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Political instability and non-market valuation: evidence from Croatia.

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Abstract.

We examine the effect of political instability on willingness to pay estimates (WTP) from nonmarket valuation, using data from a choice experiment implemented in Zagreb, Croatia to value groundwater quality and quantity. To evaluate the sensitivity of preferences for environmental quality to instability, we use the timing of a period of public protest that occurred in the city during the data collection and compare preferences before and during the protest. We find some evidence that WTP is lower in the period of political instability, but the result is sensitive to the specification used.

Keywords: Choice Experiment, Political Instability, Water Pollution, Water Quantity

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1. Introduction

This paper investigates the influence of political instability on preferences for environmental quality through non-market valuation. We use a choice experiment conducted in Zagreb, Croatia in 2011, to value a groundwater aquifer conservation plan. To assess the effect of political instability on preferences for environmental quality, we use the variation introduced by a series of anti-government protests that began in the country during data collection. We use the timing of the protests, which is exogenous to the implementation of the survey, to discriminate between respondents interviewed before and after the protest and compare their WTP. The results suggest that political instability may influence WTP in the short run. We find some evidence that instability does not affect preferences for environmental quality but influences respondents' WTP into a government managed fund. We also find that after the protest the idiosyncratic error component is smaller, suggesting that the population's view of the good has become more homogeneous. We attribute these changes to the post-protest decrease in government credibility (Oh and Hong, 2012). The results suggest that even a brief period of instability can have important effects on environmental preferences. Nevertheless, results are sensitive to the specification used, and in particular to the inclusion of an alternative specific constant for the status quo alternative.

The paper contributes to the literature in a number of ways. To our knowledge this is the first study attempting to quantify the impact of political instability on preferences for environmental quality. Contrary to much of the empirical literature on political instability that concentrates on countries with long history of social unrest and inefficient or non-functioning institutions, we use a case study from a democratic state that has been mostly peaceful and stable for the past years, and show that even brief periods of instability can have substantial influence on stated behaviour in the short run. The results are relevant for many countries that experience brief instability but do not slip into prolonged and violent political confrontation. Finally, the period we study is short, reducing the influence of confounding factors on preferences for environmental quality.

Political instability is used in research to describe a diverse range of phenomena. Events associated with political instability can generally be divided into two categories. First, political instability includes episodes of social unrest such as politically motivated violence and riots. Second, instability can suggest sudden government changes and electoral surprises that are outcomes of agents' interaction in the political system. In this paper we use the term to imply a period of politically motivated unrest that introduces uncertainty regarding the government's ability to implement policies and remain in power (Carmigani, 2003). Lacking data after the end of the unstable period, we can only speculate about the long term influence of instability.

The rest of the paper is structured as follows: Section 2 discusses the relevant literature while section 3 presents the models and hypotheses. Section 4 presents the case study and describes the survey, while section 5 reports the results. Section 6 concludes.

2. Literature Review

An increasing body of research looks at the influence of political instability on observed individual and household behaviour. Political instability is among others related to decreased welfare (Dupas and Robinson, 2010), increased risk taking (Dupas and Robinson, 2012), increased propensity to engage in violence (Miguel et al., 2011) and decreasing human capital accumulation (Shemyakina, 2011). Many studies focus on the impact of instability on health outcomes (Bundervoet et al., 2009; Akresh et al., 2011; Akresh et al., 2012). Most of those studies focus on countries with a long history of instability, often manifested by civil war. In contrast, the present paper extends research by examining the influence of a brief episode of instability in an otherwise peaceful country.

The long run influence of political instability on environmental performance and resource use is ambiguous. Fredriksson and Svensson (2003), show that the stringency of environmental regulation can decrease with increasing political instability, depending on the level of corruption. Furthermore, firm investment in abatement technology increases with government corruptibility but the effect is smaller when political instability is higher (Fredriksson and Wollscheid, 2008). Skoulikidis (2009) attributes part of the deterioration of the state of Balkan rivers to political instability during the 1990s. Stable democratic institutions (Farzin and Bond, 2006) and the quality of governance (Bhattarai and Hammig, 2004) are also important for environmental quality. Buitenzorgy and Mol (2010) find that countries transitioning to democracy have lower deforestation rates compared to established democracies and non-democracies, while Papyrakis (2013) finds a negative association between environmental performance and social and ethnic fragmentation that often motivates political instability (Annett 2001). On the other hand, researchers show that ownership risk induced by political instability can reduce resource use (Bohn and Deacon, 2000; Laurent-Lucchetti and Santugini, 2012).

The paper also relates to the literature on the temporal reliability of nonmarket valuation. To test the stability of non-market valuation estimates, studies use either independent samples or test-retest methods eliciting values from the same sample at different points in time aiming also to investigate the nature of the error component and learning effects.

Assuming preferences are time invariant, values estimated at one point in time can later be used for Cost-Benefit analysis, with the caveat that changes in external conditions affecting individual choice should change valuation in a predictable manner (Carson et al. 1997; Whitehead and Hoban 1999). Some contingent valuation studies examine the influence of specific events on the stability of valuation. Brouwer (2006) looks at the valuation of health risks relating to bathing water quality before and during extreme weather which deteriorated water quality, and finds no influence on valuation. Using contingent valuation studies conducted over 3 years, Brouwer et al. (2008) find that the introduction of bird flu did not change WTP for migratory birds' conservation. On the other hand and most relevant to our study, Loureiro and Loomis (2010) examine the influence of macroeconomic conditions on the valuation of damages from the Prestige oil spill in Spain by repeating a 2006 survey in 2009. They find significantly lower WTP in 2009 which they attribute to the adverse macroeconomic conditions in Spain at the time.

Few studies in environmental economics test the temporal reliability of valuation estimates from choice experiments. Liebe et al (2012) present a test-retest study examining choice consistency and stability of parameter and WTP estimates for landscape externalities of wind power installations. They reject the equality of the test and retest parameters when accounting for differences in the scale factor, but when comparing marginal WTP across the samples find statistically significant difference for only one attribute. Liekens et al (2012) in a test-retest evaluation of welfare changes from land use change, find significant difference in the scale factor but cannot reject the equality of WTP estimates. Bliem et al. (2012) use independent samples to value water quality and flooding frequency in Austria and conclude that valuation remains stable over the period of one year. Burton and Rigby (2011) find that additional information made available in the time between the initial and repeat samples does not influence WTP for the attributes of a novel stem cell technology in cattle breeding. Test-retest studies in health economics generally find encouraging results for the reliability of valuations from choice experiments (Bryan et al, 2000; Ryan et al, 2006; Skjoldborg et al, 2009).

3. Hypothesis and models

During data collection for this study, a series of anti-corruption and anti-government protests took place in Zagreb and other major Croatian cities. The protests started in Zagreb on the 22nd of February 2011 and continued until the end of March 2011. The most violent demonstration, on the 26th of February, resulted to the injury of over 30 people. Protestors, among other demands, asked for the resignation of the conservative Croatian Democratic Union government. International media at the time noted the diversity of protestors, as they came from the entire social and political spectrum (The Economist, 2011; The Guardian, 2011). It is worth noting that the protest did not have the support of the Social Democratic Party, the major opposition party, which the protestors also opposed and blamed for the country’s economic and political situation. Overall, the Zagreb 2011 protest expressed discontent for the major agents of the Croatian political system, inducing political instability. We use the timing of the beginning of the protest to assess the effect of political instability on valuation and investigate its sensitivity in the short run.

