Grantová agentura České republiky
Czech Science Foundation   **Part A**

Application for a Grant

Date of application: **01.04.2008**	Specialized commission No.: **402**	Registration No.: **402/09/1066**

Applicant

Surname and name: **Prof. RNDr. Ing. František Turnovec, CSc.**	Institution (name and address): **Institut ekonomických studií Fakulty sociálních věd UK v Praze**

Name of the project:
Political Economy of Voting Behavior, Rational Voter Theory and Models of Strategic Voting

Duration (years):	**3**	Starting date:	**01.01.2009**

Characteristics of the project (an abstract of max. 15 lines):

The objective of the project is extension of analysis of voting behavior and models from the standpoint of possible strategic voting (sometimes associated with manipulation). By strategic voting we mean voters' behavior promising maximization of expected individual or group utilities. By manipulation we mean such strategic behavior of one group that wants to influence some other voters to vote against their interests but for interests of manipulating group. As an innovation to existing approaches we want to introduce into the voting models categories of non-rational, semi-rational and rational voters and to study also information complexity of strategic voting. Game-theoretical and other operations research approaches (multi-criteria optimization) will be employed as a general framework of the models. There are two types of research output anticipated: theoretical models as contribution to rational voters' theory, and empirical study of the new electoral history of the Czech Republic (1993-2010) and voting rules in European Union with an emphasis on elements of strategic voting.

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Part B

Overall Costs of the Project

(In thousands of CZK)

Registration No.: **402/09/1066**

Applicant: **Prof. RNDr. Ing. František Turnovec, CSc.**	1st year	2nd year	3rd year
Operational and material costs - total	367	401	422
Instrument costs - total	0	0	0
Salaries and wages - total	210	230	270
Total costs	**577**	**631**	**692**

Applicant: František Turnovec, Charles University in Prague, Faculty of Social Sciences

Name of the Project: Political Economy of Voting Behavior, Rational Voter Theory and Models of Strategic Voting

1. Annotation

The objective of the project is extension of analysis of voting behavior and models from the standpoint of possible strategic voting (sometimes associated with manipulation). By strategic voting we mean voters' behavior promising maximization of expected individual or group utilities. By manipulation we mean such strategic behavior of one group that wants to influence some other voters to vote against their interests but for interests of manipulating group. As an innovation to existing approaches we want to introduce into the voting models categories of non-rational, semi-rational and rational voters and to study also information complexity of strategic voting. Game-theoretical and other operations research approaches (multi-criteria optimization) will be employed as a general framework of the models. There are two types of research output anticipated: theoretical models as methodological contribution to rational voters' theory, and applications, empirical studies of the new electoral history of the Czech Republic (1992-2010) and voting rules in European Union with an emphasis on elements of strategic voting.

2. State of the art

Voting is the act of registering a choice between alternatives - either between candidates, parties or questions. Since in democratic societies voting occurs on everything from town meeting questions to presidential elections, it is not surprising that both economics and political sciences are focusing attention to the topic for about last 250 years (ARROW 1951, 1963, McLEAN and HEWITT 1994, BLACK 1958, 1998).

Economic analysis of voting is based on the rational voter model (FELDMAN and SERRANO, 2006, ELIN, GELMAN, KAPLAN, 2007), derived from rational choice theory. In this model, voters are short-term instrumentally rational. That is, voters are only voting in order to make an impact on one election at a time (not, say, to build the political party for next election); voters have a set of sincere preferences, or utility rankings, by which to rate candidates (alternatives); voters have some knowledge of each other's preferences; and voters understand how best to use voting to their advantage (BRAHAM, STEFFEN 2008). The extent to which this model resembles real-life elections is the subject of considerable academic debate (STODDER 2005),

Voting systems or election methods are abstract methods for groups of people to select one or more options from many, taking into account the individual preferences of the group members (NURMI, 1987, 2006). Voting is often seen as the defining feature of democracy, and is best known for its use in elections, but it can also be used to award prizes, to select between different plans of action, or as a means for computer programs to evaluate which solution is best for a complex problem (SAARI. 1995, 1999). A key property of voting systems is that, because they are algorithms, they must be formally defined. Consensus, for example, which is sometimes put forward as a voting system, is more properly a broad way of working with others, analogous to democracy or anarchy.

