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Trading around macroeconomic announcements: Are all traders created equal?

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Abstract

This paper examines the effects of macroeconomic announcements on equity index markets using high frequency transactions data for the regular and E-mini S&P 500 index futures contracts. For ten types of announcements that significantly affect prices, we analyze the price adjustment process and the trading patterns of exchange locals and off-exchange customers around the announcements. We find a large increase in trading activity immediately after the announcement. The results also show that during this initial surge in trading activity, locals are able to time their trades better than off-exchange traders even when locals do not have the advantage of access to the order flow. The trading strategy followed by exchange locals in the first 20 seconds after the announcement tends to be profitable, while off-exchange traders tend to make losing trades over the same time period. These results lend evidence that local traders tend to react to the macroeconomic information faster than off-exchange traders.

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1. Introduction

How the arrival of information is processed into prices continues to be an important research topic in finance. Theoretical studies by Grossman and Stiglitz (1980), Kyle (1985) and others argue that private information requires trading in order to be processed by the market. On the other hand, according to the traditional view expressed by French and Roll (1986), public information is reflected in prices before anyone is able to trade on it. A prominent example of public information releases is macroeconomic announcements. Empirical studies tend to show that the initial market reaction to macroeconomic announcements is very rapid. For example, Ederington and Lee (1993, 1995) and Fleming and Remolona (1999) show that a local equilibrium price level is established within a minute after the macroeconomic announcement.

Even such rapid initial price adjustment does not necessarily preclude some traders from extracting profits by trading on the public information. Ederington and Lee (1995) point out that if prices do not adjust fast enough “traders with quick access to the market may be able to earn excess trading profits based on the initial market response.” Specifically, traditional futures exchanges allow traders to acquire an exchange seat to be able to trade for their own account without broker intermediation. Such traders are called “locals” to stress their privileged access to the trading floor. Empirical studies show that local traders have an information advantage over off-exchange traders. Manaster and Mann (1999) conclude that exchange locals in futures markets are able to exploit their information advantage by timing their trades before favorable price movements.

It is unknown, however, whether local traders can exploit their advantage over off-exchange traders around macroeconomic announcements. On the one hand, price movements immediately surrounding the information release are most likely to be dominated by the specific public information announcement, and all traders should be equally informed about the cause of the price change.¹ On the other hand, locals’ access to the open outcry floor may give them an advantage during rapid price adjustment around macroeconomic announcements because they are able to react faster to market dynamics than off-exchange traders. Furthermore, access to the institutional order flow that arrives into the trading pit immediately after the announcement may help locals interpret implications of the news, since institutional traders are likely to have superior information-processing capabilities. Finally, in addition to their advantage derived from access to the trading floor, locals may have better ability to interpret information as compared to off-exchange traders.

The question this raises is: does any particular trader type have a trading advantage around macroeconomic announcements? The purpose of this paper is to address this question empirically. Specifically, by employing transactions data that contain trader type identification codes we examine trading patterns around macroeconomic announcements on

¹ The government agencies issuing new macroeconomic information follow almost identical release procedures that ensure instantaneous public information release at the scheduled time. Ederington and Lee (1993, 1995) and Fleming and Remolona (1999) provide a description of the release procedures.

regular and E-mini S&P 500 futures markets.² In order to analyze and compare trading patterns of different trader types, it is necessary to first explore the aggregate market reaction to the macroeconomic announcements. Most of the existing studies in this area have used lower frequency data or examined a smaller set of macroeconomic announcements because the major equity markets are closed when most of the US macroeconomic news is released. By using trade-by-trade data for two liquid index futures contracts, we are able to provide new evidence concerning the impact of macroeconomic announcements on equity prices, the speed of the price adjustment to the news and the reaction of the trading volume. We find that the speed of the price reaction varies significantly across different types of announcements. Unlike other studies, we observe a significant surge in trading volume immediately after the announcement. Consistent with [Green \(2004\)](#), this result suggests that trading may facilitate processing of public information by the market.

The analysis of trading patterns of exchange locals and off-exchange traders shows that locals appear to have a trading advantage immediately after macroeconomic announcements. We find that exchange locals are net buyers (sellers) during the initial price adjustment following a good (bad) news announcement while off-exchange traders are net sellers (buyers). Furthermore, the trading strategy followed by locals immediately after the announcement tends to be profitable regardless of whether an open outcry market is operating concurrently with the electronic market. That is, locals' ability to react to information quickly and correctly does not appear to stem only from their privileged access to the order flow on the open outcry floor.

The remainder of the paper is organized as follows. Section 2 gives a brief literature review and identifies the hypotheses to be tested. Section 3 describes the data and the sample selection procedure for the macroeconomic announcements. The empirical results are discussed in Section 4. Section 5 offers a brief summary and conclusions.

2. Literature review and hypotheses

Most models of price and volume reactions to public information announcements assume that traders have identical interpretations of public information signals. A notable exception is a model developed by [Kandel and Pearson \(1995\)](#), which assumes that traders differ in interpretation of public signals. These differential interpretations induce trading and result in a positive contemporaneous correlation between trading volume and absolute price changes. [Bamber et al. \(1999\)](#) show that, consistent with [Kandel and Pearson \(1995\)](#), differential interpretations of earnings announcements explain a significant proportion of trading around the announcements.

Scheduled macroeconomic announcements are an important example of public information releases. There is an extensive empirical literature that examines market reaction to macroeconomic news releases. Studies using high frequency data reveal extremely fast market reactions to major macroeconomic news. [Ederington and Lee \(1993, 1995\)](#) analyze

² The E-mini S&P 500 index futures contract trades on GLOBEX electronic system alongside the regular S&P 500 index futures contract that trades on the floor of the Chicago Mercantile Exchange (CME). The E-mini contract is sized at one-fifth of the regular contract.

the impact of macroeconomic news on interest rate and foreign exchange futures markets and find that most of the price reaction takes place within the first minute after release of the news, while volatility remains elevated for at least fifteen minutes. Fleming and Remolona (1999) document similar results for the US Treasury market and also examine impact of the macroeconomic announcements on trading volume and bid-ask spreads. They interpret the observed sharp price change accompanied by a reduction in trading volume at the time of the announcement as evidence that impounding of public information does not require trading.

Several studies have examined reactions of international equity index futures markets to macroeconomic news. For example, ap Gwilym et al. (1998) find that the FTSE 100 futures prices adjust to UK and US macroeconomic announcements within seventy to ninety seconds. Frino and Hill (2001) find that most of the reaction in the Australian Stock Price Index (SPI) futures contract to major scheduled news occurs within the first four minutes, with a surge in volume occurring about ten seconds after the announcement.

Early studies of the impact of US macroeconomic announcements on equity markets document a rather weak reaction of the market to the economic news releases. For example, Pearce and Roley (1985) show that only monetary announcements have a significant impact on equity market, whereas Jain (1988) and McQueen and Roley (1993) find that, in addition to monetary surprises, the inflation surprises are also significant.³ More recently, Flannery and Protopapadakis (2002) apply a GARCH model to the daily returns to study the response of the equity market to macroeconomic announcements and identify six announcements that are the most significant priced factors. Boyd et al. (2005) use daily returns data to study the equity market reaction to the unemployment news and find that the direction of the impact of that type of news on the market prices depends on the state of economy.

Studies of the reaction of US equity markets to macroeconomic announcements using high frequency data are less numerous, since most of the information releases take place before the major equity markets open. Adams et al. (2004) use minute-by-minute data to analyze differences in the response of different size stocks to the PPI and CPI announcements. Finally, Andersen et al. (2004) examine the links among stock, bond and foreign exchange markets using 5-minute futures returns and document the equity market reactions to a wide range of macroeconomic announcements.

