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Market Prices as Indicators of Political Events
Evidence from the Experimental Market on the
Czech Republic Parliamentary Election in 2002

TOMÁŠ CAHLÍK, ADAM GERŠL, MICHAL HLAVÁČEK
AND MICHAEL BERLEMANN *

Abstract

According to efficient markets theory, the stock price on a competitive market is the
best estimate of the stock’s present value. This is the basic assumption for predictions using
experimental markets. The first part of the paper describes the features of such an
experimental market, discusses shortly its advantages in providing predictions as compared to
traditional opinion polls and identifies some assumptions that can influence its efficiency and
predictive accuracy. The second part of the paper is then devoted to the results of the first
experimental market organized in the Czech Republic, the political stock market on the Czech
parliamentary elections into the Chamber of Deputies in June 2002.

Keywords: Experimental economics, political stock markets, predictions.
JEL Classification: C900, D800, G140

* Tomáš Cahlík (cahlik@mbox.fsv.cuni.cz, Charles University in Prague, Faculty of Social Sciences,
Institute of Economic Studies), Adam Geršl (gersl@mbox.fsv.cuni.cz, Charles University in Prague, Faculty of
Social Sciences, Institute of Economic Studies and Czech National Bank), Michal Hlaváček
(hlavacem@mbox.fsv.cuni.cz, Charles University in Prague, Faculty of Social Sciences, Institute of Economic
Studies and Czech National Bank), Michael Berlemann (berleman@rcs.urz.tu-dresden.de, Dresden University of
Technology, Faculty of Business Management and Economics, Chair for Monetary Economics). Authors would
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1. Introduction

According to efficient markets theory, prices in stock markets reflect all available information and are the best estimates of the present value of traded assets. The same hypothesis underlies experimental stock markets. In this paper we describe the first experimental stock market organized in the Czech Republic, the political stock market on Czech Parliamentary Elections into the Chamber of Deputies in June 2002 and discuss how the market could be used to forecast the election outcome. We also discuss the accuracy of the market forecast and possibilities to transfer the method to forecasting other genuine economic events like future inflation.

During the last ten years a rising interest in using experimental markets to predict electoral outcomes could be observed. The pioneers of political stock market research Forsythe et al. (1995, 1999) designed and implemented the Iowa Presidential Stock Market (IPSM, later as Iowa Electronic Markets or IEM) in 1988 to yield predictions of the expected vote shares of Presidential candidates in that fall’s election. Inspired by the predictive success of the pioneer market a large number of political markets was further conducted in the U.S. and Europe, for example in Germany (Beckmann and Werding 1996, Brüggelambert 1997, Berlemann 2000), Austria (Ortner et al. 1995), the Netherlands (Jacobsen et al. 2000) or Sweden (Bohm and Sonnegard 1999).

The purpose of our research was to introduce the political stock market method in the Czech Republic and to yield predictions of the expected vote shares of the political parties in the parliamentary election into the Chamber of Deputies in 2002. The “2002 Czech Election Market” was conducted over Internet using the market platform of Dresden Electronic Markets (DEM) at Dresden University of Technology. The participants of the market were students and teachers at the Faculty of Social Sciences at Charles University in Prague. Because a number of traders were students of economics (often in specialization capital markets) and the market features (the way the trade exchange is organized) were not so different from the ones of the real stock markets, the project had also educational purposes. Third aim, and a “by-product” of the project, was to create a list of potential participants of further experimental markets planned in the Czech Republic.

The paper is organized as follows. In Section 2 we describe the prototype experimental stock market and discuss some basic trading strategies, compare advantages and disadvantages of the predictions made via experimental markets and via traditional polls, and we list some suggestions for raising efficiency of the experimental markets. In Section 3 we describe the results of the „2002 Czech Election Market“ and compare the prediction of this market with the predictions made by traditional political opinion research. In the final section we conclude and broadly outline our plans for further research in this field.

2. Experimental Political Stock Markets

2.1 Market Description

Political stock markets are typically fully computerized real-money futures markets operated over the Internet. Registered participants invest their own money, buy and sell contracts with the motivation to make profits and they bear the risk of losing as well as earning money. A by-product of the market is a prediction of the results of some political event, typically an election outcome.

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1 See Sunder (1995, p. 446) or Forsythe et al. (1992, p. 1142).
2 A comprehensive survey of political stock markets conducted in Europe and an assessment of their predictive accuracy can be found in Berlemann and Schmidt (2001).
The organizer of a political stock market issues contracts which are then traded among the participants. Every contract represents a promise to pay a liquidation value (after the election, of course) based upon the fraction of the popular vote received by the political party on which the contract was issued. Typically, contracts are issued on each major political party. In addition a contract for all parties not explicitly listed is issued, which is called „Rest of Field“ (mainly a bundle of minor parties with small expected vote shares).

If, for example, Party A won 20 percent of the votes, Party A contracts will be liquidated at 0.20 times the price of a unit portfolio as sold by the market organizer (for example 1 CZK). With the liquidation values determined this way, a unit portfolio (also called “bundle”) consisting of one contract for each party (including the „Rest of Field“ contract) is always liquidated for the price of 1 CZK in the end of the market because vote shares are always summing up to 100 percent. At the same time, if markets are efficient, the current price at which any particular contract is traded is a prediction on the fraction of votes traders expect to be won by the party on which the contract was issued.

In order to be allowed to take part in a political stock market and trade contracts, participants have to register via Internet, first. By registration some basic personal data and the decision about initial investment is required. After supplying the initial investment (typically via cash or bank transfer to market account) the traders get a trader-ID and a password to login the market. In addition, a cash account for each trader is created and the initial investment is transferred to the account. From this account a trader can draw funds to buy contracts. Purchases of contracts will result in transfers of contracts to the trader’s portfolio and the deduction of money from the cash account. Analogously, sales of contracts will result in transfers of contracts from trader’s portfolio to that of the buyer and crediting of the trader’s cash account.