In voting systems, tactical voting (or strategic voting) occurs when a voter misrepresents his or her sincere preferences in order to gain a more favorable outcome (FISHER, 2001). Any minimally useful

voting system has some form of tactical voting (GIBBARD 1973, SATTERTHWAITE 1975). However, the type of tactical voting and the extent to which it affects the results of the election vary dramatically from one voting system to another (BLAIS, NADEAU, GINDEGIL and NEVITTE, 2001, DUTTA, JACKSON and Le BRETON 2001, MacINTYRE 1995).

Frequently voting is considered to be a domain issue for political sciences. While the focus of economics is on human behavior on the market place, characterized by data such as GDP, inflation, unemployment, income, consumption, investments, savings, trade, etc., in political sciences we study human behavior in the public arena, outside of the market, characterized by electoral preferences, political behavior in representative bodies, behavior of central, territorial and local governments etc. In both cases we have some observable data, time series, provided by statistical service, sample studies, electoral statistics etc. It was economics which started to understand that traditional dichotomy between "homo economicus" and "homo politicus" is counterproductive and that it is not possible to understand and explain economic phenomena without study of political behavior: in a society where 40% of GDP is redistributed by different decision making bodies, where provision of public goods is regulated by various councils, committees, parliaments, where positive and negative externalities lead to market failures, the doctrine of "self-regulated market place" and "invisible hand of competition" does not provide satisfactory answers to appealing questions. Thus, approximately since 1948, within the framework of economic sciences new disciplines emerged, studying the problems of collective choice, bureaucracy behavior, rent seeking, voting behavior, institutions etc. In this respect we can speak about elements of application of economics methodology to political sciences. This approach extends power and deepness of economic analyses and provides new interesting theoretical and empirical results. It is interesting, that among Nobel Prize Laureates for economics it is possible to find outstanding scientists representing this orientation in economics: Kenneth J. Arrow (1972), James M. Buchanan (1986), John Nash, John Harsanyi and Richard Selten (1994), Amartya K. Sen (1998).

In this project we follow the Duncan Black's idea that "Economics and Political Science are the same in kind: that when we do eventually obtain a 'satisfactory' Political Science, it will have the same distinguishing marks as Walras' Elements or Pareto's Manuel, or perhaps Marshall's Principles, with the admixture of the rigorously formal and the descriptive treatment – rather than those of the existing texts in Politics. And the core of the treatment, we hold, will consist of a set of formal or mathematical propositions".[1]

Generally one credits James Buchanan, the Nobel Prize Laureate, and Gordon Tullock as the intellectual fathers of economic theory of politics. Their book from 1962 *Calculus of Consent* remains a classic in the relevant literature. But some of the ground-stones of the public choice were laid before James Buchanan and Gordon Tullock introduced the whole area as a separate field of economic theory.

Another Nobel Prize Laureate, Kenneth Arrow, formulated the basic problem of discovering of social preferences in his work from 1951 *Social Choice and Individual Values*. In 1958 Duncan Black in his book *The Theory of Committees and Elections* and in 1957 Anthony Downs in *Economic Theory of Democracy* extended concepts of economic competition to political competition. Indian economist and 1998 Nobel Prize Laureate Amartya K. Sen contributed to the economic theory of justice (*Collective Choice and Social Welfare*, 1970). Game theory, developed in the 40's by John von Neumann and Oskar Morgenstern provided the theorists with adequate methodology. In 1954 Lloyd Shapley and Martin Shubik started the branch of research focused on power analysis.

We also should not forget contribution of outstanding scientists of the 18th and 19th centuries, who were forgotten for many years and rediscovered only in the second half of 20th century in relation with the new wave of voting theory development. French mathematicians Marquis de Condorcet (1743 - 1794), who was also an important political figure shortly after the Great French Revolution, and Jean Charles de

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[1] Quoted from: Black, D., The Theory of Committees and Elections, revised second edition, edited by Iain McLean, Alistair McMillan and Burt L. Monroe, Kluwer Aacademic Publishers, Boston, Dordrecht, London, 1998, 353-361.

Borda (1733-1799), contributed to intellectual background of democratic ideas and originated the mathematical theory of voting. In 19th century, British mathematician Charles Dodgson (1832-1898), better known as Lewis Carroll, the author of Alice in Wonderland, extended the theory of voting.

