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THE IMPACT OF DISAGGREGATED SOCIAL CAPITAL ON HOUSEHOLD ELECTRICITY INTENSITY

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Abstract
This paper aims, firstly, to analyse the dynamics of electricity efficiency measured by electricity intensity in the household sector in Croatia at the subnational level, in the period 2001-2013. Then, to shed more light on determinants affecting electricity intensity, it evaluates the effect of social capital thereon by conducting the stepwise and quantile regression methods. The results of the former indicate support for a negative effect of generalised trust and reciprocity on household electricity intensity. The results of the latter show that social capital does not influence electricity intensity uniformly; in other words, its influence is more significant in tourism-oriented regions and regions lagging behind. The findings are briefly discussed within the social study findings aimed at encouraging energy efficiency and sustainable behaviour of households through collective action for which generalised trust and reciprocity, as well as social trust in general, are crucial.

JEL Classification: A13, P28, R11
Key Words: Electricity Intensity, Generalised Trust, Social Capital, Croatia

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1. Introduction

Electricity intensity is an indicator of electricity efficiency in the economy that measures the amount of electricity necessary to produce a Euro's worth of economic output. A reduction in electricity intensity may indicate greater electricity efficiency and generate positive effects on all three EU energy policy challenges – namely, security of supply, climate change and affordability - as well as better quality of life in general. Hence, exploring the intensity of electricity use is also important from an energy policy-making perspective.

Recently, there has been growing interest in explaining the dynamics and determinants of energy and electricity intensity, in particular (Bodger and Mohamed, 2005; Liddle, 2009; Inglesi-Lotz and Blignaut, 2012; De Cian *et al.*, 2014; Pickenpaugh and Balash, 2015). The results of these studies indicate that energy/electricity intensity has been declining and will decline further over years, due to the adoption of more efficient technologies and practices, structural changes, new and more demanded efficiency standards, behavioural changes, as well as financial incentives for energy improvements (see, e.g., IEA, 2015 or EIA, 2016). The value of electricity intensity varies significantly between countries and regions (e.g., Bodger and Mohamed, 2005; De Cian *et al.*, 2014), depending on their development stage, the composition of their gross domestic product (GDP), the share of the electricity sector in gross output and total energy use, the state of technology, the price of electricity, demographics, and the like. Thereby, Industrialized Asia, Western Europe and North America have the lowest electricity intensity, while Eastern Europe and developing countries the highest (Bodger and Mohamed, 2005).

Although considerable research has been devoted to investigating electricity intensity at the national or cross-national level, rather less attention has been paid to the sub-national level, particularly in Central and Eastern Europe. However, this level plays a key role in implementing energy policies and action plans. It also has important correctional functions, since energy programs, plans and actions can be supplemented and corrected to better align with the specifics of sub-national areas. Moreover, bearing in mind that electricity consumption may cause economic growth and development, and that households make up an important electricity-consuming sector, it is worth explaining, determining and monitoring how efficiently electricity is used by this sector at the sub-national level.

While previous studies mostly stress the importance of demographic characteristics of consumer units in energy use (e.g., age or educational level), physical characteristics of dwellings (e.g., type of building, residence size or its age, building materials, and the like), economic variables (such as available income or GDP) and contextual variables (e.g., climate and weather); very little attention has been paid to social context and social capital, in particular. However, Georg already (1999) illuminated that many issues related to consumption are deeply rooted in the social context, and Briceno and Stagl (2006) stressed that social capital itself can enhance the quality of life, while making the consumption process more efficient and, therefore, reducing consumption.

The main aim of this paper is twofold; first, to analyse the dynamics of electricity efficiency measured by electricity intensity in the household sector in 21 NUTS-3 (the Nomenclature of Territorial Units for Statistics) Croatian counties (hereafter: regions) over the period 2001-2013, and second, to evaluate the effects of social capital variables on electricity intensity in the household sector by conducting the stepwise regression method. The paper follows Borozan and Radman-Funaric (2016a), who defined social capital as a hierarchical construct with three main dimensions: social trust (composed of three sub-dimensions: generalised trust and reciprocity, institutional trust and trustworthiness [an individual's civic commitment and moral principles]), participation (membership in various associations, organisations and clubs) and civism (the perceived absence of opportunistic, predatory behaviour by fellow citizens, such as corruption, tax evasion or use of influential connections).

The stepwise regression method, described by Hinkle *et al.* (2003), is used to determine the set of social capital dimension and sub-dimension variables that make a statistically significant contribution to the explanation of variability in household electricity intensity. Namely, although the shortcomings of stepwise multiple regression are well known, the method is beneficial when there is little theory to guide the selection of determinants for a model (see Whittingham *et al.*, 2006). Quantile regression, proposed by Koenker and Bassett (1978), is further used to check the stepwise regression results and provides more in-depth insights into the effects of social capital variables on electricity intensity at different quantiles of electricity intensity.