This paper adds to the literature by using high frequency futures data to conduct an analysis of microstructure issues related to the reaction of US equity index markets to macroeconomic announcements. The detailed nature of our data allows us to observe announcement effects that are likely to be obscured in lower frequency data. Moreover, trader type identification codes available in our data set allow us to make contributions in understanding how different market participants react to public news releases.

Most theoretical microstructure studies treat market makers as uninformed traders.⁴ However, recent empirical studies show that exchange local traders in futures markets, who play the role of market makers, appear to be informed. For example, Manaster and

³ Pearce and Roley (1985) and McQueen and Roley (1993) use daily returns data and Jain (1988) uses hourly data.

⁴ See, for example, Glosten and Milgrom (1985), Kyle (1985), and Admati and Pfleiderer (1988).

Mann (1999) show that most of the locals' profits comes from strategic timing of their trades rather than from trade execution. Coval and Shumway (2001) show that the sound level on the open outcry floor contains important information. Such information, which is unavailable to off-exchange traders, may give exchange locals a trading advantage. Kurov and Lasser (2004) document that CME locals infer information from order flow off the exchange floor and use that information to trade on the electronic E-mini market.

We examine trading patterns of exchange locals and off-exchange traders in the regular and E-mini S&P 500 index futures markets around macroeconomic announcements. It is reasonable to expect that information contained in a macroeconomic announcement is received simultaneously by all interested traders. Nevertheless, institutional orders arriving to the exchange floor come from investors who may have superior analytical resources and ability to process new information better and faster than other market participants. Large institutions also have their own brokers on the CME floor and are able to communicate orders into the trading pit very efficiently. The ability of local traders to observe the incoming institutional order flow may give them an advantage over off-exchange traders. Therefore, we suggest the following hypothesis (stated in the null form):

H1. *Exchange locals are unable to time their trades better than off-exchange traders around macroeconomic announcements during regular trading hours when order flow is observable to local traders.*

The advantage from access to order flow, however, is only available during regular trading hours when the full-size S&P 500 futures contracts are traded on the open outcry floor and the corresponding E-mini contracts are traded on GLOBEX. It is not available during the pre-market period, when both contracts are traded electronically. Unless locals can react faster or are able to interpret macroeconomic information more accurately than off-exchange traders, locals should not be able to time their trades better than off-exchange traders during pre-market hours. Hence, Hypothesis H2 states:

H2. *Exchange locals are unable to time their trades better than off-exchange traders around macroeconomic announcements during the pre-market period when all traders have equal access to trading information.*

In both hypotheses, timing ability is defined as the ability to establish a profitable trading position. Locals may have a superior timing ability either because of their privileged access to the order flow information during the regular trading hours or simply from their ability to react faster to macroeconomic announcements. In the latter case, both hypotheses are likely to be rejected.

3. Data and sample selection

3.1. Index futures data

We examine trading activity and returns around the announcements in the regular and E-mini S&P 500 futures markets. The regular contracts are traded in the open outcry market

during regular trading hours, i.e., from 9:30 a.m. to 4:15 p.m. ET, and on the electronic GLOBEX system from 4:45 p.m. to 9:15 a.m. the following day. The E-mini contracts are traded only on GLOBEX from 4:45 p.m. to 4:15 p.m. the following day.⁵ Therefore, before regular trading hours (more precisely, before 9:15 a.m.) both regular and E-mini contracts are traded on GLOBEX. During regular trading hours the regular contracts are traded only on the open outcry floor and the E-mini contracts are traded only on GLOBEX. The sample period that we examine extends over four years from January 1, 1999 to December 31, 2002.

We use time and sales data for the regular S&P 500 futures during regular trading hours and GLOBEX trade data for the E-mini S&P 500 futures and for the regular S&P 500 futures during the pre-market period. The data are obtained from the Commodity Futures Trading Commission (CFTC). The GLOBEX trade data include all trades even when consecutive trades occur at the same price, while the standard time and sales data used in most of the existing studies of futures markets include only trades that result in price changes. Available data include trade date, trade time and order submission time to the nearest second, the contract month, buy/sell code, number of contracts traded, trade price, customer type indicator (CTI), and CTI of the opposite side of the trade. CTI ranges from 1 to 4 as follows: CTI1 are trades executed for a floor trader's personal account (local trade), CTI2 are trades executed for a clearing firm's account, CTI3 are trades executed for a personal account of another floor trader, CTI4 are trades executed for an account of an outside customer.

We also considered using available computerized trade reconstruction (CTR) data for the regular S&P 500 futures during the regular trading hours. Accurate trade timestamps are important in the analysis of the trading activity around the announcements. When the trade times are imputed by the CTR algorithm, trades for which accurate execution time is not determined are assigned to the beginning of 15-minute brackets based on trader cards. As a result, a significant amount of noise is introduced into the beginning of every 15-minute interval. We examine macroeconomic announcements made at 8:30 a.m. and 10:00 a.m. Since the results for the trading activity in the regular S&P 500 futures around the 10:00 a.m. announcements may not be reliable, we do not report these results. In contrast to the CTR data, in the GLOBEX trade data all trades are recorded automatically and reported with accurate timestamps in the exact order of occurrence.

3.2. Sample selection

The dates of macroeconomic news releases are obtained from the database on macroeconomic announcements and forecasts collected by Money Market Services (MMS) Inter-

⁵ The E-mini S&P 500 futures contracts were introduced by the CME in September 1997 in order to expand the CME's retail customer base and as a step in the eventual transition towards electronic trading. Because of the small size of the E-mini contracts, they are affordable to traders with small margin accounts. Wang and Ates (2003) show that trading in the E-mini markets is dominated by small traders. Although small traders are likely to be relatively uninformed, Hasbrouck (2003) documents that the E-mini contracts account for a dominant share of price discovery in the S&P 500 and Nasdaq-100 indexes. Kurov and Lasser (2004) show that exchange locals actively trade the E-mini contracts and may contribute to the informational dominance of the E-minis.

national, a subsidiary of Informa Financial Group.⁶ As the first step in our sample selection process, we find out which macroeconomic announcements have the largest impact on index futures prices by estimating the following regression similar to the one used by Fleming and Remolona (1997):

$$K_{it} = \gamma_0 + \sum_{t=1}^{T-1} \gamma_t D_t + \sum_{m=1}^M \eta_m D_{mit} + e_{it}, \quad (1)$$

where K_{it} is price volatility measured as absolute return on day i in the five minute interval t ; D_{mit} is a dummy variable that is equal to one if the announcement m is made on day i in the beginning of interval t ; and D_t is a dummy variable used to control for the intraday variation in volatility. Given that Hasbrouck (2003) shows that the E-mini futures dominate price discovery in the S&P 500 index markets, we use the E-mini price series to estimate the regression in (1).

The estimation results are reported in Table 1. Based on these results, we include in further analysis only the ten types of announcements that have a statistically significant impact on price volatility.⁷ The average impact of the most influential announcement (Employment Situation) is about 37.2 basis points, while the average impact of the least influential announcement out of the ten announcements that we consider (Factory Inventories) is about 4.5 basis points. The impacts of the Purchasing Managers' Index and Business Inventories are statistically significant at the 5% level, and the Factory Inventories impact is significant at the 10% level. The other seven announcements have price impacts that are significant at the 1% level. Seven of the ten announcements that we consider are made at 8:30 a.m. and three are made at 10:00 a.m.

Overall, the results reported in Table 1 are quite similar to the results of Ederington and Lee (1993) and Fleming and Remolona (1997), suggesting that the announcements that have the greatest effect on interest rates and foreign exchange rates also have the largest impact on the US equity markets. The results of Table 1 contribute to the previous literature by presenting the evidence of significant reaction of equity market to a larger variety of macroeconomic news. Furthermore, we not only document and quantify this reaction but also rank the announcements by their relative importance for the stock market.