3. Objectives of the project, research topics and time schedule

Research objectives have a methodological part and an empirical part. While methodological part is focused on extension of rational voters' behavior models, including models of strategic voting and manipulation with different levels of voters rationality, empirical part is concentrated on analysis of electorate behavior in Czech Republic during 1992-2010 and different alternatives of voting rules in European Union. Game theoretical approaches and multi-criteria optimization models applied to voters' behavior.

The following **research topics** will be considered:

1. Models of rational voter behavior and extensions
   a) Axioms of rational voters' behavior.
   b) Voting systems (Condorcet, plurality, Borda, Dodgson, approval) and impossibility theorem
   c) Efficiency of voting procedures
   d) Models of rational voters' behavior: game theoretical models and multi-criteria optimization models, properties
   e) Strategic voting and/or manipulation, non-existence of non-dictatorial and non-manipulative voting procedures
   f) Types of manipulation (classification)
   g) Manipulability of different voting procedures
   h) Information complexity of manipulation

2. Models with non-rational, semi-rational and rational voters
   a) Concepts of voter's rationality
   b) Rational voter = second best outcomes?
   c) Semi-rational voter = sincere rational voter?
   d) Manipulative rationality
   e) Non-rational voter = random voting?

3. Models of voting in small groups and decentralized committee systems
   a) Strategic voting in small groups
   b) Expert panels and selection committees: evaluation of projects (alternatives)
   c) University decision making
   d) Public finance, strategic voting and financing of public good
   e) Voting in the EU decision making procedures
   f) Distribution of voting power and strategic voting in committees.

4. Empirical study
   a) New electoral history of the Czech Republic (1992-2010)
   b) Voting rules in the EU decision making

Preliminary time schedule

Permanent research seminar of the project during 2009-2111 with presentation of partial results will be organized on bi-monthly basis

2009, January-June
Topics 1a) – 1d), methodological background of analysis

2009, July-December

Topics 1e)-1h), strategic voting is not cheating, strategic voting and manipulation

2010, January-June
Topics 2a)-2e), rationality in voting models

2010, July-December
Topics 3a)-3e), voting in small groups and complex voting systems

2011, January-June
Topics 4a)-4b), Empirical analysis and applications

2011, July-December
Closing workshop with presentation of results
Finalization of outputs

4. Expected outputs

In methodological part of the research:

a) Systematic development of voting models as multi-criteria optimization problems. Research paper: "Modeling voting as a multiple-criteria optimal choice" for an impacted journal.

b) Theory of different degrees of voters' rationality: models with rational voters, semi-rational voters and non-rational voters, models with mixed rationality of agents. Research paper: "Voting games with mixed rationality of agents" for an impacted journal.

c) Information and strategic voting and manipulation, information complexity in models of strategic voting. Research paper: "Strategic voting and its information complexity" for an impacted journal.

In empirical part of the research:

d) Analysis of results of election in the Czech Republic during 1992-2010. Research paper: "New electoral history of the Czech Republic" for a reviewed journal.

e) Analysis of alternative projects of decision making rules in the European Union and implications for the Czech Republic. Research paper: "Czech Republic and decision making games in the EU" for a reviewed journal.

All outputs mentioned above will be presented in English.

5. Elements of methodology

General model of voting as it is treated by social choice theory (SCHOFIELD 1996) is based on the concept of voting choice function. Voting choice function is defined as a mapping

$$C : T \times \mathrm{R}^U \rightarrow 2^U , C(A,R) \subseteq A \text{ for all } (A,R) \subseteq T \times R^U$$

where U is the universe of alternatives, $A \subseteq U$, $T = 2^U - \emptyset$ be the set of all non-empty subsets of U, R^U be a non-empty finite set of all preference profiles defined over U. That is, for each element $(A,R) \in T \times R^U$ the voting choice function C chooses precisely one element $C(A,R) \in 2^U$, subject to the restriction that $C(A,R)$ is a subset of A for all (A,R) in $T \times R^U$. So the voting choice function is not just a rule for some particular voting situation, but it is a function defined on the set of all thinkable voting choice situations from the set $T \times R^U$ with domain of "values" 2^U (the "values" are subsets of U).

