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# **Drivers of Reported Electricity Service Satisfaction in Transition**

## **Economies**

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### **Abstract**

Since 1990, the power sectors in the countries of the Former Soviet Union have evolved from a context of central planning towards independent regulation. There is great heterogeneity in reform progress in transition countries, with consequences to service quality in utilities and also the view the population has of such services. This article analyses drivers of reported household satisfaction with the quality of electricity services in 27 countries using cross-section survey data from the European Bank for Reconstruction and Development Life in Transition Survey II, in a context of improving regulation and infrastructure. An ordinal Random Effects Logit model is estimated, showing that key drivers of reported satisfaction are the uses of electricity within the household and some characteristics such as age and economic conditions of the household. There is no strong evidence of the effect of the state of power sector reform on the opinion of households. However, customers in countries with fully independent regulation are more likely to report higher levels of satisfaction than those in countries with no independent regulation.

JEL Codes: P21, P28, C25

Keywords: Electricity, Transition Economies, Ordinal Logit

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## **1. Introduction**

This article aims to empirically explore the drivers of reported household satisfaction with electricity supply in transition economies, in a context of improving regulatory and infrastructure frameworks. The end of central planning implied that many of these economies implemented broad market-driven reforms as a part of thoroughgoing economic and political changes in the early 1990s. Throughout the transition process, economies that emerged from the collapse of the Soviet Union faced many parallel challenges, from reforming their economic systems to creating an appropriate institutional framework for future growth and stability. However, the transition process has been very heterogeneous. As such, some differences in service provision, socio-economic characteristics and opinions about service quality are expected across transition economies.

More specifically, this article aims to assess if the perceived quality of service is influenced by the state of the power sectors in transition and what are the socio-economic drivers of responses. The motivations to analyse this unexplored topic in the literature are threefold. First, it is important for policy makers in the energy sector to evaluate if the power sector reforms in transition economies are translating to better opinions about the service. Secondly, it is of interest to evaluate the effect of the persistency of the Soviet legacy and if that affects opinions on a service that has been shifted from free provision to a mixed or market structure. Finally, when evaluating changes and reforms in the power sector, it is crucial to understand how other social and economic characteristics might drive opinions, perhaps more strongly than specific reforms themselves. These issues highlight the contribution of the article to policy makers not only in the energy sector, but also across the entire economic spectrum.

This empirical study is conducted using survey data from the EBRD (2011) and estimates an ordinal model with random effects to account for unobserved heterogeneity. The findings show that household opinions are mostly driven by general socio-economic characteristics of the household, with large variation across respondents, and that there is no evidence of a link between power sector reforms and household opinions about the electricity service. However, there is a significant effect of fully independent regulation on customer satisfaction when considered as an alternative measure. There is no evidence that past affiliation with a communist party affects reported satisfaction levels. Also, young people appear to be more dissatisfied. The policy implications are discussed at the light of the “unhappiness gap” literature in transition economies. Economic conditions and increased dependency of the service shift opinions along with regulatory independence. The persistency of the Soviet legacy is slowly fading away, but has not vanished completely.

The remainder of the article is structured as follows. Section 2 presents a literature review and key facts on the transition economies power sector. Section 3 outlines data analysis and the econometric methodology. Section 4 presents and discusses results. Section 5 concludes and points some policy implications of the findings.

## **2. Power Sector in Transition: Key Facts and Literature Review**

Since the very early stages of the Soviet Union, a strong focus was placed on electricity provision. Lenin (1920) declared that “Communism is government by the Soviets plus the electrification of the whole land” in an effort to transform the Soviet Union into a modernized world power with focus on heavy industry. The structure of the power sector in Soviet

economies was deeply influenced by the organization of the economy. Besides the frequent use of price controls, supply side policies were applied in the energy sector whenever changes in demand were observed (Cooper and Schipper, 1992). While the oil shocks of the 1970s pressured countries in the Western hemisphere to push towards macroeconomic reforms, the Soviet Union was mostly isolated from such shocks and made shy reforms efforts. Williams and Ghanadan (2006) conducted an extended analysis of electricity reforms in development and transition countries. Pre-reform electricity sectors in such countries were characterized by universal access through a state owned and highly bundled sector. With tariffs set by ministries, cross subsidizing was common for agriculture, residences and public agencies. The authors also refer to limited use of utility meters and appropriate bill collections. However, after 1990, the need for additional revenue made utilities an attractive sector to privatize and commercialize, in order to keep state accounts balanced during times of economic turmoil. The World Bank also gave power sector loans on the condition that reforms were put in place (World Bank, 1993). While the first plan of action was mostly to follow the conclusions of the Washington Consensus to liberalize and reform economies, such efforts had wide variation in time and intensity. The different paces of reform after the break-up of the USSR ultimately meant that the situation in the power sector is different between transition economies well into the transition period. Kennedy (2003) reviewed the progress in regulatory reform in the specific case of transition economies, stating that while there was progress in reforms in the power sector in most countries, there are still issues with the independence of regulators, meaning that problems like government influence (through decision making or reliance on central funding) can still appear. Government commitment is necessary as simply importing pricing mechanisms from Western countries is not enough. Transition economies face specific challenges, such as significant exchange rate risks. The authors also point that in countries where regulation and commitment are weak, strategic investors leave the sector. In this context,

the sector can face lack of investment and trust, and perpetuate lack of competition and price distortions.

