

Civil servants' education and the representativeness of the bureaucracy in environmental policy-making

Johanna Jussila Hammes – Swedish National Road and Transport Research Institute, VTI

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Abstract

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Keywords: Biologists; Bureaucracy; Civil servants; Education; Economists; Environmental policy; Political Economics; Representative bureaucracy; Surveys; Use of cost-benefit analysis; Weighted welfare

JEL Codes: H23, H83, Q25, Q53, Q58

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Author: Johanna Jussila Hammes

Address: Swedish National Road and Transport Research Institute, VTI and Centre for Transport Studies Stockholm, CTS; Box 55685; SE-102 15 Stockholm, Sweden. E-mail: johanna.jussila.hammes@vti.se. Tel: 00-46-8-555 77 035

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Introduction

The role of a bureaucracy is to provide policy advice, exercise delegated ministerial authority, negotiate within ministerially determined ranges, and administer government programs (Trebilcock, Hartle, Prichard, & Dewees, 1982). A bureau (an expert agency) can be delegated the task of drafting proposals for legislation. The bureaucracy may work in a more or less representative way, meaning it can be more or less responsive to the desires of the public (Meier (1975); Meier and Nigro (1976); Carlsson et al. (2011)). We suggest that a number of individual-level factors may influence decision-making in a bureaucracy. Thus, on the most basic level, a civil servant's underlying personal preferences may have an impact. Education may also influence the type of recommendations and decisions made. Moreover, each agency has its own "agency culture," which may affect the types of decisions that a civil servant feels able to make. Finally, career ambitions may influence a civil servant. Career ambitions may be closely related to agency culture as civil servants who follow the customary goals of an organization and the way things are done may have a greater probability of advancing their careers. Career ambitions are also related to the civil servant's education, as people with different educational backgrounds may be hired for different types of positions with varying expectations on them.

Wilson (1989) presents examples where strong professional norms and career motives form the way public employees in U.S. administrations carry out their work. For the Federal Trade Commission, Wilson cites evidence that attorneys are prosecution-minded, wanting to present clear evidence and win cases, while economists are consumer-welfare oriented. Von Borgstede et al. (2007) show that "environmentalist" civil servants are significantly more willing than other planners and economists to accept high-cost climate policy strategies and measures. Christensen (1991) studies the potential conflicts between political loyalty and

professional norms in Norway. A majority of Norwegian bureaucrats (57 percent) stated that professional decision-making norms were very important for their decision tasks, and that they would advance proposals even if they knew that it would evoke objections from their superiors. Only ten percent of the civil servants very often or relatively often had to implement policies they disagreed with. Christensen further notes that civil servants seem to be “partly pre-socialised to bureaucratic norms through their education.”

Trebilcock et al. (1982) discuss the selection of individuals to the public service and factors influencing their behavior as civil servants. They note:

As with any other occupation, the members of the bureaucracy are, to a considerable extent, self-selected. Those who place great weight on job security and/or want to influence policy are more likely to apply for positions than those dedicated to maximizing their incomes. Similarly, other things being equal, professionals who are willing to sacrifice some income for the prospective satisfaction of “changing the world” are more likely to apply for public service positions than their confreres... (Trebilcock, Hartle, Prichard, & Dewees, 1982, p. 13)

We build a formal model of civil servants’ behavior. We follow the insights originally presented by Tullock (1965) and Downs (1967) by assuming that even bureaucrats maximize utility. We hypothesize that a civil servant’s education determines whether she adjusts her private valuation of the environment according to the societal valuation as calculated in a cost-benefit analysis (CBA). CBA in Sweden is most frequently used in transport infrastructure planning and to determine the price and subsidies for medicines and not as much in environmental policy-making (Hultkrantz, 2009). Furthermore, the recommendations arising from a CBA are often not fully taken into account in decision-making (Nilsson (1991); Eliasson and Lundberg (2011); Jussila Hammes (2013)). We see this

as problematic because CBA, despite its well-known deficiencies, nevertheless represents the most comprehensive and objective measure of a policy's profitability from a societal point of view.¹ Thus, in order for policy to be "responsive," CBA results have to be taken into account in policy-making as they are the best available representation of the public's preferences.

The utility-maximizing model in the present paper is tested on data collected from a survey conducted among students of biology, economics, and social sciences at the University of Gothenburg and Stockholm University, both in Sweden, in November-December 2012. The present study focuses on the impact of education on the choice of policy: how do the professional norms and skills acquired during academic education affect the choice of environmental policy? To our knowledge, this is a new approach to the literature. Instead, extensive attention has been devoted to the problem of controlling bureaucracies, and the relationship between the U.S. Congress, the president, and the bureaucracy (Moe (2013) makes a survey). This literature examines a monolithic bureau, not taking the actions of individual civil servants into account. Another approach has examined the representativeness of bureaucracy by studying the impact of immutable characteristics of civil servants, such as gender, race, and ethnicity, on policy outcomes (Meier (1975); Keiser et al. (2002); Wilkins and Williams (2008)). Only very few studies examine self-chosen identities, such as jobs (Gade & Wilkins, 2012). An underlying assumption in the present

¹ A thoroughly done CBA describes for example the distributional aspects of a policy, both in time and space, but it cannot in a simple manner incorporate this information into the final cost-benefit figure. Furthermore, certain values can be very difficult to monetize. Examples include the value of biodiversity, landscape effects, and existence values.

study is that an individual civil servant can influence a political decision, that is, has real authority (Aghion & Tirole, 1997).

