INTRODUCING THE MINI-FUTURES CONTRACT ON IBEX 35: IMPLICATIONS FOR PRICE DISCOVERY AND VOLATILITY TRANSMISSION

Manuel Illueca and Juan A. Lafuente*

WP-EC 2004-13

Corresponding author: J.A. Lafuente, Departamento de Finanzas y Contabilidad, Universitat Jaume I; Campus del Riu Sec, 12071 Castelló de la Plana, Spain. Tel.: +34 96 472 86 06 / Fax: +34 96 472 85 91 / email: lafuent@cofin.uji.es

Editor: Instituto Valenciano de Investigaciones Económicas, S.A.
Primera Edición Mayo 2004.
Depósito Legal: V-2532-2004

IVIE working papers offer in advance the results of economic research under way in order to encourage a discussion process before sending them to scientific journals for their final publication.

* M. Illueca: Ivie and Universitat Jaume I, J.A. Lafuente: Universitat Jaume I.

INTRODUCING THE MINI-FUTURES CONTRACT ON IBEX 35: IMPLICATIONS FOR PRICE DISCOVERY AND VOLATILITY TRANSMISSION

Manuel Illueca and Juan A. Lafuente

ABSTRACT

In November 2001, the Spanish Official Exchange for Financial Futures and options launched the mini IBEX-35 futures contract. Following the seminal paper of Bessembider and Seguin (1992), this paper analyzes the effects of the introduction of the mini-futures contract in the Spanish stock index futures market. The objective of the paper is twofold: a) to analyze the potential destabilizing effect of the mini futures trading activity on the distribution of spot returns, and b) to test whether the mini futures contract significantly contributes to the price discovery process. A non-parametric approach is used to estimate the density function of spot return conditional to both spot and futures trading volume. Empirical findings using 15-minutes intraday data reveals that the mini futures trading activity enhances the price discovery function of the derivative market and does not destabilize spot prices.

KEY WORDS: Mini-futures, price discovery, destabilization, Ibex 35

RESUMEN

En Noviembre de 2001, el Mercado Oficial de Futuros y Opciones Financieros en España introdujo el contrato de futuros mini sobre el Ibex 35. En la línea del trabajo de Bessembinder y Seguin (1992), este trabajo analiza el efecto de la introducción de dicho contrato sobre el mercado de contado. En particular, hay dos objetivos fundamentales en el trabajo: a) analizar la potencial desestabilización de la actividad negociadora del mercado de derivados sobre el mercado de contado, y b) estudiar la contribución del nuevo contrato al proceso de formación de precios del mercado de contado. Para ello, se procede a la estimación no paramétrica de la función de densidad de la rentabilidad del contado, condicional al volumen de negociación tanto el mercado de contado como de futuros. Los resultados empíricos a partir de datos intradía cada 15 minutos revelan no solo que el nuevo contrato no tiende a desestabilizar el mercado de contado, sino que además contribuye de forma significativa al proceso de formación de precios en el mismo.

Palabras clave: Futuros mini, price discovery, desestabilización Ibex 35

1 Introduction

The contract design in futures markets should undoubtedly comply with traders' demands. Previous literature shows that, when the specifications of a futures contract seeks to mitigate price distortion and closely reflect the need of hedgers, the market is more likely to succeed (see, for example, Silber, 1981, Gray, 1987, Tashjian and McConnell, 1989 and Bollen et al., 2003). In accordance with this argument, and in response to customer requests to bring more efficient hedging, the Spanish Official Exchange for Financial Futures and Options launched the mini IBEX-35 futures contract in November 22, 2001. As pointed out by regulators, the aim of the mini contract is to expand futures trading activity to small investors, enhancing portfolio management by allowing them to handle lower nominal size to hedge spot positions.

Relative to the already listed contract, the main difference relies on two aspects: a) while the multiplier of the existing futures contract is 10 euros per index point, the multiplier of the mini contract becomes 1 euro per index point, and b) the tick size of the mini contract is greater: 5 index points in contrast with the 1 index points that corresponds to the standard contract.

Given that the introduction of a new futures contract might affect the trading volume of the futures contract already listed, the significant issue of whether such decision is beneficial for futures exchange immediately arises. Following the multi-product hedging model proposed by Pennings and Leuthold (2001), when adding a new futures contract the following effects can be discerned: 1) a demand (reflected in the hedged portion of the firms' endowment) increase for each futures contract already listed, 2) a demand decrease for each futures contract already listed, 3) an increase in the aggregate demand across the futures contracts already listed, 4) a decrease in the aggregate demand across the futures contracts already listed and 5) no change in the aggregate demand across the futures contracts. These authors refers to each of these five effects as *strong reinforcement*, *strong cannibalism, weak reinforcement, weak cannibalism* and *neutralism*, respectively. From a theoretical perspective, the mini contract added in the Spanish stock index futures market is a redundant asset, that is, its payoffs lie in the span of the existing tradable assets. With two futures contract written on the same underlying asset, both futures prices should exhibit a perfect and positive correlation. In these circumstances, according to Pennings and Leuthold's framework, the new contract should lead, at least, to *weak reinforcement.* Consistent with this theoretical forecast and considering a 12-months interval centered on the launching date, the aggregated futures trading activity increases, on average, by 11% before the introduction of the lower nominal.

At first glance, the mini contract is aimed to small, rather than institutional, investors, which are generally identified with uninformed traders (see, for example, Lee et al., 1999). Under the assumption of the representative agent hypothesis, expectations about the uncertain futures prices should be homogeneous across market participants. However this hypothesis do not seems to be a realistic assumption in financial markets (see Frechette and Weaver, 2001, Wang, F.A., 1998 and Harris and Raviv, 1993, among others). With heterogeneous agents, what affects investors' trading rules and how the dessign of trading strategies leads to market price updating are questions of interest to both financial practitioners and market regulators. As to stock index futures markets, one of the most important topics in the literature is whether derivative trading activity causes a destabilizing impact on spot prices. Given that spot and futures prices are linked by arbitrage operations, futures trading activity that causes futures price fluctuactions could become into *irrational* spot price volatility. This potential transmission of volatility could lead spot prices away from fundamentals, distorting the allocation of investors's resources.

Noisy rational expectations models provide theoretical explanations on the relationship between the trading behavior of investors with heterogenous information and market volatility. When information asymmetry among investors is important, uninformed traders face an adverse selection cost in trading with informed investors. For example, Hong (2000) develops a equilibrium model which uninformed investors trade in futures to hedge spot positions while informed traders also speculate on their private information. Equilibrium return and trading patterns are such that, when information asymmetry among investors is small the Samuelson effect holds, that is, return volatility in the futures market decreases with time to maturity. Harris and Raviv (1993) develops a theoretical model which traders share prior common beliefs about the returns to a particular asset and receive common information, but differ in the way in which they interpret this information. Their theoretical findings predict a positive correlation between trading volume and volatility. Shalen (1993) propose a model of a futures market with uninformed speculators and liquidity traders, showing that a greater dispersion of beliefs creates excess price volatility and volume. De Long et al. (1990) argue that uninformed traders are trend-followers, that is, they attempt to replicate informed traders buying (selling) when an increase (decrease) in prices takes place, because of such pattern likely reflects buying (selling) by informed traders. This positive-feedback trading strategy results in larger volatility.

This paper analyses the effects of introducing the mini futures contract in the Spanish stock index futures market. The aim of the paper is twofold: a) given that small traders might introduce additional noise in spot prices, the first objective is to test how the new contract affects the distribution of spot market returns, and b) the second objective is to test whether new small traders contributes to price discovery. To do this, intraday 15-minute along the period covering November 22, 2001 to December 17, 2002 are used to non-parametrically estimate the distribution of spot returns conditional to spot and both standard and mini futures trading volume. Empirical results can be summarized as follows: a) the mini futures trading activity does not destabilize spot prices, b) traders using the mini contract play a significant role in the price discovery process, regardless the contribution of traders using the standard contract. The first finding suggest that there is no significant information asymmetry among small and big investors, while the second one reveals that the introduction of the mini contract enhances the price discovery function of the futures market.