The Zagreb 2011 protest was largely opposed to perceived extensive government corruption. Public corruption can decrease trust in the political establishment (Chanley et al, 2000; Andersen and Tverdova, 2003), while trust in government affects citizens' WTP for public projects (Oh and Hong, 2012). This link is particularly relevant in our case since the valuation scenario designated the government responsible for the implementation of the groundwater conservation program. In particular, the government would design the policy, impose the conservation regulation, build the necessary infrastructure, collect and manage the required funds. The protest could also highlight the potential for misallocation of funds earmarked for environmental improvement, and create doubts over the efficiency of the implementing mechanism, leading to lower WTP in the post-protest period. Furthermore, skepticism over the credibility of the government can result in disbelief about the validity of the information provided in the survey and influence stated WTP (Kataria et al, 2012).

Political instability induces uncertainty over the government's ability to remain in power (Carmigani 2003). Given potential differences in the objectives of current and successor governments, the continuity in policy implementation can appear uncertain to survey participants. In the case of the Zagreb protest this effect is amplified by the fact that protestors were also opposed to the biggest opposition party. This created more uncertainty about the characteristics and policies of potential successor governments. Under these conditions, respondents may consider the provision of the good uncertain and state lower WTP than what they would have before the protest.

To model choice, we use the standard random utility model. The random utility model postulates that utility of individual i from alternative j is given by $U_{ij} = V_{ij} + \varepsilon_{ij}$, where V_{ij} is the systematic part of utility and ε_{ij} is the random component. The probability that an individual i will select alternative j over alternative k is given by: $Pr(U_{ij} > U_{ik}) = \Pr(\varepsilon_{ik} < \varepsilon_{ij} + V_{ij} - V_{ik})$. The MNL model assumes that the error is Gumbel distributed:, $\Pr(U_{ij} > U_{ik}) = \frac{\exp V_{ij}}{\exp V_{ij} + \sum \exp V_{ik}}$. Assuming a linear systematic component of utility, WTP for a non-monetary attribute can be calculated as the ratio of the utility coefficient of the attribute over the coefficient of the monetary attribute.

We use the date protests began to discriminate between those individuals that participated in the survey before the 22nd of February and those that participated after and including the 22nd. The null hypothesis is that political instability has no effect on the valuation of the program, implying that WTP before the protest is equal to WTP after the protest: $H_0: WTP_{pre\ protest} = WTP_{post\ protest}$. To test the hypothesis we compare WTP before the protest against WTP after the protest, using the complete combinatorial approach described in Poe et al. (2005). To gain insight on how differences in WTP in the two periods emerge, we test for parameter and scale factor equality using the procedure proposed by Swait and Louviere (1993).

4. Case study and survey description

To investigate the effect of political instability on WTP estimates, we use data from a choice experiment conducted in Zagreb, to value a groundwater aquifer conservation program. The aquifer is the exclusive source of potable water for approximately 1 million residents of Zagreb. Furthermore, groundwater is used in local agriculture and supports the local environment. The importance of groundwater in the region is acknowledged by the

Croatian government that has declared the aquifer part of the country's strategic water reserves, aiming to maintain its quality and quantity.

The aquifer is facing progressively increasing pollution as well as decreasing water quantity. The reasons for the deterioration of the aquifer's water quality relate to the human activity in the area. The aging residential sewerage network allows untreated wastewater seepage into the aquifer causing nitrate pollution. Extensive agricultural activities in the neighboring rural areas result in increasing concentrations of agricultural chemicals. Finally, there are traces of industrial and toxic pollutants due to local industrial activity. In addition to water quality, water quantity in the aquifer is deteriorating. Decreasing water quantity is the result of increased consumption and decreased groundwater recharge due to changes in the flow regime of the River Sava. While water supply is not under immediate threat, it is anticipated that if current conditions continue, water quality and quantity in the region will be significantly undermined within the next decade.

National policy outlined in the national Water Management Strategy, calls for safeguarding groundwater quality and quantity. Furthermore, Croatian governments will soon have to harmonize national environmental policy with European directives. Water policy in particular should adhere to the Water Framework Directive (WFD), aiming to attain "good ecological status" for European water bodies. As a result, there are plans by the national and local governments to design and implement a conservation program for the Zagreb aquifer focusing on safeguarding its ecological status. The program would apply policies aiming to control pollution from the residential, agricultural and industrial sectors as well as improve the efficiency of the water distribution network.

To design the choice experiment we had extensive consultations with geologists, ecologists and hydrologists in order to identify the planned conservation measures and define the attributes and their levels. Parallel to the expert consultation we conducted focus groups with members of the public to assess the significance of water pollution and quantity problems and further investigate the definition of the attributes. Based on this information, we considered the valuation of a conservation program for the Zagreb aquifer, aiming to the long run improvement of water quantity and pollution levels.

For the choice experiment we selected four attributes that would be affected by the conservation plan guided by the considerations of experts and the general public in the design stage of the study. Three attributes related to the sources of groundwater pollution while the fourth attribute related to the extent of disruption in domestic water supply from decreasing groundwater quantity. These were: pollution from residential sources, pollution from agricultural sources and pollution from industrial sources. The design phase of the survey suggested there were differences in public attitudes towards urban, agricultural and industrial pollution sources and given these distinctions, we wanted to find out how public preferences for reducing pollution depend on its source. To define the levels of the groundwater pollution attributes we relied on the WFD and the national water strategy. The WFD does not set explicit pollutant concentration limits for groundwater but prescribes that groundwater bodies should not be polluted at all. Furthermore, quality standards, such as those set out by the Drinking Water Directive (DWD) should be adhered to at all times. Given these considerations we defined three levels for each of the pollution attributes. The best level for all pollution attributes was near-zero pollution from that particular source, which corresponds to the desirable ecological status of groundwater according to the WFD.

To explain near-zero pollution from a particular source, we suggested that no pollutants from that source would find their way into the aquifer. The second-best level under intervention was pollution at the maximum safe level, which corresponds to the maximum acceptable level of concentrations, given existing standards. To explain the safe level of pollution, we suggested that pollutants from that source would find their way into the aquifer but at quantities that are considered to be at the acceptable limits set by the EU. If no measures were implemented, pollution from the residential, industrial and agricultural sectors would exceed the EU-designated safe level within the next decade. It was explained by suggesting that pollutants from this source would find their way into the aquifer in quantities that are considered excessive according to EU standards. Even though water could be treated prior to consumption, the ecological status of water in the aquifer would deteriorate. The survey suggested to respondents that this would endanger the ability to use the water resource in the future. This is especially relevant given the aquifer's role as part of the country's strategic water reserves. We did not tie the quality attributes to potential health impacts as this would move the focus of the study on the valuation of the effects of pollution on health. Furthermore epidemiological data for the region were scarce. Specific interventions to mitigate groundwater pollution were guided by the WFD and the national strategy, and included the replacement of a large part of the residential sewerage network, more expert advice to farmers on fertilizer and pesticide use, better monitoring of agricultural chemical use and application, and stricter legislation and monitoring of industrial waste treatment.

To describe the effect of decreasing water availability, we used the potential restrictions in domestic water supply. Increasing water demand due to increasing population, along with reduced recharge will necessitate measures to restrict consumption in the future. This would involve imposing quantity constraints in households' water supply. The water supply restrictions attribute had two levels. If no measures to conserve water quantity were implemented, water supply would be restricted for approximately 15 days during each summer. Under the conservation plan there would be no domestic supply restrictions. To achieve long term improvement of water quantity, the plan proposed to replace parts of the water distribution network in order to increase efficiency.