There is an increasing literature about broad aspects of the power sector in transition economies. Nepal and Jamasb (2012) assess the impacts of reforms in transition economies and highlight the interdependency of power sector reforms and wider market reforms, with the failure to harmonize multiple reforms leading to ineffective power sector reforms. Pollitt (2009) makes an analysis of the South Eastern Europe electricity markets, concluding that power sector reform should be a part of wide institutional reforms and that progress in that wide range of reform is necessary to achieve success in reforming the power sector.

According to EBRD data, countries like Azerbaijan and Belarus failed to make significant improvements in the establishment of an independent regulator and the participation of private companies in the supply of electricity for a long period, while many countries in Eastern Europe (particularly those who joined the EU) have achieved a framework of independent regulation, cost-reflective pricing policies and higher bill collection rates. As such, the experiences and opinions of the population with their utility services and public services in general are expected to be very varied. However, the focus on the industry, reforms and their macroeconomic consequences is not being followed by a focus of the literature on the household side of the problem.

Besides depending on the socio-economic characteristics of the customers, the opinion about electricity supply can also depend on the state of the power sector. There is a series of studied connections between service quality and customer satisfaction and loyalty (Ardabili et al., 2012), and customer satisfaction with services and their quality is an often discussed issue in

the marketing literature (Rekettye and Pintér, 2006). However, the specific context of transition economies needs to be considered, as in many countries there is no large-scale competition between private companies. Besides that, the historical and economic background of these countries implies that the focus of the power sector was placed on viability and attractiveness to investors instead of consumer concerns, as deteriorating national and sector finances were a driver of reforms (Williams and Ghanadan, 2006).

One of the key issues in assessing consumer satisfaction with utilities is the existence of comprehensive surveys on the subject. A study by IPSOS (2007) assessed customer satisfaction in all EU member-states regarding electricity services, including some of the transition economies. In the new member states (mostly transition economies), there was a higher percentage of both satisfied and dissatisfied consumers than in the EU15, and the average percentage of satisfied customers for transition economies is noticeably higher than the EU15 average, and especially when compared against southern Europe. Lithuania was the country with the highest percentage of satisfied customers in EU25. A survey by the European Commission (2013) also found evidence for EU countries that age influences reported opinions on electricity services and that females reported higher outcomes than males.

In transition economies, such efforts to retrieve opinions from households are scarce. A clear exception is a study conducted in Hungary to evaluate what is the opinion of customers about utility services in the country, where a consumer satisfaction survey was conducted from 1996 (Rekettye and Tersztyánszky, 2001). Rekettye and Pintér (2006) conducted a survey in Hungary to explore the relationship between satisfaction and price acceptance in electricity supply. An ordered probit response model was used, as the dependent variable was discrete. Another more general example of analysis using similar methods of discrete consumer

satisfaction outside of the power sector literature is an analysis for Spanish mobile internet services (Muñoz et al., 2012). Regarding the opinions of households in developing economies, some studies have been conducted but are driven by specific problems rather unusual in the transition bloc, such as frequent power outages. Aklin et al. (2016) show in the context of energy-poor states of India that household satisfaction responds strongly to the average hours of electricity available on a typical day, implying that measuring quality of service is more important than counting connections. However, this study does not explore socio-economic characteristics of households as possible drivers of reported satisfaction.

The major efforts in understanding citizens' concerns and problems in transition economies have been conducted through the Life in Transition Surveys, done in 2006 and 2010 in a collaboration between EBRD and the World Bank. The second survey, LiTS II (EBRD, 2011) surveyed approximately 39000 households in 34 countries in 2010, as the effects of the financial crisis were impacting the population. This survey asked a wide range of questions, related to the level of satisfaction with utility services, allowing researchers to look into household satisfaction with electricity supply all across the transition bloc. Data on income and savings is also collected, which is highly relevant to analyse the role of economic conditions. In an analysis of electric vehicle adoption in Europe, Sierzchula et al. (2016) show that the key drivers of electric vehicle adoption are financial incentives and availability of charging infrastructure, and that income and urban density are not significant, pointing for a minor role of socio-economic characteristics in that specific context.

Other specific issues of transition economies need to be considered. For example, the relevance of the age of respondents, as a large part of the citizens of these countries was educated in the Soviet system and a smaller share worked and lived a part of their adult lives in the Soviet



system, implying an exposure to a completely different electricity supply system that was characterized by very low tariffs and extensive subsidizing. This perspective, together with past experiences and political affiliation, might lead households to adopt a hostile attitude towards a reformed power sector as that implies cost-reflective prices, even if quality has improved. Djankov et al. (2016) argue that the happiness gap versus developed economies is explained by how citizens in post-communist countries perceive corruption and weaker government performance. The large transformations are associated with possible reform fatigue and long-term psychological costs. Nikolova (2016) shows that macroeconomic factors and the rule of law explain the happiness differential in transition economies, but that the conditional happiness gap has been decreasing since the 1990s, showing some signs of completion of the transition process, at least in people's minds. This stresses the importance of looking at socio-economic and political factors in this article.