The rest of the paper is organized as follows. Section II describes the data set and the variables used in the analysis. In section III we present the methodology used to estimate the conditional density function of spot returns. Section IV provides empirical evidence on the relationship between spot returns distribution and both spot and futures trading volume. Finally, section V summarizes and makes concluding remarks.

2 Data

2.1 Description of the variables and sample period

Data on the Ibex 35 spot and futures markets were provided by MEFF RV (*Mercado Español de Futuros, Renta Variable*) for the period covering from November 22, 2001 to December 20, 2002. The intraday trading period considered covers from 9:00 to 17:30. We selected 15-minute spot prices and then, returns were generated by taking the first difference of the natural logarithm. We excluded overnight returns because they are measured over a longer time period. This procedure finally gave 34 return observations for each trading day. We macth the spot trading volume as well as both the mini and standard futures trading[1] within the corresponding 15-minute trading interval. Overall, we obtained 8,874 return and trading volume observations for each market.

Since the nearest to maturity contract is systematically the most actively traded, only data for the nearby futures contract was used. The point in time at which the current contract is rolled to the next is selected according to futures market depth. Ma et al. (1992) show that the conclusions drawn from three common empirical tests of futures markets (namely, a) risk-return combinations of a buy-and-hold trading strategy, b) serial dependence between returns and c) daily effects in the pay-off distributions) are not robust to the choice of method for rolling over futures contracts. The methods considered involve combinations of alternative dates on which the current contract is rolled as well as price adjustments. Figure 1 (Appendix 2) shows the intraday average trading volume within the expiration date, revealing that at 16:30 the following maturity becomes the higher volume contract. From that moment on, returns are computed using prices that correspond to this maturity.

2.2 Decomposition of detrended volume

To detrend spot and futures volume series, we first partitioned the intraday trading period into eight intervals according to the following time sequence: [9:00 10:00 11:00 12:00 13:00 14:00 15:00 16:00 17:30][2]. For each market and each interval we formed stationary time series of trading volume by using a centered moving average (see Illueca and Lafuente (2003), Fung and Patterson (1999) and Campbell et al. (1993), among others):

[1] Trading volume is measured in millions of euros.

[2] We performed this time partition to take into account of the intraday U-shape curve in trading volume.

$$V_{t-1,t} = \frac{TV_{t-1,t}}{\frac{1}{N}\sum_{j=-\left(\frac{N-1}{2}\right)}^{\frac{N-1}{2}} TV_{t-1+j,t+j}}, \tag{1}$$

where $TV_{t-1,t}$ is the trading volume between $t-1$ and t, N is the number of observations used to capture the trend of the series. We consider $N = 21$ for the seven hourly intervals generated from 9:00 to 16:00. For the last interval (16:00 to 17:30) we set $N = 31$. This volume measure produces a detrended time series that incorporates the change in the short-run movement in trading volume concerning the past five trading days. Table 1 provides the Augmented Dickey-Fuller test on the detrended volume series for both spot and futures market, thus corroborating that they are stationary.

For each trading interval we decompose volume into predictable and unpredictable components by using a trivariate Vector Autoregression:

$$\begin{pmatrix} Vspot_t \\ Vfut_{S,t} \\ Vfut_{M,t} \end{pmatrix} = C + \sum_{j=1}^{p} \Psi_j \begin{pmatrix} Vspot_{t-p} \\ Vfut_{S,t-p} \\ Vfut_{M,t-p} \end{pmatrix} + \varepsilon_t \tag{2}$$

where $Vspot_t$ denotes spot volume, and $Vfut_{S,t}$ and $Vfut_{M,t}$ refers to the futures trading volume corresponding to the standard and mini contract, respectively; ε_t is a trivariate gaussian random verctor and Ψ_j are 3×3 matrices that capture the impact of past trading volume in both markets. The fitted values from (2) are interpreted as the informationless trading, while the residuals of the model are interpreted as the innovation in trading activity in each market. The lag structure used involves past information corresponding to the three previous days[3]. Tables 2 to 4 report the test for joint significance of each group of lags. Significant cross interactions between trading volume are detected, suggesting that a univariate ARIMA model would not be adequate to filter raw series in order to identify expected and unexpected trading volume variables.

3 Methodology

As pointed out in Illueca and Lafuente (2003a), assuming without loss of generality, that spot return (R_s) has zero mean, to test the effect of trading activity on spot volatility parametric approaches seek to test whether in

$$E\left(R_{s,t}^2 \,|TA_{f,t}, R_{s,t-j}^2, j > 0\right) = \Phi\left(R_{s,t-j}^2, j > 0\right) + \gamma TA_{f,t} \tag{3}$$

the coefficient γ is not significant at conventional levels, where Φ is a parametric function and $TA_{f,t}$ is a variable that refers to futures trading activity (trading volume, open interest and related).

[3] Empirical results reported in the paper are qualitatively robust to alternative specifications of the VAR model ($p = 24, p = 36$).

The mixture of distribution hypothesis states that volume of trade is a good proxy to represent the rate of information flow in the market. Under the assumption that the number of information arrivals is an autocorrelated random variable, volume should contribute significantly to explaining the GARCH effects in stock returns. Indeed, Lamoureux and Lastrapes (1990) provide empirical evidence which shows that the parameter estimates of the GARCH model become insignificant when volume of trade is incorporated into the equation of the conditional variance of stock returns.In accordance with such argument, to test the effect of futures trading activity Bessembinder and Seguin (1992) incorporates the spot trading activity in the specification of the dynamics of spot returns.

Additionally, any transaction in the derivative market should not be considered as a potential source of instability. Bessembinder and Seguin (1992) states that unexpected trading volume should be related to the information arrivals to the market, while the expected component can be considered as the *natural activity* in the derivative market, that is, futures trading volume when no relevant new information arrives at the market. Taking into account the previous argument and assuming the mixture of distribution hypothesis, equation (3) can be reformulated as follows:

$$E\left(R_{s,t}^2 \left| TA_{f,t}, R_{s,t-j}^2, j>0\right.\right) = \alpha + \beta\left(TA_{s,t}\right) + \gamma\left(E\left(TA_{f,t}\right)\right) + \delta\left(U\left(TA_{f,t}\right)\right) + \varepsilon_t \tag{4}$$

where $(E(TA_{f,t}))$ and $(U(TA_{f,t}))$ refers to expected and unexpected components of futures trading activity. Testing the potential destabilizing effect and assesing the contribution of futures market to price discovery rely on the significativeness of parameters γ and δ.

However, there is no reason why researchers should be only interested in the conditional variance of spot returns. Instead focusing on a concrete conditional moment, researcher might focus on the behavior of the overall spot return distribution. Regarding the conditional density the destabilizing hypothesis can be stated as follows

$$H_0 : f\left(R_s | Vspot\right) = f\left(R_s | Vspot, E\left(Vfut_M\right)\right) \quad \text{(Hypothesis 1)}$$

while the null hypothesis to be tested concerning the contribution of futures market to price discovery is:

$$H_0 : f\left(R_s | Vspot, \hat{\varepsilon}_2\right) = f\left(R_s | Vspot, \hat{\varepsilon}_2, \hat{\varepsilon}_3\right) \quad \text{(Hypothesis 2)}$$

To do this, in this paper we use kernel smoothing to non-parametrically estimate the conditional density of spot returns.To proceed with the nonparametric estimation, we use the bootstrap bandwidth selection approach proposed in Bashtannyk and Hyndman (2001). The following steps are required:

1. We fit a parametric model $R_{s,i,} = \beta_0 + \beta_1 Vspot_i + \beta_2 Vspot_i^2 + ... + \beta_k Vspot_i^k + (\sigma + \upsilon Vspot_i)\varepsilon_i$ where ε_i are standard normal iid random disturbances, $\beta_0, \beta_{1,}\beta_{2,}...\beta_k$ and σ are estimated from the data and the lag length (k) is determined using the Akaike's (1973) information criteria. This way the theoretical model of spot returns has a heteroskedasticity pattern whith higher volatility associated with higher spot volume.