Results obtained in this paper advance the energy and environment related literature in two ways. First, results show that a regional perspective in electricity conservation programs and action is not only justified but necessary, since electricity efficiency is unevenly distributed across regions and, also, dependent on economic conditions. Thereby, electricity intensity is generally higher in tourism-oriented regions and regions lagging behind, while it is lower in more developed regions. Second, social capital variables, generalised trust and reciprocity and social trust, in particular, play an important role in explaining energy intensity variability, indicating, this way, the possibility of enhancing electricity efficiency and conserving household electricity consumption by influencing social interaction in the population. This influence is particularly present in tourism-oriented regions and regions lagging behind.

The remainder of this paper is divided into four sections. Section 2 briefly reviews relevant literature on the relationships between social capital and energy efficiency. Section 3 explains the main trends in electricity intensity in Croatia and its regions, and describes the data used and the method applied. Section 4 presents and discusses empirical results, while Section 5 concludes with a brief look at some possible directions for further research.

2. A Review of Social Studies of the Relationship between Social Capital and Energy Efficiency

A positive effect of social capital and its particular dimensions on common goals of a certain group of people has been explored and corroborated in many studies (Ostrom, 1990; Putnam *et al.*, 1993; Inglehart, 1997). The aim of this paper is to find out whether social capital also affects electricity intensity in the household sector.

Allcott (2011) observed that economists, in general, and energy policymakers, in particular, have historically focused on how economic variables, such as prices or financial incentives, affect demand. However, he demonstrated that non-price interventions, like sending a letter to consumers on their electricity consumption over the past twelve months compared with the mean of their comparison group, together with suggestions on energy saving actions, can affect consumer behaviour and encourage people to conserve energy. Nolan *et al.* (2008) and Schultz *et al.* (2007) also corroborated that social norms have a significant effect on energy conservation. To that end, Nolan *et al.* (2008) showed that descriptive norm messages (e.g., information about energy consumption of neighbouring households) have a greater effect on electricity consumption than mere advice on energy conservation, while Schultz *et al.* (2007) showed that descriptive norm messages should be combined with injunctive messages so as to have a greater effect and prevent the occurrence of the so-called boomerang effect. Goldstein *et al.* (2008) explained this effect of descriptive norms on people behaviour. They emphasised that a social group adapts its behaviour to the behaviour of people in its neighbourhood, and that descriptive norm messages may have a greater effect on the individual rather than global norms. Zak and Knock (2001) demonstrated that trust is lower when the social distance between people is larger.

Empirical literature in this field also illuminates that energy conservation produces two side effects on electricity consumers: lower electricity costs and a good feeling that they contribute to environmental conservation. Frederiks *et al.* (2015) clarified that cognitive biases and motivational factors in household energy consumption and conservation behaviour are necessary in order to bridge the gap between pro-environmental knowledge, values, attitudes and intentions, and everyday energy-related behaviour of consumers. Sanditov and Arora (2016) underlined that an individual is more willing to invest in a global public good within a 'cohesive' network structure, which is rich in social ties spanning across families, neighbourhoods and circles of close friends.

Kavousian *et al.* (2013) analysed household electricity consumption and its structural and behavioural determinants for 1,628 households in the U.S.

They found out that external conditions (e.g., weather and location), physical characteristics of dwellings (e.g., residence size), appliances and electronics stocks, as well as occupants, are significant drivers of electricity consumption. Moreover, they found out that weather and physical characteristics of dwellings influence more considerably household electricity consumption compared to, e.g., occupant behaviour, a finding consistent with those by Guerra Santin *et al.* (2009). However, in terms of the impact of behavioural factors, their results agree with some previous studies (Cramer *et al.*, 1985; Gouveia *et al.*, 2012), which showed that household electricity consumption is primarily determined through the way households use electricity, rather than by the way they value energy efficiency.

Georg (1999) already found that many issues related to consumption are deeply embedded in social context. A number of factors influence, directly or indirectly, the household level of energy consumption, and from a sociological point of view, increase in consumption may be reduced to a common denominator: the trend towards individualisation. The most noticeable physical indication of individualisation is the trend towards a decreasing number of people per household, which, according to Vercalsteren and Geerken (2003), leads to the creation of new preferences and patterns of consumption centred more and more on the individual. Thus, according to Briceno and Stagl (2006: 1542), "Consumption as the search for comfort and stimulation has been substituting for some of the voids created in increasingly more individualised societies. Thus, the lack of social relations and coordinated action seems to have the potential to intensify the demands being made from the world of material consumption."