The paper is organized as follows: In the next section we develop a formal model of decision-making by an individual civil servant (a student in our case), and formulate two testable conjectures and a hypothesis. Section “Data” describes the experiment and the data collected in detail. Section “Results” contains the empirical estimation results. The last section summarizes and concludes the paper.

The model

Consider an economy consisting of N individuals. The economy has a private good (x), and individuals also derive utility from environmental quality, $e(\lambda)$, where λ is the pollutant under study. $e(\lambda)$ is differentiable, decreasing, and strictly concave in λ . We assume quasi-linear utility with additively separable preferences of the form $U_h = x_h + \alpha_h e(\lambda)$. α_h is the weight individual h gives to environmental quality and may vary between individuals. We make no specific assumptions about the distribution of α_h , but note that it may take both positive and negative values, even though we deem the latter to be unlikely.

The government determines environmental policy, here a standard on the maximum allowable nutrient level in water, $\bar{\lambda}$. Environmental policy is costly to the government, so that

$$(1) \quad R(\bar{\lambda}) = c(\lambda - \bar{\lambda})[\lambda - \bar{\lambda}],$$

where $c(\lambda - \bar{\lambda})$ is the non-constant unit cost of reducing the nutrient content in water from its present level of λ to the level prescribed by the environmental quality standard, $\bar{\lambda}$, with $\lambda \geq \bar{\lambda}$. The marginal cost increases in a greater reduction so that $c'(\lambda - \bar{\lambda}) > 0$.

We assume that the cost of environmental policy is borne entirely by the taxpayer. In order to pay for the environmental policy, individuals pay an equal share of its cost: $\frac{R(\bar{\lambda})}{N}$. An individual's indirect utility is then given by

$$(2) \quad v_h(y_h, x_h, \lambda) = y_h - \frac{R(\bar{\lambda})}{N} + \alpha_h e(\lambda),$$

where y_h is individual h 's income and $\sum_h y_h = y$ is the aggregate income. Normalizing $\sum_{h=1}^N \alpha_h = 1$, so that the individual weights on environmental quality sum up to the valuation of environment in a benefit analysis, and summing indirect utilities over all individuals yields aggregate welfare:

$$(3) \quad W(\bar{\lambda}) \equiv y - R(\bar{\lambda}) + e(\lambda - \bar{\lambda}).$$

$M \ll N$ civil servants in a governmental agency or ministry prepare a background analysis and a proposal for environmental policy.² We assume that besides considering her private utility, a civil servant's skills and professional norms learned during education may also influence her recommendation. Thus, a civil servant, seeing the results from a CBA, may recognize that her private weight on environmental quality, α_h , deviates from the average societal valuation. She may consequently adjust the weight given to environmental quality in decision-making by a factor of $q_h(m_h)$, where m_h is an indicator of the civil servant's education (major). The civil servant's indirect welfare is then given by

² The final decision is still made by politicians and may deviate from the one proposed by the bureaucrats. We are here interested in the fact that even agency proposals in Sweden sometimes deviate from CBA recommendations (Nilsson (1991), Eliasson and Lundberg (2011), Jussila Hammes (2013)) or do not include a CBA at all (Pyddoke & Nerhagen, 2010).

$$(4) \quad W_h(\bar{\lambda}) = y_h - \frac{R(\bar{\lambda})}{N} + [\alpha_h + q_h(m_h)]e(\lambda - \bar{\lambda}).$$

We start by examining social optimum, which can be found by maximizing the social welfare function (3) with respect to the standard, $\bar{\lambda}$. Using equation (1) and simplifying yields

$$(5) \quad \frac{\partial W}{\partial \bar{\lambda}} = 0 \Leftrightarrow c'(\lambda - \bar{\lambda}) = -e'(\lambda - \bar{\lambda}).$$

Since we assumed function e to be decreasing in λ , both sides of the equation are positive.

Equation (5) thus yields the familiar condition for social optimum, where the marginal cost of the environmental standard is equalized with the marginal benefit.

How about the civil servant's recommendation? The equilibrium can be found by maximizing Equation (4). Differentiating with respect to $\bar{\lambda}$ yields

$$\frac{\partial W_h}{\partial \bar{\lambda}} = 0 \Leftrightarrow -\frac{c'(\lambda - \bar{\lambda})}{N} - [\alpha_h + q_h(m_h)]e'(\lambda - \bar{\lambda}) = 0.$$

Simplifying yields the civil servant's implicit equilibrium proposal for policy:

$$(6) \quad c'(\lambda - \bar{\lambda}) = -N[\alpha_h + q_h(m_h)]e'(\lambda - \bar{\lambda}).$$

The socially optimal policy as given by equation (5) is proposed by a civil servant with an average aggregate weight on environmental quality, $\alpha_h + q_h(m_h) = \frac{1}{N}$. If the civil servant's aggregated weight exceeds (is lower than) the average, $\alpha_h + q_h(m_h) > \frac{1}{N}$ ($< \frac{1}{N}$), the proposed policy will be stricter and more costly (laxer and less costly) than the socially optimal policy. We assume that the civil servant adjusts the weight on environmental quality in the direction of the CBA valuation from her own private valuation, so that $q_h \leq 0$ (> 0) if $\alpha_h \geq \frac{1}{N}$ ($< \frac{1}{N}$), with $|q_h| \leq \left| \alpha_h - \frac{1}{N} \right|$.

