

# THE PRICE AND VOLUME EFFECT OF INITIAL SINGLE STOCK FUTURES TRADING

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## Abstract

The introduction of single stock futures to a market allows for a per company impact-assessment of futures trading activity. Thirty-eight South African companies were evaluated in terms of a possible price and volume effect due to the initial trading of their respective single stock futures contracts. An event study revealed that SSF trading had little impact on the underlying share prices while a normalised volume comparison pre to post SSF trading showed a general increase in spot market trading volumes.

**Keywords:** Single stock futures, equity shares, event study, price effect, volume effect, spot market, futures market

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## 1 Introduction

Single stock futures (SSF) are traded on relatively few exchanges, with the National Stock Exchange (NSE) of India and the Russian Trading System (RTS) Stock Exchange accounting for the majority of global volumes initially. SSF contracts were introduced to the South African market in 1999. The WFE/IOMA Derivatives Market Survey 2006 (WFE & Davydoff 2007:16) reported that the National Stock Exchange of India (NSE) was the most active exchange in the world for stock futures trading in 2006. The 2007 WFE Annual Report (WFE 2008:46) confirmed that since then the JSE Limited has overtaken its Indian counterpart, showing a two-hundred and eighty percent year-on-year (2006-2007) growth in activity, which established the JSE as number one in SSF contracts traded (265 million contracts per annum). However, if the smaller contract size adopted by the JSE is taken into account, it still lags behind the Spanish Official Exchange for Financial Futures and Options (MEFF), which took fifth place in the rankings in terms of value traded with the NSE in first place (WFE 2008:109). In the United States the trading of single stock futures was allowed with the passing of the Commodity Futures Modernization Act of 2000 by the US Congress and only launched on November 8, 2002 (Salcedo 2003:56). SSF contracts trade as universal stock futures in the United Kingdom on the London International Financial Futures and Options Exchange (LIFFE). The underlying securities are some of the world's largest

companies and not limited to shares traded on the London Stock Exchange (LSE). In May of 1994, the Sydney Futures Exchange introduced futures contracts, known as individual share futures, on selected issues of common stock in Australia (Peat and McCorry 1997) and the majority of studies done on the impact of single stock futures trading originated from the Australian market.

The trading of a SSF-contract, the price of which is derived from an underlying equity share, may conceivably impact on the underlying spot price as a result of price discovery and the setting of a future spot price. Similarly, trading volume in the futures market may either generate (equivalent trades to cover positions) or curtail (substituting one market for another) spot activity. Many past studies, mainly on share indices, investigated the impact of derivatives trading on the underlying with regards to a possible price and volume effect. The introduction of single stock futures presents an opportunity to revisit this subject from an individual company perspective. The following papers provide an overview of the results on price and volume effects experienced with initial futures trading.

## 2 Literature review

Robbani and Bhuyan (2005), using a two-sample (pair-wise) t-test and the Wilcoxon signed-rank test, found evidence that the average daily rate of return on the thirty underlying component shares of the Dow Jones Industrial Average (DJIA) decreased significantly following the introduction of futures and

options. They also noted a significant increase in the daily trading volume for the majority of index constituents (23 from 30 shares).

An event study (market-adjusted model) conducted by Aitken and Segara (2005), likewise, reported the introduction of warrants on individual equity shares in Australia to be associated with a negative price effect. Their finding was corroborated by Clarke, Gannon and Vinning (2007) in an event study (mean reversion and market models) showing generally negative abnormal returns around the date of warrant issuance. These two studies contradicted an earlier event study (market model) by Faff and Hillier (2003) that revealed positive abnormal returns by newly optioned shares (in the United Kingdom) even though no discernable trend in the magnitude of these returns over time were recorded. Concerning any volume effect, Faff and Hillier (2003) witnessed an increased trading volume in the ten-day period immediately subsequent to options introductions (dummy variable regression), while Aitken and Segara (2005) established that the relative trading volume (trading volume divided by total number of securities outstanding) in the underlying share following warrant listing was significantly greater than in the pre-warrant listing period (Wilcoxon rank-sum test). Clarke et al (2007) in this instance disagreed, providing evidence that when adjusting for the inherent upward trend in volume, warrant introduction generally causes a decrease in trading volume.

Peat and McCorry (1997) pioneered research on the listing-effect of single stock futures (SSF) and found no significant change in the underlying price level. This market-adjusted-model event study examined the impact on ten individual equity shares trading in Australia. A significant increase in trading volume was evidenced from a t-test for change in mean performed on the ten individual underlying shares. This was confirmed by Lee and Tong (1998) with an equal means and equal variances t-test and rank sum tests, accounting for the (G)ARCH effect and using a control group to rule out confounding events. Their evidence suggested that volume distributions have significantly changed after the inception of single stock futures and that post-futures volumes have higher means but smaller variation.

The only reported study in South Africa on the volume effect of futures trading was done by Swart (1998) who concluded from a regression analysis (spot volume regressed on futures volume and value) on three share indices (South African All Share, Gold and Industrial Index) that index futures trading resulted in greater volume (liquidity) in the South African equity market. The limited research in South Africa focused on the volatility effect of futures trading (see Oehley 1995; Parsons 1998; Smit & Nienaber 1997; Vanden Baviere & De Villiers 1997; Swart 1998; Kruger 2000) and no studies on any possible price effect were published.

### 3 Research methodology

An event study was conducted in an attempt to detect a possible price effect with the introduction of futures trading (i.e., the event) to the South African equity market. A market model was used to generate the abnormal returns required to analyse the impact. The average normalised trading volume pre and post SSF-introduction was evaluated using a dummy variable with trend coefficient regression to uncover any volume effect – that is, significantly changed trading volumes in the respective underlying shares.

#### 3.1 Price effect

The effect of a financial event on the value of a listed company can be measured using financial market data in an event study (Campbell, Lo & MacKinlay 1997:149). The effect of a firm-specific event (e.g., introduction of a single stock futures contract on a share) should reflect as an abnormal or unexpected change (positive or negative) in the firm's share price.

Event study methodology encompasses the econometric techniques used to estimate and draw inferences from the impact of an event or multiple identical events in a particular period. A viable and effective event study requires the isolation of the event to the greatest degree possible, independence of individual company returns, and the assumption of constant systematic risk as represented by the beta coefficient used to determine the "normal" return. Wells (2004:66-67) states that samples should be from different industries, with each sample security having a different event day, and a large sample size.

Horizon length has a big influence on event study properties and largely determines the specification level, power, and sensitivity of test statistic specification. These possible problems do not apply to short-horizon event studies (less than 12 months) as these methods are relatively straightforward and trouble-free. Short-horizon event methods are powerful if the abnormal returns are concentrated in the event window. Also, the specification of the test statistic is not highly sensitive to the benchmark model. A problem shared by both short- and long-horizon studies is the possible increase in the variance of the security's abnormal returns conditional on the event. As a result, test statistics can be miss-specified and the null hypothesis rejected too often (Kothari & Warner 2006:15-18, 50).