To sum up, the previous studies confirm the importance of social context and social norms and trust, in particular, as important drivers of household electricity consumption, and therefore, indirectly energy intensity. However, it does not consider social capital in its complexity; so, the importance of other social capital dimensions and sub-dimensions have remained unexplored. The aim of this paper is to address this gap in the literature.

3. Data, Electricity Intensity Trends and Method

3.1 Data

In the present study, data are related to social capital variables and electricity intensity for 21 Croatian NUTS-3 regions. The former were obtained by Borozan and Radman-Funaric (2016a), who conducted primary research through a questionnaire on a convenience sample (N = 1,695) in the period from 20 June to 20 December 2012 in Croatia. The details of the questionnaire, the collection process, methodology and the model are described in their papers. Based on their database, Borozan *et al.* (2016b) calculated the average value of social capital variables for each Croatian region, which are also used in this paper.

Electricity intensity may be measured in different ways: as the ratio of energy consumption to a unit of measurement (e.g., GDP, GDP per capita, number of workers, floor space, disposable income) (EIA, 1999). The paper follows Mukherjee (2008), Inglesi-Lotz and Blignaut (2012) and others, who defined electricity intensity as the ratio of electricity consumption to GDP. To study trends and exclude the impact of inflation, GDP is given in constant Euro prices using 2010 as the base year. Since electricity consumption is measured in GWh and GDP in million EUR, this ratio is measured in GWh per million EUR (GWh/MEUR). GDP and household electricity consumption data for the period 2001-2013 were obtained from the Croatian Bureau of Statistics (CBS) and Hrvatska elektroprivreda (HEP), respectively. HEP is a leading Croatian electricity company. Electricity consumption data are related to 21 Croatian distribution districts used as proxies for the Croatian 21 NUTS-3 regions. Household consumption covers the total usage of electricity for space and water heating, lighting and for all electrical appliances.

In this paper, social capital dimension and sub-dimension variables are used as predictor variables, while electricity intensity of the household sector is used as the dependent variable. Besides them, per capita GDP and professional and university qualifications will be used as control variables, as described in Section 4.1.

3.2 The Dynamics of Electricity Intensity in Croatia

As an EU Member State, Croatia is committed to more efficient energy use at every stage of the energy chain. To reach the EU energy target of at least 27% energy efficiency improvement by 2030, the country set its own indicative national energy efficiency targets and designed numerous programmes, plans and actions (for the national energy efficiency policy background, see EIHP, 2015). For example, by 2020, the national energy efficiency target expressed as the absolute amount of final energy consumption amounts to 293.04 PJ.

Average per capita household electricity consumption in Croatia in 2013 was 1.5 MWh, which is slightly below the EU-28 average in 2013 (1.6 MWh per capita; Eurostat data, 2015). Above-average consumption is recorded in nine Croatian regions, which are more developed and more tourism-oriented and use electricity for space and water heating, but also for cooking and cooling. For this sector, the share of electricity in final energy consumption remained approximately the same over the period considered (i.e., 22%).

Household electricity consumption increased annually by 2.73% in the period 2001-2008, when the economy and living standards progressed, and when winter periods were colder, but decreased in the period of economic recession (2009-2013) by an annual rate of 9.92% (see Table 1). In the same periods of time, electricity intensity, measured in GWh/MEUR of GDP at 2010 prices, changed at an annual rate of -2.10% and +1.19%, respectively.

