some of the utilities sectors (particularly the energy sector) is very high and contribute to lower service standards. It is also inconsistent with good management and protection of customers and would not be tolerated under private ownership. The discipline exercised by infrastructure providers that have been corporatised and in many cases privatised can contribute to lower outages, as non-paying enterprises get disconnected. Some of the arguments for private ownership – such as the need to access capital to meet growing demand and improve quality of service – are even stronger for transition economies. And the discipline provided by private ownership is even more needed.

<<Insert Table 1 about here>>

To illustrate the extent to which intra-infrastructure utility arrears are reinforced in a vicious circle we report the case of Moldova. The main debtors of Union Fenosa, the strategic investor that privatised three of the Moldovan electricity distribution companies, include Apa-Canal, the water company and Termocom, the heating company. Apa Canal and Termocom are in turn suffering from the non-payment of water and heat by consumers of all categories, mainly state-owned but also private enterprises. In this way, water and heat power suppliers become in arrears to electricity suppliers. In turn, electricity supplier raises tariffs. Business and residential consumers tend to prioritise the payment of electricity rather than water and heat, reinforcing a virtuous circle of non-payment of utilities bills.

To capture the obstacles faced by enterprises to get access to infrastructure services we use an indicator of waiting time; that is the average number of days needed to get connected to mainline telecom and electricity services in 2001. Regarding the expected links between access and reliability of infrastructure services we expect a positive sign. In the context of transition economies, we expect that the costs initially suffered by enterprises due to delays in provision of access to the service are aggravated later by the cost of disruptions caused by interruption of services.

Anecdotal evidence from the case studies across transition economies suggested that even getting service hook-ups for telecom, electricity or gas supplies often required side payments to the utilities and the regulators. Some enterprises resorted to steal service from neighbouring firms or renting space within existing firms' warehouses just to be able to get utility service. Albanian enterprises report that fixed telecom lines are stolen or someone would illegally connect to the lines. One of the interviewed Albanian enterprises had filed an application for 40 telephone lines in one of its buildings and has not received an answer from over a year.

We also use some qualitative assessment of the infrastructure sectors both at the enterprise and country level. Enterprises were asked to report whether infrastructure sectors represented a major obstacle to growth and expansion, relative to many other alternative obstacles creating a negative business environment. The business environment is multi-dimensional and includes key aspects of governance provided by the state such as business regulation and taxation, law and order and the judiciary, as well as infrastructure and financial services. Qualitative measures of the business environment benefit from a uniform measurement scale in terms of the extent to which each of its broad dimensions creates an obstacle to the operation and growth of firms (ranging from minor obstacle to major obstacle on a 1 to 4 scale), however these measures lack precision. It is therefore informative to consider both types of measures.[5]

Finally, in the case of telecom we can use additional information controlling for the relative importance of the use of fixed line and mobile services in interactions with clients and suppliers. We expect that more intensive users of fixed lines and mobile are characterised by lower interruption of infrastructure services. Particularly in the case of mobile we expect the presence of substitution effects in place with respect to the use of fixed line. In the context of transition economies, official data shows in the most recent years an exponential growth of mobile penetration rates versus stagnation in fixed line rates. Moreover, in many countries --not only the relatively well off EU accession countries, but also poorest countries, such as Albania-- mobile penetration rates exceeded fixed line penetration rates. The mobile penetration levels of some of the transition countries are close to Western European penetration levels. Top of the league is Slovenia,

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[5] Quantitative measures of the business environment offer a greater degree of precision, however they often focus narrowly on aspects of the business environment that are amenable to quantitative measurement (often proxy measures for transactions costs).

with an 86.6% mobile penetration rate as of the end of 2002, closely followed by the Czech Republic, Hungary and Slovak Republic, which all have penetration rates of well over 50%. Markets in these countries are fast approaching saturation and operators are increasingly turning to alternative non-voice revenues stream in order to continue growth. For a second tier of countries –including Poland, Croatia, Romania and Bulgaria - mobile markets are increasing, but where there is still potential for subscriber growth. For another set of countries -including Serbia and Montenegro, Albania, Macedonia and Bosnia and Herzegovina- mobile markets are growing fast from a low subscriber base. An interesting feature common to many countries is that the mobile arms of the incumbents are the smallest and least successful operators. Large foreign players, such as Orange in Romania, hold the largest market shares through a combination of low-cost, pre-paid offers, backed by extensive marketing and branding activity, as well as national distribution networks. In Albania, the arrival of Vodafone in the market alongside Albanian Mobile Communications (AMC) has provided a significant boost to subscriber numbers. Despite launching services in the third quarter of 2001, by the end of 2001 Vodafone's pre-paid services had proved so popular that it had gained 118,567 subscribers in just three months, helping to increase penetration to over 25% at the end of 2002. This is a great achievement, particularly in a country whose 2002 per-capita GDP was among the lowest in the region. Subscriber bases are comprised almost entirely of pre-paid subscriptions - 99% of Vodafone's Albanian subscribers at the end of 2002 were pre-paid - and are attracted by an increasing number of cheap pre-paid offers, particularly as mobile can be bought and utilised immediately, whilst fixed-line operators are still battling to overcome waiting lists. This can be interpreted as clear evidence of substitution effects, motivated also by attempts by business users to overcome the poor quality of fixed line services.