2. We simulate a bootstrap data set $R_s^{(l)} = \left\{R_{s,1}^{(l)}, R_{s,2}^{(l)}, ..., R_{s,n}^{(l)}\right\}$ based on the observations $Vspot = \{Vspot_1, Vspot_2, ..., Vspot_n\}$.

3. We choose the smoothing parameters a, b to minimize the Integrated Mean Squared Error: $M\left(a, b; m, r', \tilde{f}\right) = \frac{1}{m}\sum_{l=1}^{m} I\left(a, b; Vspot^{(l)}, R_s^{(l)}, r'_s, \tilde{f}\right)$

with: $I\left(a, b; Vspot^{(l)}, R_s^{(l)}, r'_s, \tilde{f}\right) =$
$= \frac{\triangle}{n}\sum_{j=1}^{N}\sum_{i=1}^{n}\left[\hat{f}\left(r'_{s,j} \mid Vspot^{(l)}\right) - \tilde{f}\left(r'_{s,j} \mid Vspot^{(l)}\right)\right]^2,$
where $V^{(l)} = \left\{Vspot_1^{(l)}, Vspot_2^{(l)}, ..., Vspot_n^{(l)}\right\}$, $R_s^{(l)} = \left\{R_{s,1}^{(l)}, R_{s,2}^{(l)}, ..., R_{s,n}^{(l)}\right\}$, $r'_s = \left\{r'_{s,1}, r'_{s,2}, ..., r'_{s,N}\right\}$ is a vector of equally spaced values over the sample space of R_s with $r_{s,i+1} - r_{s,i} = \triangle$, $\tilde{f}$ is a parametric estimation assuming the above parametric model and $\tilde{f}$ is calculated from $\left\{\left(Vspot_i^{(l)}, R_{s,i}^{(l)}\right)\right\}$ using the following modified form of Rosemblatt's (1969) estimator proposed in Hydman et al (1996):
$\tilde{f}\left(r_s \mid Vspot\right) = \frac{1}{b}\sum_{j=1}^{n} w_j\left(Vspot\right) K\left(\frac{\|r_s - Rs,j\|_R}{b}\right)$
where $w_j\left(Vspot\right) = \frac{K((\|r_s - r_{s,j}\|)/a)}{\sum_{i=1}^{n} K((\|r_s - r_{s,i}\|)/a)}$ and $K(\cdot)$ is the Gaussian Kernel function.

To implement the foregoing procedure considering more than one explanatory variable should be incorporated. To deal with the destabilizing effect, we partition the total matched sample of $(R_s, Vspot, E(Vfut_M))$, where $E(Vfut_M)$ refers to expected mini futures trading volume, into four equally sized groups according to .25-th quantiles of $E(Vfut_M)$. Let us denote each of the four subsamples of the bivariate $(R_s, Vspot)$ variable as $(R_s, Vspot)^j$ where j denotes that the subsample corresponds to the $[(j-1)*25, j*25]$ -th quantile of $E(Vfut_M)$.

Moreover, trading activity concerning the standard futures concerning the standard futures contract should contribute to price discovery aloing the sample period considered. Indeed Illueca and Lafuente (2003,b) provide empirical supporting this hypothesis for the period January 17, 2000-December 20, 2002. Therefore, to test the potential contribution of the mini futures trading activity to the price discovery process, we partition the total matched sample of $(R_s, Vspot, \hat{\varepsilon}_2, \hat{\varepsilon}_3)$ in accordance with the quantiles of $(\hat{\varepsilon}_2, \hat{\varepsilon}_3)$, where $\hat{\varepsilon}_2$ and $\hat{\varepsilon}_3$ refers to unexpected futures volume and unexpected mini volume, respectively. Specifically, we consider the following four subsamples of $(R_s, Vspot)$. Two subsamples corresponding to the $[0-25]$-th quantile of futures trading activity and either the $[0-50]$-th or the $[50-100]$-th quantile of mini futures trading activity, while the other two subsamples considered corresponds to the $[75-100]$-th quantile of futures trading activity and either the $[0-50]$-th or $[50-100]$-th quantile of mini futures trading activity. These four subsamples represents trading scenarios which combine high trading activity in the standard contract with either low or high trading activity in the mini contract. Let us denote each of the four subsamples of the bivariate $(R_s, Vspot)$ variable as $(R_s, Vspot)^{i,j}$ where i,j denotes that the subsample corresponds to the $[(i-1)*25, i*25]$ -th quantile of $\hat{\varepsilon}_2$ and the $[(j-1)*50, j*50]$ -th quantile of $\hat{\varepsilon}_3$.

Finally, after the visual inspection of the estimated conditional density functions for each subsample, we formally test the foregoing null hypotheses of equality between conditional distributions using a goodness-of-fit test from a discrete version of these conditional functions. To implement this test a discrete version of the conditional density function is required. A partition of both supports (spot return and volume) into r equally sized groups is considered. The chi-squared statistic to test (Hypothesis 1) is:

$\sum_{i=1}^{r}\sum_{k=1}^{r}\frac{\left(f_{ik}^{j}-p_{ik}\right)^2}{p_{ik}}$ where $p_{i,k}=\frac{f_{ik}}{\sum_i f_{ik}}\frac{T}{4r}$, T is the sample size, f_{ik}^{j} is the number of observations within the $i-th$ group of returns and the $k-th$ group of spot volume for the subsample corresponding to the $[(j-1)*25, j*25]$ -th quantile of expected mini futures volume, while f_{ik} refers to the corresponding frequency that corresponds to the overall sample. The use of the asymptotic distribution is suitable when $f_{ik}^{j}\geq 5$. To maximize the power of the test, we consider the maximum number of groups (r) subject to the previous constraint.

The chi-squared statistic to test (Hypothesis 2) is:

$\sum_{i=1}^{r}\sum_{k=1}^{r}\frac{\left(f_{ik}^{r,j}-f_{ik}^{r,j}\right)^2}{p_{ik}}$ where $f_{ik}^{r,j}$ is the number of observations within the $i-th$ group of returns and the $k-th$ group of spot volume for the subsample corresponding to the $[(r-1)*25, r*25]$ -th quantile of $Vfut_S$ and the $[(j-1)*50, j*50]$ -th quantile of $Vfut_M$. The use of the asymptotic distribution is suitable when $f_{ik}^{r,j}\geq 5$. As previously mentioned, we consider the maximum number of groups (r) subject to the previous constraint.

4 Empirical Results

Figures 2 to 5 show the density functions of spot returns conditional to expected mini futures trading volume as well as the corresponding contour plots. The conditional densities reveal that, irrespective of the mini futures trading activity, the probabilistic mass spreads as spot volume increases, revealing a positive relationship between spot volume a spot volatility. This is consistent with previous research that shows a positive correlation between volume and absolute returns in equity markets (see Karpoff, 1987). As mentioned above, one possible explanation is the information flow hypothesis. Since price changes per unit of calendar time are the sum of the price changes occurring during that period, if it is assumed that a) prices evolve when new information arrives at the market and b) the number of information arrivals is random, a positive correlation is expected between volume and absolute returns as volume is positively correlated with the number of information arrivals to the market.

Relative to the potential destabilizing effect of the mini futures trading, the comparison of the four figures reveal the continuous sequence of univariate density functions of spot returns conditional to alternative spot trading volume does not sharply change, suggesting that the expected futures trading activity of the mini contract does not significantly contributes to explain the behavior of spot returns. Table 5 reports the empirical values of the goodness of fit test for the null hypothesis (Hypothesis 1) of equality between both conditional distributions. The null hypothesis is not systematically rejected at the 1% significance level for all the cuartiles. Overall, empirical findings reveal that the conditional density of spot returns does not significantly change with expected mini futures trading activity. This support the hypothesis that the mini futures market is not a force behind spot destabilization

As to price discovery function of the new futures contract, Figures 6 to 9 depict the bivariate density function of spot returns conditional to spot volume corresponding to four alternative scenarios of the futures trading activity, as well as the corresponding contour plots. Figure 6 and 7 corresponds to low unexpected trading activity of the standard contract and low and high trading activity of the mini contract, respectively. Figures 8 and 9 are analogous, but concerning with high unexpected futures trading of the standard contract. The visual inspection of these figures clearly reveal that, given a level of unexpected futures trading relative to the higher nominal contract, the conditional density of spot returns does not remain unchanged, that is, Figure 6 and 8 clearly differs from Figure 7 and 9, respectively. This qualitative aspect is consistent with the empirical values of the goodness of fit test reported in Table 6. The null hypothesis (Hypothesis 2) is rejected in both cases at the 1% significance level. We therefore conclude that the mini futures contract significantly contributes to the price discovery, suggesting that there is no significant information asymmetry among small and institutional investors.