Here we provide a general methodological framework of our analysis leading to a more instrumental model based on combination of optimization and game theoretical models (TURNOVEC 1997). We assume that voting is multiple criteria decision-making whenever a voter casts votes to select candidates or alternative policies (using single criterion is a special case). A rational voter's behaviour can be viewed within the framework of a standard consumer behaviour pattern: voting for candidate(s) he is "buying" a policy represented by candidates maximizing his "utility" subject to a "budget constraint" given by the used voting procedure.

To formulate a model of single voter behaviour we shall start with an analogy of the consumer's budget constraint, which we shall call a voting constraint. Let m be the number of candidates (i = 1, 2, ..., m) and v be the number of votes the voter can use. Let x_i be the number of votes the voter gives to the i-th candidate. In general x_i may be any non-negative number. A vector $\mathbf{x} = (x_1, x_2, …, x_m)$ permissible under a particular voting system will be called a voter's feasible strategy. In a general case voting means to select a feasible strategy from the set $X = [\mathbf{x} \in R_m, \sum\limits_{i=1}^{m} x_i \le v, x_i \ge 0, x \in D]$, where D is an additional requirement (e.g. only integers are allowed) on the votes reflecting properties of a specific voting system. The algebraic system $\sum\limits_{i=1}^{m} x_i \le v, x_i \ge 0, x \in D$ defining feasible voting strategies we term a voting constraint. From the point of view of an individual voter, a voting decision (under some particular voting system) means to select and state or submit exactly one feasible voting strategy from the corresponding feasible set, given by the voting constraint. We can suppose that the voter is a rational agent that uses his resources (given by the voting constraint) in the "best" possible way: he selects one of his feasible strategies which is "most preferred" by him in some sense (TURNOVEC 2003).

Usually it is supposed that each rational voter has a well-behaved preference relation on the set of candidates, which is at least complete, reflexive and transitive (weak ordering), sometimes also anti-symmetry is required (strong ordering). But the process of discovering this preference relation remains unclear. Clearly the candidates' qualifications may be judged by multiple criteria, such as trustworthiness and/or honesty, capabilities, general political stance (conservative, moderate, liberal), and positions on specific political issues, evaluated from the standpoint of voter's interests. These criteria are summarised in the voter's mind, to produce a value (utility) function. Then the voter rates the candidates as to the first choice, second, third, etc., based upon the voter's utility function toward the candidates. Multiple criteria decision making theory provides an appropriate methodology to describe and analyse this rather vague process of forming an individual voter's utility function. Stating an individual voter's optimal choice problem as a multi-criteria optimization problem we shall start with several trivial and, in a sense, simplifying assumptions:

a) *Multiple issues*. We shall suppose that there is a list of major political issues $\pi = (\pi_1, \pi_2, ..., \pi_k)$ where $k > 1$ and that an individual voter is able to rank the issues by their importance to him. Let us denote the voter's ranking over this list by $\mathbf{b}_j = (b_{j1}, b_{j2}, ..., b_{jk})$, where b_{js} is an integer between 0 and t, expressing the position of the s-th issue in the j-th voter's ordering, or a cardinal measure (say, between 0 and 100) expressing the relative importance of the issue to the voter.

b) *Observability of candidates' position*. We suppose that each candidate or party publicly states his own ranking over the list of major political issues. Let us denote the i-th candidate ranking by $\mathbf{a}_i = (a_{i1}, a_{i2}, ..., a_{ik})$.

c) *Trustworthiness* of the candidates. We suppose that there is no uncertainty about the future position of the candidates (publicly declared rankings express the true position of the candidates).

Let us suppose the following proportional voting rule for electing a committee, called a *portfolio voting rule* (TURNOVEC, 1995): Each voter chooses among party lists. Let n be the number of voters, m be the number of parties, and v be the number of seats in a committee. Each voter has k votes (as many votes as

the number of seats). By x_{ji} let us denote a number of seats assigned by the j-th voter to the i-th party. For simplicity, we suppose that all voters take part in the election and use all their votes, then

