Information Driven Trading at the Prague Stock Exchange: Evidence from Intra-Day Data

Jan Hanousek and Richard Podpiera*

CERGE-EI, Prague

Abstract:

Many observers argue that informed and insider trading is widespread in the emerging financial markets of transition countries, yet rigorous treatment of this issue has been virtually non-existent. The current paper estimates the extent of informed trading on the Prague Stock Exchange (PSE) using intra-day transaction data. Our estimates confirm that the average share of informed trading is equal to 0.32, which is high relative to developed markets and varies considerably among stocks. Using the Easley et. al. (1996) approach on the very best segment of the PSE we obtained a high average probability of informed trading. Since data used in this study cover the period after the major attempts to improve market regulations, our results indicate that the PSE needs further strengthening to recover credibility and to become a real source of corporate financing.

Keywords: market microstructure, informed trading, emerging market

JEL Classification: G14, G15

---

* Hanousek: CERGE-EI, a joint workplace of Charles University and the Academy of Sciences of the Czech Republic, Prague; Podpiera: International Monetary Fund, European II Department. This paper was prepared prior to joining the staff of the International Monetary Fund and does not necessarily reflect the views or policies of the IMF.

This research was supported by the National Science Foundation of the United States (grant number SPR-9712336) and by the PHARE/ACE Research Program of the European Union (grant number P97-8118-R). We would like to thank Libor Němeček, Randall K. Filer, Barbara Forbes, and Jan Kmenta and anonymous referees for their suggestions and comments.

Correspondence and requests for reprints to: Jan Hanousek, CERGE-EI, P.O. Box 882, Politických vězňů 7, 111 21, Prague, Czech Republic, E-mail: Jan.Hanousek@cerge.cuni.cz.

Information Driven Trading at the Prague Stock Exchange: Evidence from Intra-Day Data

Introduction

The last decade goes down as one of the most extraordinary changes in economic systems ever recorded. Commonly called the transition, the shift from command to market economies in Central and Eastern Europe has radically changed the economic and political situation in this part of the world. A major component of this transition has been the privatisation of formerly state assets followed by the rapid growth of the private sector; economic output of the private sector increased from virtually nothing in 1989 to more than two-thirds (for a breakdown by countries, see EBRD Transition Report, 2001).

Properly functioning capital markets play an important role in the success of the transition. Obviously, transition economies need large amounts of capital for restructuring, since many firms have not yet been profitable enough to finance necessary restructuring through retained earnings. The banking sector, for one, has been weak and undercapitalised, so has had a limited ability to finance investment activities. This limitation suggests that there should be a great deal of reliance on equity finance and investors who have confidence that markets can not be manipulated by insiders will be more willing to invest in such markets, thereby lowering the cost of capital.

Whether equity markets in Central Europe are working properly is of practical interest since these markets showed play a critical role in the future development of the region. This essay discusses the extent of informed trading in the Czech equity

market (the Prague Stock Exchange, PSE), the market that has been identified as a by-product of large-scale privatisation.

From its inception in 1993, the Czech equity market developed very rapidly as a large number of companies floated their shares after coupon privatization. Market regulation, however, lagged significantly. Insider trading, price manipulation, fraud in the investment funds industry, and abuses of minority shareholder rights greatly eroded investor confidence. The Economist (April 1996) and the Wall Street Journal (May 1996), among others, reported on "dealing in Prague as a losers' guide to investment," and characterized the Czech capital market as "a muddy market" … "anarchy to the outsider, sweet profit to those in the know". More recently, Economist (March 1997) quoted an investor as saying "…[the government should] fight the perception that the Prague stock exchange is just a vehicle for select insiders to enrich themselves at the expense of the ordinary shareholder". In recent years, regulation has improved, but enforcement continues to be rather weak. The Czech market still offers a lot of latitude for informed and insider traders to disclose timely information (see EBRD 1996-2000; World Bank 1999, among others).

Even though informed and insider trading is supported by anecdotal evidence, formal treatment of the issues has been virtually ignored. This holds not only for the Czech Republic, but also for other financial markets in transition economies and even for emerging markets as a whole.[1] The current paper fills this gap by estimating the extent of informed trading on the Prague stock exchange (PSE) using intra-day transaction data on the central market. The approach of Easley et al. (1996) is used to

[1] Bhattacharya et al. (2000) is one of the very few studies that deals with insider and informed trading on emerging markets.

model and estimate the extent of informed trading in the SPAD trading system (a dealers' market), which is the key component of the PSE. Our findings suggest that even for the very best segment of the PSE, represented by the most liquid blue chips, there is still a high probability of informed trading. Therefore, we speculate that these estimates provide a lower bound of informed trading at the PSE.