We formulate two testable conjectures and one hypothesis:

Conjecture 1. Biologists, on average, give a higher weight to environmental quality than economists: $\alpha_{bio} > \alpha_{econ}$.

Conjecture 2. Economics majors make socially optimal policy recommendations while biologists recommend policy based on their private valuation of environmental benefits:

$$(7) \quad \alpha_{econ} + q_{econ} = \frac{1}{N}$$

$$(8) \quad \alpha_{bio} + q_{bio} > \frac{1}{N} \text{ with } q_{bio} = 0.$$

Conjecture 2 is based on the expectation that economists get trained in making efficiency analyses, and thereby in taking social welfare into account. We therefore expect them to choose policy close to the social optimum. We further assume that also studies in social sciences may contain welfare economic analyses, but not to the same extent as studies in economics. Social scientists are therefore expected to be an intermediate case. Finally, we expect biologists to be fairly unfamiliar with the type of efficiency analyses propagated by economics, and to make policy recommendations based mainly on their private valuation of environmental benefits. The null is that the weight on environmental quality does not vary depending on a civil servant's major.

Conjectures 1 and 2 determine how we expect the choice of education to impact the choice of environmental policy in Equation (6). Examining the impact of Conjectures 1 and 2 on equation (6) yields a hypothesis:

Hypothesis 3. The biologists choose the costliest environmental policy. The economists choose the least costly environmental policy.

The hypothesis arises directly from Conjecture 2 and from the observation that a higher $\alpha_h + q_h(m_h)$ implies a higher cost of the environmental policy, *ceteris paribus*.

We end with a few words about collegiality. A collegium of M civil servants could weigh (add) together their individual preferences. Adding from Equation (3) and differentiating yields

$$(9) \quad \frac{\partial \sum_{h=1}^M W_h}{\partial \bar{\lambda}} = 0 \Leftrightarrow -\frac{M}{N} c'(\lambda - \bar{\lambda}) - \sum_{h=1}^M [\alpha_h + q_h(m_h)] e'(\lambda - \bar{\lambda}) = 0.$$

Depending on the educational mix of the collegium, $\sum_{h=1}^M [\alpha_h + q_h(m_h)]$ may be greater or lower than the average weight on environment for a collegium that is representative of the entire population, $\frac{M}{N}$. For non-optimal weights on environmental quality, the results above concerning the direction of the deviation from the social optimum apply here as well. We do not pursue this question further in the present paper.

Data

We have conducted a survey using biology, economics, and social sciences students as respondents. We chose these majors since many of the civil servants working with environmental regulation in Sweden have majored in one of these subjects.

Instead of running the survey on actual civil servants, we used students because in this way we can better isolate the effect of education on the decisions. We are therefore able to avoid the possible bias created by a person's adjustment to an agency culture and the collegiality of decision-making in most agencies. The downside of this choice is that the experiment has been conducted with respondents lacking experience of the relevant kind of decision-making. The empirical results must therefore be seen as indicative at best. The

respondents were all in the final year of their bachelor's program or in a master's or PhD program. Thus, they had completed at least a few years of studies in the relevant subjects and should therefore be familiar with the professional way of thinking.

We contacted 395 students at the University of Gothenburg and Stockholm University in Sweden. The number of students who answered the questionnaire, divided according to the course they were taking (not necessarily their major) when approached by us and by university, is shown in Table 1 in Appendix A.

While the total response rate of 31.6 percent is not high, our sample seems to be reasonably representative of the population from which it was drawn. 34.4 percent of the respondents were male, which may be a bit lower than in the whole group. The mean age of the respondents was 26 years, which can be considered representative of the relevant population. The main risk is that we have attracted mainly students with a greater than average interest in environmental questions. On the other hand, it is likely that they are the type of persons who will look for jobs in the civil service, which reduces the severity of the bias.

We posed a number of questions aiming at eliciting the respondent's attitudes to societal decision-making. The questions and summary statistics are shown in Table 2 in Appendix C. The answers were given on a scale from 1 to 4, where 1 signified not at all important to consider in societal decision-making and 4 very important.

In order to reduce the number of value variables, we conducted a factor analysis. We started by controlling for the sampling adequacy by calculating a Kaiser-Meyer-Olkin measure. The lowest value is found for *Low taxes* (0.62), which is excluded from the subsequent analysis. The rest of the variables received measures above 0.7 (middling) and 0.8 (meritocratic). We

exclude the variables *The position of the less fortunate in society* and *Quality of public services* from subsequent analysis since they load heavily on more than one factor.

Based on the scree test, we retain three factor variables in our analysis. Since the underlying variables are on an ordinal scale, the factors are generated from a Spearman rank correlation matrix. Since we assume that the factors may be correlated with one another, we use an oblique rotation. We consider the first factor to encompass attitudes to economic factors (or to center-of-right political values), the second to relate to the environmental values, and the last to reflect general attitudes to equality.

We posed two questions relating to environmental decision-making where the students were asked to make two hypothetical water-environment-related decisions. In this paper we only analyze the question where we asked the students to imagine themselves in the role of a national-level civil servant.³ Background information and the question studied are translated into English in Appendix B. In order to ensure that the presence of the first question did not bias the answers to the second question, in half of the questionnaires we switched the two questions around. A *t*-test of equal means indicates that the order of the questions does not matter.