$$\sum_{i=1}^{m} x_{ji} = v, \; w_{ji} = \frac{x_{ji}}{v}$$

(for all $i = 1,2,...,m$ and $j = 1,2,...,n$) and $\mathbf{w}_j = (w_{j1}, w_{j2}, ..., w_{jm})$ is an j-th *individual voting portfolio*, or an j-th voter feasible voting strategy. Then $\boldsymbol{\alpha} = (\alpha_1, \alpha_2, ...,\alpha_m)$ such that $\alpha_i = \dfrac{\sum_{j=1}^{n} w_{ji}}{n}$ is a *social voting portfolio* according to which the seats are to be distributed in a committee. As before we denote the i-th voter ranking over a list of major political issues by $\mathbf{b}_i = (b_{i1}, b_{i2}, ..., b_{ik})$. Each party declares its own ranking over the issues $\mathbf{a}_i = (a_{i1}, a_{i2}, ..., a_{ik})$.

The individual voter's rational behaviour can then be defined by an optimal solution to the following goal programming problem:

minimize

$$d(\sum_{i=1}^{m} w_{ji}\, \mathbf{a}_i, \mathbf{b}_j) \tag{1}$$

subject to

$$\sum_{i=1}^{m} w_{ji} = 1, \; w_{ji} \geq 0 \tag{2}$$

where d is a distance between the j-th individual ranking and the aggregate committee ranking generated by the j-th voter's voting portfolio. An optimal solution $\mathbf{w}_j^0 = (w_{j1}^0, w_{j2}^0, ..., w_{jm}^0)$ to the problem (1) - (2) we can call an *j-th individual optimal voting portfolio*. Traditional model with possibility to vote for one alternative (candidate) only is a special case of (1)-(2) with 0-1 variables.

An obvious criticism of this model of rational voting behaviour in portfolio voting follows from the fact that the level of satisfaction of an individual voter with the results of voting depends not only on his decision, but also (and to a very great extent) on decisions of many other voters. It ignores strategic aspects of voting. A sophisticated voter is aware of the fact that his individual voting portfolio will certainly differ from a social voting portfolio and his satisfaction should be measured by a distance between his individual ranking and the aggregate committee ranking generated by the social voting portfolio, rather than by the individual voter's portfolio.

The distance between the r-th individual ranking and the aggregate committee ranking generated by a social voting portfolio $\boldsymbol{\alpha}$ can be measured by the r-th voter's distance function

$$\delta_r(w_r, w_1, ..., w_{r-1}, w_{r+1}, ..., w_n) = d\left(\frac{1}{n} \sum_{i=1}^{m} \left(w_{kj} + \sum_{j\_r} w_{ji} \right) a_i, b_r \right) \tag{3}$$

where only the individual portfolio variables w_{ri} are under the control of the r-th voter. Therefore, we can formulate a game of the n voters with the pay-off functions (9.3) and the strategy sets

$$W^{(r)} = [\, w_r \in R_m, \sum_{i=1}^{m} w_{ri} = 1, w_{ri} \geq 0 \,] \tag{4}$$

and look for optimal strategies in such a game.

Let $a_i = (a_{i1}, a_{i2}, ..., a_{ik})^T$, $i = 1,2,..., m$ be generic points defining a feasible allocation space as the convex hull (a set of all convex combinations) of $\mathbf{a}_i$:

$$\wp = [\, p \in R^k : p = \sum_{i=1}^{m} a_i \alpha_i,\ \sum_{i=1}^{m} \alpha_i = 1,\ \alpha_i \geq 0 \,]$$

Let $\mathbf{b}_j = (b_{j1}, b_{j2}, ..., b)^T$, $j = 1,2,..., n$ be some points of individually preferred locations of n individuals (one point for each individual), in general case different from $\mathbf{a}_i$. The problem is to select a single location $\mathbf{p}^0 \in P$ such that the distance of all individually preferred points $\mathbf{b}_j$ to $\mathbf{p}^0$ is "as small as possible". Let us assume the following method of selection:

Each individual j presents his "weighting vector" $\mathbf{w}_j = (w_{j1}, w_{j2}, ..., w_{jk})$ such that

$$\sum_{i=1}^{m} w_{ji} = 1,\ w_{ji} \geq 0$$

Then the individual weights are aggregated into "social" weights

$$\alpha_i^0 = \frac{\sum_{j=1}^{n} w_{ji}}{n}$$

and location

$$p^0 = \sum_{i=1}^{m} a_{is}\, \alpha_s^0$$

is selected.