To our knowledge, there has been only one earlier effort to estimate the extent of insider trading for a transition country. Němeček (1998) attempted to estimate an Easley et al. (1996)-type model for the PSE, but at that time the SPAD system had only begun operation and detailed data were not available which led him to conclude that insider trading was relatively insignificant. Instead, Němeček had to use data from the auction system as no data on individual trades were available. Moreover, at that time, the liquidity of the PSE's automated price-setting system was minuscule because the majority of trades were conducted outside of the exchange, as it was advantageous for informed investors to trade off the exchange. In this paper, we use completely different high frequency data from a new trading system and from a time period when the majority of the order flow is publicly observable.

In the next section, we describe the trading system and the data. In Section 2 we estimate the extent of informed trading by using the approach of Easley et al. (1996). Section 3 summarizes our findings and conclusions.

1. Trading System and Data Description

1.1. Trading System

The SPAD segment of the Prague stock exchange is formed by market makers who are obliged to quote firm prices for sale and purchase. The whole system is computer-based with all the market makers able to see all the quotes and trades. Members of the

PSE who apply and are approved serve as market makers in the SPAD system, which was launched in May 1998 with the aim of improving market liquidity. It has been successful in attracting order flow from the OTC market and, currently, the majority of trades in securities listed in SPAD are channeled through this system.[2]

The most liquid Czech stocks are traded in the system. Beginning with a single stock at the outset, SPAD grew to eight stocks at the time our data was recorded: two telecommunications companies (Český telecom and České radiokomunikace), two banks (Česká spořitelna and Komerční banka), a petrochemical company (Unipetrol), an electricity generator (ČEZ), an investment fund (RIF) and a construction company (IPS).[3] For most of its existence, daily trading volume in SPAD amounted to approximately 500 million CZK (some 17 million USD), and only at the beginning of 2000 did it jump sharply to almost 2 billion CZK (50 million USD). In the period under study (late 1999) daily trading volume hovered around 500 million CZK.[4]

In late 1999 there were 16 market makers who quoted at least one stock in the system, although on average each market maker quoted approximately six stocks. Viewed differently, each of the eight stocks had approximately 12 market makers who

---

[2] There is another registered (electronic-type, OTC) stock market called RMS.

[3] One more bank, IPB, had its stock traded in the SPAD system. In June 2000, however, IPB was put under forced administration and its stock was suspended from trading. Because it was introduced into SPAD only in November 1999 and thus was not traded in the system during the time period on which we focus, we leave it out altogether.

[4] During the period of our study the aggregate trading volume in the SPAD system accounted for 82% of the total PSE trading volume. This fact indicates that SPAD was successful in attracting order flow from the direct trades segment [Note that PSE brokers have the option of arranging their trades bilaterally. Clearly, direct trades have a minimal effect on price formation for either segment of the PSE].

were quoting it. The SPAD rules stipulate that there must be at least three market makers for each stock for it to be traded in the system. In reality, the number of market makers for each stock is considerably higher than the required minimum.[5]

Individual market makers are allowed to quote different ask and bid prices, but the maximum spread is limited. A committee of the PSE sets the exact limits, but in general it corresponds roughly to 2.5 percent of the stock's price. Depending on the development of the stock's price, the maximum spread is irregularly changed. The system operates in two phases, closed and open. The closed phase can be viewed as a technical device that allows market makers to clear the trades they did not manage to conduct during the open phase. Actual trading occurs during the open phase of the system, which lasts from 9.30 a.m. to 4.00 p.m. each trading day and during which the market makers quote firm prices for a fixed number of shares of each stock.

The trading lot sizes vary from 1,000 shares for České radiokomunikace to 20,000 shares for Unipetrol or ČEZ. The lot sizes are occasionally changed, depending on price development of the stock. That, and the trading lots are rather large compared to the overall trading volume and the capital base of some market makers.[6] The quotes are firm in the sense that if the quote is the best one available on the market and if another party in the system reacts to it by entering an instruction for a trade, the market maker is obliged to enter his instruction so that the trade can be executed. Blocks of shares that differ in size from the trading lot can be settled

[5] Before 1999, there was an informal limit on the maximum number of marker makers for one stock (10). It was abolished before the time period under study began.