In the background information to the questions, we noted that the present average nutrient content in Swedish lakes is 16 units, and that at 20 nutrient units a lake's ecosystem risks collapsing. The natural level of nutrient concentration was given as being 5-10 units. About half of the respondents also got information about the presence of an international standard

³ The other question, which asked about water policy on municipal level, is described and analyzed in Jussila Hammes et al. (2013) and in Nerhagen et al. (2013).

of 8 nutrient units. In the question analyzed in this paper, we asked the students to recommend a national nutrient limit, between 5 and 20 nutrient units. The limit would affect approximately 20,000 lakes out of a total of 100,000 lakes in Sweden. The students received information about both the costs and the benefits of different nutrient concentrations. The cost-efficient nutrient limit was designed to be 12 units.

Table 3 shows summary statistics for the nutrient limit. The mean nutrient limit chosen is approximately 10, which is close to the upper limit of what was indicated to be the “natural state” of lakes in Sweden. 23.3 percent of the respondents in the total sample chose a cost-efficient nutrient limit (12-15 units).

In order to test the conjectures and the hypothesis, we construct a measure based on Equation (6). Thus, the dependent variable is $\frac{c'(\lambda-\bar{\lambda})}{-e'(\lambda-\bar{\lambda})}$, and it is constructed from the information provided to the respondents, so that the marginal cost implied by their choice of nutrient limit is divided by a measure of the (constant) marginal benefits from environmental protection. Since the mean limit chosen by students from all three groups indicates a willingness to accept high costs of environmental protection, we use the maximum possible benefits from a unit reduction of the nutrient content; that is, a measure that takes into account both the benefits from fishing and the probable value of recreational use and biodiversity of the lake (160,000 SEK/unit).⁴ The marginal cost at the cost-efficient nutrient limit of 12 units was given as 150,000 SEK/unit. Summary statistics are shown in Table 3.

⁴ During the experiment period, one euro cost about 8.6 SEK and one US dollar about 6.6 SEK.

If the respondents had chosen the cost-efficient nutrient limit, then $\frac{c'}{-e'} = 1$. According to Table 3, all three educational groups chose on average a stricter policy, and *t*-tests confirm that the ratios differ from 1 for all three majors. The social scientists chose the most costly policy, with the average $\frac{c'}{-e'} \Big|_{soc\ sci} = 1.47$, followed by the biologists, whose average is 1.43. The economists chose a policy that was closest to the social optimum at an average score of 1.31. The difference between the average ratios chosen by the economists and the biologists/social scientists is statistically significant at the 6.3 and 5.3 percent levels, respectively.

The decision-making questions were followed by some background questions. These are summarized in Table 4 and include questions about gender and age, membership in an environmental organization (29.8 percent are members of some NGO), income (73.4 percent live on an income commensurate with the government's student allowance and loan, i.e., less than 10,000 SEK per month), the main occupation at present (93.5 percent of the respondents are students), and the highest academic degree obtained. 75.8 percent of the respondents had a bachelor's degree or higher and 23.4 percent were still working on their undergraduate degree. The table also includes summary statistics for an *International standard 8 units*, which was information that was given in 48 percent of the questionnaires in order to study the impact of standards on decision-making (see Appendix B).⁵

We ended the questionnaire with questions about the respondent's education and subjects studied. Their majors are summarized in Table 4. We classified the biologists, environmental

⁵ For further information and analysis of this variable, see Jussila Hammes et al. (2013) and Nerhagen et al. (2013).

and health students, environmental scientists, chemistry students and students of technical subjects as *Biologists* (56 respondents), the students of economics and financial economics as *Economists* (36 respondents), and the political scientists, one lawyer, students of global studies, and business administration students as *Social scientists* (32 respondents). Finally, we use an indicator variable *Economics MA* taking the value of 1 if a student of economics has a master's degree or higher (licentiate or PhD). Thirteen respondents had reached this level of education in economics. The rationale for using this variable is that learning economic analysis, for instance welfare economic analyses and concepts such as opportunity costs, takes time.

In addition to variables collected in conjunction with the survey, we use *Total unemployment* in the respective professions. The variable is constructed from data available from the Swedish Employment Agency. Based on an individual's highest education, we guessed the approximate year when they started their studies and used the total unemployment rate for the respective field in August of that year. The variable functions as a proxy for an individual's expected lifetime earnings since the biologists have on average both the lowest salary and the highest unemployment rate of the studied educational fields. Using the students' present income as an explanatory variable seems uninteresting in the light of the above described low variation in that variable.

Our sample consists of 124 observations in total. The respondents were rewarded with a movie ticket sent to them in the mail a week after the questionnaires were due.

Results

Table 5 in Appendix D shows summary statistics per educational field for the factor variable *Factor environmental values* and general summary statistics for the two other factor variables. In order to understand possible differences between the educational groups, we conducted *t*-tests of equal means. The biologists have the highest mean *Factor environmental values* and the economists the lowest, the difference being statistically significant at the 0.02 percent level. The difference in the biologists' and social scientists' environmental values is significant at the 5.6 percent level, while the difference in the economists' and the social scientists' environmental values is not statistically significant. These results support Conjecture 1.