The traders can access the market via Internet. There is no fee for trading. Trading in the market is completely anonymous, but the program keeps track of every trader’s portfolio, cash balances, outstanding offers to buy and sell contracts and all past transactions. This information can be accessed only by the organizer of the market who at the same time is therefore not allowed to trade in the market.

Contracts are placed into circulation when traders purchase unit portfolios from the market organizer for a set price of \( W \), typically 1 CZK. Each unit portfolio consists of one of each type of contract. As already mentioned, any such unit bundle is liquidated again by 1 CZK at the end of the market. Thus, a 1 CZK investment in a unit portfolio held to liquidation will yield a payoff of 1 CZK to the trader. The organizer of the market stands ready not only to sell unit portfolios but as well to repurchase them for the price of 1 CZK each at any time during the market period. Buying and selling portfolios from or to the market organizer are primary market transactions and they bear no risk, but no gains for the trader as well. The investment/payoff rule just described guarantees that the market is a zero-sum game for the market organizer. All funds invested by traders are returned to them and gains by one trader are exactly offset by losses of other traders. However, the individual participant can win or loose money, depending on his or her success in trading within the secondary market (with

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3 Another possibility is the contract on the fraction of seats won by the political party in parliament, see Forsythe et al. (1999, p. 85).
4 The investments are typically somewhat restricted due to legislative restrictions in order to provide a clear signal about the academic research character of the market, see Berlemann (2002, p. 14) or Forsythe et al. (1999, p. 86).
5 It is allowed to raise own funds by transferring further money to the own cash account (eventually up to the upper limit if it exists), but it is not allowed to withdraw money from the cash account before closure of the market.
other traders, described hereafter). Thus, taking part in political stock markets is typically no zero-sum game for traders.

The described method of issuing and liquidation of contracts has some further advantages. If, for example, the probability of success in the election of a certain political party (let’s say party X) meanwhile included in the „Rest of Field“ contract rises considerably, the organizer of the market can simply split the Rest of Field contract into two new contracts – a party X contract and a new Rest of Field contract. Every participant who holds Rest of Field contracts in his portfolio is then endowed with the same number of the two new contracts. The method of splitting contracts can be applied for other purposes as well, for example in the case of a split of a political party into two successors. Analogously, parties with expectations of diminishing vote shares can be ad hoc added into the Rest of Field contract or simply merged. The issuing and liquidation method is therefore independent of the current political situation and could be applied anywhere and almost by any political change occurring during the market period. The decision about splitting or merging is then made by the organizer of the market who acts with the aim of raising the market’s efficiency.

After buying some number of unit portfolios from the organizer, the trader can unbundle the contracts immediately and trade them individually within the secondary market, i.e. buy or sell contracts from or to other traders, in order to realize profits. The secondary market is usually organized as a so-called „continuous double-auction-market“. Traders can thus issue offers to buy (bids) or offers to sell (asks) contracts.

The first type of transactions traders can use in the secondary market is called „limit orders“. By using limit offers a trader has to specify

(a) the order type (bid or ask),
(b) the contract type (for example „party A contract“),
(c) the number of contracts he wants to trade,
(d) the transaction price (typically a „limit price“; by bids the highest price, by asks the lowest price the trader is willing to accept) and

(e) the expiration date of the order.

The order can for example correspond with following oral expression: „I would like to buy 10 party A contracts for the price of 0.23 CZK or lower and my offer lasts till February, 5th“ (because, for example, I expect that the party A will win more than 23 percent of the votes). Limit offers are then maintained in bid and asks queues, ordered first by offer price and then by time of issuance. When an offer enters the bid or ask queue, it remains there until one of the following events occurs:

(a) it is withdrawn by the trader who issued it,
(b) it reaches the top of the bid queue (or bottom of the ask queue) and is subsequently matched with an opposing offer, or

(c) it reaches its expiration date.

Short sales and purchases are disallowed by the system. In order to be able to issue a bid the trader must have sufficient funds on his market cash account. Similarly, to issue an ask the trader must have the supplied contract in his portfolio. Checks for feasibility of offers are made immediately after entering the offer.

The system carries out orders whenever bid-prices and ask-prices overlap. The principles for the execution of trades are as follows: (a) offers to buy are processed „high-prices first“; (b) offers to sell are processed „low-prices first“; (c) in the case of ties (two offers at the same price), the earliest offer to arrive on the market is processed first; and (d) when bid and ask prices overlap the trade is executed at the price of the older of these two offers.
Thus, when a new feasible offer to buy is entered with a price equal to or exceeding the current minimum price in the ask queue, the trade is immediately carried out at the (older) ask price. Analogously, a newly entered ask with a price equal to or less than the current maximum price in the bid queue is executed at the (again older) bid price. Other offers with bid prices less than the current minimum price in the ask queue and ask prices exceeding the current maximum price in the bid queue are placed in the respective queues. If a feasible limit offer can be executed only in part, the trade is then carried out to the possible extent and the rest is further maintained in the respective queue.

Traders are provided with a considerable amount of real time information. They have access to all their own private account information: which contracts they hold in their portfolios, what their cash balances are, outstanding bid and ask orders and which transactions they have completed. Every trader has further access to market information which includes:

(a) the current maximum bid price with the number of contracts demanded at that price,
(b) the current minimum ask price with the number of contracts supplied at that price,\(^6\)
(c) last transaction prices and
(d) a summary of past trading activity (development of the transaction prices from beginning of the market, volumes of contracts traded on each day).