The payment vehicle was an additional charge for the aquifer conservation program levied on the respondent's monthly water bill for five years. The monetary attribute had 7 levels. The levels for the opt-in alternatives were 30, 40, 50, 60, 80 or 100 Croatian Kuna (HRK), while the opt-out alternative was always zero-cost. Using the average exchange rate between the Euro and HRK for February and March 2011 (€1=7.40285HRK), the attribute levels translate to approximately 4.05, 5.40, 6.75, 8.10, 10.81 and 13.51 €. The fee would be paid for five years by all residential consumers and all the proceeds would be used exclusively for the implementation of the Zagreb aquifer conservation plan. The management and implementation of the plan according to the survey would be the exclusive responsibility of the central government. We selected the payment vehicle and the provision mechanism to maximize realism, credibility and reliability of the survey and to avoid cases of free riding as well as decrease protest response rates. It is worth noting that in the period of survey development, there was no indication of mistrust towards the government, either from focus groups or personal interviews. Table 1 summarizes the attributes and their levels.

Table 1 here

Given these attributes and their levels we constructed an experimental design minimizing the D-error for the MNL model (Ferrini and Scarpa, 2007)[1]. We used priors estimated from a pilot survey we conducted in the area. To limit the cognitive burden to respondents we opted for a design comprising 12 choice sets in two blocks, each containing two opt-in alternatives and a zero-cost opt-out alternative. To avoid systematic starting point bias we randomized the presentation order of the choice sets during data collection.

The survey comprised three parts. The first part introduced the participating institutions, the purpose of the research and the significance of the aquifer for the city's water supply, explaining its status as part of the country's strategic water reserves. This part of the survey also collected information on the perceptions of current water quality and quantity.

The second part of the survey described the current status of the aquifer in terms of water pollution sources, water quality and quantity and the predicted conditions over the next decade. It proceeded to detail the proposed "Zagreb Aquifer conservation plan", describing the attributes and their levels, as well as the exact technical and policy measures that would be implemented. After assuring the confidentiality of responses, the survey presented the choice sets. We asked respondents to answer while keeping in mind their budget constraints, financial obligations and other payments they make for similar goods and services (Kotchen and Reiling, 1999). Following the choice sets we asked a series of debriefing questions aiming to identify protest responses.

The third and final part of the survey collected standard socioeconomic information including age, household income, employment, education and marital status. We also

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[1] We generated the design using NGENE 1.1

recorded the date and the exact time the interview was conducted. We pretested the survey on a sample of 30 respondents. Since pretesting did not suggest any significant problems, we were able to start the data collection one week after the pretest was completed.

Data collection took place using face-to-face interviews, between the 4th of February, to the 8th of March 2011. 116 individuals were interviewed in the 18 days before the protest while 77 were interviewed in the 15 days after the protest. Blocks 1 and 2 of the experimental design pre-protest were used 57 and 59 times respectively. Post-protest, version 1 was used 38 times, while version 2 was used 39 times. Since versions were used within each sample with similar frequency, we do not expect the results to depend on the amount of times each version was used before and after the protest. Interviewers were graduate students of the Faculty of Mining, Geology and Petroleum Engineering in the University of Zagreb, who had experience with survey data collection. Interviewers were further trained by the authors on data collection for stated preference studies. We collected a random sample of 200 individuals. The response rate was approximately 62%, which compares favorably with the rates reported in the literature. We used debriefing questions to identify protestors among those that consistently selected the opt-out alternative and excluded them from the sample. Overall we identified 7 protestors (3.5% of the sample), 4 pre-protest and 3 post-protest.

5. Results

We first examine whether potential differences in WTP for groundwater quality and quantity attributes pre- and post-protest are due to systematic differences in the observable characteristics of the samples. In table 2 we report the sociodemographic characteristics for the full sample and the two subsamples, and test for mean equality of age, income, share of male respondents, share of respondents with tertiary education, and share of respondents in full employment. Mean age and mean annual household income for the full sample are 44 years and HRK119,052 (€16,081) respectively. Approximately 28% of the respondents have completed tertiary education while 59.7% are in full time employment. Column 4 reports the test results. The pre-protest and post-protest samples are equivalent with respect to these observable socioeconomic characteristics. In addition, the protest response rate did not appear significantly different before and during the period of instability. The equivalence of the two subsamples suggests that there was no self-selection at least with respect to the observable characteristics.

Table 2 here

In table 3 we examine the pattern of choice in the pre- and post-protest periods. The percentages of choices for the first alternative before and after the protest are 60.48% and 64.94% respectively, while for the second alternative the relative shares are 37.51% and 33.11%. Finally, before the protest 2.01% of choices are for the opt-out alternative while after the protest the share is 1.95%. It appears that respondents after the protest do not choose to stay out of the market more frequently compared to those interviewed before the protest. Instead, respondents opt-in with the same frequency but select other, possibly cheaper alternatives. This can be interpreted as evidence that instability impacts on the intensive rather than the extensive margin of choice (Bosworth and Taylor, 2013).

Table 3 here

We now turn to the results of the MNL models and report them in Table 4[2]. The first column reports the estimates for the full sample, while columns 2 and 3 report the estimates for the pre- and post-protest samples respectively.

Table 4 here

All coefficient estimates are statistically significant and have the expected signs for the full sample as well as for the two subsamples. The coefficients on quantity and pollution attributes are positive for all samples, indicating that respondents are more likely to select alternatives with no water supply restrictions and lower pollution. On the other hand, more expensive alternatives are relatively less desirable for all samples as indicated by the negative coefficient on the monetary attribute.

An important assumption of the MNL model is that choices must obey the Independence of Irrelevant Alternatives (IIA) property. To test this we performed Hausman tests. In all cases the test statistic was negative. Hausman and McFadden (1984) suggest that negative values are to be interpreted as supporting the null and therefore we cannot reject IIA. Given the results of the Hausman tests there is no need to use an RPL model or control for panel effects[3].

Overall, respondents approve the aquifer management plan, as they are more likely to select alternatives with lower water pollution and higher water quantity. This agrees with prior findings on the valuation of water resources (Adamowicz, 2011; Hanley et al., 2006; Hensher et al., 2005). It is important to note that the public's support for the conservation plan persists under political instability. This is not unexpected, given the significance of

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[2] All models are estimated using NLOGIT.

[3] Nevertheless, we present RPL results in the appendix.

the aquifer for the local environment and communities and the national importance of local water resources.

We now turn to the examination of the WTP values for each of the levels of the non-monetary attributes for the pre- and post-protest samples. Table 5 reports mean WTP estimates from the MNL model along with the 95% confidence interval calculated using the Krinsky and Robb (1986) method. Column 1 reports WTP estimates before the protest while Column 2 reports WTP estimates after the protest.