We control for several enterprise level control variables. The first of these control variables is represented by ownership. There might be two counteracting effects. On one hand, we expect privatised and state owned enterprises to

experience less frequent interruption in power and telecom services, because they enjoyed privileged relationships with infrastructure providers, particularly when they have not been privatised. On the other hand, private de novo enterprises can experience less frequent interruption of infrastructure services, because --where they have the means-- they try to find alternative solutions, such as installing their own power generator for power or resorting to more reliable service providers (using mobile versus fixed line services in the case of telecom). To reinforce this impact, we expect privatised and state-owned enterprises to experience more frequent interruption in power and telecom services, due also to the lack of discipline in payment. Regarding the relationship of the with firm size, we expect larger firms to be more intensive users of infrastructure services and as such to be characterised by a much higher bargaining power versus the infrastructure providers, as they represent their biggest source of revenues. More intensive users of infrastructure services can in addition find it profitable to resort to innovative solutions as described earlier, including building their own generators. This in turn leads to get better terms of access to infrastructure services.

From case studies conducted in the summer of 2002 in selected transition countries we find anecdotal evidence of an uneven playing field tilted against private de novo enterprises, particularly smaller ones. Many interviewed enterprises, complain that electricity providers face collection problems from big losing making enterprises, particularly in the state-owned sector, but never stop or change the terms of the supply to these companies. Instead, the electricity providers apply discriminatory rules to private sector enterprises, interrupting services and/or changing arbitrarily the terms of the contract. Some private enterprises in Macedonia report cases of business disputes with the electricity company related to the violation of the agreement by the electricity company by raising prices and lowering quality, by supplying lower voltage (especially during the very cold winters), which forced the company to stop production several times. However, we also find evidence of private companies resorting to the extra cost of installing a generator, particularly in the countries where the provision of power

services is unreliable. In the case of Albania, many interviewed companies have their own power generators, because they rate electricity supply and quality as completely not reliable. Having their own generators is very expensive for enterprises (roughly 3 times more than using the electricity provider) due to the higher price of fuel, but according to the enterprises' general managers there is no other alternative, because of the monopolistic status of provision of services.

Enterprises located in highly densely populated towns are less likely to experience interruption in infrastructure service provision than the ones located in less densely populated towns. In many rural areas serious problems are determined by an old infrastructure network that leads to very poor quality in the provision of infrastructure services and a lack of choice in providers that artificially keeps prices high contributing to higher costs to enterprises.

Finally, we also control for different country level variables. A better legal and regulatory framework leading to competition is expected to bring associated benefits in terms of better service quality. In particular, we use different indicators associated to increased investment, tariff increases and the establishment of an independent regulator. Private sector involvement has been characterised by specific commitment to investment in the network particularly in the case of telecom. This is expected to result in the upgrade and or development of network leading in turn to better service provision, resulting in lower interruption of services. In the case of power, transition economies are also characterised by very high energy intensity. The ratio of energy consumption to GDP gives a measure of energy intensity. High energy intensity is not necessarily a sign of inefficient use of energy. However, available evidence suggests that transition countries do not use energy as efficiently as they could and there are opportunities to reduce consumption without incurring high costs. A more efficient use of energy (that is a reduction in the energy intensity indicator) is expected to release the constraints due to oversupply of such services and lead to lower outages. For both the power and energy sector we report the progress made to date in introducing tariff reforms and introducing independent sector regulators. In the context of transition

economies, under-investment were also exacerbated by low tariffs, in many cases not allowing infrastructure providers to cover costs. This situation was sustainable given the existence of implicit and explicit subsidies and budgetary transfers to the power industry. The inability of budget constrained governments to increase support, and the failure to increase tariffs to cost recovery levels, has undermined the financial viability of power sectors in the region. In such strained financial situation infrastructure providers are not able to provide reliable services. Hence, higher tariff are expected to be positively associated to lower power and telecom outages. Tariff reforms and increased investment are expected to be supported by the presence of an independent regulator, able to implement such reforms. Vital for settling market disputes and policy issues, the regulator must be able to operate independently, strong enough to embrace regulatory reforms that will face the resistance of the incumbents.