Using a distance function d we can define the distance of the r-th individual's preferred location from selected point

$$d(p_0, b_r) = d(\sum_{i=1}^{m} a_i \alpha_i^0, b_r) = d(\frac{1}{n} \sum_{i=1}^{m} a_i \sum_{j=1}^{n} w_{ji},\ b_r)$$

Assuming that each individual is making his decision independently on all other individuals we can model the problem of individual weights selection by the minimization of each r-th individual distance from selected point

$$d(\frac{1}{n}(\sum_{i=1}^{m} a_i\, w_{ri} + \sum_{j\_r} \sum_{i=1}^{m} a_i\, w_{ji}),\ b_r) \tag{5}$$

where the r-th individual controls only his individual weights w_{ri}.

Assuming Euclidean distance d in (5) we receive

$$\sqrt{\sum_{s=1}^{m} [\frac{1}{n}(\sum_{i=1}^{m} a_{is}\, w_{ri} + \sum_{j\_r} \sum_{i=1}^{m} a_{is}\, w_{ji}) - b_{rs}]^2} \tag{6}$$

Clearly the root of the sum of square deviations has the minimum in the same point as the sum of square deviations, so minimization of (6) can be substituted by minimization of the sum of squares function

$$\sum_{s=1}^{m} [\frac{1}{n}(\sum_{i=1}^{m} a_{is}\, w_{ri} + \sum_{j\_r}\sum_{i=1}^{m} a_{is}\, w_{ji}) - b_{rs}]^2$$

By a distance game (Turnovec 1997) we mean here the non-cooperative game of n players with pay-off (minimizing) functions

$$M_r(w_1,...,w_r,...,w_n) = \sum_{s=1}^{k} [\frac{1}{n}(\sum_{i=1}^{m} a_{is}\, w_{ri} + \sum_{j\_r}\sum_{i=1}^{m} a_{is}\, w_{ji}) - b_{rs}]^2 \qquad (7)$$

and strategy sets

$$W^{(r)} = \left[w_r \in R^m : \sum_{i=1}^{m} w_{ri} = 1, w_{ri} \geq 0 \right] \qquad (8)$$

Using and extending model (1)-(8) we can introduce explicitly strategic voting based on different levels of different voters' information about the other voters' preferences, use approaches of games against nature, games with sophisticated and indifferent players, a coalitional cooperation etc.

6. Importance of the project and dissemination of results

Project has an ambition of fundamental research in the topic (problems of strategic voting, manipulation and information complexity) with applications on ex-post analysis of electoral behavior in the Czech Republic on parliamentary, regional and municipality levels and evaluation of different alternatives of decision making rules discussed in the European Union.

This research area is underdeveloped in the Czech Republic and mostly neglected by domestic political sciences departments. Methodology of economics can contribute to deeper understanding of the mechanisms of democratic decision making and properties of corresponding procedures.

New results will be submitted to refereed scientific journals, presented at the scientific conferences (European Public Choice Society, European Economic Society, Czech Economic Society, Group an negotiation etc.) and at the final workshop in 2011.

Some of the results (European Union decision making analysis) could clarify the issue from the point of view of position and interests of the Czech Republic in ongoing reforms (fairness versus efficiency, protection of minorities etc.).

As a part of the outputs the monograph "Arithmetic of Voting and Calculus of Power" (in Czech language) will be prepared and submitted to Karolinum, Charles University Press to provide non/technical survey of economics of political markets for broader audience in the Czech Republic..

7. International cooperation

Research team will benefit from long term cooperation with other European academic institutions oriented on similar research topics: Institute of Socio-Economics of University of Hamburg (Prof. Manfred Holler), Institute of Industrial Organization of Wroclaw University of Technology (Prof. J. W. Mercik), University of Turku (Prof. Hannu Nurmi), and Department of Politic al Sciences of University of Leiden (Prof. Madeleine Hosli).

8. Research team and division of labor

Research team from Institute of Economic Studies, Faculty of Social Sciences of Charles University in Prague consists of two experienced researchers (František Turnovec and Martin Gregor), two doctoral students (Lenka Gregorová and Pavel Doležel) and one expert on databases (Monika Hollmannová). All of them have experience from the PhD GAČR grant "Economic Theory of Political Markets", 2005-2008) and have published results from the field.[2] Institution provides favorable conditions for research (library, computer services, and general support).