After more than twenty years of economic transition, the political and economic choices create visible differences in the way utilities are managed across countries. One of the facts about the state of the power sector in transition is that the highest residential electricity prices are located in the countries where a fully independent regulator is established, as there is no government pressure to maintain low, non-cost reflective prices. In countries where privatization efforts were small, the percentage of household expenditure on electricity and water is generally smaller, as those countries still have a centralized power sector with no independent regulator and the control of prices by the government and subsidizing are still frequent. The countries with fully independent regulation are clearly clustered in the EU, with the exception of Croatia (that became an EU member in 2013). This is deeply related to EU guidelines on utilities. Table 1 shows the very different situations of the power sector across transition economies and also the correlation between the level of independent electricity regulation and electricity prices.

[Table 1]

The survey question that links to the dependent variable of this study is “How satisfied were you with the quality of the electricity service?”, in Question 2.18 b) of the survey questionnaire. The views of consumers can be distorted if they are dissatisfied with multiple factors. A source is the quality of the service itself and service interruptions. However, it can be argued that countries that have such problems in persistent manner can present more sympathetic opinions towards quality of the service, as no better state of the service has been known in the past (households “are used” to the problems). However, this is not consistent with the data. For example, consumers in Tajikistan are clearly amongst the most dissatisfied, in a situation of extremely low energy prices and an energy crisis with power cuts when the water levels in hydro plants are very low – this is especially serious in the winter when households demand significant amounts of electricity for heating purposes. Another opinion vector to consider relates to the competition environment created by power sector reforms. The opinion of households about the electricity service can be linked to their views on how the sector advanced, a visible increase in choice, competition and transparency, and a more professional and dedicated communication channel between customers and utility firms. The argument of transparency can be particularly important, given the “unhappiness gap” and its link to perceived corruption and weak government performance (Djankov et al., 2016).

Increased service quality, transparency and competition could lead to improved conditions and a significant positive effect of power sector reforms on the opinion of households about the service. However, there is a series of personal and economic characteristics to take into account

when evaluating reported satisfaction with electricity services. The next section discusses the methods and the data that will answer the research question.

### **3. Econometric Methods and Data Analysis**

The data used in this article is sourced from the Life in Transition II Survey, conducted in late 2010 (EBRD, 2011). The survey used a two-stage clustered stratified procedure to select the households in the sample. For the purposes of this analysis, the data was filtered to remove answers from countries outside the transition bloc (all countries with no power reform index measure from EBRD, plus Turkey), households that reported not having electricity supply, households that reported not paying electricity bills and other outliers<sup>1</sup>. Respondents were asked to state their level of satisfaction with the quality of the utility services, including electricity supply, with possible levels being 1 (very dissatisfied), 2 (dissatisfied), 3 (not satisfied nor dissatisfied), 4 (satisfied) and 5 (very satisfied). Other questions involved key social and economic issues, the existence of a utility meter, estimated expenditure in utilities and overall life satisfaction. There is no clear correlation between customer satisfaction and the latter two variables. There is also no clear correlation between the state of power sector reforms and consumer satisfaction, as satisfaction levels are very high in Azerbaijan with no regulator in the country and Lithuania has one of the lowest average satisfaction levels with a fully independent regulator established. In the IPSOS (2007) study, Lithuania was the country with the highest percentage of satisfied customers in the EU25 and remained in the top 6 in the 2013 European Commission survey. However, the Life in Transition II survey took place in a

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<sup>1</sup> The countries included in this sample are Albania, Armenia, Azerbaijan, Belarus, Bosnia, Bulgaria, Croatia, Estonia, Georgia, Hungary, Kazakhstan, Kyrgyzstan, Latvia, Lithuania, Macedonia, Moldova, Mongolia, Montenegro, Poland, Romania, Russia, Serbia, Slovakia, Slovenia, Tajikistan, Ukraine and Uzbekistan.

turbulent period, as the world was recovering from a serious recession that also had severe impacts in Eastern Europe and Asia. The amount of respondents that state they are “very dissatisfied” with the service is below 3% of the sample. The percentage of people that are very dissatisfied with their lives is particularly high in Georgia, Serbia and Ukraine, even if satisfaction with utility services is not amongst the lowest in transition economies. A description of the explanatory variables of this article is in Table 2. The base specification of the model can be summarized as follows:

$$\textit{Satisfaction with Electricity Supply} = f(\textit{Cooking, Heating, Savings, Life Satisfaction, Age, Gender, Power Sector Reform, Communist Party Membership, Relative Income})$$

[Table 2]