A market model approach was used to generate company betas and calculate normal and subsequently abnormal returns (i.e., actual minus normal). The market model is a risk-adjusted statistical model that relates the return of any given security to the return of the market portfolio. A one-factor OLS regression analysis generates the intercept or alpha ( $\alpha_i$ ), and

slope or beta ( $\beta_i$ ), thereby incorporating a risk adjustment component to the estimate of returns.

### 3.1.1 The market model

The concept of abnormal returns is the central element of event studies and the benchmark or model generating normal returns is consequently central to conducting an event study. The chosen model for this study is the market model, specified as follows:

For any security  $i$  the market model is:

$$R_{it} = \alpha_i + \beta_i R_{mt} + \varepsilon_{it} \quad (1)$$

$$E(\varepsilon_{it}) = 0 \quad \text{var}(\varepsilon_{it}) = \sigma_{\varepsilon_i}^2$$

Where:

$R_{it}$  = Period- $t$  returns on security  $i$   
(dependent variable)

$R_{mt}$  = Period- $t$  returns on the market  
portfolio  $m$  (independent variable)

$\varepsilon_{it}$  = Error or disturbance term  
representing unsystematic risk

$\alpha_i$  = Intercept term (alpha – minimum  
return of security when market return is zero)

$\beta_i$  = Slope coefficient (beta – systematic  
risk)

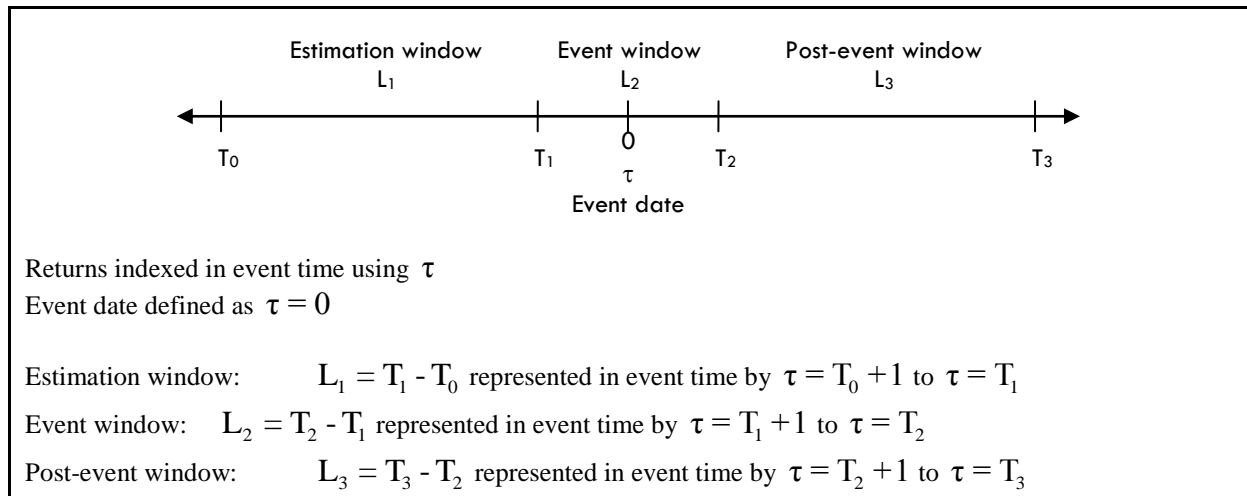
$\sigma_{\varepsilon_i}^2$  = Variance of the disturbance term

The parameters of the model ( $\alpha_i$ ,  $\beta_i$  and  $\sigma_{\varepsilon_i}^2$ ) are estimated by means of ordinary least squares (OLS) regression and used to calculate the residuals or abnormal returns.

### 3.1.2 Measuring and analysing abnormal returns

The key focus of an event study is to measure the sample securities' average and cumulative average abnormal returns around the time of an event (Kothari & Warner 2006:7). Time is redefined relative to the day of the event and the average security price-movement for the sample securities is examined during specific days around the event month.

**Figure 1.** Time line for an event study



The residual  $\varepsilon_{it}$  from the market model corresponding to day  $\tau$  is the estimator of the abnormal return for security  $i$  during event day  $\tau$ . This, according to Binder (1998:112-113), removes the effect of economy-wide factors on the return of the security and retains the portion of the return attributable to firm-specific information.

The design of the time line (timing sequence) eliminates any overlap between the estimation window and event window, ensuring that the estimated parameters of the normal return model are uninfluenced by the returns around the event. The exclusion of the event window when measuring the normal returns upholds the assumption that the abnormal returns will capture the impact of an event. The estimation framework will include the event window if the null hypothesis is expanded to accommodate any changes in risk (variance) of a firm due to the event. The post-event window data may also be included with the estimation period to estimate the normal return model (MacKinlay 1997:20).

### 3.1.3 Estimation of the market model

The relationship between a security's returns and returns on the market is estimated by ordinary least squares (OLS) regression and this relationship is used to estimate expected returns, given returns on the market.

For the  $i^{\text{th}}$  firm in event time, the OLS estimators of the market model for an estimation window of observations are:

$$\hat{\beta}_i = \frac{\sum_{\tau=T_0+1}^{T_1} (R_{it} - \hat{\mu}_i)(R_{mt} - \hat{\mu}_m)}{\sum_{\tau=T_0+1}^{T_1} (R_{mt} - \hat{\mu}_m)^2} = \frac{\text{COV}_{R_{it}, R_{mt}}}{\text{var}_{R_{mt}}} \quad (2)$$

$$\hat{\alpha}_i = \hat{\mu}_i - \hat{\beta}_i \hat{\mu}_m \quad (3)$$

$$\hat{\sigma}_{\varepsilon_i}^2 = \frac{1}{L_1 - 2} \sum_{\tau=T_0+1}^{T_1} (R_{it} - \hat{\alpha}_i - \hat{\beta}_i R_{mt})^2 = \frac{1}{L_1 - 2} \sum_{\tau=T_0+1}^{T_1} (\varepsilon_{it})^2 \quad (4)$$

Where:  $\hat{\mu}_i = \frac{1}{L_1} \sum_{\tau=T_0+1}^{T_1} R_{it}$

and  $\hat{\mu}_m = \frac{1}{L_1} \sum_{\tau=T_0+1}^{T_1} R_{mt}$

$R_{it}$  = Event-period- $\tau$  returns on security  $i$

$R_{mt}$  = Event-period- $\tau$  returns on the market portfolio  $m$

Source: MacKinlay (1997:20)

Beta is calculated as the covariance between the market and the security during the estimation period,

divided by the variance of the market in that period. The intercept term (alpha) is the difference between the average return ( $\mu$ ) on the security and the estimated return on the security as determined by the market return and calculated beta.