Division of labor:
František Turnovec: coordination of the project, research seminar "Political economy of voting", topics 1 (Models of rational voter behavior and extensions), 2 (Models with non-rational, semi-rational and rational voters) and 4 Empirical study.
Martin Gregor: topic 3 (Models of voting in small groups and decentralized committee systems) and topic 4 (Empirical study).
Lenka Gregorová: topic 3 (Models of voting in small groups and decentralized committee systems) and topic 4 (Empirical study).
Pavel Doležel: topic 2 (Models with non-rational, semi-rational and rational voters) and 4 (Empirical study)
Monika Hollmannová: database services, archive and web-page of the project.

9. References

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[2] See e.g.: Turnovec F., Mercik J., Mazurkiewicz M. (2008): *Power Indices Methodology, Decisiveness, Pivots and Swings*. In: Braham M. and F. Steffen (eds.), Power, Freedom and Voting, Conceptual, Formal and Applied Dimensions. Springer, Heidelberg, New York, 22-36. Turnovec, F. (2000): *Electoral Rules and the Fate of Nations, Czechoslovakia's Last Parliamentary Election*. In: Irreconcilable Differences? Explaining Czechoslovakia's Dissolution (eds. M. Kraus and A. Stanger), Rowman and Littlefield, Lanham, MD, 107-136. Turnovec, F. (2000): *Rozhodování o nadměrných rozpočtových deficitech v EMU* [Decision Making on Excessive Budget Deficits in the EMU]. Finance a úvěr, **50**, No. 6, 348-360. Turnovec, F. (2000), *New Issues in Voting Power Analysis*. Prague Economic Papers, 9, No. 2, 171-186. Turnovec, F. (1998): *Monotonicity of Power Indices*. In: Trends in Multicriteria Decision Making (Stewart, T. J. and R. C. van den Honert, eds.), Springer-Verlag, Berlin, 199-214. Turnovec, F. (1997): *Power, Power Indices and Intuition*. Control and Cybernetics, **26**, 613-616. Turnovec, F. (1997): *The Double Majority Principle and Decision Making Games in Extending European Union*. Institute for Advanced Studies, East European Series No. 48, Vienna. Turnovec, F. (1997c): *Votes, Seats and Power; 1996 Parliamentary Election in the Czech Republic*. Communist and Post-Communist Studies, 30, No. 3, 289-305.Turnovec, F. (1997): *Rozhodovací proces a poměr zastoupení národních reprezentací v orgánech Evropské unie*. [Decision Making Proces and Proportionality of National Representation in the EU Institutions]. Parlamentní zpravodaj [Parliamentary Review], **3**, No. 7, 297-301. Turnovec, F. (1997): *Unexpected Results of the 1996 Czech Senate Elections*. Central European Journal for Operations Research and Economics, 5, No. 1, 89-94. Turnovec, F. (1997): *MCDM and Models of Voting Decision Making*. In: Multiple Criteria Decision Making (ed. G. Fandel and T. Gal), Springer Verlag, Berlin, Heidelberg, New York, 212-221. Turnovec, F. (1997): *Distance Games and Goal Programming Models of Voting Behaviour*. In: Advances of Multiple Objective and Goal Programming (eds. R. Caballero and R. E. Steuer), Springer Verlag, Berlin, Heidelberg, New York, 102-110. Turnovec, F. (1996): *Weights and Votes in European Union: Extension and Institutional Reform*. Prague Economic Papers, No. 2, 161-174. Turnovec F. (1995), Voting as an Optimal Choice., Prague Economic Papers, 4, No. 3, 277-284. Turnovec, F. (1995): *The Political System and Economic Transition*. In: The Czech Republic and Economic Transition in Eastern Europe (Svejnar, J. ed.), Academic Press, New York, 47-103. Gregor M. (2005), Nová politická ekonomie [New Political Economics], Karolinum, Praha. ISBN 80-246-1066-3. Gregor M. (2004), *Governing Fiscal Commons in an Enlarged EU*. In: Kotabova, V., Prazova, I. a O. Schneider (eds.), Rozvoj česke společnosti v Evropské unii - 2.dil, Ekonomie a politologie. Matfyzpress, Praha 2004, str. 130-159. ISBN 80-86732-35-5.

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