Using equation (6), we normalize $N = 1$ and estimate the following equation:

$$(10) \quad \frac{c'(\lambda - \bar{\lambda})}{-e'(\lambda - \bar{\lambda})} = b_0 + \sum_{j=biol}^{econ} [b_{1j}\alpha_j + b_{2j}q_j(m_j)] + \sum_{j=1}^7 \delta_j x_j + \varepsilon_i,$$

where the proxy for α_j is *Factor environmental values*, and the proxy for $q_j(m_j)$ is a dummy variable for the respective education, biology or economics. x is a vector of control variables, namely *Factor economic values*, *Factor equality values*, *Economics MA*, *International standard 8 units*, *Gender*, *Age*, and *Total unemployment*. Table 6 shows the OLS results both for the full model (in column 1) and excluding some of the insignificant control variables (in column 2). The model in column 2 is our “preferred” model and the one we will interpret below.

Social scientists are the “base” education in model (10). Thus, $\alpha_{socsci} + q_{socsci} = 1.64$. The coefficient on *Biologists*, q_{bio} , is insignificant, and the one on *Economists*, q_{econ} , equals

–1.35, has the expected sign, and is highly significant. We deem these magnitudes of $q_h(m_h)$ to provide support for Conjecture 2, namely that $q_{bio} = 0$ while $|q_{econ}| > 0$.

In order to determine whether $\alpha_{bio} + q_{bio} > \alpha_{econ} + q_{econ}$, we run an *F*-test examining whether the summed coefficients ($b_0 + b_{1j}\alpha_j + b_{2j}$, $j = bio, econ$, b_0 for *Social scientists*) are equal or not. The calculated linear combinations are shown in Table 7. The test indicates that the linear combination of coefficients for the economists differs from the ones for the biologists and the social scientists at a very high level of significance. The biologists' measure does not differ from the social scientists' (the constant) at any meaningful level of statistical significance, however. We conclude that $\alpha_{bio} + q_{bio} = \alpha_{soc\ sci} + q_{soc\ sci} > \alpha_{econ} + q_{econ}$. We furthermore test whether the summed coefficients are equal to 1 (the cost-efficient level) or not. The test indicates that both $\alpha_{bio} + q_{bio}$ and $\alpha_{soc\ sci} + q_{soc\ sci}$ exceed 1 at least at the 1 percent level of significance. For $\alpha_{econ} + q_{econ}$ we cannot reject the null, the test statistic being significant at the 7 percent level. We therefore cannot reject Conjecture 2.

Finally, we attempt to determine the level of the α_h 's. In order to do this we have calculated further linear combinations of the regression coefficients in Table 7, namely $\alpha_{bio} = b_0 + b_{1bio}$ and $\alpha_{econ} = b_0 + b_{1econ}$. We noted above that the social scientists' valuation of the environment (*Factor environmental values*) does not differ from either of the other two majors in a statistically significant way but that it is an intermediate case. An *F*-test indicates, however, that $\alpha_{soc\ sci} = 1.64$ differs from $\alpha_{bio} = 1.84$ at the 5 percent level. This may have two reasons. The first is that the social scientists also have $|q_{soc\ sci}| > 0$ and that 1.64 is not an adequate estimate of $\alpha_{soc\ sci}$. The second is that while the coefficient on q_{bio} is insignificant, it nevertheless adjusts downward the estimate of the biologists' $\alpha_{bio} + q_{bio}$. That is, the presence of a spurious variable in the regression may have biased the results

pertaining to α_{bio} , which will consequently have to be adjusted. This explanation is supported by the results in column 3 of Table 6, where we have forced $b_{2bio} = 0$. The coefficient for *Factor environmental values*, α_{bio} , for the biologists becomes insignificant and the linear estimate of the biologists' weight on environment, $\alpha_{bio} = b_0 + b_{1bio} = 1.72$ does not differ from the social scientists' weight $\alpha_{socsci} = 1.64$ in a statistically significant manner. Moreover, the difference between $\alpha_{socsci} = 1.64$ and $\alpha_{bio} + q_{bio} = 1.52$ (calculated from column 2) is statistically insignificant, indicating that a "true" α_h lies around these values.

Based on these results, we use the intercept of the model in column 2 as a measure of the social scientists' α_{socsci} . We can use this to calculate $\alpha_{econ} = 1.98$. The calculation thus yields a very high valuation of the environment for the economists. α_{econ} is statistically higher than α_{socsci} but does not differ from α_{bio} , which violates the results above. The high calculated α_{econ} is outweighed by the large correction the economists make in the form of $q_{econ} = -1.35$, however. We attribute the results to deficiencies in the data.

Finally, in order to test Hypothesis 3 we examine the predicted values of the ratios $\frac{c'}{-e'}$ from the regression results in column 2 of Table 6. As noted above, the differences in the actual ratios are on the borderline of significance. The differences in the predicted ratios are larger, however. Thus, the predicted $\frac{c'}{-e'}\Big|_{bio} = 1.43$ exceeds the predicted $\frac{c'}{-e'}\Big|_{econ} = 1.31$ at the 0.02 percent level. It is however lower than the predicted $\frac{c'}{-e'}\Big|_{socsci} = 1.47$ at the 5.4 percent level of significance. The social scientists' predicted ratio exceeds that of the economists at a very high level of significance. Finally, if our sample were to constitute a "collegium" and the average of the policies chosen by the individuals were to constitute a

policy proposal, we would have $\frac{c'}{-e'} = 1.41$. This is marginally lower than the choices of the biologists and social scientists, but, reflecting the low share of economists in the sample, considerably above both the economists' recommendation and the cost-efficient policy level. It may however be a good reflection of actual policy-making in Swedish government agencies.