WTP estimates for the post-protest sample appear lower compared to those of the pre-protest sample. WTP for avoiding water use restrictions pre-protest is more than twice the WTP post-protest (HRK 107.07 versus HRK 46.75 - or €14.46 and €6.31 respectively). A similar pattern is evident for the rest of the attributes. WTP for near-zero pollution from the residential sector pre- and post-protest is HRK 237.06 (€32.02) and HRK 109.41 (€14.77) respectively. Respondents interviewed before the protest are willing to pay HRK 160.62 (€21.69) for safe level of urban pollution while this drops to HRK 86.07 (€11.62) during the protest. The difference is smaller but still important for the best level of agricultural pollution: mean WTP before the protest is HRK 164.51 (€22.22) while mean WTP after the protest is HRK 118.38 (€15.99). We observe important difference in WTP for reducing industrial pollution: mean WTP for near-zero industrial pollution pre-protest is HRK 205.99 (€27.82) and post-protest is HRK 124.27 (€16.79). Finally, the estimates for safe levels of industrial pollution are HRK 190.88 (€25.78) and HRK 115.49 (€15.60) before and during the period of instability respectively. In all cases confidence intervals of WTP estimates pre- and post-protest overlap, suggesting that prices may be similar. Nevertheless, Poe et al. (1994) show that the non-overlapping confidence interval criterion can be inaccurate when confidence intervals are generated from the Krinsky and Robb (1986) procedure. To test whether differences in WTP pre- and post-protest are statistically significant, we use the complete combinatorial approach of Poe et al. (2005) and report the results in the third column of Table 5. The test results reject the null hypothesis of equivalent WTP in 6 out of 7 cases and in 4 out of 7 cases, at 10% and 5% significance levels respectively. Specifically, the difference is insignificant in the case of safe limit pollution from agriculture at 10% significance level and for both levels of agricultural and safe limit residential pollution at 5% significance level. Given the lack of more information, we can suggest many speculative interpretations for the insignificant difference, ranging from the perceived difficulty in managing pollution through monitoring farmers' behaviour, to the respondents' desire to protect the agricultural sector.

Table 5 here

The results reported in Table 5 indicate that valuation of groundwater quantity and quality is sensitive to the prevailing political situation. The shock introduced by instability affects preferences for environmental quality and halves WTP for most of the attribute levels.

To further examine the influence of instability on the scale parameter, we compare preference estimates between the two samples applying the procedure suggested in Swait and Louviere (1993). We pool the subsamples and rescale the post-protest sample. The grid search procedure estimates the scale factor at 1.347 implying that the post-protest dataset has lower error variance. We report the estimates of the scaled model in Column 4 of Table 4. First, we test for the equality of parameters assuming that scale factors differ. The test statistic value is given by $-2\left(ll_{scaled}-\left(ll_{pre}+ll_{post}\right)\right)$=$-2(-754.828-$

$(-482.490-269.075))=6.526$ with 9 degrees of freedom where ll_{scaled}, ll_{pre} and ll_{post} are the log-likelihoods for the scaled, the pre-protest and post-protest models respectively. We therefore cannot reject the null hypothesis of parameter equality. Second, we test for the equality of the scale parameter across datasets. The test statistic is given by $-2(ll_{full}-ll_{scaled})=-2(-759.203+754.828)=8.750$, implying that the null is rejected at 5% level of significance. It therefore appears that political instability has significant influence on the variance of choice. Specifically, post-protest choice is more precise relative to pre-protest choice.

To investigate further the influence of instability on preferences and in particular to examine how it interacts with the attributes in the utility function, we combine the two subsamples allowing for the difference in scale. We construct a dummy variable taking the value 1 if the interview took place after the protest and interact it with all attributes and their levels. The results, reported in Table 6, indicate that the only significant interaction term is the interaction with the monetary attribute, suggesting that post-protest respondents are less likely to select more expensive alternatives compared to pre-protest respondents.

The estimates of the model with interactions, along with the results of the Swait-Louviere procedure suggest that while the coefficients of quality and quantity attributes do not change, price sensitivity increases in the second period. Instability then does not appear to influence preferences for water quantity and quality attributes, but does influence respondents' reaction to higher prices. This result is likely to be due to respondents' mistrust for the government and hesitation to pay into a government managed fund. At the same time, the idiosyncratic error component is smaller, implying that the population's view of the good is more homogenous. We can speculate why this may be the case. It is possible for example that prior to the protest the population was split roughly equally between those who trust the government to implement the project, and those who don't. Following the protest, the share of those not trusting the government may increase, resulting in a more homogenous sample[4].

Table 6 about here

Confidence intervals for the near-zero and the safe level of the pollution attributes within samples overlap, implying similarity in WTP for the two levels. This suggests that respondents may not distinguish between near-zero and safe pollution. To see whether this is true, we use the complete combinatorial method to test for the equality of WTP between "Near-zero" and "Safe" levels for each of the pollution attributes. The test results suggest that the hypothesis of equality is rejected only in the case of agricultural pollution (p=0.049 and p=0.047 for the pre- and post-protest samples respectively), while it cannot be rejected for residential pollution (p=0.210 and p=0.230 for the pre- and post-protest samples respectively) or industrial pollution (p=0.422 and p=0.373 for the pre- and post-protest samples respectively). This result can be interpreted to imply insensitivity to scope, as it appears that respondents are not sensitive to improvements in the level of pollution from industrial and residential sources beyond the safe level. Insensitivity to scope has been used to criticize the validity of non-market valuation (Kahneman and Knetsch, 1992). Nevertheless, insensitivity to scope is not necessarily inconsistent with economic theory. It is possible that respondents' marginal utility declines rapidly after a threshold level of a good is provided (Rollins and Lyke, 1998). This is likely for our case study, given the nature of the attributes and their levels. In particular, respondents may have rapidly

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[4] We thank an anonymous reviewer for suggesting this interpretation.

declining marginal utility for improvements in water quality beyond a level that is considered safe from an appropriate authority (the EU in this case). Furthermore, as Poe (1998) and Poe and Bishop (1999) note, households may engage in averting behaviour when exposure approaches threshold levels resulting to conditional benefit functions that may be non-convex around these thresholds. Finally, safety may not be an issue here since water for human consumption will be treated[5].

To see how the main conclusion of the paper is affected by this, we estimate MNL models pooling the near-zero and safe pollution levels for urban and industrial pollution, while we maintain two levels of agricultural pollution. We report estimated WTP values and test results in table 7. Pre- protest, respondents are WTP HRK79.84 (€10.79) for avoiding water supply restrictions, HRK151.65 (€20.49) for maintaining the safe limit of pollution from residential sources, HRK78.63 (€10.62) for safe level pollution from agricultural sources and HRK181.49 (€24.52) for the same level of pollution from industrial sources. Post protest, respondents are WTP HRK39.35 (€5.32) for avoiding water supply restrictions, HRK89.32 (€12.07) for maintaining the safe limit of residential pollution, HRK79.34 (€10.72) for safe level agricultural pollution and HRK117.82 (€15.92) for the safe level of pollution from industrial sources. We find no difference in the main result as pre-protest WTP is significantly higher than post-protest WTP in most cases. Specifically we reject the hypothesis of equality of pre- and post-protest WTP for avoiding water supply restrictions (p=0.037), for improving pollution from residential sources (p=0.051) and industrial sources (p=0.033). We fail to reject the equality of WTP

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[5] We thank the editor for pointing this out.

for the near-zero and safe levels of pollution from agriculture (p=0.209 and p=0.505 respectively).

Table 7 Here

The analysis so far uses the day of the first public protest, the 22nd of February, as a cut-off to discriminate between the pre- and post-protest samples. While the protests started on the 22nd, it can be argued that subsequent events and the degree of instability could not be forecasted at that time. It is possible that instability became more apparent at a later stage and especially after the largest and most violent protest that took place on the 26th. We test the sensitivity of the results to the choice of the cutoff date, repeating the analysis using the 26th of February to discriminate between the pre- and post-protest samples and find that the results (reported in table 8) are unchanged.