In addition, as a combination of private and public information, the market software is computing an estimate of the trader’s portfolio value based on the last transaction prices.

The second type of transactions traders can use is called „market orders“. In comparison with limit offers a trader chooses here only order type, contract type and volume. The trade is then executed immediately at current prices (current maximum bid price for market orders to sell and current minimum ask price for market orders to buy). If the number of contracts specified in the market order exceeds the amount available at the current price, the trade is executed only to the possible extent and the rest of the order is cancelled.

Before we turn to strategies traders can use within the market it is worth asking why people trade at all in political stock markets. The zero-sum nature of the game is the main argument against participation: when a potential trader considers his chances to make profits in such a market he knows that on average the expected profit is zero. However, this is true only if all traders had the same information. In reality we observe people participating in political stock markets. Forsythe et al. (1992, p. 1145) lists the following five reasonable motives for participation:

(a) a novelty factor (a trader treats participation in the political market like a substitute to other leisure-time activities of that kind, such as playing computer games, surfing Internet etc.),
(b) a confidence factor with regards to information (a trader believes that he has better knowledge about the election and its likely outcome relative to the knowledge of other traders; this difference in information means that the trader treats the market for himself as a non-zero-sum game),
(c) a confidence factor with regards to interpretation ability (the trader believes his ability to interpret news and their impact on the election outcome is better relative to other traders),
(d) a confidence factor with regards to talent as a trader,

\(^6\) In some markets the information about the amount demanded (supplied) at the maximum bid (minimum ask) price is not available so the trader can be only sure to be able to buy or sell at least one contract at actual price, see Berlemann (2002, p. 18)
2.2 Basic trading strategies

The trader can choose from a variety of strategies in order to yield profits. According to Berlemann (2002, p. 18), we might think of the following four types of possible strategies that can be of course combined in several ways:

(a) arbitrage strategy,
(b) expectation strategy,
(c) risk-adjusted expectation strategy and
(d) speculative strategy.

When choosing arbitrage strategy, the trader focuses on realizing risk-free profits. Arbitrage operations are possible if the sum of all actual bids to buy is above the price of unit portfolio (typically 1 CZK) or if the sum of all actual asks to sell is below the price of unit portfolio. In the former case a trader can buy a unit portfolio from the market organizer and sell it immediately at current prices within the market. Analogously, in the latter case a trader can buy a unit bundle at current prices within the market and sell it on the primary market for 1 CZK. This strategy to gain profit is of course possible only if none of the current bids or asks was issued by the trader considering an arbitrage operation. Berlemann (2002, p. 18) discusses the risk-free nature of this strategy and comes to the result that “the described arbitrage strategy is not totally risk-free because of the risk that during the arbitrage transactions someone may withdraw his order”. There is as well a possibility that some trader is faster and executes the risk-free arbitrage operation earlier. These risks are greater when trading in web-based markets as opposed to telnet markets because actual information could be gained only by reloading the web site. But if we take into account that arbitrage transactions take only few seconds the risks are very small and can be neglected.

The expectation strategy requires that traders built some expectation on the election outcome and then buy only those contracts which are in their opinions undervalued by the market and sell those contracts which are overvalued. This strategy is of course not risk-free anymore and its success is based on the quality and accuracy of the traders’ expectation.

The risk-adjusted expectations strategy is some kind of variation of the simple expectations strategy. It assumes a trader to know that his or her expectation on the election outcome could be wrong or simply imperfect. Such a trader will also buy in his opinion undervalued contracts and sell overvalued contracts; but in comparison with a trader following the simple expectations strategy he will more carefully weigh up possible profits if his expectation turns out to be correct against possible loss if it is wrong. Ceteris paribus, if a trader following the risk-adjusted expectations strategy faces rising market price of some contract, he will sell the contract earlier than a trader with simple expectations strategy.

The speculative strategy is based on a trader’s expectations of other traders’ behavior. Traders following this strategy are trying to make use of short- or middle-term trends of market prices. These traders will hold a contract even if they expect it to be overvalued as long as they expect prices will go on rising. If there are many traders following the speculative strategy it is possible that “speculative bubbles” arise and later burst, making the prediction power of experimental markets somewhat distorted.

2.3 Political Stock Markets versus traditional polls: what predicts better?

We have noted that if political stock markets are efficient, the current price at which any particular contract is trading is a prediction about the fraction of votes that traders expect to be won by the party on which the contract was issued. Because of the fact that markets close
short before election, the set of last transaction prices in the market before closing is a prediction of the election outcome generated by political stock market.

We should note that interim predictions based on transaction prices during the market existence may be biased because of possible speculative strategies practiced by some traders and possible resulting “price bubbles”. The near the closing date of the market, the less traders choose speculative strategy and the greater emphasis traders put on the expectation of the election outcome and not on the expectation of the other traders’ behavior. Thus, for comparisons of predictive accuracy with traditional polls we should use the last transaction prices.

Traditional political opinion researches or surveys (polls) are based on asking questions to a selected sample of population (respondents) about their personal preferences for candidates or political parties. The prediction is then computed from the gained raw data using some correction procedure based on empirically observed biases. The necessary conditions for predictive accuracy of polls are then (a) “representativeness” of the sample, (b) the quality (veracity) of the data and (c) the procedure used to correct the raw data. Thus, if the sample does not include some relevant part of population, or if respondents lie or the questions are not well stated, or if there is no appropriate correction method for possible biases, the forecast will not be accurate.