The possible uses of the service in both cooking and heating show increased dependence for multiple purposes. Accounting for savings after paying utility bills matters as those expenses can seriously drain the resources of households and keep them from purchasing other goods. The general opinion about the state of society and the economy can influence the opinion about specific services and utilities (this variable will be dropped in robustness checks). The age of the respondent is also included, as the experiences of the transition process dramatically vary among age groups – younger people never experienced a fully centralized, Soviet-style economy, while older people fully experienced both regimes and can therefore having a different perspective on change. The analysis accounts for the gender of respondents, as gender effects can exist in reported satisfaction levels. The EBRD index of power sector infrastructure

reform in transition is also included (this variable will be replaced in robustness checks)<sup>2</sup>. This variable is of particular interest in this study as it is related to the possibility of the state of power sector reform ultimately driving the level of satisfaction of households across transition economies. The existence of a consumption meter in the household is also included in the analysis to assess possible effects of transparent consumption metering in responses. Communist party membership is included to assess if past membership leads to more negative attitudes towards the service in transition to a different economic and social structure. Finally, a measure of the relative share of income is included to assess if belonging to lower percentiles of income leads to more negative responses about the service.

Observations where the interviewed member of the household refuses to say if he/she can make savings and how much are removed, as well as observations where the interviewed person answers “don’t know”. The same approach applies to questions related to spending. The number of people refusing to answer or answering “don’t know” is particularly high in Baltic States and Ukraine. However, across the whole sample, the age, share of females and life satisfaction of the group that refused to answer that question or did not know the answer are similar to those who did answer, which ensures that there is no risk that a specific group of people is being removed from the sample and losing weight in the sampling.

After the relevant observations are removed, individual observations were re-weighted according to the original regional survey weights within each country to ensure that all countries in the analysis have equal weights (instead of weighting the sample by population). This implies that equal weighting is given across countries, and the original weight structure

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<sup>2</sup> This data refers to 2010. Expert assessment is usually conducted mid-year, while the survey used in this article was conducted in late 2010. The indexes only changed between 2009 and 2010 for two countries (decreasing for Hungary and increasing for Montenegro), showing the stability of the indexes on the latter years of the transition process.

among regions is preserved, preventing regions where more people refuse to answer questions from losing importance in the final results. Finally, because of the very low amount of respondents of the lowest category (1), these answers are aggregated with category 2 (which becomes a general “dissatisfaction” category). This prevents estimation problems caused by having categories with very few observations. Table 3 shows summary statistics for the sample after including the changes described above.

[Table 3]

The overwhelming majority of households have utility meters, with more than 90% of respondents in each country having one (except in Slovakia). The percentage that uses electricity for heating purposes is quite low, as gas is a popular alternative in many transition economies, except in Albania, Montenegro and Tajikistan where the share of respondents is particularly high (above 35%). The average age of respondents is over 45 years old, with 40% of the respondents being 18 or younger when the Soviet Union collapsed and 16% of the respondents being over 65 by the time the survey was conducted. Most of the respondents are females, although the survey weights address the representation issues this entails. The share of users of electricity for cooking purposes is considerably higher than the share for heating, with more than 50% of respondents using electricity for cooking in 10 countries of the sample and particularly low usage in Romania, Moldova and Uzbekistan. Only 23.1% of the individuals answer that they can make savings at the end of the month after paying all their bills, which is a sign of economic comfort and higher ease to pay such obligations. The national averages for this indicator range between 2.7% in Armenia and 48.5% in Belarus, with 10% or less of the respondents being able to make savings in four countries. The life satisfaction index is much more centred on the average level (around 5) than the satisfaction with the electricity

service, implying that many people are still quite dissatisfied with their life experience in transition economies. Almost 7% of the respondents were affiliated with a communist party, with more than 10% affiliation in Serbia, Romania and Bulgaria. Also, there is a very wide variation in within country relative incomes when the average income is considered to be equal to the sample average (with a median of 0.87). The average power sector reform index across the sample is close to 3, indicating reasonable progress, but with some clear outliers<sup>3</sup>. Tajikistan and Belarus still have indexes of 2 or below, indicating political interference, low effective tariffs and little incentive for increased efficiency in the power sector. The correlations between all these measures are low, with correlations smaller than 0.15 between life satisfaction and electricity supply satisfaction, age, relative income or the power sector reform index.

The dependent variable of interest is ordinal, meaning that its ordering is known but the true distance between the categories is unknown. While fitting a multinomial model would ignore the ordering of the categories (in this case from 1 to 5), fitting a linear regression would ignore ceiling and floor restrictions on the probabilities that are considered in logit and probit models. Given that there are more than two outcomes in the ordered dependent variable, an ordinal regression model is the natural approach to follow.

Three models that include the aforementioned explanatory variables are considered. First, a simple ordered regression (OR) is considered, which is biased if there is considerable unobserved heterogeneity that is correlated with the observed variables and leads to efficiency losses if that heterogeneity is not correlated with the observables. Secondly, a random-effects ordered model is considered in order to account for unobserved heterogeneity (REOR),

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<sup>3</sup> Level 3 of power sector reforms corresponds to “Law passed providing for full-scale restructuring of industry, including vertical unbundling through account separation and set-up of regulator. Some tariff reform and improvements in revenue collection. Some private sector involvement.”

assuming that the regressors are uncorrelated with the random effects. However, this might be a restrictive assumption given that the unobserved heterogeneity might be correlated with variables, such as age. Thirdly, a random-effects ordered model with added cross-sectional means of regressors that vary within units to relax the assumption that the regressors are uncorrelated with the random effects (REORM). There is information on both country and region where the interviews were conducted. Much more unobserved heterogeneity is captured at the regional level, indicating that it is important to consider differences within countries (for cultural, socio-economic and also urban/rural dichotomy reasons). Therefore, results are presented with the unit for random effects being the 420 regions present in the data. Thresholds are allowed to be estimated flexibly without any symmetry or equidistance assumptions which are likely to be restrictive.