### 3.1.4 Statistical properties of abnormal returns (AR)

The parameter estimates of the market model allow the measurement and analysis of the abnormal returns. The abnormal return ( $AR_{it}$ ) is the disturbance term ( $\varepsilon_{it}$ ) of the market model, calculated on an out-of-sample basis:

$$AR_{it} = R_{it} - (\hat{\alpha}_i + \hat{\beta}_i R_{mt}) = \varepsilon_{it} \quad (5)$$

The abnormal returns are jointly normally distributed with zero conditional mean and conditional variance,  $\sigma_{AR_{it}}^2$ , where:

$$\sigma_{AR_{it}}^2 = \sigma_{\varepsilon_i}^2 + \frac{1}{L_1} \left[ 1 + \frac{(R_{mt} - \hat{\mu}_m)^2}{\hat{\sigma}_m^2} \right] \quad (6)$$

The conditional variance comprises the disturbance variance  $\sigma_{\varepsilon_i}^2$  from (1) and the additional variance due to the sampling error in  $\alpha_i$  and  $\beta_i$ . This sampling error leads to serial correlation of the abnormal returns even though the real disturbances are independent through time. However, the sampling error of the parameters disappears with a large estimation window ( $L_1$ ) and this additional variance then approaches zero. The variance of the abnormal return will therefore be  $\sigma_{\varepsilon_i}^2$  and the abnormal return observations will become independent through time (MacKinlay 1997:21). These distributional properties are used to draw inferences over any period within the event window.

Under the null hypothesis ( $H_0$  = Event has no impact on the behaviour of returns) the distribution of the sample abnormal returns of a given observation in the event window is:

$$AR_{it} : N(0, \sigma_{AR_{it}}^2) \quad (7)$$

Where:  $\sigma_{AR_{it}}^2 = \sigma_{\varepsilon_i}^2$  with a large estimation window ( $L_1$ )

### 3.1.5 Aggregation of abnormal returns (CAR)

In an event study the focus is on the mean and the cumulative mean of the dispersion of abnormal returns. The abnormal return observations must be

aggregated across observations of the event in order to draw overall inferences for the event of interest. Aggregation may occur along two dimensions – through time and/or across securities. This study focuses on the impact of a single event on several different firms (i.e., aggregation across securities). The event windows of the included securities should not overlap (no clustering assumption). The absence of any overlap and the distributional assumptions imply that the abnormal returns and the cumulative abnormal returns are independent across securities. The individual securities' abnormal returns are aggregated and averaged (8).

The cross-sectional average abnormal returns (residuals) in common event time:

$$\overline{AR}_\tau = \frac{1}{N} \sum_{i=1}^N AR_{i\tau} \quad (8)$$

For a large estimation window,  $L_1$ , the variance is:

$$\text{var}(\overline{AR}_\tau) = \frac{1}{N^2} \sum_{i=1}^N \sigma_{\varepsilon_i}^2 \quad (9)$$

Where:

N = Number of firms in the sample  
 $\tau$  = Event date

The average abnormal returns per event day are summed across days to measure the average cumulative effect of an event on the sample securities from day  $\tau_1$  to day  $\tau_2$ . Cumulating these periodic average residuals over a particular time interval (number of days in the event window) allows for inferences concerning the general impact of the event.

The aggregated average abnormal returns over the event window:

$$\overline{CAR}_{\tau_1, \tau_2} = \sum_{\tau=\tau_1}^{\tau_2} \overline{AR}_\tau \quad (10)$$

Variance:

$$\text{var}(\overline{CAR}_{\tau_1, \tau_2}) = \sum_{\tau=\tau_1}^{\tau_2} \text{var}(\overline{AR}_\tau) = \frac{1}{N^2} \sum_{i=1}^N \sigma_{i, \tau_1, \tau_2}^2 \quad (11)$$

Where  $T_1 < \tau_1 \leq \tau_2 \leq T_2$

### 3.1.6 Tests for significance

A test statistic is calculated and compared to the assumed distribution under the null hypothesis that the event has no impact on the behaviour of returns (i.e., the mean abnormal return equals zero). The null hypothesis is rejected if the test statistic exceeds a critical value corresponding to the specified test level or size of the test. The standard test statistic is obtained by dividing the average or cumulative

average abnormal return by the relevant standard deviation (13).

Inferences about the cumulative average abnormal returns are drawn using:

$$\overline{CAR}_{\tau_1, \tau_2} : N\left[0, \text{var}(\overline{CAR}_{\tau_1, \tau_2})\right] \quad (12)$$

$H_0$  (Event has no impact on the behaviour of returns) tested using:

$$\theta_1 = \frac{\overline{CAR}_{\tau_1, \tau_2}}{\text{stdev}(\overline{CAR}_{\tau_1, \tau_2})} : N(0,1) \quad (13)$$

A possible modification of the basic approach that may lead to more powerful tests (i.e., the ability to detect non-zero abnormal returns) is to standardise each abnormal return using an estimator of its standard deviation (MacKinlay 1997:24). The purpose, according to Serra (2002:5) is to ensure that each abnormal return has the same variance. By dividing an abnormal residual by its standard deviation, each residual has an estimated variance of one. An amended test statistic of the hypothesis that the average standardised residual of a firm is equal to zero is calculated (not shown).

A two-sided test of the null hypothesis on the cumulative abnormal return based statistic  $\theta_1$  from (13) is used. A confidence-interval approach as shown in (14) is used and values lying in this interval are plausible under  $H_0$  with  $100(1-\alpha)\%$  confidence. Hence, do not reject the null hypothesis if the value lies within this region. Outside the interval it may be rejected.

The null distribution is standard normal for a two-sided test size of  $\alpha$  and the null hypothesis will be rejected if  $\theta_1$  lies in the following critical region:

$$\theta_1 < c\left(\frac{\alpha}{2}\right) \text{ or } \theta_1 > c\left(1 - \frac{\alpha}{2}\right) \quad (14)$$

Where  $c(x) = \Phi^{-1}(x)$

[ $\Phi(x)$  is the standard normal cumulative distribution function (CDF)]

### 3.2 Volume effect

Share trading volume is a highly volatile factor, according to Clarke et al (2007:30), often resulting in large variances, generally non-normal distributions and many outliers. An exponential smoothing process was applied to the data to normalise the volume and these normalised volume figures were used in the analysis.

An exponentially weighted moving average (EWMA) process assigns exponentially decreasing weights to older data. The single exponential smoothing method is appropriate for a series that moves randomly above and below a constant mean with no trend or seasonal patterns. A double smoothing method is appropriate for a series with a linear trend. The smoothed series is calculated recursively, by evaluating the formula presented in (15). The forecasted value is a weighted average of the past values of the series where the weights decline exponentially with time. The smaller the damping or smoothing factor, the more smoothed the eventual forecasted series (NIST 2006).

Single exponential smoothing formula:

$$s_t = \alpha y_t + (1 - \alpha) s_{t-1} = s_{t-1} + \alpha (y_t - s_{t-1}) \quad (15)$$

Where:

$y_t$	=	Raw data
$s$	=	Output of the exponential smoothing algorithm
$\alpha$	=	Smoothing factor ( $0 < \alpha \leq 1$ )

Sources: EViews (2007:356) and NIST (2006)

To determine whether the event caused a permanent change in volume, the average normalised volume in a specified number of days prior to the event was compared to the average normalised volume in the period subsequent to the event. Trading volume generally tends to increase over time and a dummy variable regression (16) considering this trend was used, as this is not captured by a t-test for change in mean.