5 Conclusions

This paper provides empirical evidence on the effect of futures trading activity on the distribution of spot market returns in the Spanish stock index futures market after the introduction of the mini contract. Instead of simply focusing on the effect of futures trading on spot volatility, we propose a more general approach which consists of examining the contemporaneous relationship between futures trading activity and the overall probability distribution of spot market returns. In particular two objectives are carried out: a) the analysis of the potential destabilizing effect of mini futures trading activity and b) the study of the potential contribution of the mini contract to the price discovery process in the market.

Using 15-minute intraday data covering the period November 11, 2001-December 20, 2002, non-parametric kernel smoothing is applied to estimate the conditional density function of spot returns conditional to spot volume. Consistent with the information flow hypothesis, spot volume significantly contributes to explaining spot price fluctuations.

To test the effect of mini futures trading on the distribution of spot returns, we estimate the conditional density function of spot returns under different levels of mini futures trading volume. Empirical results suggest that the conditional density function of spot returns does not depend on mini expected futures trading, and therefore that mini futures trading can not be considered as a source of irrational spot price fluctuations. Moreover, the added contract, specially aimed to small investors enhances the price discovery function of the derivatives market.

References

[1] Bashtannyk, D.M. and R. Hyndman (2001), Bandwidth selection for kernel conditional density estimation, *Computational Statistics and Data Analysis*, 36, 279-298.

[2] Bessembinder H. and P. J. Seguin (1992). Futures trading activity and stock price volatility. *Journal of Finance* 47, 2015-2034.

[3] Bollen, N.P.H., Smith, T. and R.E. Whaley (2003), Optimal contract design: For whom?, *Journal of Futures Markets* 23(8), 719-750.

[4] Campbell, J. Y., Grossman, S.J. and J. Wang (1993), Trading volume and serial correlation in stock returns, *Quaterly Journal of Economics*, 108, 905-939.

[5] De Long, J.B. Shleifer, A., Summers, L.H. and R,J. Waldman (1990), Noise trader risk in financial markets, *Journal of Political Economy* 98, 703-738.

[6] Frechette D.L. and R.D. Weaver (2001), Heterogeneous expectations of traders in speculative futures markets, *Journal of Futures Markets,* 21(5), 429-446.

[7] Fung H. and G. A. Patterson (1999), The dynamic relationship of volatility, volume, and market depth in currency fuutures markets, *Journal of International Financial Markets Institutions and Money,* 9, 35-39.

[8] Gray, R.W. (1987), Why does futures trading succeed or fail: an analysis of selected commodities. In: Peck, A.E. (Ed.), Readings in Futures Markets. Chicago Board of Trade, Chicago, pp.235-248.

[9] Harris, M. and A. Raviv (1993), Differences of opinion make a horse race, *Review of Financial Studies* 44, 431-449.

[10] Hong, H. (2000), A model of returns and trading in futures markets, *Journal of Finance* 55(2), 959-988.

[11] Illueca M. and J.A. Lafuente (2003). The effect of spot and futures trading on stock index volatility: A non-parametric approach, *Journal of Futures Markets,* 23(9), 841-858.

[12] Illueca M. and J.A. Lafuente (2003). The effect of futures trading activity on the distribution of spot market returns. Working Paper, EC 2003-23. Instituto Valenciano de Investigaciones Económicas.

[13] Karpoff, J.M. (1987). The relationship between price changes and trading volume: A survey, *Journal of Financial and Quantitative Analysis* 22, 109-126.

[14] Lee, Y., Lin J. and Y. Liu (1999), Trading patterns of big versus small players in an emerging market: An empirical analysis, *Journal of Banking and Finance* 23, 701-725.

[15] Pennings, J.M.E. and R.M. Leuthold (2001), Introducing new futures contract: reinforcement versus cannibalism, *Journal of International Money and Finance* 20.

[16] Shalen, T.V. (1993), Volume, volatility, and the dispersion of beliefs, *Review of Financial Studies* 6, 405-434.

[17] Silber, W.L. (1981), Innovation, competition, and new contract design in futures markets, *Journal of Futures Markets 1(2), 123-155.*

[18] Tashjian, E. and J. McConnell (1989). Requiem for a market: an analysis of the rise and fall of a financial futures contract, *Review of Financial Studies* 2(1), 1-23.

[19] Wang, F.A. (1998), Strategic trading, asymmetric information, and heterogenous prior beliefs, *Journal of Financial Markets* 1, 321-352.

Appendix 1 (Tables)

Table 1. Unit root test for stock and futures market volume series

	Spot volume	Futures volume	
		Standard contract	Mini contract
Trading interval			
9:00-10:00	-12.90	-12.75	-11.72
10:00-11:00	-14.08	-13.11	-14.92
11:00-12:00	-14.55	-13.84	-14.13
12:00-13:00	-13.64	-12.96	-13.29
13:00-14:00	-12.99	-12.22	-12.27
14:00-15:00	-14.69	-12.39	-14.06
15:00-16:00	-13.08	-12.36	-12.59
16:00-17:30	-16.56	-14-10	-15.73

The table reports the results of the test of the null hypothesis $H_0 : \rho = 0$ from the regresions of the form:

$$\Delta V_t = \rho V_{t-1} + \alpha + \sum_{j=1}^{p} \Delta V_{t-j} + \varepsilon_t$$

where the number of lags ($p = 15$) is chosen in order to ensure no significant residual autocorrelation. The MacKinnon critical values for rejection of hypothesis of a unit root at the 1% and 5% signifcance level are -3.4421 and -2.8660, respectively.

Table 2. Test of joint significance in the VAR model

Dependent variable	$Vspot$		
Group of regressors	$Vspot$	$Vfut_S$	$Vfut_M$
Trading interval			
9:00 - 10:00	171.59 (0.00)	30.01 (0.00)	17.21 (0.14)
10:00 - 11:00	71.47 (0.00)	27.93 (0.01)	20.41 (0.06)
11:00 - 12:00	85.11 (0.00)	17.06 (0.15)	5.73 (0.93)
12:00 - 13:00	129.52 (0.00)	34.48 (0.00)	17.61 (0.13)
13:00 - 14:00	123.87 (0.00)	15.75 (0.20)	8.84 (0.72)
14:00 - 15:00	125.44 (0.00)	21.92 (0.04)	6.82 (0.87)
15:00 - 16:00	253.11 (0.00)	15.78 (0.20)	22.80 (0.03)
16:00 - 17:30	209.99 (0.00)	108.03 (0.00)	14.40 (0.28)

Note: The null hypothesis that all the coefficients corresponding to each group of regressors are equal to zero. Wald test is asymptotically distributed as a chi-squared with 12 degrees of freedom. In parentheses are the p-values.

Table 3. Test of joint significance in the VAR model

Dependent variable	$Vfut_S$		
Group of regressors	$Vspot$	$Vfut_S$	$Vfut_M$
Trading interval			
9:00 - 10:00	55.59 (0.00)	96.13 (0.00)	20.28 (0.06)
10:00 - 11:00	108.81 (0.00)	59.41 (0.00)	10.73 (0.55)
11:00 - 12:00	92.53 (0.00)	32.40 (0.00)	11.68 (0.47)
12:00 - 13:00	60.70 (0.00)	74.28 (0.00)	12.91 (0.38)
13:00 - 14:00	79.88 (0.00)	39.15 (0.00)	11.06 (0.52)
14:00 - 15:00	121.65 (0.00)	37.98 (0.00)	27.55 (0.01)
15:00 - 16:00	113.48 (0.00)	81.41 (0.00)	12.91 (0.38)
16:00 - 17:30	25.51 (0.01)	57.37 (0.00)	49.61 (0.00)

Note: The null hypothesis that all the coefficients corresponding to each group of regressors are equal to zero. Wald test is asymptotically distributed as a chi-squared with 12 degrees of freedom. In parentheses are the p-values.