[6] The market value of one trading lot ranged from 0.7mn CZK to 5.3mn CZK in late 1999 and averaged slightly below 2.0mn CZK.

through the system as well, but these trades are negotiated in advance over the phone and are not frequent.

In order to limit the risk of default, there exists a standard settlement procedure and a guarantee fund into which market makers must make a deposit, and there are procedures that come into play if one side of the trade defaults. Overall, trading in SPAD appears to be safe, as no serious problems of default have been reported since its inception.

1.2. Data Description

Data on individual SPAD trades from early 1999 to July 2000 are publicly available. We concentrate on four months in late 1999–August through November. This time period offers enough data points for estimating our model, and we can assume that market participants already knew the market mechanism well. Moreover, there were no large disturbances during these months, which could affect the functioning of the market.

For each trade for the time period under study, our database carries a stock identification, transaction price, number of shares, time when the trade was concluded, and the best bid and ask quotes at the time the transaction took place. We are also able to identify so-called cross trades: that is, we are able to distinguish trades conducted between the inventory of a market maker and the market maker's clients, since these must be reported in the system as well.

Table 1 depicts the basic characteristics of all eight stocks traded in the system. Even though they represent the most liquid equities on the Czech market, there are substantial differences among them. Their market capitalization ranges between a mere 2bn CZK for IPS to 126bn CZK for Český Telecom. And IPS, for

instance, averages only four trades per day, while SPT Telecom averages 33 daily trades. Other stocks are concentrated in the range of 10–51bn CZK of market capitalization and, with the exception of RIF, exhibit stable trading activity through out whole period studied.

<Insert Table 1 here>

The total daily turnover exceeded 500mn CZK from August through November 1999, and the size of trading lots varied considerably in the number of shares, though somewhat less in terms of the market value of trading lots. The average spread varied considerably in CZK, but its relative value in percent of average price is more important. Here, the variation is smaller and, with the exception of RIF, the percentage spread depends heavily on the trading activity. The spread is largest for IPS, at 2.7 percent and lowest for SPT Telecom, below 1 percent. For the other stocks, the relation between the percentage spread and the trading activity is basically monotonic.

A comparison of the stocks in our sample with those used in previous studies of informed trading and the components of the bid-ask spread appears to be in order. Naturally, the volumes and market capitalization of SPAD stocks are dramatically smaller than those of the most liquid U.S. stocks. The average trading volume of the stocks in our sample approximately equals the average trading volume of the fifth decile stocks from the NYSE included in Easley et al., 1996 (Given the skewness of the distribution, average size of those firms is smaller compared to the average U.S. stock).

Overall, Czech stocks are less frequently traded and have larger posted spreads than blue chips from the U.S. The differences are not so dramatic, however, as to prevent us from comparing our results with those of previous studies. In fact, the

opposite is true, since our stocks are comparable to an average U.S. stock. The small differences do suggest that the adverse selection component should be larger in the Czech equity market, since lower trading volume was shown by Easley et al. (1996) to be associated with a larger probability of informed trading.

2. Estimating the Extent of Informed Trading

2.1. Model and Estimation Method

In order to compare our results to those from developed markets, we use the model developed by Easley et al. (1996). As a by-product of their effort to relate differences in information-based trading with the variation in bid-ask spread. Easley et al. estimated the extent of informed trading for the first, fifth, and eighth deciles of NYSE stocks ranked by trading volume. Let us note that Easley et al. deal with the quote-setting problem of a single uninformed market maker, whereas our situation we have more than one market maker this might lead to more complicated interactions, but these are outside of the scope of this paper. Furthermore, as we cannot identify particular market maker trading patterns the data will be analyzed as if it were generated in a single market maker environment.[7]

Their basic model is as follows.[8] Potentially informed and uninformed traders trade a risky asset with a competitive risk-neutral market maker. Time is split into separate trading days and is continuous within each trading day. Before each trading day begins, nature determines whether an information event that influences the value

[7] There are several other models to estimate information driven trading (See for example Glosten and Harris, 1988 or Cambell et al., 1997). These models can be more sensitive to several competing market makers than the EKF model, which mostly relies on the assumption of information flows rather than the number of market makers. Indeed, there are clearly many ways in which more than one market maker can lead to more complicated interactions.