3. Distribution of the key variables

This section reports the distribution of the key variables that we will use in our empirical analysis by the main enterprise characteristics, including ownership, size and geographical location. Table 2 reports the distribution of the key variables by ownership. It is interesting to note that the interruption of power and telecom services is the highest for privatised enterprises, across the different ownership categories. It is also interesting to note that overall telecom services appear to be more reliable than power services. In the case waiting times, instead, the delays suffered by enterprises before getting connected to the services are on average higher for telecom services rather than electricity. Both in the telecom and power sector, de novo enterprises experience the highest waiting times. Likewise, the business environment appears to be tilted against private de novo enterprises, even if the difference by ownership types is rather small.

<<Insert Table 2 about here>>

Utilities arrears are significantly more widespread for state-owned enterprises, with a percentage above 16% of SOE characterised by overdues to infrastructure providers, a percentage more than 3 times higher than for private de novo enterprises. This provides some evidence of how privatized and state-owned enterprises are by far the greatest beneficiaries of soft budget constraints for all countries, confirming also in this context the presence of an uneven playing field tilted against private de novo. Finally, the use of fixed line services in the interactions with clients and suppliers is the highest for state owned enterprises (with a percentage of SOEs above 98%, versus 94% of private de novo), but the business use of mobile is much more diffused across private de novo enterprises (with a percentage close to 86% of de novo versus 76% of SOEs).

Table 3 reports the distribution by size. Uneven playing field tilted against sme (small and medium enterprises) both in terms of access and reliability of energy and telecom services. Energy outages times vary from close to 13 days for small enterprises versus about 7 days for large enterprises. Telecom waiting times ranges from 11 days for small enterprises to 5 days for large enterprises. Infrastructure obstacles are also rated as higher by smaller enterprises, particularly in the case of telecom.

<<Insert Table 3 about here>>

As in the case of ownership, utility arrears are much more widespread across large enterprise. However, in this case only twice as many large enterprises report overdue payments to utilities. As one would expect a higher percentage of large enterprises use regularly telecom services in their interactions with clients and suppliers (with a percentage very close to 99%, versus 93% of small enterprises). The difference is even more relevant in the case of cellular services, where a percentage close to 93% of large enterprises compares rather favourably to 80% of small enterprises.

Table 4 reports the distribution by geographical location. Here the distribution provides some evidence of a divide between urban and rural areas. The two less densely populated categories (including cities with population densities lower than 250,000) are characterised by substantially higher costs due to interruption of power and telecom services.

<<Insert Table 4 about here>>

In terms of waiting times the relation with population density is non-linear and there are no substantial differences across the different location groups. Infrastructure obstacles do not vary substantially across different location categories. Utility arrears, instead, are more widespread across rural enterprises, but the difference is not as significant as for ownership and size classes. Instead, the most significant variations in use of telecom services occur by population density, particularly in the case of mobile, rather than by ownership and size.

4. Regression Results at the Enterprise Level

In this section we test the hypotheses that we put forward in section 2 for the two infrastructure sectors for which we can collect the required data: that is, the energy and telecom sectors.

<<Insert Table 5 about here>>

Equations (1)-(3) in Table 5 report the results of ordinary OLS regressions, where the dependent variable is the number of working days characterised by power outages. The covariance matrix is reported in Appendix 2.

In equation (1) the only explanatory variables are represented by enterprise level characteristics. The relation between the presence of arrears and power outages is positive and highly significant at the 1% level. This suggests that the discipline exercised by infrastructure providers that have been corporatised and in

many cases privatised is starting to have some impact, as non-paying enterprises get disconnected.

Our analysis also shows a strong correlation between business obstacles and added costs and constraints of businesses. That is, enterprises that identify the power sector as more severe obstacles to growth and expansion, relative to many other alternative obstacles creating an adverse business environment are also the ones that are more severely affected by power outages. In particular all three dummies that correspond to an increasing intensity of the obstacles from minor to major (compared to the missing category of no obstacles) are significant at 1% confidence level and characterised by an increasing value of the coefficient.

Our results do not show the presence of significant links between power waiting times and outages. Equation (1) also controls for ownership, size and geographical effects. In terms of ownership dummies, only privatised enterprises are significantly linked to higher power outages (with respect to the missing dummy identifying private de novo enterprises). This can provide some evidence to our hypothesis according to which private de novo enterprises are able to overcome power outages by relying on their own generators. In line with our expectation, larger enterprises are also characterised by lower interruption of power services, most likely due to the strongest bargaining position relative to smaller enterprises.