Table 8 here

We also repeat the analysis excluding individuals that were interviewed in the ambiguous period, some days before and some days after the protest. Specifically we exclude those interviewed between the 19th and 24th of February. Again, the results do not change. Willingness to pay pre- and post-protest is significantly different for no water supply restrictions (p=0.006), near-zero and safe pollution from residential sources (p=0.006 and p=0.011 respectively), near-zero pollution from agricultural sources (p=0.083), near zero and safe pollution from industrial sources (p=0.023 and p=0.033 respectively). Equality cannot be rejected for safe pollution from agricultural sources (p=0.597).

The models presented so far do not include an alternative specific constant (ASC) given that the data come from an unlabeled choice experiment. ASCs are often included in unlabeled choice experiments to capture status quo effects[6]. Estimating the models with a constant for the opt-out alternative we find significant difference in the scale factor, but cannot reject parameter equality, similarly to the case of the models without an ASC[7]. Contrary to the models without an ASC, the difference in WTP between the pre- and post-protest samples is not statistically significant. The models including an ASC for the status quo alternative therefore suggest that political instability does not influence preferences or WTP for the aquifer conservation program but can decrease the idiosyncratic error component, implying that respondents’ view of the good becomes more homogenous. There can be at least two reasons for this result: first, it is possible that political instability has no influence on environmental valuation. Second, it can be that the event we study wasn’t strong enough to affect consumers’ WTP. Parameter estimates from the MNL models suggest that respondents in both periods have strong preferences for moving from the status quo implied by negative and significant ASCs, while avoiding water restrictions is not a significant determinant of choice. WTP values are lower compared to the ones estimated previously. In particular, pre-protest WTP ranges from HRK44.26 for near-zero pollution from industry to HRK57.36 for safe-limit pollution from agriculture. To some extent respondents approached the aquifer management plan as an entity rather than as a combination of the attributes.

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[6] Studies presenting results from unlabelled Choice Experiments excluding an ASC in the model specification include Beharry-Borg and Scarpa (2010), Zander and Straton (2010), Travisi and Nijkamp (2008) and Zander and Drucker (2008). On the other hand studies using an ASC with generic alternatives include, Rungie et al (2014), Colombo et al (2013) and Hanley et al (2005).

[7] Tables A1 and A2 in the appendix present the results of the MNL models and the WTP equality tests.

To investigate the validity of the results from a model without an ASC, we repeat the analysis removing those observations for which the status quo option was selected. We do this for both the 22nd of February and the 26th of February cut-offs. In the first case, the tests do not reject the null at 5% level of significance. At 10% level of significance, the test rejects the equality of WTP for no water restrictions (p=0.095) and for near zero pollution from residential sources (p=0.100). On the other hand, the test does not reject the null hypothesis in the case of safe level of pollution from residential sources (p=0.122), both levels of pollution from agricultural sources (p=0.131 and p=0.326 for the near zero and safe levels respectively) and both levels of pollution from industry (p=0.108 and p=0.112 for the near zero and safe levels respectively). In the case of the test results for the 26th of February, as in the case of the main result and the results reported in table 7, WTP equality is rejected for 6 out of 7 cases at 10% level of significance. In particular equality is rejected for no water restrictions (p=0.052), near zero and safe level of pollution from residential sources (p=0.057 and p=0.067 respectively), near zero pollution from agricultural sources (p=0.088) and near zero and safe level of pollution from industrial sources (p=0.077 and p=0.085 respectively). Overall, though the results can be interpreted as supportive of the conclusion that WTP for aquifer conservation declines following the emergence of political instability while preferences do not change, they appear sensitive to the specification used.

Even though the focus of this paper is on the influence of political instability on WTP for groundwater quality and quantity, the estimated values are also of interest as they provide information on the value of groundwater in Croatia and can be used for benefits transfer. It is therefore useful to examine the estimated values in the context of other groundwater valuation studies. To the best of our knowledge this is the first study to investigate the WTP for groundwater quality and quantity in Croatia. The WTP values reported in tables 5 and 7 are within the range of the values reported in the literature. The results of groundwater quality valuation studies conducted in Europe between 1998 and 2009 are summarized by Tempesta and Vecchiato (2013). They report WTP estimates that range from €25 (2005 prices) to €1170 (2011 prices) per household per year. Stenger and Willinger (1998) using Contingent Valuation (CV) estimate the WTP for the conservation of the Alsatian aquifer in France between €91.47 and €109.76 per household per year (1995 prices). Travisi and Nijkamp (2008) estimate that households in Milan, Italy are willing to pay €1465 (2003 prices) to eliminate soil and groundwater contamination in farmland areas in a CE. Tempesta and Vecchiato (2013) using a CE, estimate WTP for reducing groundwater nitrogen concentrations in the Serio River Natural Park to 10mg/l and 50mg/l at €93.4 and €53.1 (2011 prices) per household per year respectively. Hassler et al (2005) find that the annual household WTP for groundwater conservation in Denmark ranges between €106 and €376 per household per year, depending on the method used. Tentes and Damigos (2012) in a CV study to estimate WTP for the restoration of the Asopos river basin aquifer in Greece find that household WTP ranges between €180 and €239 per year (2009 prices). When using a CE, Tentes and Damigos (2014) estimate the WTP for the restoration of the aquifer between €219 and €690 (2012 prices). Boyle et al (1994) in a metaanalysis of contingent values for groundwater quality in the United States from 8 studies, report estimates ranging between $56 and $1154 (1992 prices). Poe et al (2001) revisit this study adding estimates from 8 more studies and report estimates ranging from $46 to $1316 (1997 prices). De Silva and Williams (2015) estimate mean WTP for the conservation of water in the Ogallala Aquifer in Texas at $17.66 per household.

6. Discussion

This paper explores the influence of political instability on environmental preferences, using data from a choice experiment and exploiting a period of political instability that occurred in Croatia in 2011. Political instability appears to be a significant determinant of stated preferences for groundwater quantity and quality, but the result is sensitive to the inclusion of an ASC for the status quo alternative. In a model excluding the ASC, after the protest the scale factor increases while WTP decreases by 28.1% to 56.5% relative to WTP before the protest. In a model including the ASC, testing fails to reject the hypothesis of equality of pre- and post-protest WTP.

The results presented in this paper suggest that it is possible that political instability has an immediate effect on preferences for environmental quality. Specifically, some models suggest that WTP for water quantity and quality can decrease in a matter of days from the onset of instability. Lacking data after the end of the unstable period we cannot provide a conclusive answer for the long term influence on preferences. We consider it possible that preferences recover after the short period of instability ends, given that macroeconomic conditions or other external aggregate factors also recover. The speed of recovery however is open to speculation.

A factor influencing preferences for public projects is trust in government (Oh and Hong, 2012). Political instability can have negative effects on both trust in the way the government functions, and trust in the ability of the government to remain in power. Assuming that preferences for environmental quality through public projects are dependent on the level of trust, recovery to pre-instability levels may be lengthy. A slow speed of recovery would imply that a brief period of instability can influence environmental policy even after its conclusion. Expressed preferences for environmental quality may remain below pre-instability levels due to mistrust to the government. In this case policy makers should be wary of designing policies based on non-market valuation surveys with data collected during or near periods of political instability.

More generally, the result hints to the importance of political stability and institutional quality for maintaining or improving environmental quality. Earlier studies suggest that stable democratic institutions (Farzin and Bond, 2006; Bernauer and Koubi, 2009) and the quality of governance (Bhattarai and Hammig, 2004) are important for expressing environmental preferences and promoting environmental quality. A prolonged period of political instability that shakes the institutional foundations of the state or destabilizes democracy can affect preferences, which can in turn lead to more extensive deterioration of environmental quality.