On the other hand, political stock markets have some indisputable advantages with regards to the above mentioned conditions: firstly, there is no need for the sample to be representative. Forsythe et al. (1999, p. 87) stress that “the markets do not require that traders reveal anything at all about their personal preferences for candidates or parties through their trading”. The role of traders is to try to predict better than other traders how the election outcome will be. Thus, they only need to have good information about aggregate voting behavior. But different from polls, the forecast generated by political stock market is obtained by marginal behavior of traders via last trading prices (due to the market mechanism the highest bid price and the lowest ask price which overlapped), not by the average of the traders’ opinions (as for example by the average price of ask or bid queue).

In order to get a good election forecast, there is thus no need that all traders be well informed about the probable election outcome. The necessary condition is only that at least a small part of traders is well informed, i.e. the information is available within the market. This is the so-called “Hayek hypothesis” which asserts that markets can work correctly even if the participants have very limited knowledge about their environment or about their participants. In the realm of experimental economics and political stock markets it means that “the efficiency of the market depends not on the average trader, but on what we call the “marginal trader”, a trader relatively free of judgment bias who consistently buys and sells at prices close to the equilibrium price” (Forsythe et al., 1992, p. 1143). Thus, political stock markets

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7 But in reality there were no “price bubbles” documented in political stock markets, so the argument is more a theoretical one. It could be therefore argued that the speculative strategy is as well only a theoretical one and that traders are more practicing the expectations or arbitrage strategy.

8 Berlemann and Schmidt (2001) or Berlemann (1999) mention for example so called “pressure of the climate of opinion” bias based on the tendency of people with preferences toward the political party which leads in the surveys to hide their true preferences. Another well known bias is the tendency of the supporter of extreme parties to cover their true preferences as well.


10 See one of Hayek’s most cited paper The Use of Knowledge in Society (Hayek, 1945). For the introduction of this thesis into the experimental economics see Smith (1982).
serve as a test of this hypothesis as well and empirical results from experimental economics have so far supported this thesis.\textsuperscript{11}

Secondly, political stock markets do not have to take care of systematic errors of traditional polls caused by methods of asking question, recording answers etc. Although there are some correction procedures applied by polls, there is no guarantee that the resulting forecast will be free of such errors.

Thirdly, there is a difference between motivations of people who are subject to the measurement of political opinion in traditional polls and in political stock markets. Pollsters have to rely on the goodwill of the interviewed persons who at the same time have no motivation to reveal their true political preferences.\textsuperscript{12} Additionally, there could be an incentive deficit or mistakes on the side of the pollsters as well. On the other hand, the traders in the political stock markets are highly motivated by the possibility of earning profits if they do the best from their information. As Berlemann and Schmidt (2001, p. 17) state, there is some kind of self-selection of the traders. Only those traders, who believe to have good information about the possible election outcome, take part in the market. Thus, non-informed traders have no incentive to enter the market and they do not influence the election forecast. There are some further advantages of political stock markets. If we neglect the possibility of speculative “price bubbles”, there is a prediction of election outcome at any time the market is running. Traditional polls are in contrast organized mostly on a weekly basis and there is moreover time needed to record, summarize and correct the data, which means that results from such surveys are somewhat outdated when published. We should mention as well that political stock markets are much cheaper to run than traditional polls.

But there are some advantages of traditional polls as well. For example, we cannot get some data about political preferences of certain social groups and sub-samples via political stock markets. There is moreover the “existence” question, i.e. could the political stock markets exist if there were no traditional polls? We should therefore consider both methods of forecasting as complements rather than substitutes because the published polls results are doubtless one of the main information sources which traders in the political stock market use.\textsuperscript{13}

Berlemann and Schmidt (2001) discuss the empirical evidence in Germany about predictive accuracy of political stock markets and traditional polls. They conclude that more than a half of the political stock markets conducted in Germany predicted better than traditional polls (on the 10% confidence level of statistical significance; for the testing methodology see part 3 of this paper). This could be a further argument for improving our predictions of political events by introducing political stock market method in addition to the traditional polls.

\textbf{2.4 Raising efficiency and predictive accuracy of political stock markets}

In order to get the best prediction of some political event, the political stock market must operate efficiently. As we have already mentioned, there is some evidence (at least in case of Germany) that some of the conducted markets performed well and some of them worse than

\textsuperscript{11} See Smith (1982) or Sunder (1995). Forsythe et al. (1992) or Forsythe et al. (1999) discuss the systematic judgment bias which they found among traders and its possible sources as wish fulfillment, false consensus effect etc. They argue that in spite of the existence of biases in average, the markets predict well because the prices are determined by marginal, best informed traders.

\textsuperscript{12} Berlemann and Schmidt (2001) discuss the problems of the data quality. For example, interviewed people do not have to consider the questions carefully or they can cover their preferences even if they are financially rewarded when answering etc.

\textsuperscript{13} Forsythe et al. (1992, p. 1153) oppositely argue that their data rejected the view that polls drive the market. Traders were thus able to find out about the mood of the electorate without relying on opinion polls. In our opinion this fact cannot exclude opinion polls as one of the information sources which traders make usually use of but states only that traders are not relying exclusively on published opinion survey results.
polls. Could we identify any features that raise efficiency of the political stock market and thus its predictive power?

First of all, there is usual praxis that initial investment of traders is subsidized. Because the market can be considered as zero-sum game, there can be a lack of interest in participation at such a market if potential traders in average expect zero profits. For the traders, there is a better alternative having their money in bank yielding interest. The subsidy is rather symbolic (about 10 percent of initial investment) and it serves as well for attracting interest of potential traders.

Berg et al. (1997) conducted an empirical analysis of 16 U.S. election stock markets in order to find significant features and identified two broad groups of factors that could generally influence the efficiency of the market:

(a) election properties that lie beyond the ability of market organizer to improve or change them (with small exceptions), and

(b) market properties that could be deliberately improved by market designer.