The positive and highly significant (at 1% confidence level) coefficient on geographic location confirms the divide between urban and rural areas, as we expected. This confirms our predicted hypothesis; that is, the disadvantages of rural areas in terms of lack of choice in the provision of infrastructure services.

Equation (2) tests the robustness of our model with respect to the additional controls. We find that countries that identify the power sector as a more severe obstacle to growth and expansion are also the ones that are more severely affected by power outages. This confirms the relevance of the business environment variable both at the country and enterprise level.

Finally, equation (3) also controls for policy-level variables. All the results

reported above still hold. In terms of country level variables, all the three selected variables are highly significant and carry the expected sign. Decreased energy intensity, increased tariffs and the establishment of an independent regulator are all significantly associated to the reduction of power outages.

<<Insert Table 6 about here>>

Equations (1)-(3) in Table 6 report the results of similar regressions in the case of the telecom sector. The dependent variable in this case is the number of working days characterised by mainline telecom outages. The main results are very similar to the previous one.

As in the case of the energy sector, the relation between the presence of arrears and outages is positive and highly significant at the 1% level. We also find a strong correlation between telecom business obstacles and added costs and constraints of businesses in terms of outages. In particular all three dummies that correspond to an increasing intensity of the obstacles from minor to major (compared to the missing category of no obstacles) are significant and characterised by an increasing value of the coefficient.

In contrast to the energy sector, our results for telecom show the presence of positive and significant links between telecom waiting times and outages. Enterprises that wait longer to get connected to fixed line services are also suffering higher costs in interruptions of the services. In the case of telecom we are able to control for specific effects, identifying more intensive users of fixed line and telecom services. The results show that more intensive users of fixed lines and mobile are characterised by lower interruption of fixed line telecom services. In the case of mobile, this confirms the use of mobiles by businesses as an alternative to less reliable fixed line services.

Neither ownership nor size dummies are significantly associated to

telecom outages.[6] However, the divide between more and less densely populated areas in terms of disruptions of fixed line services emerges only after controlling for country level effects.[7] In terms of country level variables, all the three selected variables are highly significant and carry the expected sign. Increased investment, tariff increases and the establishment of an independent regulator are all significantly associated to the reduction of telecom outages.

5. Conclusions and Policy Recommendations

The main aim of this paper is to assess whether investment in infrastructure and broader institutional reforms have been reflected in improved performance indicators of infrastructure services. In particular, we use standard OLS regressions to analyse the key explanatory variables underlying the cost imposed to enterprises by interruption in the provision of electricity and telecom services.

Our econometric analysis at the enterprise level shows some interesting results. At the enterprise level, the reduction of utility arrears is significantly associated to the reduction of power and telecom outages. This suggests that the discipline exercised by infrastructure providers that have been corporatised and in many cases privatised is starting to have some impact, as non-paying enterprises get disconnected. Interestingly, business users' qualitative and quantitative assessment of the infrastructure sectors are consistent both at the enterprise and country level. That is, enterprises that identify the relevant infrastructure sector as one of the main obstacles to growth and expansion, relative to many other

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[6] It should be noted that if we drop the dummy capturing substitution effects of fixed line with mobile privatised and state-owned enterprises dummies are significant and carry a positive sign.

[7] If we introduce the population density as five dummies, the dummies representing rural areas is always significant at 1% confidence level.

alternative obstacles creating a negative investment climate, are also the ones that are more severely affected by power and telecom outages. At the country level our regression results show that increased investment, tariff increases and the establishment of an independent regulator are all significantly associated to the reduction of power and telecom outages. These results hold controlling for ownership, size and location effects. Finally, our data provides a strong evidence of power and telecom infrastructure determining a divide not only between countries but also within countries, notably between urban and rural areas, as the regression results confirms.

Let us now draw some policy implications. Our analysis provides strong support to the importance of implementing regulatory reforms. The appropriateness of the regulatory rules themselves can matter enormously, removing one significant obstacle to the development to the growth and expansion of business, as well as to regional integration. Experience in infrastructure reforms and the widespread private participation in infrastructure around the world suggests that the introduction of the private sector in a well-regulated and liberalised environment results in lower prices and better quality of the sector.[8] The ideal sequencing is to set in place the regulatory framework before privatizing utilities, as well as using privatisation to design the most appropriate market structure.[9] Our analysis confirms the importance of establishing an independent, transparent and publicly accountable regulatory oversight process and institutions, bringing transition economies close to meet EU requirements.[10] This includes strengthening the independence of the newly created sectoral regulatory agencies,

[8] See, among others, Newbery and Pollitt (1997).