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8. Tables

Table 1: Attributes and Levels

Attribute	Levels
Pollution from residential sources	1. Near-zero pollution 2. Pollution at the maximum safe level *3. Pollution 10% higher than the safe level*
Pollution from agricultural sources	1. Near-zero pollution 2. Pollution at the maximum safe level *3. Pollution 10% higher than the safe level*
Pollution from industrial sources	1. Near-zero pollution 2. Pollution at the maximum safe level *3. Pollution 10% higher than the safe level*
Water supply restrictions	1. No water supply restrictions *2. Water supply restrictions for 15 days per year*
Price	1. *0 HRK* 2. 30 HRK 3. 40 HRK 4. 50 HRK 5. 60 HRK 6. 80 HRK 7. 100 HRK

Status quo levels in italics

Table 2: Descriptive statistics

	1	2	3	4
Variable	**Full Sample** Mean (St Dev)	**Pre-protest Sample** Mean (St Dev)	**Post-protest Sample** Mean (St Dev)	**t-stat**
Age	44.425	43.819	45.338	-0.678
	(15.216)	(15.701)	(14.508)	
Income	119,052.3	116,000.5	123,696.2	-0.733
	(55,222.59)	(57,310.53)	(52,158.34)	
Male	0.487	0.474	0.506	-0.438

	(0.501)	(0.501)	(0.503)	
Tertiary education	0.280	0.310	0.234	1.159
	(0.450)	(0.465)	(0.426)	
In full time employment	0.597	0.621	0.56	0.832
	(0.492)	(0.487)	(0.500)	

"Age" refers to the age of the respondent. "Income" refers to annual gross household income. "Male", "Tertiary education" and "In full employment" are indicator variables.

Table 3: Descriptive analysis of choices

	Pre-protest	**Post-protest**
Respondents	116	77
Choices	696	462
Number of choices that were:		
1. For alternative 1	421	300
2. For alternative 2	261	153
3. For alternative 3 (opt out)	14	9
Percentage of choices that were:		
1. For alternative 1	60.48	64.94
2. For alternative 2	37.51	33.11
3. For alternative 3 (opt out)	2.01	1.95

Table 4: MNL Models

		(1) **Full sample**	**(2)** **Pre-protest Sample**	**(3)** **Post-protest Sample**	**(4)** **Full Sample Scaled Model**
Water supply restrictions	No water supply restrictions	0.977***	0.978***	0.967***	0.867***
		(0.145)	(0.181)	(0.248)	(0.129)
Pollution from residential sources	Near-zero pollution	2.186***	2.166***	2.264***	1.930***
		(0.184)	(0.235)	(0.300)	(0.163)
	Pollution at the safe limit	1.565***	1.467***	1.781***	1.401***
		(0.153)	(0.193)	(0.258)	(0.136)
Pollution from agricultural sources	Near-zero pollution	1.819***	1.503***	2.449***	1.662***
		(0.187)	(0.227)	(0.344)	(0.167)
	Pollution at the safe limit	1.131***	0.848***	1.728***	1.047***
		(0.199)	(0.246)	(0.362)	(0.178)
Pollution from industrial sources	Near-zero pollution	2.109***	1.882***	2.571***	1.903***
		(0.164)	(0.201)	(0.294)	(0.146)
	Pollution at the safe limit	1.962***	1.744***	2.389***	1.761***
		(0.121)	(0.147)	(0.217)	(0.108)
	Price	-0.0133***	-0.00914***	-0.021***	-0.012***
		(0.002)	(0.003)	(0.003)	(0.002)
	Log Likelihood	-759.203	-482.490	-269.075	-754.828
	Rsq	0.115	0.0763	0.195	0.120
	Observations	1158	696	462	1158

***, **, * = Significance at 1%, 5%, 10% level. St. Errors in parentheses.

Table 5: WTP estimates, MNL Models

		(1) **Pre-protest Sample**	(2) **Post-protest Sample**	(3) **P-value**
Water supply restrictions	No water supply restrictions	107.07 (59.85 - 241.25)	46.75 (23.56 - 81.41)	0.024
Pollution from residential sources	Near-zero pollution	237.06 (138.72 - 570.35)	109.41 (72.09 – 176.48)	0.021
	Pollution at the safe limit	160.62 (90.82 – 384.08)	86.07 (55.84 – 137.10)	0.053
Pollution from agricultural sources	Near-zero pollution	164.51 (114.16 - 314.06)	118.38 (93.04 - 161.34)	0.087
	Pollution at the safe limit	92.81 (50.84 – 169.67)	83.53 (57.14 – 115.62)	0.363
Pollution from industrial sources	Near-zero pollution	205.99 (139.40 - 427.03)	124.27 (96.67 – 171.19)	0.031
	Pollution at the safe limit	190.88 (125.33 - 410.24)	115.49 (88.18 - 163.39)	0.043

95% confidence intervals calculated using the Krinsky and Robb (1986) procedure with 5000 draws. P-values refer to the null hypothesis of equality of WTP for the pre- and post-protest samples derived using the complete combinatorial approach from Poe et al (2005).

Table 6: MNL with interactions

		(1) Coefficient	(2) (St. Error)
Water supply restrictions	No water supply restrictions	0.978***	(0.181)
	No water supply restrictions*Post-protest	-0.260	(0.258)
Pollution from residential sources	Near-zero pollution	2.166***	(0.235)
	Near-zero pollution * Post-protest	-0.485	(0.324)
	Pollution at the safe limit	1.467***	(0.193)
	Pollution at the safe limit * Post- protest	-0.145	(0.272)
Pollution from agricultural sources	Near-zero pollution	1.503***	(0.227)
	Near-zero pollution * Post-protest	0.315	(0.342)
	Pollution at the safe limit	0.848***	(0.246)
	Pollution at the safe limit*Post-protest	0.435	(0.364)
Pollution from industrial sources	Near-zero pollution	1.882***	(0.201)
	Near-zero pollution * Post-protest	0.027	(0.297)
	Pollution at the safe limit	1.744***	(0.147)
	Pollution at the safe limit*Post-protest	0.030	(0.218)
	Price	-0.009***	(0.003)
	Price * Post protest	-0.006*	(0.004)
	Log Likelihood	-751.565	
	Rsq	0.124	
	Observations	1158	

***, **, * = Significance at 1%, 5%, 10% level. St. Errors in parentheses.

Table 7: WTP estimates from model with merged levels

		Pre-protest	**Post-protest**	**P-value**
Water supply restrictions	No water supply restrictions	79.84 (46.17- 148.68)	39.35 (16.70- 66.41)	0.037
Pollution from residential sources	Pollution at the safe limit	151.65 (95.23- 302.12)	89.32 (61.65- 138.63)	0.051
Pollution from agricultural sources	Near-zero pollution	124.60 (89.59- 201.15)	104.52 (81.87- 135.42)	0.209
	Pollution at the safe limit	78.63 (43.89- 128.61)	79.34 (53.54- 109.16)	0.506
Pollution from industrial sources	Pollution at the safe limit	181.49 (129.10- 312.90)	117.82 (93.17- 161.17)	0.033

WTP in HRK. 95% confidence intervals calculated using the Krinsky and Robb (1986) procedure with 5000 draws. P-values refer to the null hypothesis of equality of WTP for the pre- and post-protest samples derived using the complete combinatorial approach from Poe et al (2005)