#### **4. Results and discussion**

Estimation is conducted in the statistical environment R 3.2.1 using the “ordinal” package, fitting the model with adaptive Gauss-Hermite quadrature approximation, using six quadrature points to ensure precise estimates. The chosen link function is Logit. Although a Probit link function renders similar coefficient signs and significance results, it leads to a much smaller variance of the random effects and also a poorer fit. Logit regressions point for smaller maximum absolute gradient of the log-likelihood function with respect to the parameters across all specifications.

Results from all considered specifications are presented in Table 4. Besides the coefficients and the standard errors of the coefficients of interest, the variance of the random effects in each case is also presented, as well as a likelihood ratio test between REOR and REORM models.



Coefficients for the cross-sectional means in REORM are omitted. Alternative Probit estimation, which leads to very similar results, is present in Appendix A.1.

[Table 4]

Alternative specifications of the REORM model are estimated, to assess the effect of different levels of independent regulation as a substitute for a measure of power sector reform which includes other factors in the calculation of the index, and also to assess how estimates change by removing the life satisfaction index measure. Statements on inference are made on coefficients, not on marginal effects, as the latter case is testing a hypothesis regarding a function of all the coefficients and not just the coefficient of interest.

The REOR model shows a large variance of the random effects, as well as many differences in coefficients when compared to OR model. However, the cross sectional means of the explanatory variables are jointly (strongly) significant in the REORM specification, indicating that the latter is the preferred model for analysis. The other specifications do not account for unobserved heterogeneity or the possible correlation of this heterogeneity with the explanatory variables. The power sector reform index has a positive coefficient across all specifications, but is not significant in the REORM specifications. This is a key result: advances in power sector reforms don't appear to translate to a better opinion about the service in transition countries, with the drivers of that opinion mostly being personal and economic characteristics of the household. This could be due to the conflicting effects between increasing quality and competition and increasing prices, as they are contradictory forces driving the sign of the coefficient. If the argument is that most of the effect of power sector reform is driven through price changes in the service and that is the most visible aspect for households, a negative sign

could be expected. Increasing transparency, self-sufficiency and improvement of the sector in terms of quality would drive a positive result. Therefore, the result of neutrality can be seen as the lack of dominance of one of them over the others. To test this further, the measure of power sector reform is substituted with dummy variables for partial independent regulation and fully independent regulation of power sectors in transition economies in specifications REORM3 and REORM4. This shows a significant impact of full regulation versus no regulation in increased customer satisfaction with electricity supply.

As a robustness check, an alternative estimation which allows for cluster robust standard errors but is less flexible in the consideration of survey weights is conducted. Clustering is done at the region level, as clustering at the country level would imply the panels are not nested within clusters. REORM specifications without survey weights only leads to major changes in significance of the female dummy variable. On the other hand, estimation without survey weights but with cluster robust standard errors leads to very similar results to the ones obtained in Table 3, except for less significance of the relative income variable and gender dummy. In all cases the variance of the random effects resembles those in Table 4 (for Logit) and Appendix A.1 (for Probit). The significance of power sector indicators or independent regulation dummy variables is not changed in these robustness checks.

Other coefficients show interesting insights into electricity services in transition economies. Although using the service for cooking and heating leads to increasing dependence on the service, only the use for heating has a negative effect while the use for cooking has the opposite effect. A possible cause is that heating constitutes a much larger portion of spending for households that do use it, besides adding more dependence on the service. There is no evidence that the use of electricity meters in the household leads to an effect on the likelihood of

reporting different levels of satisfaction with the service. Clearly, the strongest socio-economic links to the dependent variable are established with age, life satisfaction, the ability to make savings and a measure of relative income. Older people tend to be more satisfied with service provision, and there is no significant impact of communist party membership up to 1990. This implies that historical political affiliation does not significantly play a role in reported satisfaction with the service, although the sign of the coefficient is negative. Higher levels of relative income compared to other people in the country are also associated with reporting of higher levels of satisfaction, which was to be expected. Including this variable in the model decreases the magnitude of the savings dummy coefficient, but does not erode its significance. These results show the impact of economic conditions, which goes against the findings of Sierzchula et al. (2016) regarding electric vehicle adoption. There is also light evidence that interviewed females report higher levels of satisfaction with the service, keeping all other factors constant.