3.3. Using announcement surprises to classify announcements as good or bad news

Our hypotheses focus on the trading activity of exchange locals and off-exchange traders around the announcements. To test these hypotheses, we classify announcements as good or bad news using the announcement surprises based on the MMS data. Every week MMS contacts a cross-section of market participants in order to collect their forecasts regarding the following week's economic announcements. The median of collected forecasts serves

⁶ Announcement release dates for four types of announcements (Unemployment Claims, Beige Book, Federal Budget, and Installment Credit) are collected from "The Week Ahead" section of Business Week.

⁷ One important announcement (Industrial Production) is made at 9:15 a.m. However, the regular futures stop trading in GLOBEX exactly at 9:15 a.m. Therefore, we limit our analysis to announcements made at 8:30 a.m. and 10:00 a.m.

Table 1
Average impact of macroeconomic announcements

Rank	Announcement	Release time (ET)	Coefficient	<i>t</i> -statistic
1	Employment	8:30	0.372***	6.19
2	Gross Domestic Product	8:30	0.199***	4.29
3	Retail Sales	8:30	0.140***	3.93
4	Consumer Price Index	8:30	0.121***	3.50
5	Consumer Confidence	10:00	0.119***	3.44
6	Durable Goods Orders	8:30	0.113***	3.47
7	Purchasing Managers' Index	10:00	0.108**	2.16
8	Producer Price Index	8:30	0.101***	2.80
9	Business Inventories	8:30	0.079**	2.38
10	Factory Inventories	10:00	0.045*	1.84
11	Construction Spending	10:00	0.031	0.65
12	Industrial Production	9:15	0.026***	2.84
13	Export–Import Prices	8:30	0.021	0.93
14	Leading Indicators	10:00	0.017	0.75
15	Beige Book	14:00	0.014	0.91
16	International Trade	8:30	0.013	0.92
17	Housing Starts	8:30	0.011	0.62
18	Unemployment Claims	8:30	0.008	0.60
19	Federal Budget	14:00	−0.002	−0.14
20	Consumer Sentiment	10:00	−0.002	−0.12
21	Installment Credit	15:00	−0.010	−0.74
22	Personal Income	8:30	−0.015	−0.92
	Adjusted R^2		0.077	

Notes. This table shows the impact of macroeconomic announcements on the prices of the E-mini S&P 500 index futures contracts for the period from January 1, 1999 to December 31, 2002. The reported coefficients represent the average impact of the announcement on the return volatility for the S&P500 futures prices measured by estimating the regression in Eq. (1). Volatility is computed as absolute value of the log price change times 100. Reported *t*-statistics are based on the Newey and West (1987) heteroskedasticity and autocorrelation consistent covariance matrix.

* The impact on volatility is statistically significant at the 10% level in a two-tailed test.

** Idem., 5%.

*** Idem., 1%.

as an estimate for the market expectations of the upcoming releases. In computing the size of the news surprises we follow methodology commonly used in studies of macroeconomic announcements.⁸ The unexpected component S_m for announcement m (announcements surprise) is estimated as follows:

$$S_m = MA_m - E_m, \quad (2)$$

where MA_m is the released value for the announcement and E_m is the median forecast from the MMS International survey. Different economic indicators are measured in different units. Therefore, we standardize the surprise measures by dividing the surprises by their standard deviation across all observations for a given announcement.

⁸ See, for example, Adams et al. (2004), Balduzzi et al. (2001), Boyd et al. (2005).

As noted by [Boyd et al. \(2005\)](#), macroeconomic news releases may contain information about three factors driving stock prices: expectations of future cash flows, the risk-free rate, and the equity risk premium. For example, an unexpected increase in the unemployment rate may signal a likely decrease of the risk-free rate (good news for the stock prices) but also reduce the expected rate of growth of corporate earnings and increase the equity premium (bad news for the stock prices). These potentially offsetting effects may make it difficult to specify the sign of the relationship between announcement surprises and stock prices a priori. [Boyd et al. \(2005\)](#) and [Andersen et al. \(2004\)](#) show that the same surprise contained in an announcement may be perceived by the market as good news during economic expansions and as bad news during recessions. Therefore, to determine the directional impact of announcement surprises on the stock market, we first separate the sample period into economic expansion and recession subperiods. We classify the period from January 1, 1999 to February 28, 2001 as the economic expansion subperiod and the period from March 1, 2001 to December 31, 2002 as the economic contraction subperiod.⁹ We then estimate the following regression separately for each of these two subperiods:

$$R_{5t} = \gamma_0 + \sum_{m=1}^M \gamma_m S_{mt} + \varepsilon_t, \quad (3)$$

where R_{5t} is the return on the E-mini S&P 500 index futures contracts over the five minutes after an announcement and S_{mt} is the standardized surprise for announcement type m . S_{mt} is equal to zero if the announced value of the economic variable was equal to the median MMS forecast or if the announcement of a particular type did not occur at time t . Only the ten announcement types selected in the previous subsection are included in the regression.

The regression results for the full sample, as well as for the two sub-samples, are presented in [Table 2](#). For the full sample the relationship between post-announcement returns and announcement surprises appears to be weak, with only one announcement (Consumer Confidence) significant at the 5% level and four other announcements significant at the 10% level. The results are much stronger, however, when the sample is divided into the two sub-samples based on the state of the economy. In the economic expansion sample, for five announcements there is a strong negative relationship between returns and announcement surprises. In contrast, in the recession sample, this relationship is positive for seven announcement types. Only one announcement (Business Inventories) is insignificant in both sub-samples. These results are broadly consistent with [Andersen et al. \(2004\)](#).

Finally, we classify an announcement as good or bad news based on the sign of the announcement surprise coefficient. For example, for the expansion sample the announcements with significantly negative coefficients are classified as good news if the announcement surprise is negative and as bad news if the announcement surprise is positive. Similarly, for the recession sample the announcements with significantly positive coefficients are classified as good news if the announcement surprise is positive and as bad news if the announcement surprise is negative. Announcements with insignificant surprise coefficients

⁹ Following [Andersen et al. \(2004\)](#), we define recession as beginning with three consecutive monthly declines in nonfarm payrolls and ending with three consecutive increases in nonfarm payrolls.

Table 2
Announcement surprise coefficients

Announcement	Full sample		Expansion		Recession	
	Coefficient	<i>t</i> -statistic	Coefficient	<i>t</i> -statistic	Coefficient	<i>t</i> -statistic
<i>Panel A. 8:30 a.m. announcements</i>						
Employment	−0.007	−0.07	−0.156	−1.57	0.311***	2.76
Gross Domestic Product	0.100	1.51	0.007	0.07	0.228***	4.10
Retail Sales	0.046*	1.72	−0.422**	−2.11	0.084**	2.19
Consumer Price Index	−0.102*	−1.85	−0.185**	−2.22	0.000	0.01
Producer Price Index	−0.080*	−1.68	−0.189**	−2.04	−0.019	−0.64
Durable Goods Orders	0.053	1.08	−0.072***	−2.79	0.185**	2.00
Business Inventories	−0.014	−0.38	0.024	0.28	−0.032	−1.47
<i>Panel B. 10:00 a.m. announcements</i>						
Purchasing Managers' Index	0.056	0.83	−0.167**	−2.02	0.244***	4.83
Consumer Confidence	0.119**	2.22	−0.056	−0.70	0.186***	2.75
Factory Inventories	0.047*	1.78	−0.045	−1.30	0.127***	3.62
Number of observations	474		252		222	
Adjusted R^2	0.0215		0.0755		0.2363	

Notes. This table shows the effect of macroeconomic news surprises on the prices of the E-mini S&P 500 index futures contracts. The reported coefficients are obtained from regression of the return on E-mini S&P 500 index futures contracts in the five-minute interval following an announcement on the standardized announcement surprises. Reported *t*-statistics are based on the Newey and West (1987) heteroskedasticity and autocorrelation consistent covariance matrix. The full sample period is from January 1, 1999 to December 31, 2002. The expansion sample period is from January 1, 1999 to February 28, 2001. The recession sample period is from March 1, 2001 to December 31, 2002.