[9] On the relevance of sequencing of reforms, see among others Wallstein (2002).

[10] For an overview of the progress made by EU accession countries in this regard see Buiter and Vagliasindi (2003)

also financially to ensure that they have the necessary resources to operate. At the same time independence needs to be balanced by accountability and requirement for monitoring and assessment of regulatory impact, in terms of cost-benefit analysis.

In the context of transition economies, a crucial regulatory challenge is to implement tariff reforms, in light of the initial conditions characterised by low tariffs, in many cases not allowing infrastructure providers to cover costs. The failure to increase tariffs to cost recovery levels has undermined the financial viability of the infrastructure sectors in the region. In such strained financial situation infrastructure providers were not able to provide reliable services.

Promoting further private sector involvement is also crucially dependent on the implementation of tariff increases. Private sector involvement includes needed steps towards commercialization, restructuring and ultimately privatisation of the key utility sectors. The choice of the method of privatisation is also crucial. Where possible, it is preferable to involve strategic investors in order to secure finance for necessary investments and to strengthen incentives for improved efficiency. The electricity sector privatisation can be designed so as to encourage payment discipline through appropriate sequencing. A private firm owned or managed by a foreign strategic investor will have a stronger incentive to enforce payments discipline. Hence, privatisation of distribution should occur not later than privatisation of generation when payments discipline is a problem. This is because privatisation of generation when there is low cash collection is likely to attract low sale revenues and may not support necessary investment. This could in turn lead to increasing political objections to reforms.

Our analysis shows that utility arrears are still key problems across transition economies and are strongly associated to lower standards of infrastructure services. Experience to date suggests that in cases where the private sector has entered power distribution, there have been major improvements in payments discipline. Improvements in efficiency resulting from private participation may in turn reduce the price increases necessary to ensure the

viability of the power sector. The introduction of the private sector would also help to mobilize finance and increase the possibility of further investments in the sector.

One of the most critical bottlenecks constraining entry is the market power exercised by infrastructure service providers and the regulatory regime governing their service offerings. In the key infrastructure services --electricity and telecommunications-- state-dominated monopolies still play a major role. In purchasing such infrastructure services, manufacturing firms, particularly new, smaller ones, are offered little --if any-- price competition and have few opportunities to choose among suppliers. In many cases regulation is needed to support competition. There are important regulation involves designing rules to ensure the emergence of effective competition, by providing access to the incumbent's network. Those operators with the ability to abuse their market power should be subject to special rules (*ex ante* regulation) to ensure that they do not abuse their dominance. The EU directives for telecom, energy and transport require the establishment of fair, transparent and non-discriminatory terms of access.

Finally, our paper identifies the presence of a strong divide between urban and rural areas. Policies aiming at divide issues should not only address those factors which are only temporary and will be resolved through market forces without government intervention. Technological innovation and regulatory reforms are making access to infrastructure services more affordable and provides tremendous opportunities to close the divide, particularly in the case of telecom. Broader market based reforms (including privatisation, competition and regulatory reforms, including cost-based pricing) should be used to close the gap between the current level of infrastructure development and the level achievable in a liberalized market. However, market based reforms will not expand service to uneconomic areas. Going forward, regulatory institutions should address issues such as whether and how infrastructure should be subsidised in under-served areas. Regulatory incentives can be created through specific universal access

policies and public investment subsidies schemes. Such strategies of public support can maximize their impact by leveraging private investment through minimal and well targeted subsidies to achieve commercial viability in the long run.[11] The successful experience of some Latin American countries, such as Chile and Peru, can be used to guide some of the Eastern European countries. In Chile and Peru, many licenses awarded though competitive bidding process (where the lowest bidder was awarded the subsidy and right to operate network to expand services) were granted with a zero subsidy.

[11] See among others the analysis of Navas et al (2002).