Table 4. Test of joint significance in the VAR model

Dependent variable	$Vfut_M$		
Group of regressors	$Vspot$	$Vfut_S$	$Vfut_M$
Trading interval			
9:00 - 10:00	42.36 (0.00)	25.87 (0.01)	72.37 (0.00)
10:00 - 11:00	65.34 (0.00)	35.43 (0.00)	57.88 (0.00)
11:00 - 12:00	89.21 (0.00)	19.79 (0.07)	68.69 (0.00)
12:00 - 13:00	82.32 (0.00)	17.22 (0.14)	44.97 (0.00)
13:00 - 14:00	93.10 (0.00)	12.98 (0.37)	60.89 (0.00)
14:00 - 15:00	111.66 (0.00)	22.09 (0.04)	64.08 (0.00)
15:00 - 16:00	157.48 (0.00)	12.94 (0.37)	73.32 (0.00)
16:00 - 17:30	104.49 (0.00)	17.90 (0.12)	10.96 (0.00)

Note: The null hypothesis that all the coefficients corresponding to each group of regressors are equal to zero. Wald test is asymptotically distributed as a chi-squared with 12 degrees of freedom. In parentheses are the p-values.

Table 5. Test of the equality between conditional distributions of spot returns for alternative levels of total futures trading volume

Null Hypothesis:	$\chi^2_{(r-1)^2}$	p-value	r
$g\left(R_s\|Vspot\right) = f(R_s\|Vspot^1)$	122.06	0.07	11
$g\left(R_s\|Vspot\right) = f\left(R_s\|Vspot^2\right)$	116.68	0.12	11
$g\left(R_s\|Vspot\right) = f\left(R_s\|Vspot^3\right)$	112.13	0.71	12
$g\left(R_s\|Vspot\right) = f\left(R_s\|Vspot^4\right)$	92.76	0.18	10

Note: $Vspot^j$ refers to the subsample of $(R_s, Vspot)$ that corresponds to the $[(j-1)*20, j*20]$ -th quantile of expected mini futures volume.

Table 6. Test of the equality between conditional distributions of spot returns for alternative levels of total futures trading volume

Null Hypothesis:	$\chi^2_{(r-1)^2}$	p-value	r
$g\left(R_s\|Vspot^{1,1}\right) = f(R_s\|Vspot^{1,2})$	326.53	(0.00)	7
$g\left(R_s\|Vspot^{4,1}\right) = f\left(R_s\|Vspot^{4,2}\right)$	373.33	(0.00)	9

Note: $Vspot^{i,j}$ refers to the subsample of $(R_s, Vspot)$ that corresponds to the $[(i-1)*25, i*25]$ -th quantile of unexpected futures volume and the $[(j-1)*50, j*50]$ -th quantile of unexpected mini futures volume.

Appendix 2 (Figures)

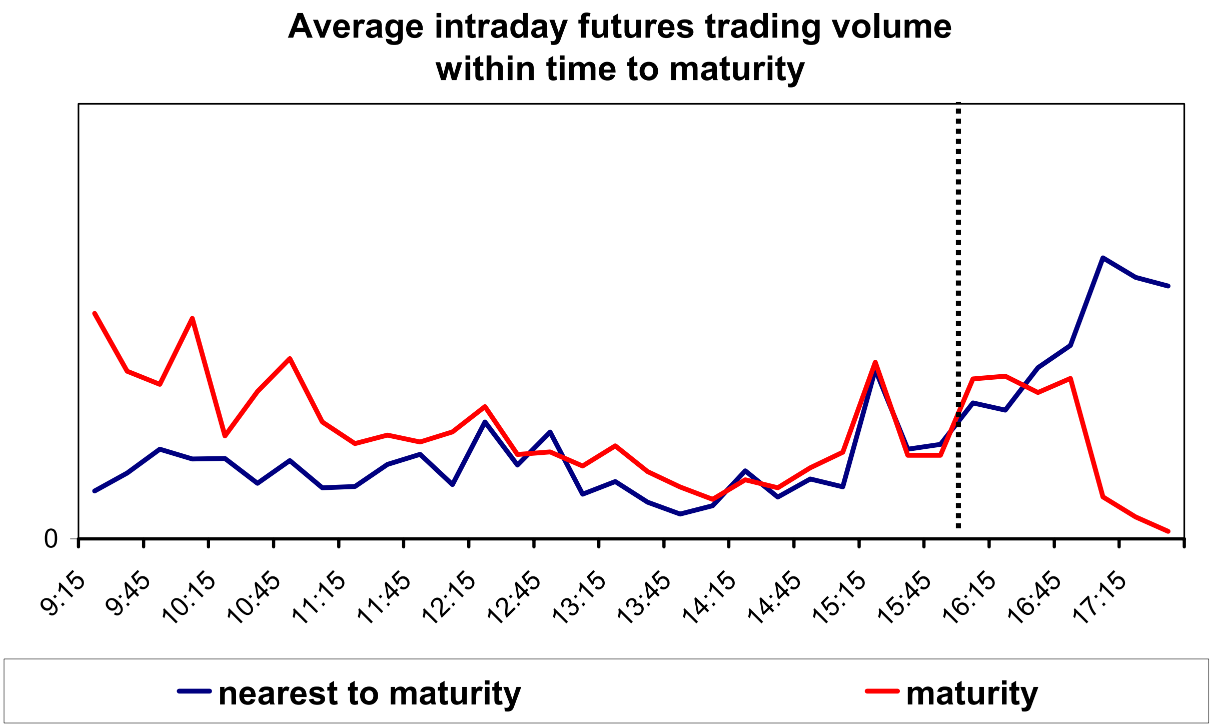


Figure 1: Average intraday futures trading volume within time to maturity

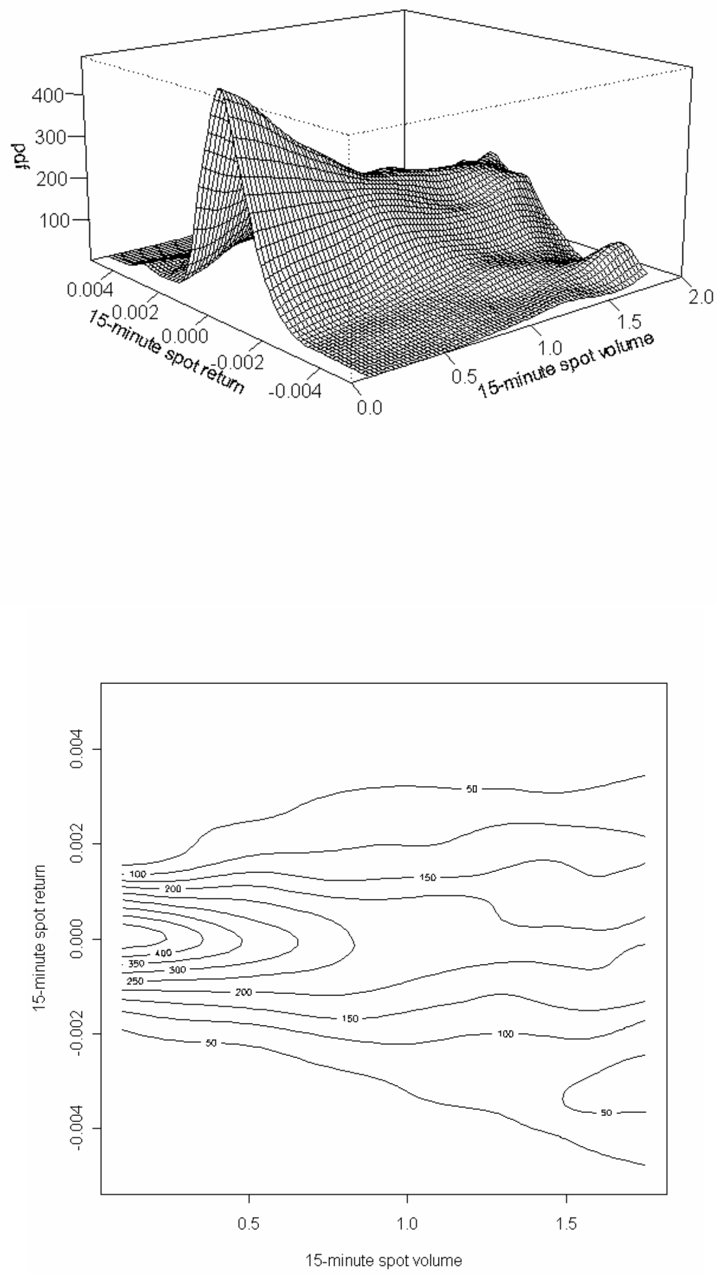


Figure 2. Density function of spot return conditional to total spot volume when the contemporaneous expected mini futures volume $\in$ [0-25]-th quantile