Table 1. Annual rates of household electricity consumption and intensity changes

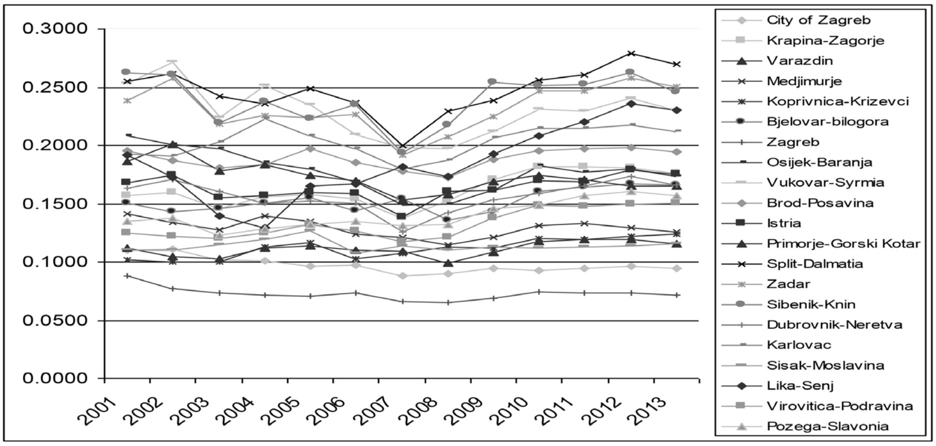
	Annual rates of change (in %)					
	Electricity consumption			Electricity intensity		
Region	2001-2013	2001-2008	2009-2013	2001-2013	2001-2008	2009-2013
City of Zagreb	0.822	2.661	-1.214	-1.269	-2.919	0.018
Krapina-Zagorje	-0.074	1.180	-1.521	0.954	-0.426	0.772
Varazdin	0.453	1.419	-1.121	0.269	-1.644	1.604
Medjimurje	0.435	1.707	-0.885	-0.949	-2.894	0.887
Koprivnica-Krizevci	0.529	2.203	-1.895	1.645	1.477	2.555
Bjelovar-bilogora	0.546	1.999	-1.313	0.862	-1.373	3.812
Zagreb	0.752	2.257	-1.314	-1.659	-4.100	1.159
Osijek-Baranja	-0.344	0.685	-1.562	-1.513	-4.596	1.791
Vukovar-Syrmia	-0.266	1.110	-1.836	-0.762	-3.479	2.151
Brod-Posavina	0.013	1.302	-1.567	-0.033	-1.770	0.856
Istria*	1.425	3.434	-0.432	0.345	-0.623	1.991
Primorje-Gorski Kotar*	0.974	2.863	-0.996	-0.992	-2.329	-0.518
Split-Dalmatia*	1.821	3.985	0.251	0.461	-1.519	3.092
Zadar*	2.789	5.405	-0.010	0.400	-2.001	2.715
Sibenik-Knin*	1.757	3.733	-0.858	-0.550	-2.632	-0.834
Dubrovnik-Neretva*	2.598	4.881	-0.264	0.136	-1.909	2.046
Karlovac	0.329	1.758	-1.190	0.785	-0.456	0.650
Sisak-Moslavina	0.279	2.110	-2.233	0.386	-0.102	0.639
Lika-Senj*	2.072	4.228	-0.498	1.527	-1.431	4.517
Virovitica-Podravina	0.228	1.546	-1.456	1.599	-0.379	2.283
Pozega-Slavonia	0.392	2.003	-1.749	1.275	-0.217	1.747
Croatia	0.963	2.726	-0.920	-0.376	-2.103	1.188

Note:
* denotes regions of Adriatic Croatia;
the other regions (without *) belong to Continental Croatia

The same pattern of behaviour can be noticed at the NUTS-3 level, although there are significant differences in electricity intensity. Over the period under consideration, electricity intensity ranges between the lowest value at 0.1394 GWh/MEUR 2010 in 2008 and the highest of 0.2138 GWh/MEUR 2010 in 2001. Figure 1 illustrates the evolution of energy intensity across Croatian NUTS-3 regions.

While there is a similar pattern in electricity intensity for the Croatian NUTS-3 regions, the evolution in some of the regions shows heterogeneity in the series and across regions, and also the possible existence of significant structural break(s) occurring mostly at the beginning of the recession. Hence, at least two time periods can be noticed in the dynamics of the series, namely, before and during the recession (see Table 1). In Croatia, the recession started in the last quarter of 2008 and lasted until the end of 2014. Before the recession (2001-2008), which was particularly severe (GDP declined by approximately 13%), household electricity consumption increased, while electricity intensity decreased. However, during the recession, these behaviour patterns changed in most regions. In fact, household electricity consumption declined due to increasing electricity rates and food prices, decreasing disposable income and rising economic uncertainty in general, as well as due to warmer winter periods (particularly in the period 2011-2013), while electricity intensity increased due to both a decrease in the electricity nominator and the GDP denominator. This is a common effect of economic downturns, already noticed in many other countries going through a similar economic situation (e.g., IEA, 2012; Nelder, 2013).

Figure 1. The evolution of energy intensity across Croatian NUTS-3 regions 2001-2013



However, there is a distinguishing pattern in energy intensities of Continental and Adriatic regions and more and less developed regions in Croatia. Electricity intensity is generally higher in tourism-oriented regions, i.e., regions belonging to the so-called Adriatic Croatia (e.g., Split-Dalmatia, Zadar, Sibenik-Knin or Lika-Senj), and regions lagging behind (e.g., Vukovar-Syrmia or Brod-Posavina), while it is lower in more developed regions of the so-called Continental Croatia (e.g., the City of Zagreb or Varazdin). The former use more electricity per capita for space and water heating, cooking and cooling over the year (Adriatic Croatia) or generate less GDP while, at the same time, they use less electricity (regions lagging behind located in Continental Croatia). The latter use mostly natural gas for space & water heating and cooking, while they also generate more GDP.