Among election properties belong level of election and number of candidates. They argue that the higher level of election, the more information is available to traders because of greater media coverage and higher interest among trader and people. At the same time the higher level of election, the higher chance that a trader himself will be one of the voters, thus having at least his own private information about how he will vote. Thus, more information is available within the market and makes the prediction more accurate.

The number of candidates roughly corresponds to the number of contract types (with the exception of the contract “Rest of Field”). Increasing the number of political parties (and thus the number of contract types) increases the number of variables that the market must predict, making the prediction more difficult. The traders have to deal with more information bearing more costs of seeking for and analyzing them. This feature has been found very significant, recommending the inclusion of more relatively small parties into the contract “Rest of Field”.

Market properties include trading volume, number of active traders, participant experience level and some queue information like spreads or differences in depth of queues, measuring imbalances and “movement” in prices. More trading volumes means that private information is revealed faster, thus increasing the amount of information within the market. This property is as well very significant in the study of Berg et al. (1997) which means that “active” markets with high volumes of trade predict better. The same could be said about the number of active traders, who not only bring more information into the market, but increasing the number of active traders increases competition among them as well, thus increasing the speed with which new information is incorporated in the market.

If traders are experienced, the political stock markets operate more efficient, there are less “price bubbles” and traders simply make fewer mistakes as they gain experience. Additionally, more experienced traders may have been studying the election longer and they can bring more information to the market.

Finally, there is an evidence that greater spreads and greater differences in depths of bid and ask queues indicate that the market is not yet in the equilibrium, that it has not yet absorbed all information and that the prices are still moving. The higher these variables shortly before the election are, the worse the predictive accuracy of the market is.

There are some other features not mentioned by Berg et al. (1997) that influence the efficiency. The logic tells us that the more money traders invested in the market, the more they believe in their private information and ability to make profits, thus there is a great chance that a lot of information will be included in the market, making its efficiency higher.\footnote{More money invested in the market does not have to mean that there is more trading activity. The traders can let their money lie on cash accounts without being forced to trade at all. On the other hand, and...}
Another variable positively influencing efficiency is the heterogeneity of traders. If all traders have the same beliefs, information and style of trading or if they influence each other (being for example from one class at the university), the market can operate with biases. Berlemann and Schmidt (2001) discuss the risk of false information in the market if traders largely bank on results from opinion polls that can be biased due to errors (discussion see above). There can be moreover some judgment bias of traders with regard to their personal experience with election and political parties (for example excessive sympathy for some party), preventing traders from “rational, fact-based” considerations and expectation.

Last, but not least, the market should be constructed only on such an event which does not require excessive effort to find and analyze information. Parliamentary, presidential election or national referenda are suitable events to be predicted by experimental stock markets because of the ease to find almost all relevant information in the Internet where the trading also takes place.

3. The 2002 Czech Election Market

3.1 Market design

The political stock market on Czech Parliamentary Elections into the Chamber of Deputies in June 2002 was organized by Merit Research, a non-profit research organization established in 2001 in Prague. The organizer was responsible for financial affairs and the official web-site of the project (http://www.merit-research.cz) in collaboration with colleagues from Charles University in Prague, Faculty of Social Sciences, Institute of Economic Studies (IES FSV UK). The market was technically operated by Dresden Electronic Markets at Dresden University of Technology.

The market started on Monday, March 18, 2002 at 12 a.m., and closed on Wednesday, June 11, 2002, at 12 p.m. Contracts were issued on the following parties (alphabetically ordered):

- CSSD - Czech Social Democratic Party,
- KOAL - Coalition of KDU-CSL (Christian and Democratic Union – Czechoslovak People’s Party) and US-DEU (Freedom Union – Democratic Union),
- KSCM – Communist Party of Bohemia and Moravia,
- ODS – Civic Democratic Party, and
- ROF – Rest of Field (parties with very small probability of getting some seats in the parliament).

The contracts represented promises to pay liquidation values after the election based upon the fraction of all valid votes received by the party (coalition, Rest of Field) on which the contract was issued. Precisely, the liquidation value was determined by following expression:

\[
\text{Liquidation Value} = \frac{\text{Votes}}{\text{Total Votes}} \times \text{Initial Investment}
\]

because of the positive effect of trading volume on predictive accuracy, the subsidy of initial investment is usually conditioned by certain trader’s activity, measured for example by a fraction of his trades with other traders on his initial investment (primary operations with unit portfolios are not accepted because they do not bring any new information into the market).

15 See http://www.merit-research.cz. Merit Research was represented in the project by Adam Geršl.
16 Tomáš Cahlík and Michal Hlaváček.
18 See the election server of the Czech Statistical Office, http://www.volby.cz, for political subjects registered for the election into the Chamber of Deputies in June 2002. There were 29 parties, movements and coalitions, thus ROF included 25 subjects. None of them reached the necessary limit of 5 % of votes in order to get seats in the Chamber.
\[ A_i = s_i W \]

where \( A_i \) denotes the liquidation value of contract \( i \) in CZK, \( s_i \) is the vote share (thus a number between 0 and 1) of the party \( i \), and \( W \) is the price of unit portfolio. The price of unit portfolios was set to 1 CZK.