* The coefficient is statistically significant at the 10% level in a two-tailed test.

** Idem., 5%.

*** Idem., 1%.

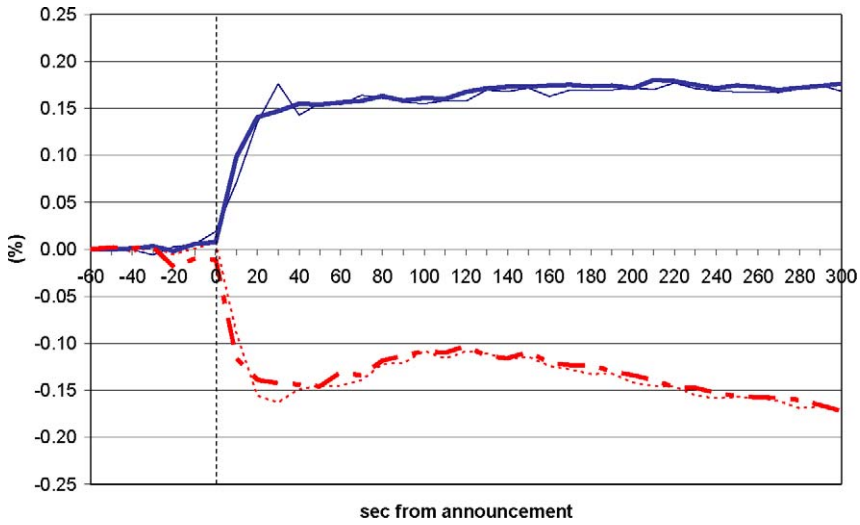
are removed either from the expansion sample or from the recession sample. The Business Inventories announcement is removed from both samples.

4. Empirical results

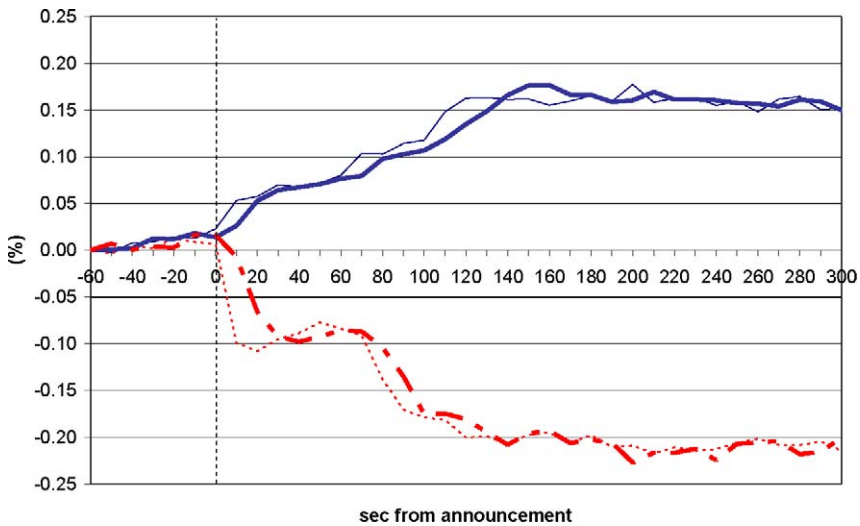
4.1. The speed of price reaction to macroeconomic announcements

To examine the speed of the S&P 500 futures reaction to the news, we compute average returns over ten-second intervals and cumulative average returns (CARs) around the announcements. We analyze the CARs separately for good and bad news announcements, as defined above, to check for asymmetry in the price response.

Figure 1 shows CARs for the regular and E-mini futures around 8:30 a.m. announcements, when both markets operate electronically, and around 10:00 a.m. announcements, when the regular futures contract operates as an open outcry market, from one minute before to five minutes after the announcements. The average price impact of the announcements is about 15–20 basis points for both 8:30 a.m. and 10:00 a.m. announcements. For 8:30 a.m. announcements almost all of the short-term price reaction appears to occur within



(a) Panel A. 8:30 a.m. announcements



(b) Panel B. 10:00 a.m. announcements

— E-mini (good news) ···· E-mini (bad news)
— regular (good news) — regular (bad news)

Fig. 1. Cumulative Average Returns (CARs) of the regular and E-mini S&P 500 futures around macroeconomic announcements. The announcements are classified as good or bad news by the sign of announcement surprise as discussed in Section 3.3.

the first 20 seconds after the announcement. This result suggests that the initial price reaction in the S&P 500 index futures markets appears to be somewhat faster than the price reactions documented in the previous studies. The CARs graph for the bad news announcements also provides some evidence of a possible reversal after an initial overreaction.¹⁰ The price adjustment appears to be slower after the 10:00 a.m. announcements. Figure 1 seems to show that on average it takes at least two minutes for prices to reach new equilibrium levels. Furthermore, the initial price reaction of the regular futures contract appears to lag the 10 a.m. announcements by about ten seconds.¹¹

To examine the speed of the market reaction more closely, we use the method suggested by Balduzzi et al. (2001). Specifically, we estimate the following regression of returns on the announcement surprises:

$$R_{\tau t} = \gamma_0 + \sum_{m=1}^M \gamma_m S_{mt} + \varepsilon_t, \quad (4)$$

where $R_{\tau t}$ is the return on the E-mini S&P 500 index futures contracts over the interval from τ sec to five minutes after an announcement and S_{mt} is the standardized surprise for announcement type m . The initial reaction to the announcement is the part of the reaction correlated with the announcement surprise. If the surprise coefficient is significant, it means that the time it takes for the new information to be fully reflected in the prices exceeds τ . In other words, the lowest value of τ for which the surprise coefficient is insignificant is the approximate time required for the prices to adjust to the news.

The results reported in Table 3 allow us to make inferences about the speed of the price adjustment to different types of announcements. For all announcements in the sample the price adjustment is complete after 4.5 minutes. However, for many of the announcements the price adjustment takes longer in the recessionary period than during the economic expansion. Specifically, in the expansion sample for all announcement types with the exception of the Purchasing Manager's Index the short-term price reaction occurs within 20 seconds after the announcement, while in the recession sample for five announcement types the price adjustment takes at least one minute. Consistent with the CAR graphs discussed above, for two of the 10:00 a.m. announcements the price adjustment appears to take more than two minutes.

4.2. Trading activity around macroeconomic announcements

To further examine the market reaction to the news, we analyze the trading activity around announcements. We compute the number of trades for the event window that includes one minute before and five minutes after the announcement time for the days when

¹⁰ Similarly, Ederington and Lee (1995), ap Gwilym et al. (1998) and Frino and Hill (2001) document an initial overreaction of futures prices, which is corrected within several minutes after the announcement.

¹¹ Several factors may account for this result. Firstly, it takes several seconds for incoming customer orders to reach the trading pit after an announcement. Secondly, the electronic market may impound the information faster. Thirdly, it is possible that news traders tend to trade in GLOBEX, leading to a faster price reaction in the electronic market. Finally, there may be a reporting lag between the actual trade execution time and the timestamps in the time and sales sequence that we use to compute returns of the regular futures.