Equation used to estimate volume:

$$V_{it} = \alpha_i + \beta_i T_{it} + \delta D_F + \varepsilon_{it} \quad (16)$$

Where:

$V_{it}$	=	Normalised volume for security i at time t
$\alpha_i$	=	Intercept
$\beta_i T_{it}$	=	Trend (day) coefficient and variable
$\delta D_F$	=	Dummy coefficient and variable

The dummy variable takes the value of zero for the pre-event period and one for the post-event period. The coefficient is interpreted as a change in trading volume after considering any underlying trend which may bias the results of the dummy variable. The level of significance is indicated by the relevant p-value of the statistical output.

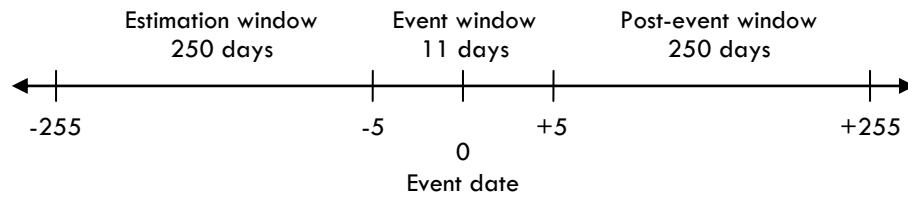
#### 4 Data and statistical analysis

The South African market saw three-hundred and fifty-seven (357) first-time introductions (available for trade) of physically-settled SSF contracts from 1999 to 2007. Ninety-nine (99) cash-settled SSF contracts (dual issues) have been introduced since February 2007. Two (2) inward listed contracts (i.e., based on foreign reference assets or issued by foreign entities and listed on the JSE) were made available for trade in this period. These potential candidates for inclusion in the study were subjected to the following selection criteria:

- No corporate actions or events that may have affected the shareholder's entitlement to benefits (i.e., share splits, capitalisation/rights issues, unbundling, mergers, or takeovers).
- No direct or indirect prior introductions of SSF contracts.
- Trading activity – available for trade and the actual trading of contracts occurring within a two week period.
- No overlapping of the 11-day (including day zero) event periods – no clustering assumption
- 250 days (excluding the event period) of spot trading before and after the event.

Thirty-eight (38) companies matched all the selection criteria, representing seven (7) different industries which in turn translate to twelve (12) supersectors, eighteen (18) sectors, and twenty-five (25) subsectors (refer to Appendix A). This satisfies the event study requirement that samples are from different industries and not focused on a specific industry.

The company returns were regressed on the returns of the market (All Share Index – ALSI), thereby determining the company's beta (slope coefficient – sensitivity to return of the market) in order to establish the "normal" daily returns of a company during the event period. The difference between this normal or anticipated return (beta times the market return) and the actual return of the company, represents the abnormal return on a specified day.





The 250 daily returns of the company and the ALSI preceding the event period (ten days excluding the event date) were used in the market model regression (while there are 365 days in a year, only approximately 250 of them are trading days, thus representing a one-year period of trading data before and after an event or event window). The abnormal returns (actual minus normal) five days before (pre-SSF period), on the actual first trading day (day 0), and after (post-SSF period) the event were calculated and assigned to either a one-, five- or ten-percent level of significance, or as non-significant (too small relative to the standard deviation). These daily abnormal returns for each company were averaged (average abnormal return – AAR), cumulated (cumulative average abnormal return – CAAR) and evaluated for statistical significance.

The selected model (market model), generating individual company betas, was not assessed in terms of “goodness-of-fit” (R-squared) in each instance, but simply used to establish a normal return as determined by the market, to be compared with the actual return from the movement in individual share prices. The discrepancies between the relative and actual company returns during the event period are presented and attributed in the following table (table 1). Inferences regarding the statistical validity of each abnormal return and the conclusion reached on the impact of initial SSF trading on the underlying share price follow the statistical output.

In general, most daily abnormal returns proved to be non-significant, not exceeding the 1,68 critical value cut-off for a 10%-level of significance (90% confidence level). SSF trading, according to this event study, had no effect (no significant abnormal returns during the event period) on the share prices of eighteen (out of thirty-eight) companies included in this study.

#### INSERT TABLE 1 ABOUT HERE

The following fourteen companies showed a statistically significant abnormal return on a single day during the event period under investigation – Allied Technologies (3 – ALT), Amalgamated Appliance Holdings (4 – AMA), Argent Industrial (6 – ART), Brandcorp Holdings (7 – BRC), Cadiz Holdings (8 – CDZ), Enterprise Risk Management (15 – ERM), Grindrod (18 –GND), Jasco Electronics (21 –JSC), Liberty Holdings (25 – LBH), Lonmin (26- LON), Prism Holdings (30 – PIM), Pick and Pay Holdings (31 – PWK), Simmer and Jack Mines (34 – SIM) and UCS Group (37 – UCS). With only one day showing a statistically significant deviation from the normal return, it can be concluded that the advent of SSF trading had very little effect on the share prices of these fourteen companies.

EOH Holdings (14 – EOH) and Paragon Holdings (29 – PCN) each exhibited only two days of statistically significant abnormal returns, providing virtually no evidence that SSF trading had influenced

their share prices. Similarly, only three days of sufficiently sized abnormal returns reported by Shoprite Holdings (33 – SHP), Super Group (36 – SPG) and Winhold (38 – WNH) confirmed that SSF trading had little effect on the returns of these companies.

Hudaco Industries (19 – HDC) was the only company to reveal some share-price impact caused by initial SSF trading. Showing abnormal returns on six days (including day zero), Hudaco Industries mainly experienced abnormal share-price activity in the five-day period leading up to the availability of SSF contracts on its equity shares. Only three companies displayed statistically significant abnormal returns on trading-day zero, namely Hudaco Industries, Pick and Pay Holdings, and Winhold.

On an individual company-by-company basis it is clear that the introduction (trading) of single stock futures had little or no impact on the underlying companies’ share prices and the event study presented no conclusive evidence to establish either a positive or a negative price effect due to SSF trading.