Minimal initial investment was set to 10 CZK, maximal investment to 500 CZK. The upper limit of all initial investments was 50 000 CZK. Every trader got additional 10 percent of his initial investment on his cash account immediately after the cash transfer on condition that he then traded within the secondary market more than 20 percent of his initial investment. This condition was set to prevent traders from using the market as a favorable deposit. If a trader had not satisfied this condition, he got his portfolio liquidation value minus the subsidy provided by the organizer at the liquidation date.\(^{19}\)

### 3.2 Market liquidation and traders’ payoffs

The liquidation of the market and final payouts of traders were made on the first working day after election day (Monday, June 17). Table 1 shows the liquidation values of the contracts based on the results of the election that were announced one day before, on Sunday, June 16.\(^{20}\)

**Table 1: Liquidation values of contracts**

<table>
<thead>
<tr>
<th>Contract</th>
<th>Vote share</th>
<th>Liquidation value</th>
</tr>
</thead>
<tbody>
<tr>
<td>CSSD</td>
<td>30.2 %</td>
<td>0.302 CZK</td>
</tr>
<tr>
<td>KOAL</td>
<td>14.3 %</td>
<td>0.143 CZK</td>
</tr>
<tr>
<td>KSCM</td>
<td>18.5 %</td>
<td>0.185 CZK</td>
</tr>
<tr>
<td>ODS</td>
<td>24.5 %</td>
<td>0.245 CZK</td>
</tr>
<tr>
<td>ROF</td>
<td>12.5 %</td>
<td>0.125 CZK</td>
</tr>
<tr>
<td>Unit portfolio</td>
<td>100 %</td>
<td>1.000 CZK</td>
</tr>
</tbody>
</table>

A total of 23 traders enrolled in the market; most of them were economics students at Faculty of Social Sciences of Charles University in Prague. As the number of traders is rather small when compared to other electronic markets (Berg et al. 2003), the results must be interpreted with caution. Average initial investment was 216 CZK. The highest rate of return (on initial investment plus the subsidy provided by the market organizer) was 19 percent and the highest loss was minus 17 percent.\(^{21}\) However, almost all “unsuccesful” traders (with only one exception) realized a positive net gain, which means that losses from trading did not exceed the 10 percent subsidy from the market organizer.

The average rate of return was 2.02 percent (median 0.28 percent), successful traders (13 participants) realized an average profit of 7.28 percent (median 6.77 percent), unsuccessful

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\(^{19}\) It must be mentioned that subsidizing traders is not a usual practice in electronic markets. We have decided for this option in order to motivate traders to participate, as this market was the first to be run on a Czech election ever.

\(^{20}\) Final payouts to traders were rounded up to tenth of CZK.

\(^{21}\) Under assumption that traders enrolled the market on the first day of its existence and traded the whole period of market duration (86 days), the highest annualized rate of return was 80.6 percent, the highest loss 72.2 percent (year=365 days). Compare with the results referred in Forsythe et al. (1992, p. 1147), where the highest annualized rate of return was 65.8 percent and the highest annualized loss was 659.0 percent. Forsythe et al. (1992) used a little different formula for computing annualized rates, taking only the actual period of traders’ investment into consideration.
traders (10 participants) incurred an average loss of minus 4.82 percent (median minus 3.27 percent).

One might expect that traders with higher initial investment should realize higher rates of return, because better informed and self-confident traders would invest more believing in their success and actively searching for profit opportunities. A second reason might be that getting relevant information incurs some fixed cost; thus traders with higher investments are more likely to cover the fixed cost in order to get better information and higher profit chances. Fosythe et al. (1992) found such a positive relationship between initial investment and realized profit by “marginal traders”. In our case, the relationship is not clear, as the results are statistically insignificant.\(^\text{22}\)

Figure 1: Distribution of initial investments and final payoffs

The fact that there was no significant relationship between initial investments and realized profits also indicates that the market did not raise inequality of initial investment distribution. Figure 1 shows the overlapping Lorenz-curves for initial investments and final payoffs. The Gini-coefficient denoting inequality in distribution\(^\text{23}\) even decreased somewhat from 0.390 (initial investment distribution) to 0.379 (final payoffs). Thus, the participants’ decision about initial investments might not have been motivated by expectation of profits or necessity to invest some fix costs for obtaining relevant information, but by interest in the market as such. We can thus argue that participants with higher interest in this new “afternoon” activity invested more money than others. Another motive for higher investment could be the subsidy

\(^{22}\) The regression was in the following form: rate of return in \(\% = 5.968 \% (2.262) - 0.166 (-1.857) \times \text{initial investment},\)

number in parentheses denoting t-statistics, \(R^2\) was 0.376, F-statistics was 3.447 (0.077).

\(^{23}\) The Gini-coefficient can be calculated as 

\[ G = \frac{2 \sum_{i=1}^{n} ix_i - (n + 1) \sum_{i=1}^{n} x_i^2}{n \sum_{i=1}^{n} x_i}, \]

where \(n\) is the number of observation and \(x_i\) is the value of observation \(i\), thus \(G\) being between 0 (equal distribution) and 1 (total unequal distribution).
provided by the market organizer. Thus, participants might have invested more money in order to get more subsidy, realized only necessary “20 percent trades” without directly aiming to gain profits by seeking and using relevant information and waited till the end of the game. However, we did not find any significant negative relationship between initial investment and market activity, on the contrary, traders with highest investment (400-500 CZK) traded on average more than other traders. The subsidy also played an eminent role in attracting potential traders to the game. The evidence thus tells us that the insignificant relationship between initial investment and realized profit has no single cause and was probably induced by the small number of participants, making every single unordinary behavior quite influential.

3.3 Market Activity

Figure 2 shows market activity measured by the number of contracts traded per day. After an initial period of high interest in trading in the last weeks of March, the activity decreased somewhat, an observation which has often been made in experimental forecasting markets. Figure 2: Market Activity

While one might suspect that the observed pattern might have to do with the beginning of the final examinations period at the university or a possible loss of interest in trading by some traders we suggest that the primary reason for the somewhat diminishing trading activity is that market participants’ expectations on the final election outcome somewhat converged. Thus, there were fewer possibilities to find profitable trading opportunities over the market period thereby leading to decreasing trading activity.