Given the constant marginal benefits from an improvement in water quality (160,000 SEK), we can use these ratios to calculate the implied mean marginal costs that the students representing different majors are willing to accept. Thus, the economists are on average willing to accept costs of 209,200 SEK, while the biologists accept costs of 229,500 SEK. The social scientists have the highest willingness to accept costs at 235,000 SEK. The predicted average for the entire sample is 225,000 SEK. Given the borderline significance of the difference in the ratios for the biologists and the social scientists, we are unwilling to take this result as an outright rejection of Hypothesis 3 but note that the biologists and social scientists both seem to choose environmental policy of a similarly high stringency and cost. The economists clearly choose the cheapest policy, however, and we accept this part of the hypothesis.

Summary and conclusions

This study has examined how an individual civil servant's attitudes, political values, and professional norms and skills acquired through education affect her recommendations for environmental policy. In order to study the questions empirically, we asked biology, economics, and social science students to make an environmental policy choice in the role of a civil servant at a national public agency.

The study controls both for the collegiality of decision-making in governmental agencies and ministries by asking the respondents to determine their response alone, and for the organizational culture of actual government agencies by recruiting students with little relevant work experience and therefore limited exposed to agency culture. The hypothesis in the paper is that education matters, so that we expected majors in biology to choose a more far-reaching and therefore costlier environmental policy than majors in economics. We thus expect that a bureaucracy consisting of economists would be more responsive to the public's preferences as expressed in a CBA than a bureaucracy consisting of biologist civil servants.

We formulated two conjectures and one testable hypothesis. Thus, we conjectured that the biologists would put greater weight on environmental quality in their utility function than either the economists or the social scientists. We find certain support for this assumption since the biologists have the highest *Factor environmental values*, which are used as a measure of environmental values. The consequent regression results however confound the finding as the calculated weights on environmental benefits indicate that the economists might give the highest private weight on the environment out of the three majors.

Another aspect of our model is the assumption that the economics students have learned to adjust their personal preferences towards a level indicated by a CBA as optimal for society. We believe that biologists have not learned social welfare maximization and that they therefore do not adjust their personal preferences according to the CBA results. Our empirical findings confirm the expectation for both majors.

Based on the two conjectures, we hypothesized that the biologists would choose the strictest and therefore costliest environmental policy while the economists would choose the cheapest and consequently laxest policy, in the vicinity of what is socially optimal. We

find support for the hypothesis of differences between the economists and the other two groups. The social scientists and the biologists seem to choose environmental policy implying similar costs and levels of environmental protection. Even the economists choose costlier than optimal policy, however.

Finally, a word of caution is warranted. While our results on average show that the economists have learned to adjust their personal preferences according to the CBA results and therefore choose policy somewhat consistent with cost efficiency, and that the biologists and social scientists choose a policy that is stricter and more costly than optimal from a social welfare-maximizing point of view, there is large variation in the results for all educational groups. Thus, there are economists in our data who chose very strict and costly policy, while some biologists and social scientists chose in a very cost-efficient manner. Thus, our results cannot be used as a general guideline as to “whom to hire in order to get cost-efficient policy.” The individuals still have to be vetted on their own merits; i.e., professional skills, and attitudes.

To our knowledge, this is the first study that models the behavior of civil servants with personal utility maximization as a starting point and allowing education to modify the personal preferences in a (possibly) socially optimal direction. We furthermore test the theory with survey (or experimental) data. The study leaves many questions for future research, however. Firstly, it would be interesting to try to recruit a larger sample of students from different relevant disciplines, including the three included in this study, in order to possibly increase the robustness of the results. Secondly, we would like to test the hypotheses on actual civil servants from relevant governmental agencies. The question might also be interesting in an international context, including civil servants from different

countries and/or the European Commission. It seems like CBA is used to different extents in different countries and within different policy areas. The question is whether education can explain this difference also in countries other than Sweden, or whether other factors provide a better explanation. Finally, in the introduction, we identified a number of other factors besides education that might explain decision-making in bureaucracies, such as agency culture and career motives. Both of these questions could be modeled and tested.

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A. Appendix

Table 1. The courses where students were recruited and universities attended by the students participating in the experiment. The two middle columns show the number of each type of student who responded with and without a norm. The fifth column indicates the number of flyers distributed to the students in each sub-group. The last column calculates the response rate. A total of 125 complete answers were obtained.

Major	University	With an int'l standard	Without an int'l standard	Number of flyers distributed	Response rate
Biology	Gothenburg	7	10	47	36.2 %
Ecotoxicology	Gothenburg	2	6	23	34.8 %
Environment and health protection	Gothenburg	2	0	2	100 %
Environmental sciences	Stockholm	4	8	35	34.3 %
	Gothenburg	4	3	12	58.3 %
	Stockholm	3	1	8	50.0 %
Economics	Gothenburg	8	10	72	25.0 %
	Stockholm	6	5	35	31.4 %
Financial economics	Gothenburg	4	3	19	36.8 %
SMIL ⁶	Gothenburg	9	4	55	23.6 %
Global studies	Gothenburg	2	4	29	20.7 %
Political science	Gothenburg	9	11	58	34.5 %
Total		60	65	395	31.6 %

⁶ Social scientific program for environmental science.