[8] The description here is very brief due to space constraints. Please check the original Easley et al. (1996) paper for details.

of the asset occurs. These independently distributed information events occur with probability α and are good news with probability 1- δ and bad news with probability δ. Naturally, the asset has a higher value when good news is coming to the market and a lower value for bad news. The news is fully realized by the traders at the end of each day. In this sense, the days are separated.

Both uninformed (did not see any signal) and informed (saw some signal) traders arrive at the market. The arrival rates are independent Poisson processes. The arrival rate of uninformed buyers and uninformed sellers is denoted by ε. When an information event occurs, informed traders also arrive, at a rate μ, which is again the same for informed sellers, who arrive in the case of bad news, and informed buyers, who are attracted by good news.

<Insert Figure 1 here>

The market maker knows the initial probabilities attached to each branch of the tree and updates his beliefs in a Bayesian manner based on the observed order flow. For instance, a sell order might come from both an informed and an uninformed trader, but its appearance changes the belief of the market maker about bad news.

Thus, there are three possible events—no news, good news, and bad news. The arrival rates of traders are represented by the number of buy and sell transactions that occur during the day. The likelihood of observing a given number of buys (B) and sells (S) given a vector of parameters $\theta = (\alpha\ \delta\ \varepsilon\ \mu)$ can be expressed as

$$L((B,S)\,|\,\theta) = (1-\alpha) * \mathrm{e}^{-\varepsilon \mathrm{T}} \frac{(\varepsilon T)^{B}}{B!} \mathrm{e}^{-\varepsilon \mathrm{T}} \frac{(\varepsilon T)^{S}}{S!} + \alpha\delta * \mathrm{e}^{-\varepsilon \mathrm{T}} \frac{(\varepsilon T)^{B}}{B!} \mathrm{e}^{-(\mu+\varepsilon)\mathrm{T}} \frac{[(\varepsilon+\mu)T]^{S}}{S!} +$$

$$+ \alpha(1-\delta) * \mathrm{e}^{-(\mu+\varepsilon)\mathrm{T}} \frac{[(\varepsilon+\mu)T]^{B}}{B!} \mathrm{e}^{-\varepsilon \mathrm{T}} \frac{(\varepsilon T)^{S}}{S!} \quad . \qquad (1)$$

The first term of the likelihood denotes the "no event day", the second the "bad event day" and the last the "good event day". The likelihood contributions of these day types take this form because of to the assumption of independent Poisson processes driving the arrival of traders. What makes the difference among the three expressions are the arrival rates of buyers and sellers. While this is what we observe, we cannot say whether some traders saw a signal or not. In fact, only the order flow, that is, the number of buys and sells, is used to make an inference about the extent of informed trading in this model. Since days are independent, the likelihood of observing a series of buys and sells is the product of the likelihoods for individual days:

$$L(M\,|\,\theta) = \prod_{\mathrm{i}=1}^{\mathrm{I}} L(\theta\,|\,\mathrm{B_i}, S_i) \qquad for\ M = (B_i, S_i)_{i=1}^{I}. \qquad (2)$$

Given the data on the frequency of buy and sell orders, maximizing the likelihood expression above will yield the estimates of the four models' key parameters (α δ ε μ). Even though we do not observe the order flow directly, we can infer from the transaction data which trades were buyer-initiated and which were seller-initiated. We use the simple rule that trades occurring above the quote midpoint, that is, above the average of best bid and ask quotes, are considered buys, and those below the midpoint are coded as sells.

Since the parameters of the model describe the arrival rates of informed and uninformed traders and express the probability that an information event will occur,

their estimates can be used to assess the probability that a transaction will be information-based. The probability of an informed trade is expressed as

$$\Pr(\text{inf}) = \frac{\alpha\mu}{\alpha\mu + 2\varepsilon} \tag{3}$$

This expression compares the expected arrival of informed traders and the expected arrival of all traders. Thus, if it is more probable that an information event occurs and that the arrival rate of the informed traders is greater than that of the uninformed ones, then it is also more likely that a trade is motivated by knowledge of information unknown to all market participants.

2.2. Estimation Results

We have estimated the model described in Section 3.1 by maximizing the likelihood (2) using the ML procedure in the TSP 4.5 package. The estimates are depicted in Table 2.