3.3 Method

Considering that there is little theoretical background to guide the selection of social capital variables for the household electricity intensity model, the stepwise regression method is chosen. It has already been used in energy or environmental modelling aiming to identify the most influential explanatory variables (e.g., Hygh *et al.*, 2012 or Kavousian *et al.*, 2013). To determine the best combination of social capital dimension and sub-dimension predictor variables, three variable selection procedures were used: forward selection, backward elimination, and stepwise selection procedure. As usual, threshold values for *F*-to-enter and *F*-to-remove are set at 0.05 and 0.10, respectively. These procedures are briefly explained below, while more information about them may be found in Hinkle *et al.* (2003).

The forward selection procedure starts with no candidate variables in the model. Then, it selects the variable that has the highest *F*-to-enter statistics. At each further step, it selects the candidate variables that have an *F*-to-enter test higher than the threshold value. When none of the remaining variables is significant, the procedure stops adding variables. During this process, once a predictor variable enters the model, it cannot be deleted. In the backward elimination procedure, all predictor variables are entered into the regression equation. Then, the regression procedure successively removes variables with the smallest *F*-to-remove statistics, provided that this is below the threshold value for *F*-to-remove. In the case of the stepwise procedure that combines the forward and the backward selection one, predictor variables are entered into the regression equation one at a time, based on *F*-to-enter statistics. More precisely, a particular predictor variable that demonstrates the highest bivariate correlation with the dependent variable (i.e., the highest *F*-to-enter statistics) is entered first in the regression equation. The regression procedure then looks for the next significant variable, if any, at step two, and then produces regression results based on these two variables. This procedure is continued until all independent variables, with *F*-to-enter statistics above the threshold, have been entered into the equation. The method also examines whether the *F*-to-remove statistics of any variable previously added has fallen below the *F*-to-remove threshold. If so, the worst of them are removed, and then the procedure attempts to continue. It ends when no variable, either in or out of the model, has *F*-statistics on the wrong side of their respective thresholds.

In addition to the stepwise regression method, the quantile regression method is employed. As stated by Koenker and Hallock (2001: 143), it is "an extension of ordinary least squares estimation of conditional mean models to the estimation of an ensemble of models for several conditional quantile functions". The method enables the estimation of a linear relationship between regressors and a specified quantile of the dependent variable. This method provides deeper insights into the conditional distribution of the dependent variable by allowing the estimation of various quantile functions of a conditional distribution rather than using conditional mean analysis alone. Putting different quantile regressions together, the method also provides a more complete description of the underlying conditional distribution (Kuan, 2007). Moreover, no strong distributional assumptions are required, which makes this a robust method for modelling the relationship between regressors and a specified quantile of the dependent variable (Buchinsky, 1998; Kuan, 2007). For a detailed discussion of quantile regressions, one may refer to Koenker and Bassett (1978) or Kuan (2007). Recently, quantile regression has gained much attention and wide applications in different fields, including energy and environmental economics (e.g., Kaza, 2010; Frondel *et al.*, 2012; Aydin, 2017).

The general linear specification for conditional quantiles of the dependent variable of interest (y_i) of an object *i* can be defined as follows

$$y_i = x_i^{'}\beta + e_i , \tag{1}$$

where x_i is a k x 1 vector of independent variables, e_t is an unknown error term and β is an unknown k x 1 vector of regression parameters that has to be estimated for different conditional quantile functions. To estimate them, the boostrap resampling method may be used, since it is more efficient in small samples and is robust to heteroscedasticity (Buchinsky, 1998).

The basic empirical model we estimate includes the following social capital variables: generalised trust and reciprocity (*g_trust*), institutional trust (*i_trust*), trustworthiness (*t_trust*), participation (*part*) and civism (*civism*). It is given by the following expression

$$intensity_i = f\,(g\_trust_i,\ i\_trust_i,\ t\_trust_i,\ part_i,\ civism_i), \tag{2}$$

where *intenstiy* denotes electricity intensity, the dependent variable in a region *i* (*i* = 1,…, 21). Data are related to the year 2012. Descriptive statistics of the data used in the analysis is given in Table A1 of the Appendix.

4. Results and Discussion

4.1 Results

There is a statistically significant negative bivariate correlation between electricity intensity and generalised trust and reciprocity (-0.382; p = 0.10), which means that, if households have more trust in other people in general, and, hence, if they believe more in honesty and others' intentions to cooperate, they are more likely to use energy more efficiently. The dependent variable shows no statistically significant correlation with any other social capital variables.