Table 8: WTP estimates, different cut-off date

		(1)	(2)	(3)
		Pre-protest Sample	**Post-protest Sample**	**P-value**
Water supply restrictions	No water supply restrictions	107.10 (62.65-218.85)	37.54 (15.65-69.13)	0.006
Pollution from residential sources	Near-zero pollution	239.37 (141.96-511.94)	86.93 (54.40-142.64)	0.003
	Pollution at the safe limit	165.37 (97.75-350.85)	68.99 (41.91-112.12)	0.010
Pollution from agricultural sources	Near-zero pollution	162.14 (115.79-278.58)	114.07 (89.31-154.17)	0.061
	Pollution at the safe limit	91.11 (53.49-155.30)	83.61 (55.93-116.37)	0.380
Pollution from industrial sources	Near-zero pollution	201.20 (139.51-378.10)	117.00 (92.18-158.90)	0.016
	Pollution at the safe limit	185.63 (123.30-357.08)	108.20 (82.91-151.5)	0.024

95% confidence intervals calculated using the Krinsky and Robb (1986) procedure with 5000 draws. P-values refer to the null hypothesis of equality of WTP for the pre- and post-protest samples derived using the complete combinatorial approach from Poe et al (2005).

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Appendix 1: Additional Results

Table A1: MNL Models including an alternative specific constant for the status quo alternative

		(1) Full sample	(2) Pre-protest Sample	(3) Post-protest Sample
Water supply restrictions	No water supply restrictions	-0.003 (0.210)	-0.139 (0.277)	0.191 (0.373)
Pollution from residential sources	Near-zero pollution	0.581* (0.333)	0.365 (0.418)	0.954* (0.572)
	Pollution at the safe limit	0.366 (0.261)	0.116 (0.329)	0.811* (0.446)
Pollution from agricultural sources	Near-zero pollution	1.264*** (0.212)	0.865*** (0.262)	2.022*** (0.380)
	Pollution at the safe limit	1.264*** (0.209)	0.980*** (0.257)	1.868*** (0.382)
Pollution from industrial sources	Near-zero pollution	1.110*** (0.235)	0.756*** (0.293)	1.762*** (0.409)
	Pollution at the safe limit	1.222*** (0.176)	0.904*** (0.219)	1.801*** (0.304)
	Price	-0.020*** (0.002)	-0.017*** (0.003)	-0.026*** (0.004)
Alternative Specific Constant		-2.545*** (0.515)	-2.941*** (0.673)	-1.967** (0.826)
	Log Likelihood	-745.334	-471.183	-266.043
	Rsq	0.131	0.098	0.204
	Observations	1158	696	462

***, **, * = Significance at 1%, 5%, 10% level. St. Errors in parentheses.

Table A2: WTP estimates from MNL Models including an ASC for the status quo alternative.

		(1) Pre-protest Sample	(2) Post-protest Sample	(3) P-value
Water supply restrictions	No water supply restrictions	-8.13 (-38.04-28.04)	7.26 (-17.60-41.60)	0.762
Pollution from residential sources	Near-zero pollution	21.36 (-23.91-92.13)	36.31 (-5.57-99.23)	0.654
	Pollution at the safe limit	6.79 (-27.85-58.91)	30.85 (-2.68-82.88)	0.797
Pollution from agricultural sources	Near-zero pollution	50.61 (21.11-89.52)	76.95 (49.15-115.60)	0.869
	Pollution at the safe limit	57.36 (33.29-84.16)	71.07 (48.43-97.25)	0.785
Pollution from industrial sources	Near-zero pollution	44.26 (9.71-95.54)	67.06 (34.71-117.49)	0.787
	Pollution at the safe limit	52.93 (24.19-101.56)	68.53 (40.31-113.77)	0.730

95% confidence intervals calculated using the Krinsky and Robb (1986) procedure with 5000 draws. P-values refer to the null hypothesis of equality of WTP for the pre- and post-protest samples derived using the complete combinatorial approach from Poe et al (2005).

To assess the robustness of the results to model choice we estimate Random Parameter Logit models. We specify all attribute coefficients other than the coefficient on the monetary attribute to follow a normal distribution. The model was estimated using 500 Halton draws. Results of the RPL models for the full sample and the two subsamples are reported in Table A3 below.

Table A3: RPL Models

		(1) **Full sample**	**(2)** **Pre-protest**	**(3)** **Post-protest**
		Random Parameters		
Water supply restrictions	No water supply restrictions	0.829*** (0.178)	0.839*** (0.220)	0.793** (0.318)
Pollution from residential sources	Near-zero pollution	2.224*** (0.186)	2.199*** (0.247)	2.394*** (0.316)
	Pollution at the safe limit	1.599*** (0.158)	1.494*** (0.198)	1.897*** (0.286)
Pollution from agricultural sources	Near-zero pollution	1.982*** (0.215)	1.636*** (0.253)	2.861*** (0.440)
	Pollution at the safe limit	1.298*** (0.234)	0.976*** (0.283)	2.128*** (0.449)
Pollution from industrial sources	Near-zero pollution	2.221*** (0.177)	1.974*** (0.211)	2.870*** (0.357)
	Pollution at the safe limit	2.041*** (0.136)	1.819*** (0.161)	2.628*** (0.288)
		Non-Random Parameters		
	Price	-0.014*** (0.002)	-0.010*** (0.003)	-0.024*** (0.004)
		Derived St. Deviations of Random Coefficients		
Water supply restrictions	No water supply restrictions	1.123*** (0.214)	1.043*** (0.269)	1.338*** (0.404)
Pollution from residential sources	Near-zero pollution	0.095 (0.866)	0.188 (0.925)	0.037 (0.711)
	Pollution at the safe limit	0.289 (0.267)	0.006 (0.635)	0.657** (0.327)

Pollution from agricultural sources	Near-zero pollution	0.002 (0.260)	0.010 (0.404)	0.002 (0.317)
	Pollution at the safe limit	0.143 (0.722)	0.504 (0.318)	0.015 (0.437)
Pollution from industrial sources	Near-zero pollution	0.009 (0.385)	0.020 (0.382)	0.357 (0.521)
	Pollution at the safe limit	0.070 (0.449)	0.025 (0.468)	0.191 (0.969)
	Log Likelihood	-751.896	-477.878	-265.153
	Rsq	0.409	0.375	0.478
	Observations	1158	696	462

***, **, * = Significance at 1%, 5%, 10% level. St. Errors in parentheses.

The estimates are qualitatively similar to those derived from the MNL model for all samples. Respondents are more likely to select attributes with no water supply restrictions and lower pollution from residential, agricultural and industrial sources. The derived standard deviation is significant only for the water supply restrictions attribute, for the full and the pre-protest samples. For the post-protest sample, the significant derived standard deviations are those of the water supply restrictions attribute and of the safe level of the agricultural pollution attribute. The size of the derived standard deviation of the "water supply restrictions" coefficient suggests that part of the sample has negative preference for no water supply restrictions. It is possible that these are respondents who consider emerging water quality problems to be serious enough to warrant more radical measures compared to those described in the survey. In particular, these would be respondents who believe that the only trustworthy measure to conserve water quantity would be to impose quantity controls to limit water consumption.

Table A4 presents the WTP estimates from the RPL models.