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Table 1
Explanatory Variables Influencing Infrastructure Outages
(Expected Relationship)

Variables	Definition	Exp. Sign
Utility arrears	= 1 if the firm has any utilities payments overdue (by more than 90 days) = 0 otherwise	+
Waiting Times	= number of days needed to get connected to infrastructure services	+
Infrastructure Obstacles	= 1, 2, 3, 4 if the obstacle posed by the relevant infrastructure service is perceived as not existent, minor, moderate, major	+
Telecom Business use	= 1 if the firm regularly use fixed line services (mobile) in its interactions with clients and suppliers = 0 otherwise	-
BASIC CONTROLS		
Private De Novo	= 1 if private since established = 0 otherwise	?
Privatized SOE	= 1 if privatized = 0 otherwise	?
SOE	= 1 if state-owned = 0 otherwise	?
Small	= 1 if small enterprise (below 50 employees) = 0 otherwise	+
Medium	= 1 if medium enterprise (between 50 and 250 employees) = 0 otherwise	-
Large	= 1 if large enterprise (between 250 and 10,000 employees) = 0 otherwise	-
Population Density	= 1, 2, 3, 4, 5 if the enterprise is respectively located in the capital, in an other city with density over 1 million, between 250,000 and 1,000,000 50,000 – 250,000, under 50,000	+
COUNTRY-LEVEL VARIABLES		
Independent Regulator	= 1 if an independent telecom/energy regulator has been established = 0 otherwise	-
Average tariff	= average tariff for fixed line (monthly subscription rates in US$) and electricity services (US cent per KWh)	-
Investment	= telecom investment (capital expenditure in telecom infrastructure, in % of GDP)	-
Energy Intensity	= Energy consumption (tonnes of oil) per US$ 1,000 of GDP	+

Table 2
Distribution of variables by ownership

	DE NOVO	PRIVATISED	SOE
OUTAGES			
Electricity	11.49	13.15	11.20
Telecom	5.53	8.02	7.19
WAITING TIMES			
Electricity	4.80	3.13	3.10
Telecom	11.99	6.46	6.09
ELECTRICITY OBSTACLES			
No	66.28%	68.30%	68.54%
Minor	16.55%	15%	14.59%
Moderate	9.23%	9.43%	8.86%
Major	7.93%	7.26%	8%
TELECOM OBSTACLES			
No	68.44%	71.36%	71.63%
Minor	18.34%	16.38%	15.33%
Moderate	8.20%	8.10%	8.20%
Major	5%	4.10%	4.80%
SBC			
Utility arrears	5.03%	9.75%	16.25%
BUSINESS USE			
Fixed line	93.97%	96.25%	98.18%
Mobile	85.75%	75.91%	76.39%

Source: Business Environment and Enterprise Performance Survey (2002).

Table 3
Distribution of variables by size

	SMALL	MEDIUM	LARGE
OUTAGES			
Electricity	12.68	11.67	7.29
Telecom	6.36	6.73	4.64
WAITING TIMES			
Electricity	4.39	4.64	2.83
Telecom	11.02	9.96	5.46
ELECTRICITY OBSTACLES			
No	66.43%	66.76%	69.06%
Minor	15.95%	16.89%	14.59%
Moderate	9.37%	9.20%	9.18%
Major	8.25%	7.16%	7.18%
TELECOM OBSTACLES			
No	68.17%	72.31%	71.63%
Minor	17.90%	15.67%	18.32%
Moderate	8.48%	7.83%	7.20%
Major	5.44%	4.18%	2.83%
SBC			
Utility arrears	6.05%	10.13%	11.52%
BUSINESS USE			
Fixed line	93.41%	98.16%	98.95%
Mobile	79.55%	86.84%	92.52%

Source: Business Environment and Enterprise Performance Survey (2002).

Table 4
Distribution of variables by population density

	Capital	Large (> 1 million)	Large (> 250,000)	Small (50,000-250,000)	Rural (< 50,000)
OUTAGES					
Electricity	7.50	6.05	8.69	15.06	16.86
Telecom	5.04	3.28	3.64	7.57	8.44
WAITING TIMES					
Electricity	4.22	4.11	4.63	5.09	3.23
Telecom	10.01	11.80	9.91	10.19	9.77
ELECTRICITY OBSTACLES					
No	70.72%	70.28%	71.45%	71.45%	71.45%
Minor	14.54%	15.52%	16.37%	16.37%	16.37%
Moderate	8.11%	8.31%	7.28%	7.28%	7.28%
Major	6.62%	5.88%	4.90%	4.90%	4.90%
TELECOM OBSTACLES					
No	71.45%	73.17%	70.55%	65.68%	68.95%
Minor	16.37%	17.77%	16.35%	19.75%	17.67%
Moderate	7.28%	5.23%	8.17%	9.83%	8.37%
Major	4.90%	3.83%	4.92%	4.74%	5%
SBC					
Utility arrears	6.00%	3.06%	6.95%	10.57%	7.96%
BUSINESS USE					
Fixed line	96.53%	98.64%	97.36%	93.82%	92.32%
Mobile	88.21%	84.74%	82.83%	80.26%	77.55%

Source: Business Environment and Enterprise Performance Survey (2002).