To assess the effect of the main social capital variables on household electricity intensity, stepwise regressions with three different selection procedures (stepwise, forward and backward) were run.

Table 2 summarises the results using the stepwise procedure, including the raw and the standardised regression coefficients of social capital variables together with their t-statistics and significance. It should be made clear that results are the same regardless of the selection procedure chosen, and there is no evidence of multicollinearity.

Table 2. Stepwise regression results

Dependent variable: electricity intensity					
Predictor variable	Unstandardised coefficient		Standardised coefficient	t	Significance
	b	SE	beta		
Constant	0.165	0.011		15.243	0.000
g_trust	-0.149	0.058	-0.507	-2.562	0.019

Note: $R^2 = 0.257$; F (1, 19) = 6.556, p = 0.019. Forward (Criterion: Probability-of-*F*-to-enter ≤ 0.05); Backward (criterion: Probability of *F*-to-remove ≥ 0.1); Stepwise (Criteria: Probability-of-*F*-to-enter ≤ 0.05, Probability-of-*F*-to-remove ≥ 0.1). SE = Standard Error.

Energy literature has shown that besides social capital variables, economic and human capital variables may be important determinants for energy consumption and, therefore, electricity intensity. Hence, we introduced two additional variables: per capita GDP (*GDP*) and professional and university qualifications per 100,000 inhabitants (*graduates*) as the control variables in our regression. Thereby, the former is used as a proxy for the level of economic development, while the latter is used as a proxy for human capital. The source of both variables is the CBS and descriptive statistics is given in Table A1 of the Appendix. Stepwise regression with three different selection procedures (stepwise, forward and backward) was run again; however, the final results remained the same as shown in Table 2. Nevertheless, since the method enables a model specification that strictly relies on statistical criteria, its results should be treated as preliminary, since further research is required.

To gain additional knowledge concerning the effect of social capital variables on electricity intensity, quantile regression with bootstrapped standard error was employed. This method allows us to estimate different parameter estimates for various conditional quantiles of electricity intensity distribution. In view of the heterogeneity of electricity intensity shown in Figure 1, this method can be particularly beneficial. The method is a generalisation of median regression analysis to other quantiles, and, particularly, the 0.25 quantile, median (0.5), and 0.75 quantile, in our case.

The results of the 0.25 quantile, 0.5, and 0.75 quantile regressions for two models are shown in Table 2. Thereby, Model I, which refers to the social trust sub-dimension variables, is

$$intensity_i = f(g\_trust_i, i\_trust_i, t\_trust_i, GDP_i, graduates_i), \quad (3)$$

while Model II, which refers to social capital dimension variables, is

$$intensity_i = f(s\_trust_i, part_i, civism_i, GDP_i, graduates_i), \quad (4)$$

where *s_trust* denotes social trust.

Table 3. Quantile regression results

	Model I						Model II					
	Q0.25		Q0.50		Q0.75		Q0.25		Q0.50		Q0.75	
	Coeff	Bootstrap Std. Err.	Coeff	Bootstrap Std. Err.	Coeff	Bootstrap Std. Err.	Coeff	Bootstrap Std. Err.	Coeff	Bootstrap Std. Err.	Coeff	Bootstrap Std. Err.
g_trust	-0.191	0.163	-0.259	0.054*	-0.193	0.062*						
i_trust	0.072	0.086	0.048	0.076	0.010	0.059						
t_trust	-0.048	0.199	0.056	0.180	0.028	0.093						
s_trust							0.039	0.230	-0.061	0.113	-0.232	0.121***
part							0.031	0.139	0.061	0.070	0.057	0.059
civism							-0.140	0.070***	-0.128	0.070***	-0.030	0.092
graduates	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
GDP	-0.000	0.000	-0.000	0.000	-0.000	0.000	-0.000	0.000	-0.000	0.000***	-0.000	0.000***
Constant	0.165	0.173	0.185	0.075**	0.241	0.083**	0.159	0.177	0.135	0.089	0.241	0.083*
Pseudo R^2	0.321		0.393		0.495		0.317		0.298		0.421	

Note: * p < 0.01; ** p < 0.05; *** p < 001. Coef = coefficient; Std. Err. = standard error.

According to the results shown for Model I in Table 2, generalised trust and reciprocity affect electricity intensity at median (0.5) and 0.75 quantile of electricity intensity at 1% significance level. In Model II, civism is statistically significant at 10% significance level in the 0.25 and 0.5 quantile regression models, while social trust is statistically significant at the same significance level in the 0.75 quantile model. In addition to social capital variables in the median and 0.75 quantile regression models, per capita GDP is significant at 10% significance level.