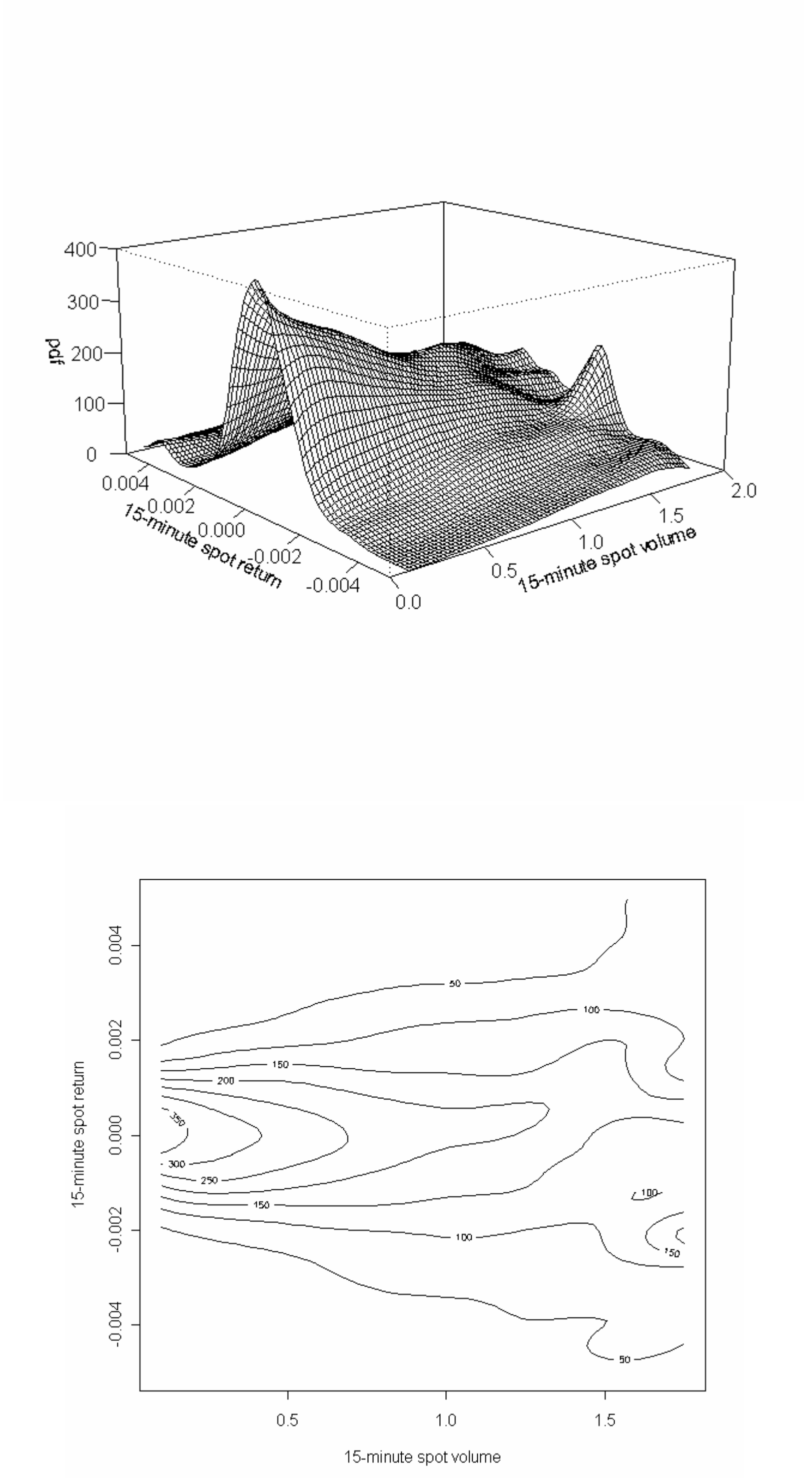
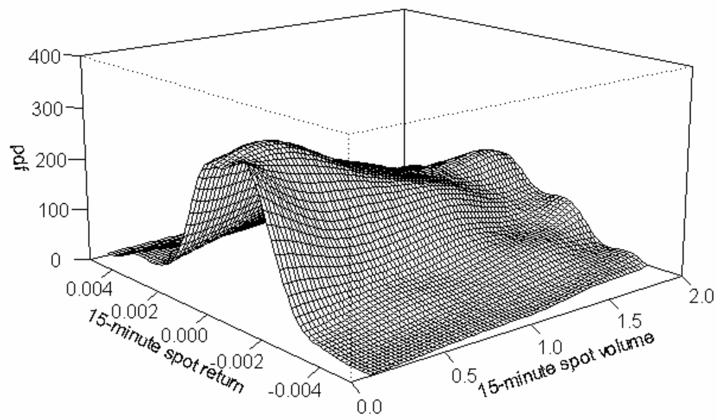


Figure 3: Density function of spot return conditional to total spot volume when the contemporaneous expected mini futures volume ∈ [25-50]-th quantile



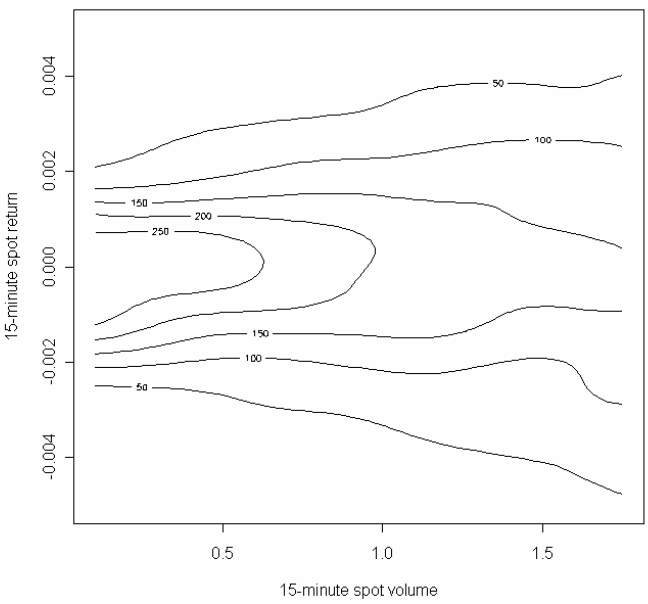


Figure 4: Density function of spot return conditional to total spot volume when the contemporaneous expected mini futures volume ∈ [50-75]-th quantile