Table 5
Determinants of Power outages

	(1)	(2)	(3)
Utility arrears	5.544*** (1.701)	8.729*** (1.493)	7.029*** (1.507)
Waiting times	0.012 (0.008)	0.008 (0.017)	-0.005 (0.017)
Minor Obstacle	10.216*** (1.228)	6.504*** (1.202)	5.895** (1.029)
Moderate Obstacle	18.954*** (1.534)	12.494*** (1.520)	12.823*** (1.557)
Major Obstacle	36.746*** (1.667)	24.639*** (1.728)	25.294*** (1.749)
BASIC CONTROLS			
Privatised	2.860** (1.251)	2.658** (1.209)	1.603 (1.222)
SOE	0.959 (1.364)	0.456 (1.319)	-0.165 (1.339)
Medium	-1.626 (1.210)	-1.686 (1.170)	-1.489 (1.184)
Large	-5.544*** (1.701)	-4.868*** (1.386)	-4.309*** (3.063)
Pop Dens	1.674*** (0.280)	2.201*** (0.272)	2.360*** (0.278)
COUNTRY LEVEL VARIABLES			
Obstacles		24.340*** (1.252)	20.147*** (1.348)
Energy Intensity			3.779*** (0.812)
Ind reg			-5.121*** (0.953)
Tariff			-0.657*** (0.265)
N	5407	5407	5186
F	71.69***	104.09***	93.76***
Adj R^2	0.1156	0.1734	0.2003

Notes: *** indicates significance at 1% level, ** at 5%, * at 10%. All regressions are based on enterprise-level variables for Albania, Armenia, Azerbaijan, Belarus, Bosnia and Herzegovina, Bulgaria, Croatia, Czech Republic, Estonia, Georgia, Hungary, Kazakhstan, Kyrgyzstan, Latvia, Lithuania, FYR Macedonia, Moldova, Poland, Romania, Russia, Serbia and Montenegro, Slovak Republic, Slovenia, Tajikistan, Ukraine and Uzbekistan.

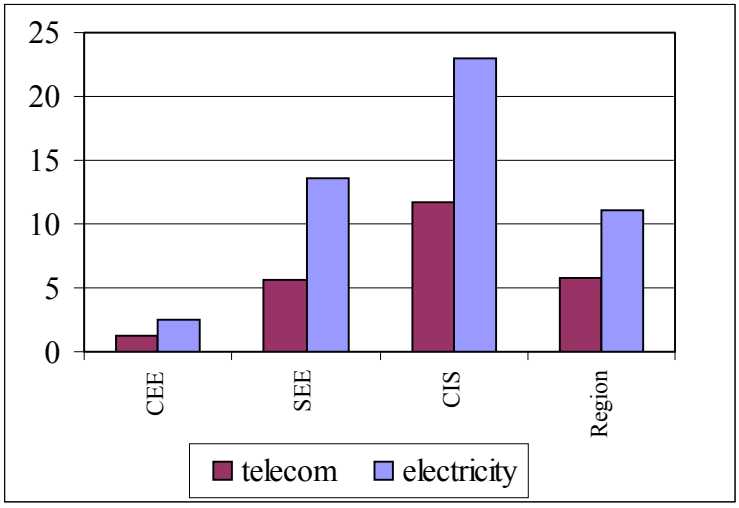
Table 6
Determinants of Telecom outages

	(1)	(2)	(3)
Utility arrears	8.625*** (1.489)	8.406*** (1.487)	6.839*** (1.502)
Waiting times	0.146*** (0.009)	0.145*** (0.009)	0.166*** (0.010)
Minor Obstacle	2.973*** (1.027)	2.576** (1.032)	2.352** (1.026)
Moderate Obstacle	6.893*** (1.411)	6.176*** (1.418)	6.198*** (1.417)
Major obstacle	17.425*** (1.838)	16.265*** (1.854)	14.893*** (1.870)
Fixed line use	-16.696*** (1.880)	-16.505*** (1.877)	-17.392*** (2.004)
Mobile use	-8.111*** (1.073)	-7.712*** (1.075)	-6.710*** (1.113)
BASIC CONTROLS			
Privatised	1.354 (0.244)	1.330 (1.109)	1.659 (1.107)
SOE	1.923 (1.206)	1.814 (1.204)	2.926 (1.200)
Medium	0.620 (1.064)	0.468 (1.062)	0.598 (1.058)
Large	0.180 (1.272)	0.173 (1.270)	0.148 (1.263)
Pop Dens	0.354 (0.245)	0.385 (0.244)	0.653*** (0.247)
COUNTRY LEVEL VARIABLES			
Obstacles		10.492*** (2.408)	6.121*** (2.502)
Investment			-182.727*** (55.458)
Ind reg			-2.635*** (0.952)
Tariff			-0.499*** (0. 200)
N	5379	5379	5150
F	53.90***	51.38***	48.27***
Adj R^2	0.1056	0.1086	0.1281