Table 3
Speed of adjustment to macroeconomic announcements

Announcement	0	10 sec	20 sec	30 sec	60 sec	90 sec	120 sec	180 sec	240 sec	270 sec
<i>Panel A. Expansion sample</i>										
Employment	−0.156	−0.058	0.069	0.074	0.113	0.059	0.046	−0.008	−0.007	0.004
Gross Domestic Product	0.007	0.063	0.078	0.045	0.033	0.044*	0.075**	0.010	0.009	0.001
Retail Sales	−0.422**	−0.269	−0.054	0.111	−0.046	−0.034	−0.024	0.008	0.042	−0.028
Consumer Price Index	−0.185**	−0.143*	−0.076	−0.053	−0.019	−0.052	−0.020	−0.004	−0.007	0.003
Producer Price Index	−0.189**	−0.132*	0.064	0.133	0.052	0.009	−0.025	0.010	−0.004	−0.008
Durable Goods Orders	−0.072***	−0.052*	−0.004	0.006	−0.022	−0.025	−0.038	−0.031**	−0.004	−0.007
Business Inventories	0.024	0.080	0.039	−0.011	−0.011	0.005	0.003	−0.017	−0.008	−0.006
Purchasing Managers' Index	−0.167**	−0.166**	−0.180**	−0.162**	−0.165**	−0.079	0.018	−0.001	−0.021	−0.008
Consumer Confidence	−0.056	−0.042	−0.029	−0.009	0.019	0.031	0.053	0.036	0.005	−0.007
Factory Inventories	−0.045	−0.047	−0.040	−0.027	−0.020	−0.027	−0.029	−0.028	−0.013	−0.014
<i>Panel B. Recession sample</i>										
Employment	0.311***	0.206*	0.190*	0.160*	0.118*	0.110*	0.088	0.048	0.023	0.031
Gross Domestic Product	0.228***	0.083*	0.077**	0.053	0.060*	0.058**	0.057**	0.076*	0.026**	0.001
Retail Sales	0.084**	0.040	0.025*	0.030	0.024**	0.010	0.019	0.022***	0.018***	0.004
Consumer Price Index	0.000	0.022	0.058**	0.047***	0.049**	0.014	−0.006	−0.022	−0.008	0.013
Producer Price Index	−0.019	0.016	0.010	0.022	−0.005	−0.023	−0.018	−0.018	0.006	0.006
Durable Goods Orders	0.185**	0.080	0.042	0.035	0.084	0.046	0.031	0.025	0.005	0.011
Business Inventories	−0.032	−0.010	−0.008	0.001	−0.013	−0.015	−0.013	−0.005	0.007	−0.004
Purchasing Managers' Index	0.311***	0.217***	0.221***	0.214***	0.246***	0.178***	0.067	0.074	0.011	0.013
Consumer Confidence	0.228***	0.037	−0.005	0.002	−0.003	−0.037	−0.059	−0.034	−0.015	−0.021**
Factory Inventories	0.084**	0.061*	0.072**	0.091***	0.075*	0.045	0.061*	0.042*	0.021	0.008

Notes. This table reports the impact of the macroeconomic news surprises on the E-mini S&P 500 futures prices over consecutive time intervals. The reported coefficients are for the regression in Eq. (4). The regression is estimated using GMM and the Newey and West (1987) heteroskedasticity and autocorrelation consistent covariance matrix. The expansion sample period is from January 1, 1999 to February 28, 2001. The recession sample period is from March 1, 2001 to December 31, 2002. Employment, Gross Domestic Product, Retail Sales, Consumer Price Index, Producer Price Index, Durable Goods Orders, and Business Inventories announcements are made at 8:30 a.m. Purchasing Managers' Index, Consumer Confidence, and Factory Inventories announcements are made at 10:00 a.m.

* The coefficient is statistically significant at the 10% level in a two-tailed test.

** Idem., 5%.

*** Idem., 1%.

there was at least one of the announcements included in our sample.¹² Since the classification of announcements as good or bad news is not essential to this analysis, we examine all announcements of the ten types identified in Section 3.2. As a benchmark, we calculate the number of trades in the same time window for the days without an announcement at the same time of the day.

Table 4 reports the average number of trades within the event window for announcement and non-announcement days. Similar to the previous literature, we find a significant increase in trading volume around the 8:30 a.m. announcements for both regular and E-mini contracts and around the 10:00 a.m. announcements for the E-mini contract. However, in contrast to previous studies, we observe a volume increase immediately after the information release. The trading volume in the first ten seconds after the 8:30 a.m. announcements increases by a factor of about seven from the ten-second interval right before the announcement. The increase in trading activity after the announcement is less pronounced during the regular trading hours. After the initial surge, the volume gradually declines but stays relatively high for the next five minutes.

Figure 2 displays abnormal number of trades calculated as the average number of trades during announcement days minus the average number of trades during non-announcement days. There is a reduction in trading activity before the 10:00 a.m. announcements, suggesting that some traders prefer to stay out of the market during this period of high uncertainty. A similar reduction is not observed before the 8:30 a.m. announcements, possibly because of the generally low level of trading activity during the pre-market period.

The difference in the trading volume results compared to earlier studies is likely to be explained by the different market microstructures. For example, Fleming and Remolona look at a physically and operationally dispersed interdealer market. In contrast, index futures contracts are traded in centralized auction markets that have no designated market makers. Frino and Hill analyze index futures traded on the Sydney Futures Exchange (SFE) at the time when trading was conducted on the open outcry floor.¹³ Since most of the customer orders arrive to the trading pits by phone, it should take several seconds for the wave of orders to hit the floor. The increase in the trading volume in the first ten seconds after the announcement that we document occurs in the electronic GLOBEX system. According to GLOBEX traders, it usually takes less than a second for a market order to be executed. It is also possible that market makers in an open outcry market stop quoting for a few seconds after the announcement and watch the incoming order flow to interpret the implications of the news before beginning to announce new quotes. As a result, during this brief initial period there may be “no market” in the pit. The surge in the trading volume in the first ten seconds after the announcement that we observe indicates that GLOBEX traders may be able to trade against standing limit orders immediately after the announcement.¹⁴

¹² We also looked at the average trade sizes around the announcements but did not observe significant changes.

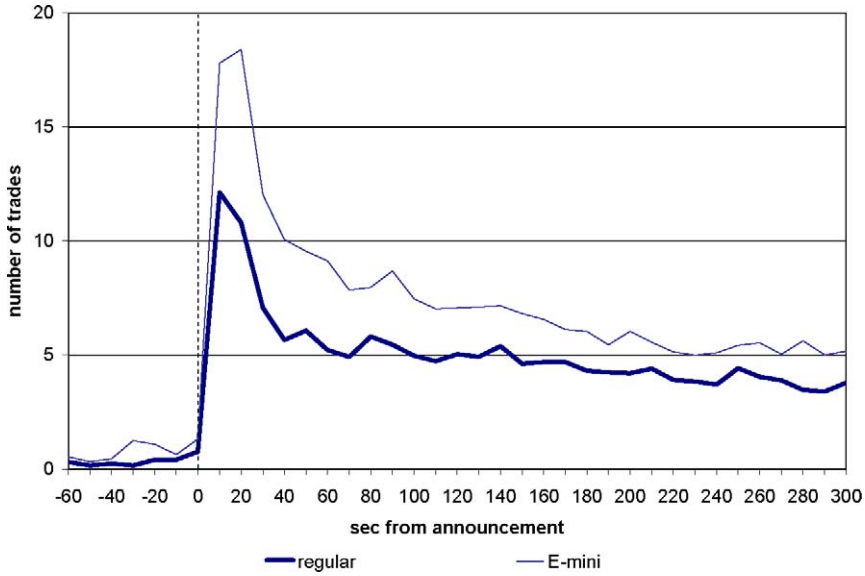
¹³ The SFE went electronic in December 1999.

¹⁴ A recent study by Erenburg and Lasser (2005) provides evidence on the existence of such standing limit orders in the limit order book of Island Electronic Communication Network (ECN) around macroeconomic announcements.