Another reason might have been that traders had simply actively traded in the beginning in order to fulfill the condition of trades of at least 20% of initial investment in order to qualify for the subsidy. A question may arise whether such a condition, and hereby induced active trading, may have biased prices. We argue that if traders are rational, they will use all available information for trading in secondary markets to maximize profits even when conducting “necessary” trades of 20% of their initial investment. Thus, such a condition, despite its impact on market activity, should not have any negative influence on predictive accuracy of prices.

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3.4 Market forecasts and their accuracy

We will now turn to a presentation of the market forecast of the election outcome and an attempt at evaluating its accuracy. In figures 3-7 we show the markets forecasts (ExpMarket), the forecasts published by the polling agencies Taylor Nelson Sofres Factum (TNSF) and Stem/Mark (STEM), and the actual election results (Reality). It is easy to see that the political stock market was quite successful in predicting the vote shares for CSSD, KOAL and ROF. On the other hand, the forecast errors for ODS and KSCM turned out to be quite large.

In the beginning of the market there was already information in favor of the election success of CSSD available (for example good macroeconomic data, expected and well-perceived changes of the party’s leader and administration). The market caught the rising preferences for CSSD quite well. There were also news that made the prospects of election success of the coalition worse (disintegration of former 4-party-coalition into a 3-party-coalition and finally a 2-party-coalition, inside problems in the “two-party” coalition), being absorbed by the market quite well by diminishing value of the contract KOAL.

**Figure 3:** Forecasts of the vote share for CSSD

![Graph showing forecasts for CSSD](image)

**Figure 4:** Forecasts of the vote share for ODS

![Graph showing forecasts for ODS](image)
Figure 5: Forecasts of the vote share for KOAL

Figure 6: Forecasts of the vote share for KSCM
On the other hand, there was no significant news with regards to ODS in March and April. The culmination of pre-election fight via telephone campaign in the end of Mai was not perceived well by the public and caused the decline of preferences for ODS. The market seems not to have absorbed this information which was quite heavily discussed in media. The unpredictable rise of vote share for KSCM can be considered as a kind of shock, because it was not by any way expected and there were no signs indicating such a rise in preferences for the direct successor of the “single party” of the communist period 1948-1989. The figures indicate some advantages of the political stock market method in comparison with polls which have been discussed above in more detail: the market provided every day predictions, the volatility thus being lower than in surveys. The market was also superior to polls in reflecting the shifts of expected vote shares among parties. While the polls by TNSF correctly reflected the decline in preferences for ODS resulting from its aggressive telephone campaign, the polls failed to predict correctly the direction of the change of preferences.

A common way of evaluating the accuracy of the forecasting market’s predictions is to compare the market forecast’s accuracy to the one of available polls on the basis of simple error measures. In order to do so we compare the final market forecast resulting from normalized market closing prices with the last polls published before the election. There are various simple error measures which could be used to compare forecasts:

(a) the average absolute prediction error (or mean absolute error, MAE), used for example in the empirical analysis conducted by Berg et al. (1997), being computed as

$$MAE = \frac{1}{K} \sum_{i=1}^{K} |v_i - \hat{v}_i|,$$

where $K$ is the number of contracts, respectively parties (including “Rest of Field”), $v_i$ is the actual vote share of the party $i$, and $\hat{v}_i$ is the vote share prediction for the party $i$.

(b) the average squared error (or mean squared error, MSE), being computed as

$$MSE = \frac{1}{K} \sum_{i=1}^{K} (v_i - \hat{v}_i)^2.$$
The average squared error puts more weight on large forecast errors than the mean absolute error. However, the appropriate choice of an error measure in the end depends on the cost function of the forecaster. Berlemann and Schmidt (2001) argue that large forecast errors typically lead to highly inaccurate predictions of future governments or government coalitions. Thus, the mean squared error might be more useful to evaluate election forecasts. However, in table 2 we report both error measures for the market forecast and the last published polls of TNSF and STEM. Even though the market delivered quite inaccurate forecasts for ODS and KSCM the market performed better than the polls under both error measures.

### Table 2: Comparison of election forecasts’ accuracy

<table>
<thead>
<tr>
<th>Actual Vote Share</th>
<th>Market Forecast (11.6.02)</th>
<th>TNSF Forecast (10.6.02)</th>
<th>STEM Forecast (6.5.02)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CSSD</td>
<td>30.2</td>
<td>27.9</td>
<td>28.0</td>
</tr>
<tr>
<td>ODS</td>
<td>24.5</td>
<td>30.9</td>
<td>24.0</td>
</tr>
<tr>
<td>KOAL</td>
<td>14.3</td>
<td>15.0</td>
<td>16.0</td>
</tr>
<tr>
<td>KSCM</td>
<td>18.5</td>
<td>13.9</td>
<td>12.0</td>
</tr>
<tr>
<td>ROF</td>
<td>12.5</td>
<td>12.4</td>
<td>20.0</td>
</tr>
<tr>
<td>MAE</td>
<td>-</td>
<td>2.8</td>
<td>3.7</td>
</tr>
<tr>
<td>MSE</td>
<td>-</td>
<td>13.6</td>
<td>21.3</td>
</tr>
</tbody>
</table>

In figure 8 we show the development of predictive accuracy of the market forecast and polls in the course of time. For simplicity we use the sum of absolute forecast errors (SAE), being calculated as

$$ SAE = \sum_{i=1}^{K} |v_i - \hat{v}_i|.$$  

Figure 8 shows that predictive quality of the polls of superior quality by TNSF was more volatile than the one of the market forecast.