As a robustness check, the life satisfaction variable is removed from specifications REORM2 and REORM3. This is done because of doubts on what the measure means for those being interviewed, as there is evidence that Eastern Europeans link their life satisfaction to higher perceived corruption and weaker government performance (Djankov et al., 2016). Removing the variable does not change key results for other variables. The same result occurs if electricity uses for cooking and heating are ignored in the specification. In other attempted specifications, a utility spending variable (expressed as a share of income spent on many utilities, from electricity to gas and phone expenses) is added to the regression. The power sector reform coefficient becomes slightly less positive and remains non-significant. The same happens if the square of age is added to the specification to investigate non-linear effects, with the noticeable change being the lack of significance of both age coefficients, although both have a positive

sign. The results are in general very robust to the specification changes above, reinforcing the conclusion of lack of evidence for the significance of the power sector reform variable.

## **5. Conclusions and Policy Implications**

This article presents a study on several Eastern European and ex-USSR countries to assess what explains the opinions that households have of their electricity supply service. This is achieved through the use of extensive survey data from transition economies and the estimation of a random effects ordered Logit model. Key drivers are socio-economic characteristics of the respondent, such as their use of electricity, their age, savings, income and overall life satisfaction. Removing the latter from specifications does not alter other key conclusions. Different aspects of power sector reform generate conflicting effects that cancel out on aggregate. However, there is a significant positive impact on opinions of having a fully independent electricity regulator, compared against having no independent regulator, which is a sign that households can perceive changes in the power sector and that can reflect on their reported outcomes. New generations appear to have a more negative attitude about the service even when across the sample younger people report higher life satisfaction levels than older people, and general happiness, economic conditions and specific use of the service drive opinions. However, past political affiliations do not seem to impact reported outcomes.

The policy implications of these findings go beyond the power sector policy makers. Economic conditions and increased dependency of the service are the key shift factors of opinions, along with increased power sector regulation. This is in line with the argument that Eastern Europeans link their life satisfaction to higher perceived corruption and weaker government performance

(Djankov et al., 2016) and are more likely to be satisfied with visible institutional advances. Dissatisfaction could be minimized with clear and visible independence of institutions in the power sector, given that intermediate steps for fully independent regulation do not seem enough to cause a positive effect on opinions. Reported life satisfaction plays a large role in explaining opinions on the electricity service, even after controlling for a series of other factors. This relates again to the “unhappiness gap” argument, as a sign that the perceived problems in the power sector can be also associated to more general issues of transparency and rule of law. However, past political affiliations do not lead to significant changes in reported satisfaction, showing that one of the possible channels through which the Soviet legacy could shed doubt on economic and social changes seems to have faded away. Significant age effects point that younger people are harder to satisfy and that institutional advances could take shape to aim to particularly convince that group of people.

Future work paths in this field include further analysis of the relationship of electricity prices and reported outcomes by households. This and other paths could be facilitated by upcoming surveys to be conducted in transition countries, as panel data techniques and further data on electricity spending and use could allow for further inference.

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Table 1. Power sector regulation and other indicators across transition economies

	<b>Independence of electricity regulator</b>	<b>Household expenditure on power and water (%)</b>	<b>Cumulative Privatization Revenue in % of GDP (year)</b>	<b>Residential Electricity Tariff in USD cents (year)</b>
<b>Albania</b>	partial	5	16 (2009)	9.6 (2008)
<b>Armenia</b>	partial	6	10.2 (2004)	7.9 (2008)
<b>Azerbaijan</b>	no	3.5	3.2 (2005)	7.5 (2009)
<b>Belarus</b>	no	4	6.3 (2008)	6 (2009)
<b>Bosnia and Herzegovina</b>	partial	4.9	2.6 (2004)	9.1 (2008)
<b>Bulgaria</b>	full	11.2	24.3 (2009)	10.9 (2008)
<b>Croatia</b>	full	13.1	17.4 (2009)	12.4 (2008)
<b>Estonia</b>	full	6.1	7.2 (2004)	11.5 (2008)
<b>FYR Macedonia</b>	partial	6.6	21.2 (2009)	6.7 (2009)
<b>Georgia</b>	partial	11	41.8 (2008)	10.3 (2008)
<b>Hungary</b>	full	10.9	33.1 (2008)	18.3 (2009)
<b>Kazakhstan</b>	partial	3.7	30.6 (2010)	5.3 (2008)
<b>Kyrgyz Republic</b>	partial	4.4	7.5 (2010)	1.6 (2009)
<b>Latvia</b>	full	3.8	10.8 (2008)	11.8 (2008)
<b>Lithuania</b>	full	3.8	16.6 (2008)	11.1 (2009)
<b>Moldova</b>	partial	9.6	0 (2008)	10.1 (2008)
<b>Mongolia</b>	partial	9.4	11.1 (2009)	5.5 (2008)
<b>Montenegro</b>	partial	11.7	n.a.	12.4 (2008)
<b>Poland</b>	full	6.8	14.2 (2007)	20 (2008)
<b>Romania</b>	full	3.7	n.a.	14.5 (2008)
<b>Russia</b>	partial	6.6	6.5 (2009)	6.7 (2008)
<b>Serbia</b>	partial	9.3	23.1 (2009)	8.8 (2008)
<b>Slovak Republic</b>	full	9.5	35.2 (2007)	22.8 (2008)
<b>Slovenia</b>	full	9.1	6.5 (2009)	18.4 (2008)
<b>Tajikistan</b>	no	6.0	8.6 (2008)	1.1 (2008)
<b>Turkmenistan</b>	no	0.3	0.6 (2005)	0.3 (2008)
<b>Turkey</b>	full	28.4 (2007)	8.2 (2008)	15.5 (2009)
<b>Ukraine</b>	partial	9.1 (2008)	15.5 (2008)	4.6 (2008)
<b>Uzbekistan</b>	no	5.2	6.3 (2008)	3.4 (2007)