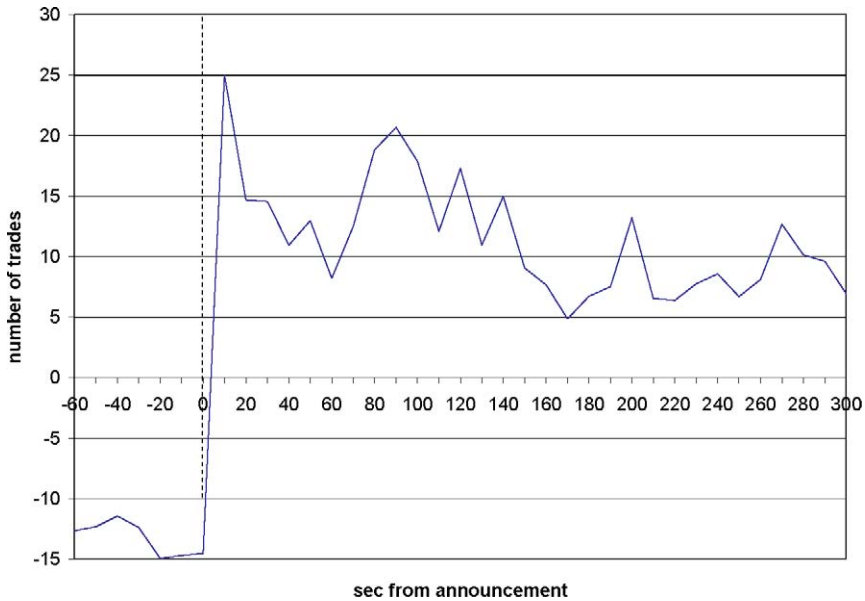
Table 4
Trading activity around macroeconomic announcements

Event time interval, sec	Regular S&P 500 futures			E-mini S&P 500 futures					
	8:30 a.m.			8:30 a.m.			10:00 a.m.		
	Announc. day	Non-announc. day	z-statistic	Announc. day	Non-announc. day	z-statistic	Announc. day	Non-announc. day	z-statistic
(–60; –50)	1.22	1.06	3.02	2.20	1.86	2.41	22.84	35.17	–4.35
(–50; –40)	1.39	1.14	3.52	2.25	1.80	3.15	23.43	34.87	–3.85
(–40; –30)	1.31	1.15	2.32	2.84	1.60	5.16	23.49	35.88	–4.18
(–30; –20)	1.48	1.07	3.40	2.79	1.71	4.71	21.53	36.47	–5.00
(–20; –10)	1.37	0.96	3.08	2.22	1.59	3.33	22.64	37.33	–4.44
(–10; 0)	1.82	1.06	4.27	3.03	1.71	3.75	23.23	37.77	–4.50
(0; 10)	13.95	1.82	15.81	20.58	2.79	13.80	70.09	45.10	0.48
(10; 20)	12.15	1.34	16.96	21.04	2.64	16.01	60.17	45.50	–0.05
(20; 30)	8.39	1.32	14.82	14.52	2.50	15.00	59.04	44.49	1.33
(30; 40)	7.02	1.36	14.08	12.32	2.26	14.78	55.84	44.91	1.81
(40; 50)	7.29	1.23	13.87	11.68	2.13	14.83	56.47	43.50	1.11
(50; 60)	6.63	1.41	13.13	11.17	2.05	14.37	50.89	42.70	1.12
(60; 120)	39.38	8.45	15.81	59.34	13.29	15.82	355.80	256.60	3.84
(120; 180)	36.27	7.66	16.65	52.69	12.90	15.94	303.40	249.24	2.78
(180; 240)	32.18	7.89	15.86	44.68	12.40	15.39	284.76	234.87	2.18
(240; 300)	29.94	6.91	16.48	43.67	11.88	14.94	283.97	229.92	2.80

Notes. This table shows trading activity (number of trades) surrounding 8:30 a.m. and 10:00 a.m. macroeconomic announcements for the period from January 1, 1999 to December 31, 2002. The z-statistics are used to compare trading activity on announcement and non-announcement days. These statistics are calculated using the Wilcoxon rank-sum test of the difference between two independent samples. The announcements included in the sample are Employment, Gross Domestic Product, Retail Sales, Consumer Price Index, Producer Price Index, Durable Goods Orders, Business Inventories, Purchasing Managers' Index, Consumer Confidence, and Factory Inventories.



(a) Panel A. 8:30 a.m. announcements, regular and E-mini S&P 500 futures



(b) Panel B. 10:00 a.m. announcements, E-mini S&P 500 futures

Fig. 2. Abnormal volumes (number of trades) around macroeconomic announcements. Abnormal number of trades is calculated as the average number of trades over a ten-second interval during announcement days minus the average number of trades over the same interval during non-announcement days.

4.3. Trading patterns and estimated trading profits of exchange locals and off-exchange traders

Finally, to test our two hypotheses regarding the ability of locals to time their trades, we examine the order flows of locals (CTI1) and off-exchange traders (CTI4) surrounding the announcements.¹⁵ The order flows are calculated as the number of contracts bought minus the number of contracts sold. A positive order flow in a particular interval suggests that more than half of all contracts traded in that interval by the specific trader type were bought. Similarly, a negative order flow suggests that the specific trader type tended to be on the sell side in that particular time interval. To examine whether locals are able to trade in the same direction as prices are expected to move based on the announcement surprise, we classify the announcements as good or bad news as outlined in Section 3.3 above.

Figure 3 and Table 5 report the order flows of locals and off-exchange traders for both the pre-market and 10:00 a.m. announcements for the regular and E-mini contracts. In the pre-market period exchange locals appear to make most of their trades after the announcement in the direction of the expected price movement in the regular futures. In other words, they are net buyers immediately after the good news announcements and net sellers immediately after the bad news announcements. Off-exchange traders, however, appear to be net buyers after bad news announcements and net sellers after good news announcements. Most of these order flows are statistically significant. Alternatively, the order flow pattern is less pronounced after the 8:30 a.m. announcements in the E-mini futures, where most of the order flows are not statistically significant. This result is not surprising, given that both contracts are traded electronically during the pre-market hours and that the regular contract has lower transaction costs.¹⁶

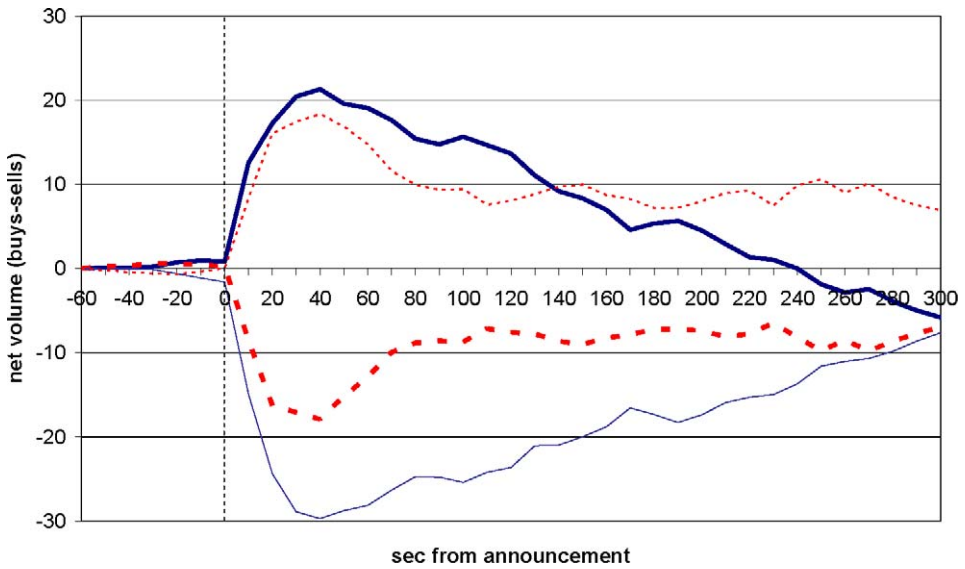
E-mini order flow results around the 10:00 a.m. announcements exhibit a pattern similar to that found in the regular contract at 8:30 a.m.¹⁷ Locals appear to trade in the direction of the expected price movement immediately after the announcement, i.e., they are net buyers after the good news announcements and net sellers after bad news announcements. Alternatively, off-exchange traders appear to be caught on the “wrong” side of the market in the first ten seconds after the announcement. These order flows are statistically significant at the 1% level. The order flow results show that the difference in buy relative to sell trades initially occurs immediately after the announcement, coinciding with the period of the major price reaction found previously. These results are consistent with the notion that locals are able to identify direction of the price movement and react quickly in taking a position immediately after macroeconomic announcements.¹⁸

¹⁵ CTI2 and CTI3 trades are relatively infrequent. Therefore, we omit these two types of trades from analysis.