<Insert Table 2 here>

The estimates of α averaged at 0.32. There is a tendency for more frequently traded stocks to have higher α. Frequently traded SPT Telecom's α is close to 0.50, while the least frequently traded IPS and RIF have α's of 0.22 and 0.11. This finding may be connected with less intensive analyst coverage of the less frequently traded stocks. On average, the estimate of δ, which is close to 0.5, can be interpreted to mean that both good and bad news are just as likely. There is some variation in these estimates among individual stocks, but with the exception of RIF and Unipetrol, all come close to 0.5.

The resulting probability of informed trading, denoted as Prob(inf) and computed according to equation (3), varies from 0.25 for České radiokomunikace to 0.48 for IPS, with most of the estimates clustered around 0.30. With an average value of 0.32 our estimate is considerably higher than the probability of informed trading on the NYSE as estimated by Easley et al. (1996b), who estimated this probability to vary from 0.16 for the most liquid (first decile) stocks to 0.22 for the eighth decile stocks. It is worth noting that the probability of informed trading for Czech stocks

is considerably higher than results for the fifth decile at NYSE (0.21) which is comparable also in terms of trading volume but also higher than result for the eighth decile, the lowest volume Easley et al. (1996) used in estimation.[9]

It appears that informed trading is far more influential at the PSE than at the NYSE, even if we take into account the differences in trading volume. Moreover, the difference between ε and μ (order flow of uninformed and informed traders) is greater on the Czech market (on average the ratio of μ to ε is 3.9 in the case of Czech stocks), while it varied from 0.7 to 1.6 in the Easley et al. study. This feature increases rather than decreases the variability of order flow. If the market maker is not risk-neutral (as in the Easley et al. 1996 model), this would increase the demanded compensation for market-making services and thus also the adverse selection component of the bid-ask spread.

Comparison of our results with the previous study that dealt with the extent of informed trading on the Czech market is in order. Němeček (1998) modified the Easley et al. (1996) model to use data from the auction mechanism since at the time he conducted his study, there was no system of market makers. Using data from the

[9] It should be noted that the average trading volume of the stocks in our sample is considerably higher than that of the eighth decile stocks used by Easley et al.

advent of the trading of each stock until late 1996 he founded that the probability of informed trading varied from a negligible 0.002 to a small 0.02. We see two problems that weaken his estimates. First, it is difficult to estimate the probability of informed trading from auction results because of problems with identification of the model. A second and more fundamental problem is that at that time only a very low fraction of trades were channeled through the auction system. The actual order flow and hence the information it contained was simply not observable in the auction data. We conclude, then, that informed trading played an important role in the Czech market in the second half of 1999.

3. Conclusion

In this paper we estimate the extent of informed trading in the blue chip segment of the PSE, which is called SPAD. Let us note that the trading lots at SPAD are quite large, so in most trades only one lot changes hands, which allows us to abstract from the trade size. Also, there are several market makers for each stock who compete for order flow. Only the most liquid Czech stocks are included in the system, but these are only medium-sized by international standards. Therefore, we used Easley et al. (1996) approach to estimate the probability of informed trading.

Our results show that the probability of informed trading is considerably higher in the Czech market than in developed markets. Our estimates vary from 0.11 to 0.48, averaging 0.32. Moreover, if an information event occurs, the arrival rate of informed traders is much higher than the arrival rate of uninformed traders, which further increases the risk market makers face. Market makers should thus be expected to require higher compensation for this risk and increase the adverse-selection component of the spread. We can speculate that this would result in higher trading

costs and, in conjunction with cross-listing of the leading stocks abroad, could have a significant effect on the functioning of the PSE.

Let us note that estimation of information driven trading covers two components: legal trading, and illegal insider trading. From a theoretical perspective there is clearly a difference between these components; however, in intra-day transactions data both informed and insider trading have similar effects and thus it is not feasible to separate the two without more detailed data. [10]

Our data and results indicate that the PSE still needs further strengthening in spite of efforts to improve market regulation prior to the dates of our study. From a policy perspective, the combination of high insider trading, weak market regulation, and poor reputation means a hard recovery of its credibility if the PSE is to become a viable source of corporate financing.

[10] This conscious description was brought up by one of the referees.

References

Bhattacharya Utpal, Hazem Daouk, Brian Jorgenson, and Carl-Heinrich Kehr. 2000. "When an Event Is Not an Event: The Curious Case of an Emerging Market". *Journal of Financial Economics*, 55, pages 69-101.