4.2 Discussion

The stepwise model is statistically significant, F (1, 19) = 6.556, p = 0.019, and accounts for approximately 26% of household electricity intensity variance. This suggests that generalised trust and reciprocity can predict the dependent variable in a statistically significant manner. The impact of other social capital variables turned out to be insignificant. Additionally, the perception of generalised trust and reciprocity is negatively correlated with household electricity intensity. Furthermore, we find, from the quantile regression analysis, that social capital variables do not have a uniform impact on electricity intensity. Model I shows that generalised trust and reciprocity have a significant effect on electricity intensity at median and 0.75 quantile, i.e. in tourism-oriented regions and regions lagging behind. In these two regressions, selected variables account for 39% (Q0.5 regression) and 50% (Q0.75 regression) of household electricity intensity variance. In Model II, social trust turned out to be an important determinant of electricity intensity in the same regions, i.e., tourism-oriented regions and regions lagging behind, indicating that these regions use electricity in a less efficient way. This can be indirectly supported by Bohdanowicz *et al.* (2015), who claim that tourism uses significant amounts of energy for providing comfort and services to guests, but, typically, at an alarmingly low level of energy-efficiency; besides, Irsag *et al.* (2012) as well as Borozan and Borozan (2017) have shown that there is significant margin for energy savings in the tourism sector in Croatia. In addition, many other authors (for a review, see Bjornskov, 2017) confirmed that trust is more important in less developed countries and regions.

Generalised trust may be defined as generalised expectation that other people are generally trustworthy and honest, while its level is determined by general expectations of individuals related to social motives of other people or the nature of the world (Jones *et al.*, 1997). Reciprocity implies that people are obliged to repay in kind what another person will provide for them in the future (Cialdini, 2006). Hence, it represents a basis for building a continuing relationships and mutual exchanges, as well as social norms.

An important role of trust and reciprocity in energy efficient behaviour has already been recognised in promoting cooperation among individuals and groups of people, contributing to the economic performance of firms (Cooke and Clifton, 2002) and countries (Inglehart, 1997; Norris, 2002), as well as in coserving the environment (Ostrom, 1990; Ostrom and Ahn, 2003; Carattini *et al.*, 2015). At a micro level, social capital reduces transaction costs (Zak and Knack, 2001) and generally promotes collective action (Coleman, 1988; Putman *et al.*, 1993).

When it comes to the role of generalised trust and reciprocity and social trust, in general, in energy efficiency behaviour and pro-environmental behaviour, the results observed in our study are in line with previous studies (for a review, see Volland, 2016); namely, other studies confirm that more trusting people tend to buy environmentally friendly products (Gupta and Ogden, 2009), use more collectively desirable commuting options (van Lange *et al.*, 1998) or support pro-environmental policies (Irwin and Berigan, 2013). Moreover, Carattini *et al.* (2015) demonstrated that countries with a higher share of trusting citizens have lower per capita energy consumption and, subsequently, emit considerably fewer greenhouse gases per capita, while Volland (2016) revealed that trust is negatively correlated with household energy demand.

According to the result of the 0.25 quantile and median regressions, civism, i.e., the perceived absence of opportunistic, self-interest behaviour by fellow citizens, such as corruption or tax evasion, turned out to be an important determinant of electricity intensity only in more developed regions. This is not unusual; for example, Ruth (2002), as well as Fortelny (2014) highlighted that the energy sector is a prime target for corruption and that theft and other kinds of corrupt activities are more intensive in less developed countries. Furthermore, Fredriksson *et al.* (2004) demonstrated that corruption reduces energy efficiency. For the same sample, Borozan *et al.* (2016b) revealed that the perception of civism represents a strong direct predictor of relative per capita household electricity consumption in Croatian NUTS-3 regions.

The absence of a statistically significant relationship between other social capital variables and energy intensity is not consistent with some research findings. For example, Allcott (2011) observed that adjustment of norms conditioned by consumption of neighbours leads to reduction in electricity consumption in one's own household. Marbuah and Gren (2015) showed that trust in national government helps reduce CO_2 emission levels in 21 counties in Sweden. McMichael and Shipworth (2013) emphasised the role of social networks for informing community-based energy-efficiency programmes. Borozan and Radman-Funaric (2016a) found out that social capital variables show strong mutual correlation. So, further research should shed more light on the causal relationship between such variables, and the mechanism that enables the transformation of their influence on energy efficiency.