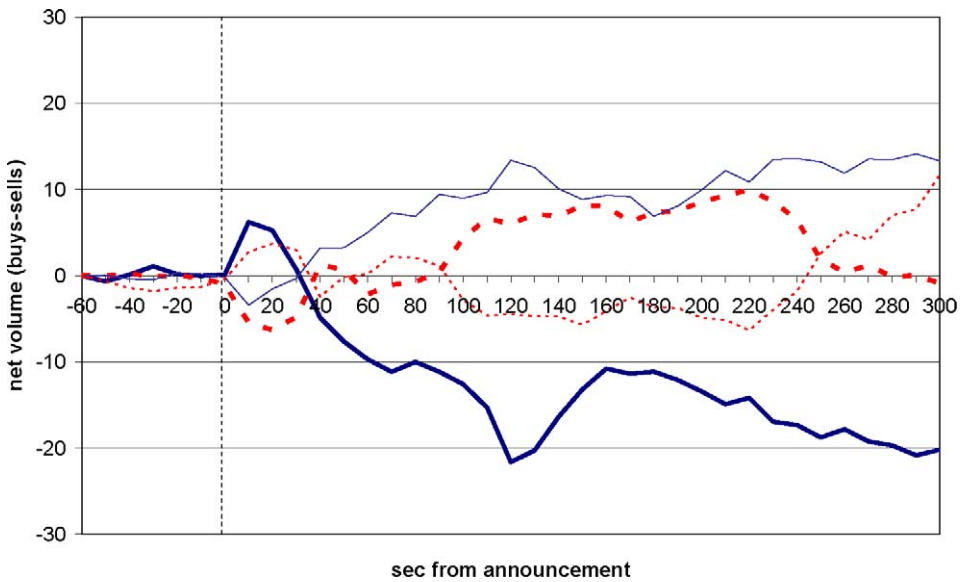
¹⁶ The lower transaction costs in the regular contract are due to the fact that the regular contract is five times larger than the E-mini contract and that some transactions costs, such as clearing and execution fees, are paid on a per contract basis.

¹⁷ We do not look at order flows in the regular futures around the 10:00 a.m. announcements because the reporting errors in the CTR data discussed above may distort the results.

¹⁸ We also examined the relationship between the magnitude of the announcement surprises and order flows of locals and off-floor traders. The results, which are not reported for brevity but available upon request, show that there is a positive correlation between local trader order flow and announcement surprise magnitude.



(a) Panel A. 8:30 a.m. announcements, regular E-mini S&P 500 futures



(b) Panel B. 8:30 a.m. announcements, E-mini S&P 500 futures

— CTI1 (good news) - - - CTI1 (bad news)
— CTI4 (good news) . . . CTI4 (bad news)

Fig. 3. Cumulative average order flows of locals (CTI1) and off-exchange traders (CTI4) in the regular and E-mini S&P 500 futures around macroeconomic announcements. The announcements are classified as good or bad news by the sign of announcement surprise as discussed in Section 3.3. The order flows are calculated as the number of contracts bought minus the number of contracts sold in ten-second intervals. CTI2 and CTI3 trades account for the imbalance between CTI1 and CTI4 order flows.

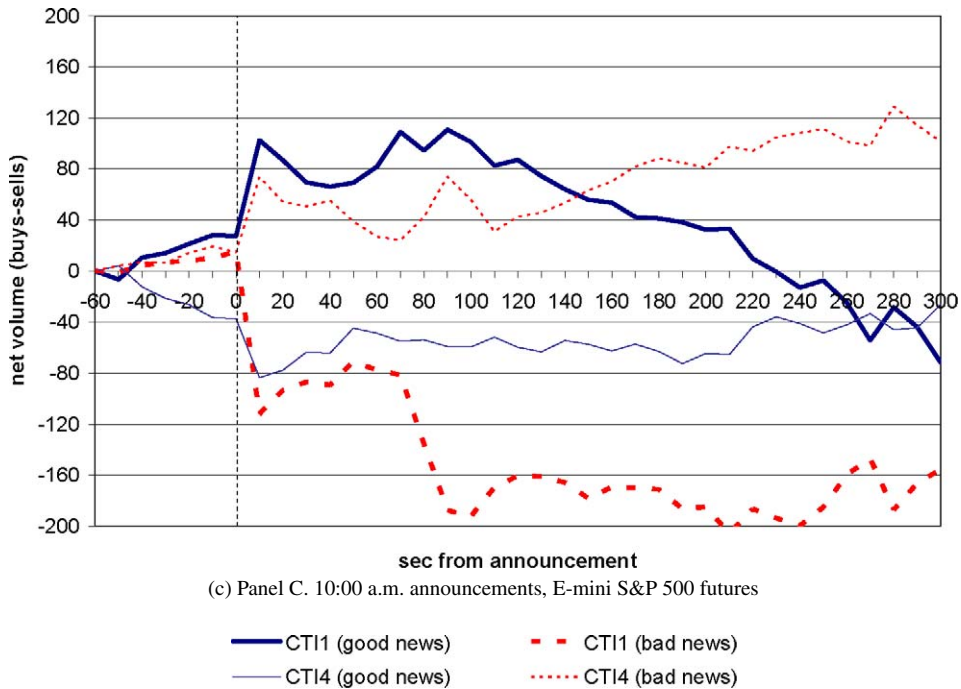


Fig. 3. Continued.

One could argue, however, that these results may be driven, at least in part, simply by the locals' order flow causing the price change and not due to their correctly predicting price changes. Therefore, we also test whether the trading strategy followed by locals is profitable by estimating trading profits for the first 10 to 20 seconds after an announcement. The trading profit for a trade at time t is estimated as follows¹⁹:

$$Profit_t = D_t(RP_t - P_t)Q_tM, \quad (5)$$

where RP_t is the reference price, P_t is the trade price, D_t is an indicator variable equal to one for buys and minus one for sells, Q_t is the trade size and M is the contract multiplier (\$250 for the regular S&P 500 futures and \$50 for the E-mini S&P 500 futures). Since the bid-ask quotes are not available in our data set, the reference price is calculated as the volume weighted average trade price during the sixth minute after the announcement. This price is used as the benchmark because based on the order flow results the trading strategy used by locals after the announcement appears to be very short-term.²⁰

¹⁹ Chang and Locke (1996) and Chakravarty and Li (2003), among others, use a similar approach to estimate trading profits in futures markets.

²⁰ We repeated the analysis of trading profits by using prices one, ten and 30 minutes after the announcement as the benchmark. The results were qualitatively unchanged.