B. Appendix

In this appendix we translate from Swedish both the background information given to the respondents prior to the two environmental policy-making questions in the questionnaire and the actual questions. The underlined sentence about an internationally-agreed threshold was included in about half of the surveys.

Environmental policy-making

EU's goal and your job

EU legislation stipulates that all member countries should implement measures to protect water quality, with the goal of maintaining or restoring good ecological status. A good ecological status is to be understood as a lake having conditions close to those in an unaffected forest lake. As a basis for efforts to restore water quality, a survey and analysis of water containing information about human impacts on water quality and an economic analysis of water use should be carried out.

You will soon get to answer two questions and one follow-up question, where we want you to try to put yourself in the role of a civil servant. But first you will get information describing the environmental problem and the measures that can be implemented to improve the environment. Read the text carefully, you cannot return to it once you have left the page with background information.

Background information about water and environmental effects in Sweden

In Sweden, there are almost 100 000 lakes and streams. Many of these are affected by pollution although measures have been implemented to reduce the impact. One problem is eutrophication, i.e. the concentration of nutrients is too high. In this study, we assume that about 20 000 lakes have concentrations much above the value that can be considered a

natural state. Measures that can be implemented to reduce impacts include: improving municipal wastewater treatment plants and reducing emissions from agriculture. The internationally-agreed threshold indicating a desirable level of nutrition is 8 nutrient units/litre.

Research has shown that the nutrient content is an important factor affecting fish stocks and the rest of the ecosystem of a lake. An unaffected forest lake has a total content of 5-10 nutrition units/litre; the ecosystem may collapse at a level of 20 nutrient units/litre.

One way to measure the impact of increased nutrient content is to measure the ratio of perch and carp. A ratio of 0.5 is that of an unaffected lake. If the nutrient content increases, the ratio falls (see figure). The amount of perch decreases relative to carp, which has a negative impact on the ecosystem of a lake. When the number of perch decreases, the amount of zooplankton that eat phytoplankton also falls. This makes lakes turbid with poor visibility. It also reduces the biodiversity of the lake and makes it less attractive for, for example, swimming.

Economic background

A survey has been carried out showing how concentrations in a lake with an average level of pollution located in an agricultural area near an urban area can be reduced by various measures. In the following questions, you will receive information about the costs of implementing the various measures that can reduce the levels.

A study indicating the value of reduced levels to society has also been conducted. The economic value of a one-unit reduction in nutrient levels in a polluted lake is 80,000 SEK as a result of improved fishing. To this can be added the increased recreational value and the

value of increased biodiversity, which are estimated to between 40,000 and 80,000 SEK per unit decrease in nutrient content.

Question: Recommended nutrient limit

The EU directive states that the requirements for environmental improvement should be adapted to the conditions in different countries. You work at a governmental agency and are to submit proposals for a Swedish national threshold aimed to guide efforts to improve water quality. As a basis for decisions, information has been generated on different combinations of actions that lead to environmental improvements in one Swedish lake with average pollution level. There are an estimated 20 000 of lakes that are very eutrophic. Any action lowers the total nutrient content but in different quantities.

The measures are ranked from the cheapest to the most expensive in the table below. It does not pay off to take measure B without first having taken measure A, measure C does not pay unless A and B have been taken and so on. The measure combinations show ways to reach different environmental quality, and give an indication of the environmental impact that a different level may provide and how much it would cost. A limit must not be set so that a certain action combination is reached exactly. The socio-economic value of reducing the total concentration by one unit is estimated to 120,000-160,000 SEK.

	Total nutrient content	Total cost over 5 years	Reduction in total nutrient content of an additional measure	Cost per unit change in an additional measure
No measure	16	0	0	0
A	15	110 000	1	110 000
A+B	12	560 000	3	150 000

A+B+C	10	1 040 000	2	240 000
A+B+C+D	7	1 820 000	3	260 000
A+B+C+D+E	6	2 100 000	1	280 000

Which total nutrient content (between 5 and 20) do you think should be set as the nutrient limit?

C. Appendix

In this appendix we present tables related to the data.

Table 2. Summary statistics for the value variables.

Variable	Obs	Mean	Std. Dev.	Min	Max
Precautionary principle	124	3.32	0.70	1	4
Natural state of the environment	124	3.40	0.70	1	4
Ecological sustainability	124	3.61	0.61	2	4
Gender equality	124	3.56	0.65	2	4
Equality of people	124	3.60	0.60	1	4
Justice	124	3.64	0.60	2	4
Economic efficiency	124	3.10	0.68	1	4
Unemployment	124	3.12	0.72	1	4
Cost efficiency	124	2.90	0.74	1	4
Good conditions for firms	124	2.77	0.67	1	4
Low taxes	124	2.05	0.76	1	4
Competitiveness of Swedish firms	124	2.85	0.79	1	4
Regional justice	124	2.85	0.81	1	4
Locally produced	124	3.05	0.81	1	4
The position of the less fortunate in society	124	3.27	0.71	1	4
Religion	124	1.94	0.90	1	4
Physical safety	124	3.16	0.77	1	4
Individual's right to choose for themselves	124	3.05	0.79	1	4
Democracy	124	3.55	0.63	2	4
Quality of public services	124	3.35	0.65	1	4
Human rights	124	3.80	0.48	2	4

Table 3. Summary statistics for the choice of nutrient limit and the dependent variable $\frac{c'}{-e'}$.