Notes: *** indicates significance at 1% level, ** at 5%, * at 10%. All regressions are based on enterprise-level variables for Albania, Armenia, Azerbaijan, Belarus, Bosnia and Herzegovina, Bulgaria, Croatia, Czech Republic, Estonia, Georgia, Hungary, Kazakhstan, Kyrgyzstan, Latvia, Lithuania, FYR Macedonia, Moldova, Poland, Romania, Russia, Serbia and Montenegro, Slovak Republic, Slovenia, Tajikistan, Ukraine and Uzbekistan.

Fig. 1

Infrastructure outages across regions



Source: Business Environment and Enterprise Performance Survey (2002).

Appendix 1

Sample structure

The minimum quotas of the samples for each country were: 1) At least 10 per cent of the total sample should be small in size (2 to 49 employees), 10 per cent medium-sized (50 to 249 employees) and 10 per cent large (250 to 9,999 employees) Firms with only one employee and 10,000 or more employees were excluded from the sample. 2) At least 10 per cent of the firms should have foreign control and 10 per cent state control, where control is defined as an ownership share of more than 50 per cent. 3) At least 10 per cent of the firms should be exporters, meaning that at least 20 per cent of their total sales are from exports. 4) At least 10 per cent of the firms should be located in a small city (population under 50,000) or countryside. In addition, enterprises established after 1999 were excluded from the sample because the questions on business performance covered the period 1999 to 2001. The quotas were fulfilled in the final sample in all but the following cases: state-owned enterprises in FRY Macedonia, Hungary and Slovenia and foreign-owned firms in Tajikistan.

Basic firm characteristics of the sample

Characteristic Sample share
(in per cent)

Sector	
Industry	38.7%
Services	61.3%
Size	
Small	67.6%
Medium	18.5%
Large	13.9%
Ownership	
Private De Novo	68.0%
Privatised	17.7%
SOE	14.3%
Location	
Capital	31.9%
Large cities (above 1 million)	4.8%
Large cities (above 250,000)	14.8%
Small cities (between 50,000 and 250,000)	23.4%
Rural (below 50,000)	25.1%

Annex 2

Correlation between Power Outages and explanatory variables

	outages	utiarr	wait times	Min obst	sign obst	major obst	priv	soe	med	large	City
outages	1										
utiarr	0.071	1									
wait times	0.027	0.006	1								
min obst	0.050	0.014	0.042	1							
sign obst	0.126	0.039	0.032	-0.140	1						
major obst	0.273	0.059	0.027	-0.129	-0.095	1					
priv	0.350	0.091	0.037	0.072	0.154	0.327	1				
soe	0.02	0.041	-0.021	-0.016	0.004	-0.011	-0.008	1			
med	-0.01	0.128	-0.022	-0.014	-0.001	-0.005	0.016	-0.198	1		
large	-0.005	0.043	0.012	0.009	0.008	-0.023	0.010	0.137	0.108	1	
city	-0.055	0.050	-0.028	-0.011	-0.004	-0.016	-0.025	0.188	0.225	-0.189	1

Correlation between Telecom Outages and Explanatory Variables

	outages	utiarr	wait	min obs	Sign obs	maj obs	fix	mob	priv	soe	med	large	city
outages	1												
utiarr	0.072	1											
wait	0.257	-0.018	1										
Min obs	0.028	0.025	0.044	1									
Sign obs	0.073	0.006	0.054	-0.143	1								
Major obs	0.132	0.016	0.097	-0.104	-0.067	1							
Fix	0.148	-0.015	0.062	0.008	0.057	0.017	1						
Mob	0.135	0.048	0.012	0.020	0.025	-0.010	0.090	1					
Priv	0.015	0.039	-0.042	-0.012	-0.003	-0.020	-0.037	0.075	1				
Soe	0.020	0.124	-0.042	-0.024	-0.003	0.006	-0.057	0.067	-0.195	1			
Med	0.003	0.049	-0.010	-0.028	-0.006	-0.017	-0.054	-0.046	0.135	0.114	1		
Large	-0.023	0.051	-0.045	0.018	-0.022	-0.038	-0.070	-0.104	0.200	0.230	-0.192	1	
City	0.042	0.056	-0.010	0.019	0.03	-0.006	0.057	0.107	0.052	-0.025	-0.015	-0.090	1