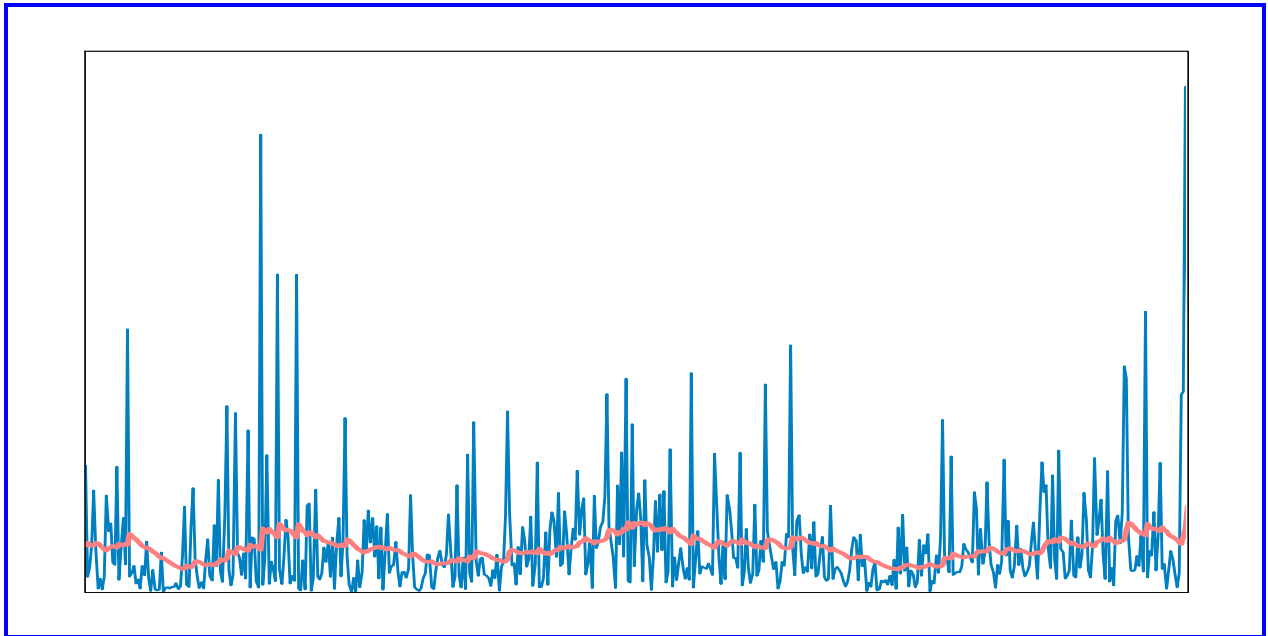
However, in an event study the focus is on the mean and the cumulative mean of the dispersion of abnormal returns. The individual securities’ abnormal returns are aggregated and averaged. These average abnormal returns per event day are summed across days to measure the average cumulative effect of the event on the sample securities for the whole event period or a variety of periods within the event window. Cumulating these periodic average residuals over a particular time interval (number of days in the event window) allows for meaningful inferences concerning the general impact of the event. If the initial SSF trading caused a price effect, significant abnormal returns on day zero and possible significant abnormal returns on day -1 and day +1 should be uncovered. Significance should be lower as one moves further from the event date and for longer periods or periods not including the actual event.

#### INSERT TABLE 2 ABOUT HERE

Table 2 shows that the only significant average abnormal return was recorded on day +3 of the event period. Periods (-5 to -3), (-5 to -2), (-5 to -1) and (-5 to 0) all showed significant cumulative average abnormal returns. Results indicate a 10% significance level for a period that includes the event day (-5 to 0), but for shorter periods inclusive of day zero [(-3 to 0), (0 to +3), (-1 to 0) and (0 to +1)] no significance is evidenced. Shorter time periods (-5 to -2) and (-5 to -3) do show increased significance, but do not include the actual event date. The most promising result, therefore, is the significant positive CAAR of 2,17% during the six-day (including the event day) pre-SSF period.

Positive

**Figure 2.** Normalised (smoothed) volume



Source: McGregor-BFA (EViews6 generated)

, but non-significant, average abnormal returns on day -1 and 0, as well as positive, but non-significant, cumulative average abnormal returns in periods (-3 to 0) and (-1 to 0) tend to confirm the favourable impact of SSF trading on the underlying share price in the period immediately preceding the event and on the event day itself, as shown by the significant (-5 to 0) subperiod.

Diminishing significance for shorter periods closer to the event implies that no clear evidence to suggest any price effect (positive or negative) on the underlying due to the introduction of single stock futures resulted from this study.

The effect of SSF trading on the spot market volume of the underlying company before and after the first futures market transaction was tested by comparing the average normalised trading volume pre- and post-SSF with a dummy variable and trend coefficient (a time series variable that checks for a trend) regression to determine whether the volume significantly changed after accounting for the tendency of the volume to increase (trend) over time.

Figure 2 depicts the normalised daily trading volume (red) of AECI Holdings (1 – AFE), used as an example, after an exponential smoothing process was performed on the actual data (blue). The forecasted value is a weighted average of the past values of the series where the weights decline exponentially with time (higher weight allocated to more recent data).

Trading volume generally tends to increase over time and a dummy variable regression considering this trending nature of volume is used, as this is not captured by a t-test for change in mean. The dummy variable regression is augmented with a trend (day) coefficient to isolate the size of the increase/decrease in trading volume witnessed after initial SSF trading. The dummy variable takes the value of zero for the pre-SSF period and one for the post-SSF period. The coefficient is interpreted as a change in trading volume after considering any underlying trend which may bias the results of the dummy variable.

### INSERT TABLE 3 ABOUT HERE

In line with the dummy variable regression (with trend), the number of companies showing a significant increase in average normalised volume is nineteen (three non-significant increases). Fifteen companies exhibited a significant decrease in average normalised trading volume (one non-significant decrease). A small majority of companies (19 vs. 15), therefore, experienced a significant increase in trading volume following the onset of single stock futures trading.

A t-test for change in mean (not accounting for any trend) confirmed that the majority of companies (27 of 37 significant results) experienced highly significant increases in normalised trading volume after the introduction of SSF-trading (De Beer 2008:78).

## 5 Summary of results

A pre-SSF (estimation period) regression analysis generated beta coefficients for each of the thirty-eight individual companies and established normal daily returns via the market return during the event period. The difference between this normal return and the actual return of the company represented the abnormal return (AR) on a specified day. Average abnormal returns (AAR) and cumulative average abnormal returns (CAAR) for the sample were also calculated. The abnormal return in excess of the relevant standard deviation (acceptable divergence) determined statistical significance.

Fourteen companies (37%) showed a statistically significant abnormal return (AR) on a single day during the event period under investigation. Two companies (5%) exhibited only two days of statistically significant abnormal returns. Three days of sufficiently sized abnormal returns were reported in three instances (8%). Only one company (3%) revealed some share-price impact caused by initial SSF trading, showing abnormal returns on six days (including day zero), and mainly in the five-day period leading up to the availability of SSF contracts on its equity shares. Only three companies (5%) displayed statistically significant abnormal returns on the day of the event itself. The only significant average abnormal return (AAR) was recorded three days after the event. Significant cumulative average abnormal returns (CAAR) were recorded for longer periods and periods further away from and before the event. The six day pre-event period that included the event day showed statistical significance, but no shorter periods inclusive of day zero displayed any significance.