Variable	Obs	Mean	Std. Dev.	Min	Max
Nutrient limit	124	9.61	2.16	5.00	16.00
Nutrient limit chosen by biologists	56	9.52	1.89	5.00	12.00
Nutrient limit chosen by economists	36	9.97	2.50	6.00	16.00
Nutrient limit chosen by social scientists	32	9.38	2.23	6.00	15.00
MC/MB = 160,000 SEK/unit	124	1.41	0.31	0.00	1.75
MC/MB = 160,000 SEK/unit, biologists	56	1.43	0.26	0.94	1.75
MC/MB = 160,000 SEK/unit, economists	36	1.31	0.39	0.00	1.75
MC/MB = 160,000 SEK/unit, social scientists	32	1.47	0.26	0.69	1.75

Table 4. Summary statistics for background and educational variables.

Variable	Obs.	Mean	Std. Dev.	Min	Max
Gender	124	0.35	0.48	0	1
Age	124	26.07	4.37	20	43
Member in an environmental NGO	124	0.30	0.46	0	1
Monthly income < 10 KSEK	124	0.73	0.44	0	1
Monthly income 10-30 KSEK	124	0.19	0.40	0	1
Main occupation work	124	0.04	0.20	0	1
Main occupation study	124	0.94	0.25	0	1
Highest degree high school	124	0.23	0.43	0	1
Highest degree bachelor's	124	0.51	0.50	0	1
Highest degree master's	124	0.22	0.41	0	1
Highest degree licentiate	124	0.02	0.13	0	1
Highest degree PhD	124	0.02	0.13	0	1
International standard 8 units	124	0.48	0.50	0	1
<i>Major subjects:</i>					
Biology	124	0.21	0.41	0	1
Environmental and health studies	124	0.06	0.25	0	1
Environmental science	124	0.15	0.35	0	1
Technical subjects	124	0.01	0.09	0	1
Economics	124	0.23	0.43	0	1
Financial economics	124	0.06	0.23	0	1
Business administration	124	0.02	0.13	0	1
Cultural geography	124	0.02	0.15	0	1
Political science	124	0.19	0.40	0	1
Global studies	124	0.02	0.13	0	1
Other majors	124	0.03	0.18	0	1

D. Appendix

In this appendix we present the results pertaining to the section “Results.”

Table 5. Summary statistics per education for *Factor environmental values*, for total values of the two other factor variables

Variable	Obs.	Mean	Std. Dev.	Min	Max
<i>Factor environmental values: total</i>	124	3.07	0.62	0.62	3.96
<i>Factor environmental values: biology</i>	56	3.27	0.59	0.86	3.91
<i>Factor environmental values: economics</i>	36	2.80	0.52	1.63	3.73
<i>Factor environmental values: social sciences</i>	32	3.00	0.67	0.62	3.96
<i>Factor economic values</i>	124	3.92	0.66	2.10	5.32
<i>Factor equality values</i>	124	3.31	0.57	1.73	3.97

Table 6. OLS regression results from equation (10). The dependent variable is $\frac{c'}{-e'}$. The first column includes all control variables. In column 2 the insignificant ones that do not have to be included because of aspects of the data have been excluded. The model in column 2 is the preferred model. In the model in the third column we force $b_{2bio} = 0$.

	(1)	(2)	(3)
Biologists	-0.326 (-1.39)	-0.316 (-1.38)	
Economists	-1.360*** (-5.00)	-1.353*** (-5.12)	-1.343*** (-5.06)
Biologists' environmental values	0.134 (1.97)	0.133* (2.00)	0.0503 (1.76)
Economists' environmental values	0.422*** (4.48)	0.416*** (4.55)	0.419*** (4.56)
Factor economic values	-0.0167 (-0.41)		
Factor equality values	0.0156 (0.33)		
MA or higher in economics	0.0896 (0.85)	0.0885 (0.91)	0.0825 (0.84)
International standard 8 units	0.00479 (0.09)	0.00768 (0.15)	0.0241 (0.47)
Gender, woman = 0	-0.00233 (-0.04)		
Age, years	-0.000483 (-0.08)		
Total unemployment year of study start	-2.473 (-1.79)	-2.580 (-1.97)	-2.958* (-2.30)
Constant	1.660*** (5.96)	1.641*** (15.30)	1.645*** (15.27)
Observations	124	124	124
R^2	0.235	0.234	0.221
Adjusted R^2	0.160	0.187	0.181

t statistics in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 7. Linear combinations of the coefficient estimates in Table 6 using the mean values of *Factor environmental values* for the biologists (1.48) and economists (0.81).

	Coefficient	Std. Err.	<i>t</i>	<i>P</i> > <i>t</i>	[95% Conf. Interval]	
$\alpha_{\text{bio}} + q_{\text{bio}}$	1.52	0.19	7.82	0.00	1.14	1.91
$\alpha_{\text{econ}} + q_{\text{econ}}$	0.63	0.20	3.08	0.00	0.22	1.03
α_{bio}	1.84	0.16	11.67	0.00	1.53	2.15
α_{econ}	1.98	0.14	14.50	0.00	1.71	2.25