The paper indicates that per capita GDP is a statistically significant determinant of electricity intensity in the median and 0.75-quantile model, i.e. in tourism-oriented and less developed regions. However, the estimated value is very low, indicating that per capita GDP had little influence on electricity intensity even in these regions. Generally, poorer regions have fewer opportunities to build new energy-saving buildings, buy new low energy-consuming equipment or products or invest in energy-saving innovations. However, increased income may lead to a decrease in household electricity intensity. Recent studies have also shown that energy efficiency generally improves as an economy develops (World Bank, 2001; Wu, 2012). On the contrary, human capital, operationalised by means of the number of highly educated people, does not seem to matter much at each quantile regression in this study. Certainly, one should expect that educational level significantly influences electricity intensity, i.e. that people with tertiary education are more aware of and concerned about efficiency and other pro-environmental issues. However, this study is related to the recession year, when even highly educated people were less inclined to undertake investment in new energy-saving appliances and innovation in general. Hence, it might be worthwhile to conduct the same research when the economy is going through an expansionary phase.

The values of the coefficient of determination indicate that social capital and other selected variables, albeit not negligible, are not the only determinants of energy intensity; hence, further research should extend the list of considered predictor variables. Moreover, bearing in mind the disadvantages of stepwise methods, alternative methods may also be used to select an optimal model for energy intensity. Finally, further research should take into consideration the fact that electricity intensity may be calculated in different ways (Nelder, 2013).

5. Conclusions

Electricity efficiency has become an important topic for energy policy authorities since it contributes to reaching EU energy policy targets. It has also attracted a growing interest by researchers trying to explain the dynamics and determinants of energy and, particularly, electricity efficiency. Their results indicate that electricity intensity has been reduced over the last years, but, also, that its values vary significantly between countries and regions, depending on development stage, composition of GDP, share of the electricity sector in gross output and energy use, state of technology, price of electricity, and the like. They also indicate that energy efficiency behaviour and decisions are framed within a given social context and driven by social norms.

Bearing in mind that electricity consumption may cause economic growth and development, and that the household sector is an important electricity-consuming sector, this paper analysed the dynamics of electricity efficiency measured by electricity intensity in the household sector in 21 NUTS-3 Croatian regions during the period 2001-2013. The results show that household electricity efficiency in Croatia is unevenly distributed and also dependent on economic conditions. They reveal that electricity intensity is generally higher in tourism-oriented regions and regions lagging behind, while it is lower in more developed regions. Furthermore, household electricity behaviour in Croatia confirms the known effect of economic downturns: electricity consumption decreases during a severe economic downturn, while, at the same time, electricity intensity increases.

The present paper followed the assumption that consumption is deeply rooted in the social context and that social capital may contribute to its reduction. Consequently, it evaluated the effects of social capital variables on electricity intensity in the household sector by using the stepwise regression method. Results suggest that generalised trust and reciprocity have statistically significant influence on electricity intensity, implying that, if household members have more trust in other people, descriptive and injunctive norm messages of electricity consumption of their neighbours may contribute to their more pro-environmental consumption and behaviour, in general. In addition to the stepwise regression method, the paper employed the quantile regression method to gain new knowledge on the effects of social capital variables on electricity intensity. We find that they do not have a uniform impact on electricity intensity. While social capital variables, except for civism, do not have much effect on electricity intensity in more developed regions, they do have a statistically significant effect on electricity intensity in tourism-oriented regions and less developed regions. This influence is primarily associated with social trust (generalised trust and reciprocity, in particular) and civism.

Further research should shed more light onto the causal relationship between variables, as well as the mechanism that enables the transformation of their influence on energy efficiency. Certainly, social capital variables, although not negligible, are not the only determinants of energy intensity. Hence, further research should also extend the list of predictor variables considered, and use alternative methods to select an optimal model for energy intensity.

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Appendix

Table A1. Descriptive statistics

Variable	Obs	Mean	Std. Dev.	Minimum	Maximum
Generalised trust and reciprocity	21	-0.036	0.188	-0.468	0.249
Institutional trust	21	0.026	0.168	-0.332	0.317
Trustworthiness	21	-0.016	0.153	-0.299	0.239
Social trust	21	-0.010	0.166	-0.327	0.273
Participation	21	0.040	0.242	-0.371	0.461
Civism	21	0.007	0.200	-0.560	0.367
Per capita GDP (in EUR)	21	8,602.381	2,966.189	5,853.000	18,506.000
Graduates*	21	782.409	119.245	600.429	1,077.476
Electricity intensity (in GWh/MEUR)	21	0.171	0.055	0.071	0.270

Note: * Graduates from professional and university study programs per 100,000 inhabitants; Obs = Observation; Std. Dev. = Standard Deviation.