**Figure 3.** Changes in normalised trading volume

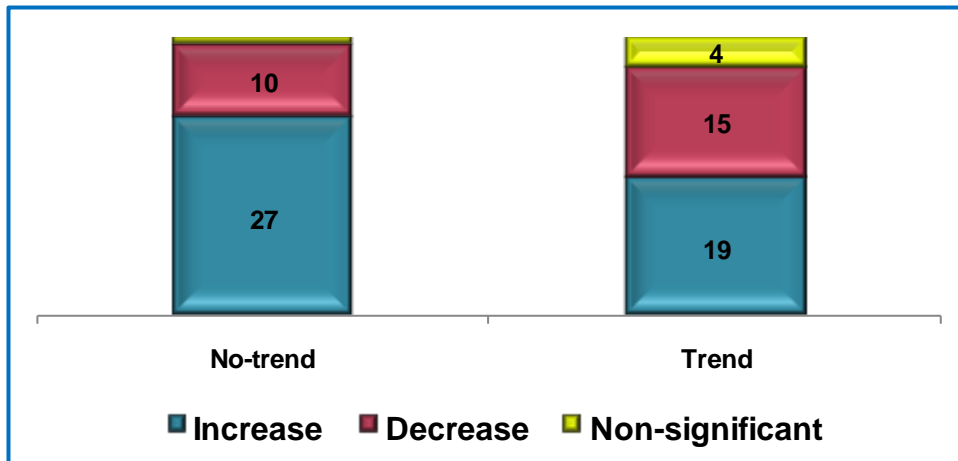


Figure 3 illustrates the result from the t-test (no-trend) compared to that of the dummy regression with trend coefficient. A t-test for change in mean showed that the introduction of SSF trading resulted in a highly significant increase in normalised trading volume in the majority (71%) of cases. A smaller majority (56%) of statistically significant outcomes from the dummy variable with trend coefficient evaluation indicated an increase in trading volume following the onset of single stock futures trading.

## 6 Conclusion

Judged on an individual company-by-company basis, the introduction (trading) of single stock futures had little or no impact on the underlying share prices.

In addition, the pattern of significant cumulative average abnormal returns implies that no clear evidence exists that SSF trading in general has had any price effect (positive or negative) on the underlying. The diminishing significance exhibited for shorter periods closer to the event is in contrast to the conditions required to conclude a general price effect, namely significant abnormal returns on day zero and possible significant abnormal returns on day -1 and day +1. Significance should be lower with increasing distance from the event date and for longer periods or periods not including the actual event.

However, it was concluded that SSF market activity in general led to increased trading activity in the underlying market, even allowing for the natural increase in spot volume over time.

## Note

This article is based on a study done on the impact of single stock futures on the South African equity market that also reported on any changes in the level and structure of volatility post initial single stock futures trading.

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## Appendices

Table 1. Price effect – Abnormal returns

Abnormal returns (AR) as calculated from a market model ( $R_{it} = \alpha_i + \beta_i R_{mt} + \varepsilon_{it}$ ) for all companies on a specific day during the event period.

No	Days										
	-5	-4	-3	-2	-1	0	+1	+2	+3	+4	+5
1	1.24% (0.79)	2.11% (1.34)	0.14% (0.09)	-0.33% (-0.21)	-0.43% (-0.27)	-1.00% (-0.64)	-0.56% (-0.35)	-1.79% (-1.14)	-1.47% (-0.94)	-0.15% (-0.10)	-0.37% (-0.24)
2	-1.78% (-0.37)	0.62% (0.13)	1.38% (0.29)	-5.08% (-1.07)	-3.32% (-0.70)	-0.28% (-0.06)	-3.42% (-0.72)	-5.13% (-1.08)	2.25% (0.47)	5.98% (1.25)	-3.44% (-0.72)
3	-0.01% (0.00)	1.12% (0.75)	2.22% (1.47)	-1.11% (-0.74)	-0.01% (0.00)	0.66% (0.44)	1.53% (1.01)	-2.25% (-1.49)	-1.30% (-0.87)	3.53% (2.35) **	-0.49% (-0.32)
4	-0.46% (-0.23)	-1.09% (-0.54)	0.42% (0.21)	-1.58% (-0.78)	0.72% (0.36)	-0.24% (-0.12)	-0.53% (-0.27)	0.66% (0.33)	3.41% (1.69) *	5.46% (2.71) ***	-0.55% (-0.27)
5	-0.97% (-0.33)	2.71% (0.92)	-0.75% (-0.26)	-0.27% (-0.09)	0.64% (0.22)	-0.75% (-0.25)	-0.85% (-0.29)	-0.67% (-0.23)	0.78% (0.26)	-0.02% (-0.01)	1.07% (0.36)
6	-0.27% (-0.13)	0.06% (0.03)	3.51% (1.67) *	-0.31% (-0.15)	1.08% (0.52)	-0.52% (-0.25)	-1.28% (-0.61)	-1.04% (-0.49)	0.29% (0.14)	-1.19% (-0.57)	-2.04% (-0.97)
7	3.19% (1.31)	1.03% (0.42)	-0.51% (-0.21)	1.22% (0.50)	1.20% (0.49)	-1.00% (-0.41)	-0.79% (-0.33)	-4.32% (-1.77) *	3.64% (1.49)	2.20% (0.90)	1.05% (0.43)
8	0.32% (0.13)	-1.18% (-0.49)	3.19% (1.33)	5.13% (2.14) **	0.01% (0.00)	-0.44% (-0.18)	-1.45% (-0.60)	3.79% (1.58)	-0.45% (-0.19)	-0.10% (-0.04)	-0.21% (-0.09)
9	0.15% (0.08)	-0.94% (-0.49)	-0.48% (-0.25)	0.53% (0.28)	-0.21% (-0.11)	1.74% (0.91)	2.63% (1.37)	0.51% (0.27)	-0.33% (-0.17)	0.19% (0.10)	0.02% (0.01)
10	1.10% (0.65)	0.59% (0.35)	0.29% (0.17)	1.42% (0.85)	-0.10% (-0.06)	0.64% (0.38)	-0.23% (-0.14)	0.57% (0.34)	-0.09% (-0.05)	-0.18% (-0.11)	0.32% (0.19)
11	1.58% (0.60)	1.92% (0.72)	-2.23% (-0.84)	-2.31% (-0.87)	-2.19% (-0.82)	-0.93% (-0.35)	-0.17% (-0.07)	-3.49% (-1.32)	-1.33% (-0.50)	-2.24% (-0.84)	1.15% (0.43)
12	1.19% (0.42)	-0.01% (0.00)	-1.51% (-0.53)	-0.20% (-0.07)	-0.60% (-0.21)	3.90% (1.38)	3.34% (1.18)	-3.41% (-1.21)	-0.18% (-0.06)	1.97% (0.70)	2.32% (0.82)
13	0.16% (0.03)	-2.17% (-0.41)	1.29% (0.25)	-2.31% (-0.44)	-0.47% (-0.09)	-1.07% (-0.20)	-4.20% (-0.80)	0.67% (0.13)	-2.48% (-0.47)	-0.37% (-0.07)	-0.56% (-0.11)
14	-1.75% (-1.34)	-0.54% (-0.42)	3.08% (2.36) **	-0.10% (-0.08)	-0.56% (-0.43)	-0.82% (-0.63)	2.72% (2.08) **	0.43% (0.33)	0.01% (0.01)	-1.77% (-1.35)	1.32% (1.01)
15	1.40% (0.58)	-1.72% (-0.72)	1.53% (0.64)	-0.11% (-0.05)	-2.32% (-0.97)	1.25% (0.66)	-3.09% (-1.28)	-0.88% (-0.37)	5.92% (2.46) **	-0.85% (-0.36)	0.86% (0.36)
16	-0.19% (-0.07)	0.90% (0.31)	-0.16% (-0.05)	-0.32% (-0.11)	-0.18% (-0.06)	1.09% (0.38)	-0.57% (-0.20)	-0.48% (-0.17)	-0.75% (-0.26)	0.38% (0.13)	-0.14% (-0.05)
17	0.06% (0.01)	-1.65% (-0.30)	0.18% (0.03)	1.85% (0.33)	3.45% (0.62)	1.84% (0.33)	1.74% (0.31)	-6.61% (-1.19)	1.74% (0.31)	1.77% (0.32)	0.18% (0.03)
18	2.18% (0.91)	4.70% (1.96)	1.42% (0.59)	-1.79% (-0.75)	-3.27% (-1.37)	2.25% (0.94)	-2.41% (-1.01)	1.49% (0.62)	-0.37% (-0.15)	-0.39% (-0.16)	3.90% (1.63)

Abnormal returns (AR) as calculated from a market model ( $R_{it} = \alpha_i + \beta_i R_{mt} + \varepsilon_{it}$ ) for all companies on a specific day during the event period.