Table 5

Average order flows of locals (CTI1) and off-exchange traders (CTI4) around macroeconomic announcements

Event time interval, sec	CTI1		CTI4	
	Good news	Bad news	Good news	Bad news
<i>Panel A. 8:30 a.m. announcements</i>				
Regular S&P 500 futures				
(−10; 0)	−0.09 (0.43)	−0.35 (0.49)	−0.47 (0.60)	0.38 (0.49)
(0; 10)	11.71*** (2.25)	−8.68*** (1.66)	−13.29*** (2.62)	8.33*** (1.80)
(10; 30)	7.89*** (1.76)	−8.57*** (3.07)	−14.00*** (2.84)	9.11*** (3.35)
(30; 60)	−1.35 (2.29)	4.22*** (1.62)	0.76 (2.44)	−2.69* (1.88)
(60; 120)	−5.44* (3.36)	2.33** (2.88)	4.53 (3.94)	−6.67** (3.20)
E-mini S&P 500 futures				
(−10; 0)	0.13 (0.58)	−0.70 (0.86)	−0.40 (0.65)	0.86 (0.75)
(0; 10)	6.12*** (2.51)	−4.48* (3.02)	−3.23 (3.37)	3.18 (2.96)
(10; 30)	−5.53* (3.39)	0.65 (3.73)	3.12 (3.37)	0.22 (3.85)
(30; 60)	−10.41*** (3.20)	2.64 (5.21)	5.32* (3.58)	−2.76 (4.99)
(60; 120)	−11.92*** (4.70)	8.15** (4.79)	8.37* (5.51)	−4.70 (5.31)
No. of announcements	75	81	75	81
<i>Panel B. 10:00 a.m. announcements</i>				
E-mini S&P 500 futures				
(−10; 0)	−0.77 (4.40)	4.88 (5.90)	−0.87 (4.66)	−4.67 (5.30)
(0; 10)	75.23*** (23.99)	−126.95*** (44.67)	−46.30*** (16.73)	59.02*** (19.73)
(10; 30)	−33.15* (20.58)	25.09 (37.60)	19.98* (14.48)	−22.86 (22.73)
(30; 60)	12.32 (25.18)	9.25 (40.30)	14.89 (18.91)	−23.95 (27.90)
(60; 120)	5.51 (35.56)	−82.84** (46.73)	−11.00 (17.90)	15.81 (35.56)
No. of announcements	47	43	47	43

Notes. This table shows average order flows of locals (CTI1) and off-exchange traders (CTI4) in the regular and E-mini S&P 500 futures surrounding macroeconomic announcements for the period from January 1, 1999 to December 31, 2002. The order flows are calculated as the number of contracts bought minus the number of contracts sold. CTI2 and CTI3 trades account for the imbalance between the CTI1 and CTI4 order flows. Standard errors are given in parentheses. Only announcements classified as good or bad news (as discussed in section III C) are included in the sample. Announcements that occurred simultaneously with an announcement of a different sign of the announcement surprise are removed from the sample.

* The order flow is statistically significant at the 10% level in a two-tailed test.

** Idem., 5%.

*** Idem., 1%.

Table 6

Estimated trading profits of locals (CTI1) and off-exchange traders (CTI4) around macroeconomic announcements

Event time interval, sec	Trader type	Mean	St. error of mean	Median	<i>p</i> -value	Number of trades
<i>Panel A. 8:30 a.m. announcements</i>						
Regular S&P 500 futures:						
(–60; 0)	CTI1	–7.3	99.3	–3.6	0.9681	765
	CTI4	–157.7	110.6	–109.1	0.0187	1479
(0; 10)	CTI1	154.9	59.10	161.2	<0.0001	1831
	CTI4	–60.4	86.1	–111.2	0.0400	2439
(10; 20)	CTI1	297.4	89.4	75.0	0.0077	1689
	CTI4	–314.4	104.2	–65.0	0.0045	2021
E-mini S&P 500 futures:						
(–60; 0)	CTI1	14.3	18.8	–6.0	0.6003	1777
	CTI4	9.3	13.4	0.0	0.8967	2525
(0; 10)	CTI1	44.9	14.1	36.0	<0.0001	2616
	CTI4	–13.8	8.0	–10.6	0.0002	4764
(10; 20)	CTI1	16.1	13.8	0.57	0.6973	2869
	CTI4	–4.2	8.8	–0.66	0.9300	4075
<i>Panel B. 10:00 a.m. announcements</i>						
E-mini S&P 500 futures:						
(–60; 0)	CTI1	18.9	10.4	–7.0	0.8343	12,648
	CTI4	–38.4	9.6	–3.9	0.0955	12,667
(0; 10)	CTI1	198.1	18.3	78.9	<0.0001	6799
	CTI4	–67.3	13.4	–36.9	<0.0001	9161

Notes. This table shows estimated trading profits of locals (CTI1) and off-exchange traders (CTI4) for 8:30 a.m. and 10:00 a.m. macroeconomic announcements for the period from January 1, 1999 to December 31, 2002. Trading profit (in dollars) for a trade at time t is estimated through Eq. (5). The p -values are for the Wilcoxon signed rank test of the null hypothesis that the trading revenues are equal to zero. Only announcements classified as good or bad news (as discussed in Section 3.3) are included in the sample. Announcements that occurred simultaneously with an announcement of a different sign of the announcement surprise are removed from the sample.

Table 6 provides the estimated profits of locals and off-floor customers for the E-mini futures separately for 8:30 a.m. and 10:00 a.m. announcements and for the regular futures for 8:30 a.m. announcements. For the regular contract around 8:30 a.m. announcements, the estimated trading profit for locals is about \$150 per trade in the first ten seconds after the announcement and about \$300 per trade in the second ten-second interval. Consistent with the order flow results, the estimated trading profits of locals are smaller in the E-mini contract after 8:30 a.m. announcements. At the same time, the estimated trading profits of locals in the E-mini contract are about \$200 per trade in the first ten-second interval after the 10:00 a.m. announcements. In all cases the estimated trading profits of locals are insignificant in the one-minute interval immediately before the announcement. The results reported in Table 6 also show that off-floor customers tend to incur losses in their trades immediately after the announcement.²¹

²¹ We also tested whether the trading strategy used by locals is more profitable after announcements with larger surprises by looking at announcements with the absolute values of standardized surprises greater than one. The

The results in [Tables 5 and 6](#) appear to reject [Hypothesis H1](#), which states that locals are unable to time their trades better than off-exchange traders around macroeconomic announcements during regular trading hours. The results from the analysis of pre-market trading seem to suggest that locals possess some advantage over off-exchange traders even when the open outcry floor is closed. These results lead us to reject our second hypothesis, that exchange locals are not able to time their trading activity more accurately than off-exchange traders around pre-market macroeconomic announcements. These results lend evidence that on average locals are able to react faster to new information than off-exchange traders.

5. Conclusions

This paper conducts a detailed intraday analysis of the impact of the major macroeconomic announcements on US equity markets using trade data for the S&P 500 index futures. We document the speed of the price reaction to different types of announcements and show that trading volume increases significantly in the first ten seconds after the news release. Our data set identifies trader types for both sides of each trade, allowing us to examine the trading behavior of different types of market participants around macroeconomic announcements.

The empirical results show that, during the initial surge in trading activity, exchange local traders are able to time their trades better than off-exchange traders by buying (selling) futures when the news is good (bad). During the pre-market period, when trading in both the regular and E-mini futures contracts takes place in GLOBEX electronic system, the timing behavior of exchange locals appears primarily in the regular futures contract. During regular trading hour announcements, locals appear to trade in the right direction in the E-mini futures market. In all cases, off-exchange traders tend to trade in the opposite direction relative to locals. The trading strategy followed by locals in both pre-market and regular trading hours appears to be profitable, while off-floor traders tend to make losing trades immediately after the announcement. From these results we conclude that local traders tend to react to macroeconomic information faster than off-exchange traders.

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estimated trading profits of locals increase substantially in the regular contract after the 8:30 a.m. announcements and in the E-mini contract after the 10:00 a.m. announcements. These results are not reported for brevity, but are available upon request.

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