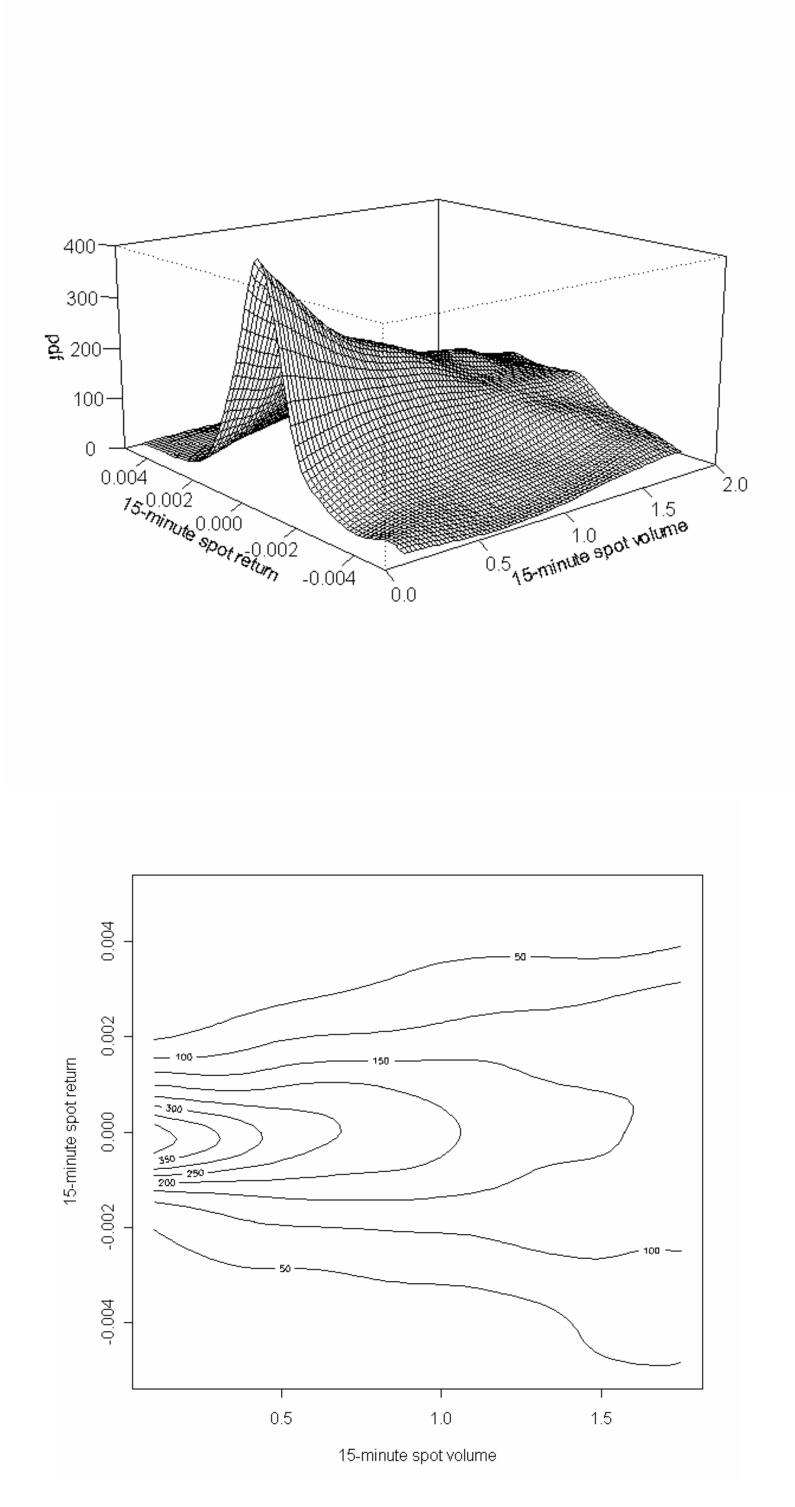


Figure 5: Density function of spot return conditional to total spot volume when the contemporaneous expected mini futures volume ∈ [75-100]-th quantile

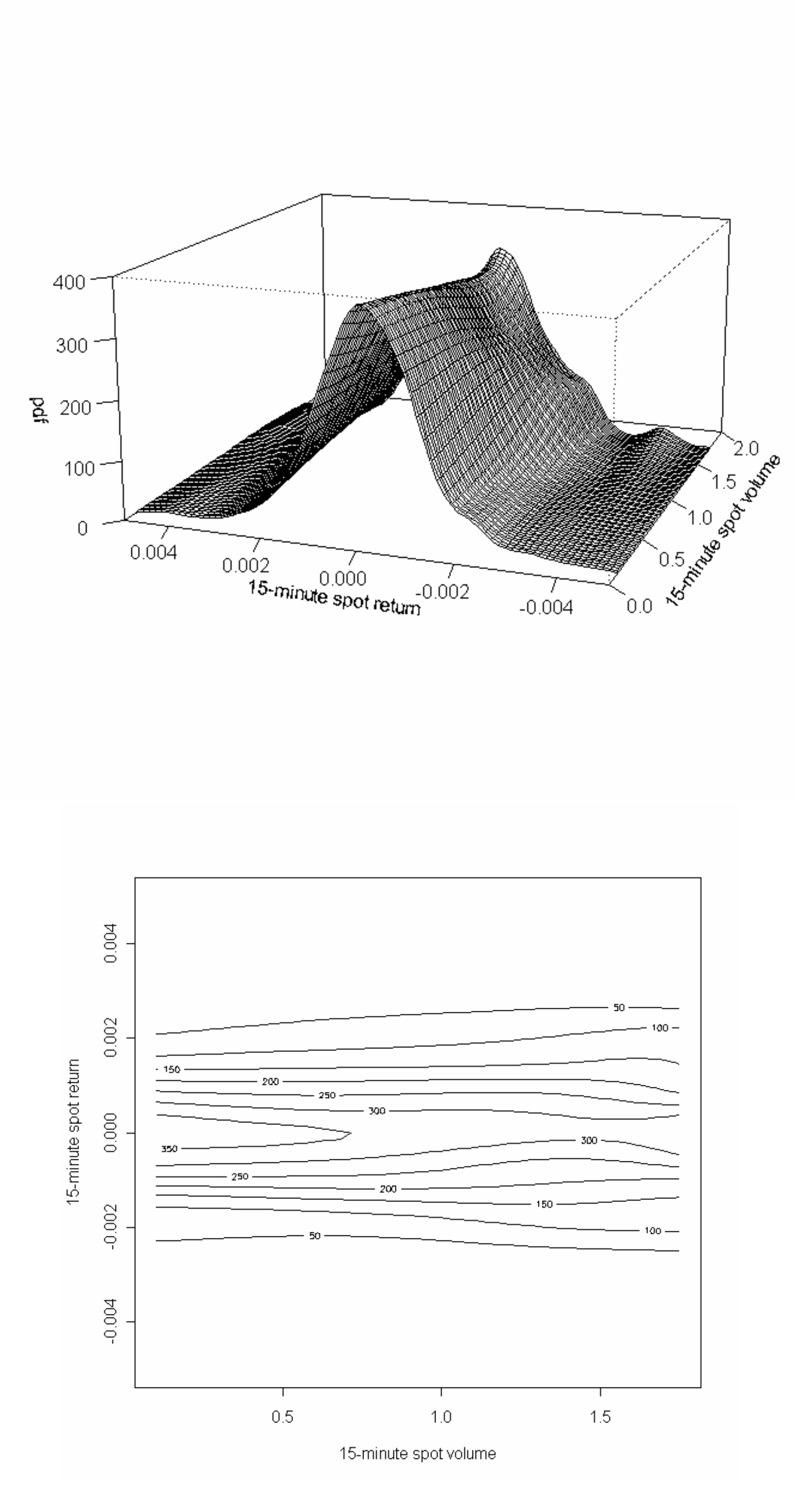


Figure 6: Density function of spot return conditional to total spot volume when the contemporaneous unexpected standard futures volume ∈ [0-25]-th quantile and the contemporaneous unexpected mini futures volume ∈ [0-50]-th quantile