No	Days										
	-5	-4	-3	-2	-1	0	+1	+2	+3	+4	+5
		**									
19	3.01% (2.49) **	-4.18% (-3.46) ***	3.99% (3.30) ***	2.65% (2.20) **	-0.26% (-0.21)	-4.30% (-3.56) ***	-1.56% (-1.29)	1.39% (1.15)	1.41% (1.17)	2.68% (2.22) **	-0.75% (-0.62)
20	4.43% (1.15)	2.32% (0.61)	-0.37% (-0.10)	0.94% (0.24)	-0.51% (-0.13)	4.13% (1.08)	-0.33% (-0.09)	-4.45% (-1.16)	2.28% (0.60)	1.02% (0.27)	1.90% (0.50)
21	-2.69% (-0.88)	3.28% (1.07)	2.09% (0.68)	-3.08% (-1.00)	-0.31% (-0.10)	-2.10% (-0.68)	5.29% (1.73) *	-1.79% (-0.58)	0.99% (0.32)	-1.89% (-0.62)	0.23% (0.07)
22	-2.07% (-0.36)	0.59% (0.10)	1.24% (0.22)	3.30% (0.58)	-1.28% (-0.23)	-1.68% (-0.30)	-1.25% (-0.22)	-3.29% (-0.58)	-0.51% (-0.09)	0.66% (0.12)	5.76% (1.02)
23	-1.90% (-1.01)	-1.42% (-0.76)	-0.79% (-0.42)	0.85% (0.46)	-0.13% (-0.07)	0.10% (0.05)	-0.22% (-0.12)	-0.10% (-0.05)	0.72% (0.38)	0.89% (0.47)	-1.19% (-0.64)
24	-2.66% (-1.54)	-0.01% (-0.01)	0.18% (0.10)	-0.20% (-0.12)	0.17% (0.10)	-0.18% (-0.10)	-0.06% (-0.04)	-1.92% (-1.11)	0.17% (0.10)	-0.48% (-0.28)	0.26% (0.15)
25	-0.68% (-0.45)	-1.30% (-0.85)	0.42% (0.28)	0.23% (0.15)	4.01% (2.63) ***	-0.71% (-0.46)	0.84% (0.55)	0.55% (0.36)	0.40% (0.26)	-1.41% (-0.92)	-0.82% (-0.54)
26	-3.78% (-1.67) *	1.51% (0.66)	1.38% (0.61)	0.93% (0.41)	-1.15% (-0.51)	-0.07% (-0.03)	0.62% (0.27)	0.15% (0.06)	-0.93% (-0.41)	-0.53% (-0.23)	1.40% (0.62)
27	-3.05% (-0.84)	-2.19% (-0.60)	-1.22% (-0.34)	-1.05% (-0.29)	-1.46% (-0.40)	-3.28% (-0.90)	-3.56% (-0.98)	1.00% (0.28)	0.64% (0.17)	-0.45% (-0.12)	-2.97% (-0.82)
28	0.48% (0.21)	-1.20% (-0.54)	-0.49% (-0.22)	-1.21% (-0.54)	-0.15% (-0.07)	-0.66% (-0.30)	-0.18% (-0.08)	-0.36% (-0.16)	-0.84% (-0.38)	0.22% (0.10)	0.01% (0.00)
29	4.68% (1.28)	0.05% (0.01)	3.99% (1.09)	-7.29% (-2.00) **	6.95% (1.91) *	-4.86% (-1.33)	0.90% (0.25)	-0.21% (-0.06)	-3.45% (-0.95)	-0.24% (-0.07)	-1.15% (-0.32)
30	7.46% (1.48)	2.24% (0.45)	-5.51% (-1.10)	2.40% (0.48)	4.23% (0.84)	4.71% (0.94)	1.72% (0.34)	-6.33% (-1.26)	8.72% (1.73) *	-1.96% (-0.39)	-11.63% (-2.31) **
31	-0.31% (-0.23)	0.18% (0.14)	0.74% (0.55)	-0.94% (-0.70)	0.69% (0.51)	2.37% (1.77) *	-0.13% (-0.10)	-2.70% (-2.01) **	1.23% (0.92)	-1.24% (-0.92)	1.90% (1.42)
32	2.86% (0.72)	0.15% (0.04)	0.13% (0.03)	-0.21% (0.05)	-1.19% (-0.30)	1.15% (0.29)	2.84% (0.71)	0.20% (0.05)	5.86% (1.47)	5.25% (1.32)	-1.39% (-0.35)
33	-0.23% (-0.14)	3.09% (1.88) *	-0.71% (-0.43)	0.27% (0.17)	2.79% (1.70) *	1.82% (1.11)	1.17% (0.71)	2.31% (1.41)	-0.82% (-0.50)	-1.51% (-0.92)	-3.82% (-2.32) **
34	1.43% (0.20)	18.05% (2.53) **	11.18% (1.57)	2.41% (0.34)	-1.52% (-0.21)	1.24% (0.17)	1.51% (0.21)	4.98% (0.70)	3.68% (0.52)	5.76% (0.81)	5.18% (0.73)
35	0.72% (0.34)	-0.02% (-0.01)	0.76% (0.36)	0.62% (0.29)	-1.24% (-0.58)	-0.29% (-0.14)	-2.01% (-0.95)	-3.37% (-1.59)	-0.12% (-0.06)	-0.98% (-0.46)	-1.28% (-0.60)
36	3.28% (1.72) *	-0.15% (-0.08)	-1.06% (-0.55)	-2.06% (-1.08)	-2.19% (-1.15)	-0.38% (-0.20)	-4.32% (-2.26) **	4.29% (2.24) **	0.89% (0.47)	0.23% (0.12)	-2.90% (-1.52)

Abnormal returns (AR) as calculated from a market model ( $R_{it} = \alpha_i + \beta_i R_{mt} + \varepsilon_{it}$ ) for all companies on a specific day during the event period.