Cambell, J., A Lo, and A. C. MacKinley, 1997. *The Econometrics of Financial Markets*, Princeton University Press.

Easley, David, Nicholas M. Kiefer, Maureen O'Hara and Joseph B. Paperman. 1996. "Liquidity, Information, and Infrequently Traded Stocks". *Journal of Finance*. September 1996, 51 (4), pages 1405–1436.

EBRD, 1996-2000. *Transition Report*, European Bank for Reconstruction and Development, London.

Glosten, L. and L. Harris, 1988. Estimating the Components of the Bid/Ask Spread, *Journal of Financial Economics*, 21, 123-142.

Němeček, Libor. 1998. "Asymmetric Information and Insider Trading". In: Libor Němeček, Ph.D. Dissertation, CERGE-EI. Prague, August 1998.

World Bank Country Study: Czech Republic – Toward EU Accession. 1999. World Bank: Washington, D.C.

Tables

Table 1:

Basic Characteristics of the Stocks in Our Sample (Aug. through Nov. 1999)

Stock	Market Cap. (mn CZK)	Average Price (CZK)	Daily Turnover (mn CZK)	Daily Number of Trades	Trading Lot (number of shares)	Avg. Spread* (CZK)	Avg. Spread* (percent)	Number of market makers
ČESKÉ RADIOKOMUNIKACE	36,223	1 177	43	26	1,000	16.2	1.4%	13
ČESKÁ SPOŘITELNA	11,579	179	40	19	10,000	4.1	2.3%	11
ČESKÝ TELECOM (SPT TELECOM)	126,460	538	188	33	10,000	5.1	0.9%	14
ČEZ	50,233	85	79	32	20,000	0.9	1.0%	15
IPS	1,927	139	4	4	5,000	3.7	2.7%	11
KOMERČNÍ BANKA	17,177	904	74	23	3,000	12.0	1.3%	12
RIF	12,697	1 324	12	4	1,000	10.7	0.8%	10
UNIPETROL	10,918	60	66	27	20,000	1.2	2.0%	13
Average	**33,402**	**n.a.**	**63**	**21**	**n.a.**	**6.7**	**1.6%**	**12.4**

Source: Prague Stock Exchange and authors' calculation. The average exchange rate amounted to 34.4 CZK/USD.

Note: There were 86 trading days from August through November 1999. The total number of trades in these four months stood at 14,586.

**This is the posted spread, that is, the difference between best bid and best ask prices.*

Table 2: Estimates of the Extent of Informed Trading (Aug. through Nov. 1999)

Company	α	δ	ε	μ	Prob(inf)	μ / ε
ČESKÁ SPOŘITELNA	0.31 (0.07)	0.59 (0.10)	6.23 (0.13)	18.35 (0.88)	**0.31** **(0.05)**	2.9 (0.2)
ČESKÉ RADIOKOMUNIKACE	0.31 (0.06)	0.53 (0.10)	9.70 (0.15)	20.85 (0.79)	**0.25** **(0.04)**	2.2 (0.11)
ČEZ	0.48 (0.07)	0.50 (0.08)	10.63 (0.15)	21.40 (0.76)	**0.32** **(0.03)**	2.0 (0.1)
IPS	0.22 (0.06)	0.38 (0.13)	1.14 (0.06)	9.41 (0.60)	**0.48** **(0.07)**	8.3 (0.8)
KOMERČNÍ BANKA	0.33 (0.07)	0.38 (0.11)	8.52 (0.16)	18.20 (0.57)	**0.26** **(0.05)**	2.1 (0.10)
RIF	0.11 (0.04)	0.22 (0.14)	1.45 (0.07)	13.32 (0.69)	**0.34** **(0.09)**	9.2 (0.8)
SPT TELECOM	0.48 (0.08)	0.52 (0.08)	11.84 (0.19)	19.41 (0.73)	**0.28** **(0.04)**	1.6 (0.08)
UNIPETROL	0.31 (0.09)	0.77 (0.09)	9.52 (0.16)	26.21 (0.78)	**0.30** **(0.07)**	2.75 (0.12)
Average	**0.32**	**0.49**	**7.38**	**18.39**	**0.32**	**3.9**

Note: Standard errors in parentheses. Prob(inf) denotes the probability of informed trading.

Figures

Figure 1: Trading Process