Sources: EBRD Structural Change Indicators, EBRD Transition Development Snapshots

Table 2. Description of explanatory variables

<b>Explanatory Variable</b>	<b>Description</b>
Uses electricity for cooking dummy	A dummy variable that has value 1 if the household uses electricity for cooking purposes and 0 otherwise
Uses electricity for heating dummy	A dummy variable that has value 1 if the household uses electricity for heating purposes and 0 otherwise
Has a utility meter dummy	A dummy variable that has value 1 if the household has a consumption meter and 0 otherwise
Savings dummy	A dummy variable that has value 1 if the household can make savings after paying utility bills and 0 otherwise.
Satisfaction with life in transition	Self-reported happiness regarding life in transition, in a scale ranging from 1 to 10
Age	Age of the respondent in years
Female Dummy	A dummy variable that takes value 1 if the respondent is female and 0 otherwise
Power Reform Index	EBRD index of power sector infrastructure reform in transition
Communist Party membership dummy	A dummy variable taking value 1 if the interviewed member of the household was a member of a communist party up to 1990 and 0 otherwise
Relative income compared to country average (in the sample)	The sum of reported expenses and reported savings in the survey, divided by the average of that measure for the country where the interview was conducted

Table 3. Descriptive statistics

	<b>Mean</b>	<b>Std. Dev</b>	<b>Min</b>	<b>Max</b>
Satisfaction with electricity service	3.913851	0.77214	2	5
Uses electricity for cooking dummy	0.396405	0.489162	0	1
Uses electricity for heating dummy	0.16908	0.374831	0	1
Has a utility meter dummy	0.967177	0.178177	0	1
Savings dummy	0.231187	0.421601	0	1
Satisfaction with life in transition	5.196065	2.074433	1	10
Age	45.66864	17.33703	18	99
Female Dummy	0.613203	0.487028	0	1
Power Reform Index	2.967057	0.555283	1	4
Communist Party membership dummy	0.066382	0.248954	0	1
Relative income compared to country average (in the sample)	1	1.14729	.0010037	105.7943

Total number of observations: 21753

Table 4. Ordinal Logit Estimation results

	<b>OR</b>	<b>REOR</b>	<b>REORM</b>	<b>REORM2</b>	<b>REORM3</b>	<b>REORM4</b>
Uses electricity for cooking dummy	<b>-0.0845</b> (0.0303)***	<b>0.1215</b> (0.0398)***	0.1583 (0.0407)***	<b>0.1746</b> (0.0407)***	<b>0.1745</b> (0.0407)***	<b>0.1581</b> (0.0407)***
Uses electricity for heating dummy	<b>-0.4203</b> (0.0390)***	<b>-0.2554</b> (0.0460)***	-0.2349 (0.0466)***	<b>-0.2390</b> (0.0466)***	<b>-0.2388</b> (0.0466)***	<b>-0.2348</b> (0.0466)***
Has a utility meter dummy	<b>0.1509</b> (0.0738)**	0.1250 (0.0875)	0.1153 (0.0886)	0.1225 (0.0886)	0.1226 (0.0887)	0.1153 (0.0886)
Savings dummy	<b>0.2383</b> (0.0340)***	<b>0.2289</b> (0.0389)***	<b>0.2251</b> (0.0392)***	<b>0.2889</b> (0.0387)***	<b>0.2886</b> (0.0387)***	<b>0.2247</b> (0.0392)***
Satisfaction with life in transition	<b>0.0933</b> (0.0071)***	<b>0.0852</b> (0.0079)***	<b>0.0849</b> (0.0079)***	-	-	<b>0.0850</b> (0.0079)***
Age	<b>0.0099</b> (0.0009)***	<b>0.0039</b> (0.0010)***	<b>0.0036</b> (0.0010)***	<b>0.0023</b> (0.0010)**	<b>0.0023</b> (0.0010)**	<b>0.0036</b> (0.0010)***
Female Dummy	<b>0.0668</b> (0.0293)**	<b>0.0599</b> (0.0311)*	<b>0.0576</b> (0.0311)*	<b>0.0568</b> (0.0311)*	<b>0.0571</b> (0.0311)*	<b>0.0578</b> (0.0312)*
Power Reform Index	<b>0.3598</b> (0.0239)***	<b>0.2563</b> (0.0935)***	0.1203 (0.1015)	0.0951 (0.1005)	-	-
Communist Party membership dummy	-0.0999 (0.0615)	-0.0498 (0.0659)	-0.0374 (0.0664)	-0.0188 (0.0662)	-0.0192 (0.0662)	-0.0377 (0.0663)
Relative income compared to country average (in the sample)	<b>0.0433</b> (0.0139)***	<b>0.0385</b> (0.0142)***	<b>0.0380</b> (0.0143)***	<b>0.0469</b> (0.0137)***	<b>0.0470</b> (0.0137)***	<b>0.0380</b> (0.0143)***
Partly indep. Regulator dummy	-	-	-	-	0.1200 (0.1789)	0.1463 (0.1801)
Fully indep. Regulator dummy	-	-	-	-	<b>0.4212</b> (0.2032)**	<b>0.4382</b> (0.2033)**
<i>Log. Lik.</i>	-21274.27	-19439.14	-19421.95	-19480.95	-19478.16	-19419.42
<i>Akaike Information Criteria (AIC)</i>	42574.55	38906.27	38889.89	39003.89	39000.32	38886.84
<i>Var. RE</i>	-	1.192	1.091	1.096	1.072	1.071
<i>Likelihood ratio test REOR vs REORM (p-value)</i>	-	<b>0.0001</b> ***		-	-	-