### Figure 8: Development of SAE for market forecast and polls
Since the Czech Parliamentary Election Market was the first electronic forecasting market in the Czech Republic it is also interesting to compare the forecasting accuracy to markets conducted abroad. Berg et al. (1997) analyzed 16 vote share markets conducted by Iowa Electronic Markets in the U.S.; the average mean absolute error (MAE) of these markets range from 0.06 percent to 8.6 percent. Thus, in comparison with the U.S. markets the Czech Parliamentary Election Market performed quite well with a mean absolute error of 2.8 percent. Berlemann and Schmidt (2001) survey 25 vote share markets conducted in Germany, thereby reporting average mean absolute errors in between 0.58 and 3.67 percent.

Experimental markets generate time series of fixed event forecasts, i.e. forecasts of one and the same event at different points in time. Nordhaus (1987) proposed a concept of examining (weak) efficiency of fixed event forecasts via studying in how far the forecast revisions are auto-correlated. An efficient forecast should not allow for an enhancement of forecast quality via using information present in past (and thus observable) forecast revisions. We applied this test to the market forecasts of the vote shares generated by the market. The results are shown in table 3.

<table>
<thead>
<tr>
<th>Party share</th>
<th>coefficient</th>
<th>t-statistic</th>
<th>probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>ODS</td>
<td>-0.44</td>
<td>-4.41</td>
<td>p&lt;0.01</td>
</tr>
<tr>
<td>CSSD</td>
<td>-0.18</td>
<td>-1.63</td>
<td>p&gt;0.1</td>
</tr>
<tr>
<td>KOAL</td>
<td>-0.27</td>
<td>-2.45</td>
<td>p&lt;0.05</td>
</tr>
<tr>
<td>KSCM</td>
<td>-0.03</td>
<td>-0.30</td>
<td>p&gt;0.1</td>
</tr>
<tr>
<td>ROF</td>
<td>-0.48</td>
<td>-4.75</td>
<td>p&lt;0.01</td>
</tr>
</tbody>
</table>

Only the revisions of the market forecasts of the CSSD and KSCM turned out to be serially uncorrelated. The remaining forecasts show a considerable degree of serial correlation indicating that new information was not always quickly incorporated into market prices. Altogether we conclude that the Czech Parliamentary Election Market of 2002 delivered results which are comparable to those in U.S. and German markets. In addition to that the Czech election market generated better forecasts than the polling agencies. These results are remarkable when taking into account that the forecasting market obviously suffered from some inefficiencies.

4. Conclusions and outlook

The results of the political stock market conducted on the Czech Election in June 2002 indicate that the method is promising and problematic simultaneously. In order to generate highly accurate forecasts the market has to function efficiently. While the number of traders participating in electronic markets has yet not proved to be a significant factor of forecasting accuracy the comparatively low number of only 23 traders that took part in the project are on the lower limit of efficient market performance. Because of legal barriers preventing the participation of the large public in the market, only the students and staff of the university were entitled to trade in the market. This can lead to some serious biases, wish-fulfillments effects and further problems, preventing all relevant information to be reflected in the market prices. Thus, it might be necessary to open future markets for a wider audience.

Experience gained by the pilot project in the Czech Republic will provide a basis for further research in this field of experimental economics. One possible direction of future research is

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to apply the method to the prediction of economic variables, as e.g. inflation. To provide inflation forecasts via electronic stock markets is not so easy as in the case of some political event because the inflation, though being very relevant for economists and public as well, is not so interesting for a wide audience like parliamentary or presidential election.

First attempts to transfer the method to forecast macroeconomic variables have recently been made by Berlemann (2002) when conducting a prototype experimental inflation forecasting market. Differently from the political stock market, such forecasting markets are organized as so-called winner-takes-all markets. The contracts in these markets cover the range of all possible values the inflation rate might take.\(^{27}\) The liquidation value of contracts then depend on the probability that the factual inflation rate falls into the intervals.

There are some problems with such markets: Firstly, the more intervals we have, the more precise the forecast can be, but at the same time traders have to deal with more contracts, making the prediction more complicated. Secondly, inflation forecasts are relevant especially for inflation targeting central banks, but they need some forecasts of two- or three-year-ahead inflation. Since markets can not be liquidated before the event, the market is conducted on, has occurred, there is quite a long period of time between the beginning of the market period and liquidation of the market. However, first experiences with designing a regular forecasting system via electronic markets in Bulgaria show that the problems are at least partially manageable.\(^{28}\)

Although experimental stock markets are often designed to generate predictions, there are of course other aims of conducting such markets. As we have noted in the introduction, the educational purpose for students participating in the market is relevant and useful as well. Another aim of such experiments is to investigate the use and distribution of information in markets and its reflection in prices, as pointed out by Beckmann et al. (1996), Smith (1982) or Sunder (1995), providing a fruitful experimental data for information economics. Last, but not least, the experimental markets can tell us more about the behavior of traders, their behavioral patterns, learning capabilities and decision making, contributing mainly to the field of evolutionary economics.\(^{29}\)

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\(^{27}\) More precisely, he dealt with following 8 intervals into which the inflation rate can fall: \((-\infty, 0.0), <0.0, 1.5), <1.5, 2.0), <2.0, 2.5>, <2.5, 3.0), <3.0, 3.5), <3.5, 4.0), <4.0, +\infty).\) The determination of the intervals reflects of course some inflation expectation of the market designer, but it is further possible to split some contracts into two or more, if the current set does not seem to be appropriate.

\(^{28}\) In a series of experiments in Bulgaria forecasting markets with horizons up to one year were already organized.

\(^{29}\) See several articles in the Journal of Evolutionary Economics that emerged in 1991.
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