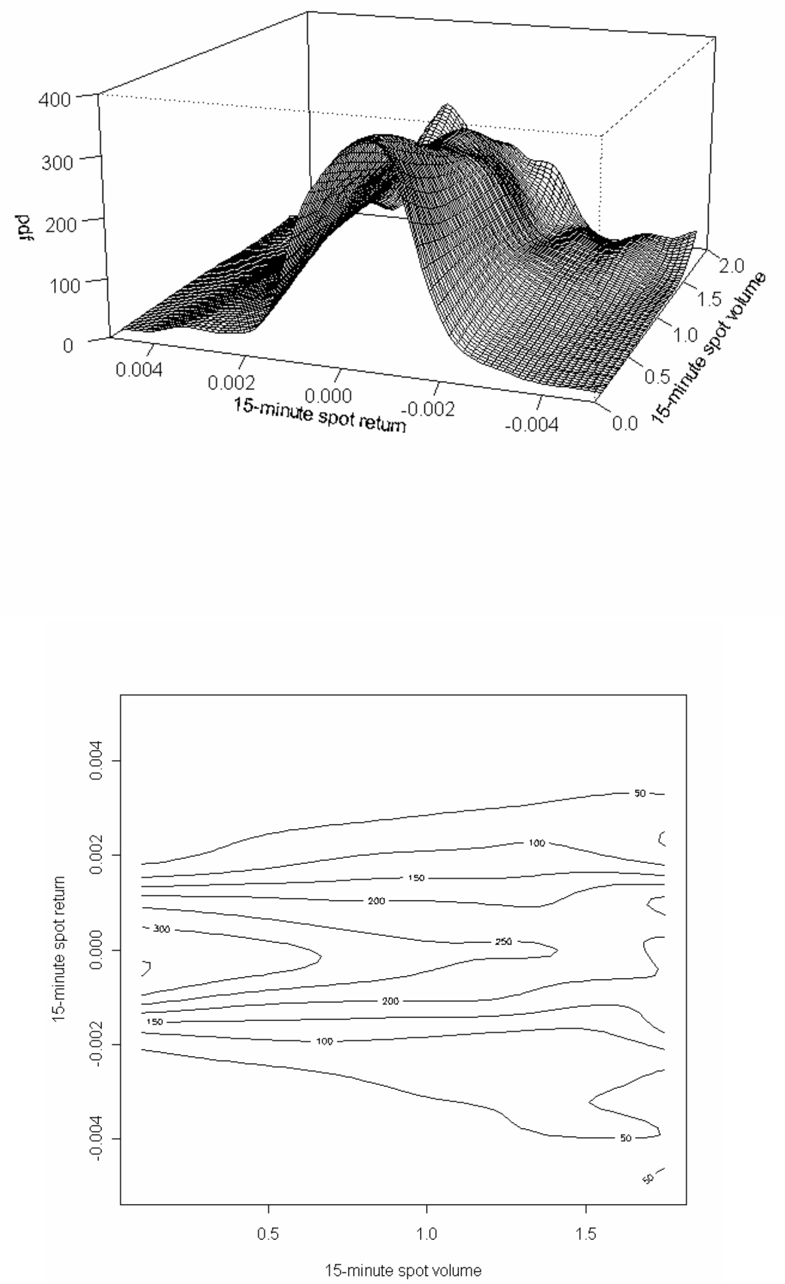
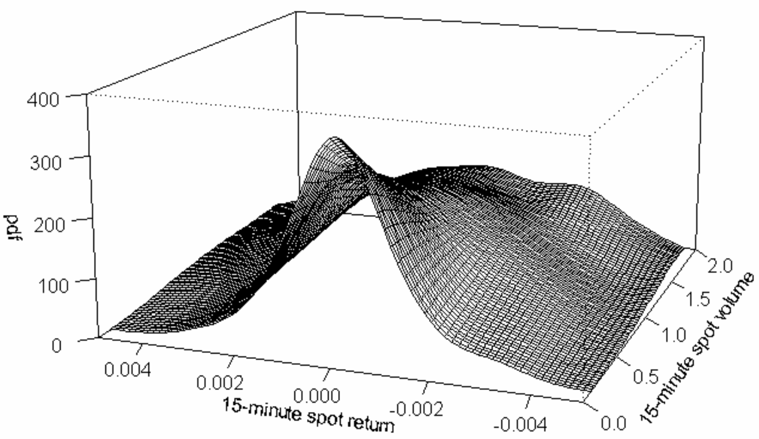


Figure 7: Density function of spot return conditional to total spot volume when the contemporaneous unexpected standard futures volume ∈ [0-25]-th quantile and the contemporaneous unexpected mini futures volume ∈ [50-100]-th quantile



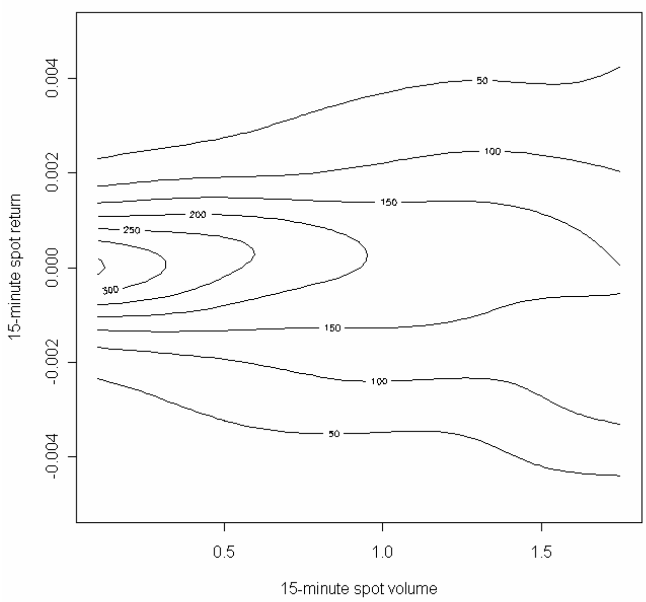
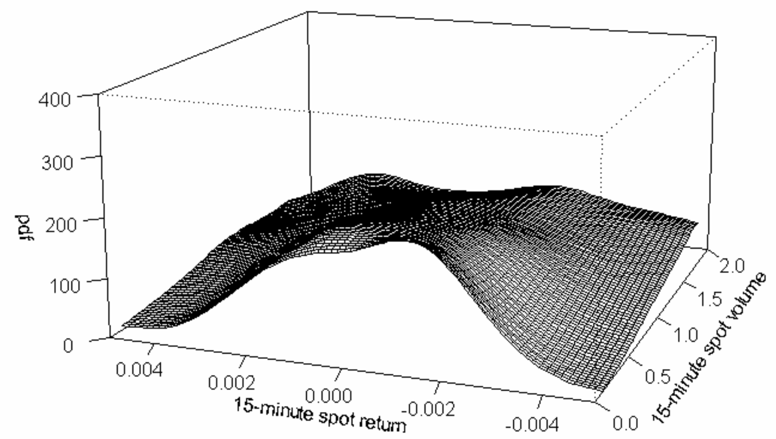


Figure 8: Density function of spot return conditional to total spot volume when the contemporaneous unexpected standard futures volume ∈ [75-100]-th quantile and the contemporaneous unexpected mini futures volume ∈ [0-50]-th quantile



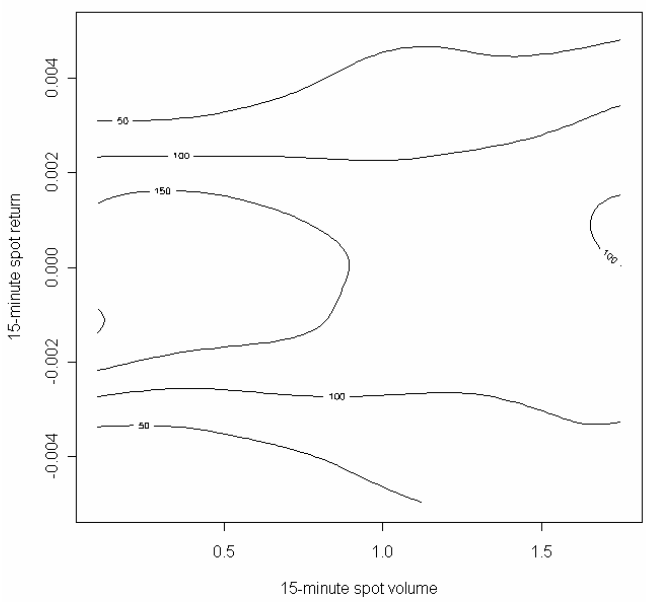


Figure 9: Density function of spot return conditional to total spot volume when the contemporaneous unexpected standard futures volume ∈ [75-100]-th quantile and the contemporaneous unexpected mini futures volume ∈ [50-100]-th quantile