\*\*\*, \*\* and \* represent significance at the 1%, 5% and 10% levels respectively. Coefficients with a relevant level of significance in bold.

### Appendix A.1. Ordinal Probit Estimation results

	<b>OR</b>	<b>REOR</b>	<b>REORM</b>	<b>REORM2</b>	<b>REORM3</b>	<b>REORM4</b>
Uses electricity for cooking dummy	<b>-0.0436</b> (0.0168)***	<b>0.0667</b> (0.0219)***	<b>0.0872</b> (0.0224)***	<b>0.0958</b> (0.0224)***	<b>0.0957</b> (0.0224)***	<b>0.0871</b> (0.0224)***
Uses electricity for heating dummy	<b>-0.2242</b> (0.0215)***	<b>-0.1325</b> (0.0253)***	<b>-0.1205</b> (0.0256)***	<b>-0.1226</b> (0.0256)***	<b>-0.1225</b> (0.0256)***	<b>-0.1204</b> (0.0256)***
Has a utility meter dummy	<b>0.0725</b> (0.0408)*	0.0604 (0.0475)	0.0556 (0.0480)	0.0575 (0.0480)	0.0576 (0.0480)	0.0559 (0.0480)
Savings dummy	<b>0.1361</b> (0.0188)***	<b>0.1304</b> (0.0214)***	<b>0.1280</b> (0.0216)***	<b>0.1633</b> (0.0213)***	<b>0.1632</b> (0.0213)***	<b>0.1279</b> (0.0216)***
Satisfaction with life in transition	<b>0.0512</b> (0.0039)***	<b>0.0453</b> (0.0043)***	<b>0.0452</b> (0.0043)***	-	-	<b>0.0452</b> (0.0043)***
Age	<b>0.0055</b> (0.0005)***	<b>0.0021</b> (0.0005)***	<b>0.0020</b> (0.0005)***	<b>0.0013</b> (0.0005)**	<b>0.0012</b> (0.0005)**	<b>0.0020</b> (0.0005)***
Female Dummy	<b>0.0360</b> (0.0162)**	<b>0.0339</b> (0.0172)**	<b>0.0324</b> (0.0172)*	<b>0.0324</b> (0.0172)*	<b>0.0325</b> (0.0172)*	<b>0.0325</b> (0.0172)*
Power Reform Index	<b>0.2067</b> (0.0131)***	<b>0.1447</b> (0.0510)***	0.0691 (0.0554)	0.0561 (0.0549)	-	-
Communist Party membership dummy	<b>-0.0564</b> (0.0342)*	-0.0276 (0.0365)	-0.0207 (0.0367)	-0.0109 (0.0366)	-0.0112 (0.0366)	-0.0209 (0.0367)
Relative income compared to country average (in the sample)	<b>0.0234</b> (0.0078)***	<b>0.0189</b> (0.0070)***	<b>0.0187</b> (0.0070)***	<b>0.0230</b> (0.0075)***	<b>0.0230</b> (0.0075)***	<b>0.0187</b> (0.0070)***
Partly indep. Regulator dummy	-	-	-	-	0.0747 (0.0988)	0.0873 (0.0985)
Fully indep. Regulator dummy	-	-	-	-	<b>0.2351</b> (0.1111)**	<b>0.2434</b> (0.1112)**
<i>Log. Lik.</i>	-21265.34	-19501.33	-19484.09	-19539.43	-19536.76	-19481.66
<i>Akaike Information Criteria (AIC)</i>	42556.73	39030.66	39014.19	39120.86	39117.51	39011.32
<i>Var. RE</i>	-	0.354	0.3241	0.3252	0.3184	0.3181
<i>Likelihood ratio test REOR vs REORM (p-value)</i>	-	0.0001***		-	-	-

\*\*\*, \*\* and \* represent significance at the 1%, 5% and 10% levels respectively. Coefficients relevant level of significance in bold.