Table A4: WTP estimates, RPL Models

		Pre-protest	**Post-protest**	**P-value**
Water supply restrictions	No water supply restrictions	91.87	33.24	0.059
		(32.84 - 206.95)	(2.54 - 67.95)	
Pollution from residential sources	Near-zero pollution	251.6	101.38	0.017
		(123.57 - 553.38)	(64.317 - 158.90)	
	Pollution at the safe limit	166.299	80.55	0.044
		(80.85-367.070)	(50.41 - 126.65)	
Pollution from agricultural sources	Near-zero pollution	177.15	118.85	0.082
		(113.84 - 313.44)	(91.67 - 155.21)	
	Pollution at the safe limit	100.97	87.77	0.360
		(53.15 - 173.46)	(60.86 - 118.23)	
Pollution from industrial sources	Near-zero pollution	214.13	120.27	0.025
		(133.77 - 415.48)	(91.34 - 163.01)	
	Pollution at the safe limit	200.95	110.25	0.036
		(117.19 - 390.91)	(81.18 - 155.42)	

95% confidence intervals calculated using the Krinsky and Robb (1986) procedure with 5000 draws. P-values refer to the null hypothesis of equality of WTP for the pre- and post-protest samples derived using the complete combinatorial approach from Poe et al (2005).

Estimated WTP for unrestricted water supply for the pre- and the post-protest sample is HRK 91.87 and HRK 33.24 respectively. This change is statistically significant as indicated by the Poe et al (2005) test. Similarly, WTP for avoiding pollution from urban sources more than halves, from HRK 251.60 to 101.38 for near-zero pollution and from

HRK 173.28 to HRK 80.55 for safe concentrations respectively. Once again, the difference between the values before and after the protest is statistically significant. The impact of instability is less obvious but still significant for improvement to near-zero pollution from agricultural sources: mean WTP is HRK177.15 before the protest but only HRK 118.85 after the protest. Nevertheless, we cannot reject the null of equivalent WTP in the case of safe concentrations of agricultural chemicals. Turning to the WTP for mitigating industrial pollution, the pattern of statistically significant decrease is resumed: mean WTP for near-zero industrial pollution drops from HRK 214.13 to HRK 120.27 while for safe industrial pollution from HRK 200.95 to HRK 110.25. Overall, as in the case of WTP from the MNL model, 6 out of 7 tests reject the equality of estimated WTP indicating the negative impact of political instability on environmental preference.

Appendix 2: Survey

Zagreb Aquifer Water Valuation Survey
Valuation Scenario

Dear Sir/ Madam,
My name is ______________ and I currently work for a project financed by _______, implemented by the ________ in _________ and ___________ in _______. The purpose of this project is to examine the publics' preferences for improving water quantity and quality in the Zagreb aquifer. Would you be willing to spend 20 minutes of your time to respond to our questions?

Keep in mind that there are no right or wrong answers and that we are only asking for your opinions. Your responses will be anonymous and strictly confidential and any information you provide will not be transferred to third parties.

The Zagreb aquifer is a very important source of water for the entire region. Groundwater from the aquifer is used for agricultural and residential uses. Zagreb aquifer is recognized to be of national importance and is designated part of the country's strategic water reserves, protected by the Croatian government. Given its importance, the government wants to maintain the condition of groundwater to the highest ecological standard, safeguarding its quantity and quality.

At the moment, groundwater in Zagreb faces threats regarding its quantity and quality:

1. Water levels in the aquifer have been decreasing over the past 40 years and at the moment are low enough to cause problems to the city's water supply in summer months. The reasons for this are:
    a. Increased consumption due to population increase.
    b. Decreased groundwater recharge resulting from decreased rainfall due to climate change.
    c. Decreased groundwater recharge resulting from the regulation of the Sava River.

If no measures are taken in the coming 10 years, water shortages will be the cause for limited water supply for households.

2. Water quality is deteriorating as pollutants are increasingly being traced in the groundwater. Groundwater pollution is a result of:
    a. Untreated Wastewater leaking from the sewerage system. This results to nitrate pollution, which has been associated with damages in human health and the natural environment.
    b. Chemicals Used in Agriculture. This refers to substances used as pesticides and fertilizers. These can be toxic and are also associated with damages to human and animal health.
    c. Byproducts of Industrial Activity. These include including lead, arsenic and mercury. These pollutants can also damage human health and the environment.

If no measures are taken in the coming 10 years, water quality in the aquifer will deteriorate. Extensive water treatment will be required before the water can be used for human consumption, while negative effects on the populations of local wildlife and the quality of local agricultural produce are expected.

In order to mitigate the problems with water quality and water quantity in Zagreb, and maintain good ecological conditions in the Zagreb aquifer, the government is planning an aquifer conservation program which will include a series of measures:

To improve water availability the government will:

1. Implement water saving campaigns to motivate rational water use throughout the year.
2. Reconstruct and replace large segments of the water distribution network in order to reduce losses of water that currently stand at 25% of the water consumption.

The target is to prevent water supply restrictions in the coming 10 years.

To mitigate water quality problems, the government will:

1. Replace parts of the leaking sewerage network in order to limit residential wastewater seeping to the groundwater.
2. Inform and train farmers on the use of fertilizers and pesticides that pollute water and also monitor the use of agricultural chemicals. This will have no effect on farmers' standard of living.

3. Regulate and monitor industrial activities to control water pollution from the industry.

The proposed measures will influence both water quantity and water quality in the following ways:

1. **Water use restrictions.** If no measures are implemented water use restrictions in the form of limited water supply for all households in Zagreb will occur on average *15 days per year*. If water saving measures are implemented, there will be no days with restricted supply.
2. **Pollution from Residential Sources.** Depending on the degree of intervention, pollution from urban wastewater can take the following values: *1. Near-zero Pollution:* No pollutants associated with urban wastewater find their way in the aquifer. *2. At the EU set safe limit*: Concentrations of pollutants from residential sources will be at the limits set by the EU. 3. If no measures are implemented, pollution from urban wastewater will increase to *10% over the limit* set by the EU within the next decade.
3. **Pollution from Agricultural Sources.** Depending on the degree of intervention, pollution from agricultural chemicals can take the following levels: *1. Near-zero Pollution:* Agricultural chemicals will not find their way in the aquifer. *2. At the EU set safe limit*: Concentrations of pollutants from agricultural sources will be at the limits set by the EU. If no measures are implemented, pollution from agricultural sources will increase to *10% over the limit* set by the EU.
4. **Pollution from Industrial Sources.** Depending on the degree of intervention, pollution from industrial byproducts can take the following levels: 1. *Near-zero Pollution:* Industrial byproducts and industrial wastes will not find their way in the aquifer. *2. At the EU set safe limit:* Concentrations of pollutants from industrial sources will be at the limits set by the EU. If no measures are implemented, pollution from industrial sources will increase to *10% over the limit* set by the EU.
5. **Cost to the consumer.** To finance the policy measures for protecting water quantity and quality the government will introduce an extra charge on the water bill. This charge will be paid in all water bills starting from 2012 until the final water bill of 2017. The funds collected will be exclusively used by the government to finance the aquifer conservation program. Depending on the selected option, surcharge in your water bill will be HRK30, HRK40, HRK50, HRK60, HRK80 or HRK100. If no measure is implemented there will be no additional charge.

Please keep in mind that although you will not be called to pay any amount at this time, your responses will be used to assist policy formulation. Specifically the alternative that will attract the majority of positive responses from the public will be proposed to the government and subsequently utilized. As a result we would like you to answer as realistically as possible.
Furthermore we would like you to make decisions keeping in mind all the expenses you make for similar goods and services, your disposable income and financial obligations.