No	Days										
	-5	-4	-3	-2	-1	0	+1	+2	+3	+4	+5
37	-2.93% (-1.05)	1.31% (0.47)	1.11% (0.40)	-0.23% (-0.08)	3.29% (1.17)	-0.70% (-0.25)	0.39% (0.14)	2.83% (1.01)	-0.55% (-0.20)	3.42% (1.22)	4.97% (1.78) *
38	-0.17% (-0.07)	0.33% (0.14)	0.82% (0.34)	0.28% (0.12)	-0.06% (-0.02)	7.19% (2.99) ***	-5.60% (-2.33) **	-0.85% (-0.35)	6.18% (2.57) **	0.16% (0.07)	-4.20% (-1.75) *
	(z-stat) ***		1% level of significance		(z-stat) **		5% level of significance		(z-stat) *		10% level of significance

**Table 2.** Price effect – Average and cumulative abnormal returns

The table shows the average abnormal returns (AAR) for all companies on a specific day during the event period and the cumulative average abnormal returns (CAAR) for the whole period as well as over a variety of time periods within the event window.

Day	AAR (z-stat)		Period	CAAR (z-stat)		Period	CAAR (z-stat)	
-5	0.40%	(0.77)	-5 to -5	0.40%	(0.77)	-1 to +1	0.07%	(0.08)
-4	0.77%	(1.49)	-5 to -4	1.16%	(1.60)	-2 to +2	-0.88%	(-0.77)
-3	0.81%	(1.59)	-5 to -3	1.97%	(2.22)**	-3 to +3	0.86%	(0.63)
-2	-0.18%	(-0.34)	-5 to -2	1.80%	(1.76)*	-4 to +4	2.25%	(1.46)
-1	0.11%	(0.21)	-5 to -1	1.91%	(1.66)*	-5 to +5	2.48%	(1.46)
0	0.27%	(0.52)	-5 to 0	2.17%	(1.73)*	-5 to 0	2.17%	(1.73)*
+1	-0.30%	(-0.59)	-5 to +1	1.87%	(1.38)	0 to +5	0.58%	(0.46)
+2	-0.78%	(-1.52)	-5 to +2	1.09%	(0.75)	-3 to 0	1.01%	(0.99)
+3	0.93%	(1.81)*	-5 to +3	2.02%	(1.31)	0 to +3	0.11%	(0.11)
+4	0.63%	(1.22)	-5 to +4	2.64%	(1.63)	-1 to 0	0.37%	(0.52)
+5	-0.16%	(-0.31)	-5 to +5	2.48%	(1.46)	0 to +1	-0.04%	(-0.05)
(z-stat)*** - 1% significance			(z-stat)** - 5% significance			(z-stat)* - 10% significance		

**Table 3.** Volume results

The results from a dummy variable regression that checks for an underlying trend that may have resulted in the trading volume of a share naturally increasing (or decreasing) between the periods. The dummy tests for a structural break in the trend around the initial trading of single stock futures. The equation  $V_{it} = \alpha_i + \beta_i T_{it} + \delta D_F + \varepsilon_{it}$  included a time series variable (T) that checked for a trend and a dummy variable to differentiate between the two periods.

No	JSE Code	Company	Constant	Trend	Change
1	AFE	AECI Limited	158 205.8 (0.0000)***	-7.04 (0.7832)	11 441.80 (0.1229)
2	AFL	The Afrikander Lease Ltd	763 589.7 (0.0000)***	84.47 (0.7099)	-209 287.90 (0.0015)***
3	ALT	Allied Food Technologies Limited	69 614.9 (0.0000)***	-21.86 (0.0009)***	21 420.91 (0.0000)***
4	AMA	Amalgamated Appliance Holdings Limited	327 494.9 (0.0000)***	511.50 (0.0000)***	56 956.11 (0.0000)***
5	APK	Astrapak Limited	143 858.9 (0.0000)***	112.73 (0.0387)**	31 874.35 (0.0435)**
6	ART	Argent Industrial Limited	109 958.7	-94.63	86 738.92



The results from a dummy variable regression that checks for an underlying trend that may have resulted in the trading volume of a share naturally increasing (or decreasing) between the periods. The dummy tests for a structural break in the trend around the initial trading of single stock futures. The equation  $V_{it} = \alpha_i + \beta_1 T_{it} + \delta D_F + \varepsilon_{it}$  included a time series variable (T) that checked for a trend and a dummy variable to differentiate between the two periods.

No	JSE Code	Company	Constant	Trend	Change
			(0.0000)***	(0.1439)	(0.0000)***
7	BRC	Brandcorp Holdings Ltd	65 699.0 (0.0000)***	15.40 (0.0000)***	-652.87 (0.0586)*
8	CDZ	Cadiz Holdings Limited	171 395.4 (0.0000)***	268.19 (0.0000)***	51 405.31 (0.0000)***
9	CPT	Capital Alliance Holdings Limited	198 929.7 (0.0000)***	315.92 (0.0000)***	-15 059.80 (0.0009)***
10	CSB	Cashbuild Limited	24 061.8 (0.0000)***	-1.39 (0.0000)***	477.01 (0.0000)***
11	DDT	Dimension Data Holdings Limited	1 385 476.0 (0.0000)***	2 632.65 (0.0000)***	-147 731.90 (0.0560)*
12	DGC	Digicore Holdings Limited	82 987.6 (0.0000)***	-1 098.69 (0.0000)***	375 229.80 (0.0000)***
13	DUR	Durban Roodepoort Deep	173 906.4 (0.0000)***	115.23 (0.2110)	123 640.30 (0.0000)***
14	EOH	EOH Holdings Limited	82 169.9 (0.0000)***	-1.41 (0.1722)	1 687.96 (0.0000)***
15	ERM	Enterprise Risk Management Limited	166 149.6 (0.0000)***	83.70 (0.0000)***	1 994.31 (0.2170)
16	GDF	Gold Reef Casino's Resorts Limited	144 191.1 (0.0000)***	-16.63 (0.0000)***	894.98 (0.0063)***
17	GIJ	Gijima AST Group Limited	629 430.4 (0.0000)***	410.04 (0.1413)	160 480.00 (0.0470)**
18	GND	Grindrod Limited	66 352.8 (0.0000)***	145.92 (0.0000)***	60 929.19 (0.0000)***
19	HDC	Hudaco Industries Limited	55 036.7 (0.0000)***	-17.12 (0.0218)**	-12 211.89 (0.0000)***
20	JCD	JCI Limited	3 089 814.0 (0.0000)***	1 287.41 (0.1146)	-771 797.30 (0.0011)***
21	JSC	Jasco Electronics Limited	36 622.3 (0.0000)***	-85.22 (0.0000)***	49 330.38 (0.0000)***
22	KAP	KAP International Holdings	328 572.4 (0.0000)***	1 674.91 (0.0000)***	-14 667.84 (0.6367)
23	KGM	Kagiso Media Limited	112 820.7 (0.0000)***	6.54 (0.0040)***	-4 803.55 (0.0000)***
24	KWV	KWV Investments Limited	14 363.6 (0.0000)***	5.45 (0.0000)***	-339.41 (0.0000)***
25	LBH	Liberty Holdings Limited	15 951.2 (0.0000)***	36.60 (0.0000)***	2 386.05 (0.0014)***
26	LON	Lonmin PLC	9 446.3 (0.0001)***	-167.02 (0.0000)***	48 085.26 (0.0000)***
27	MCE	M-Cell Limited	1 878 747.0 (0.0000)***	2 843.96 (0.0000)***	-528 433.70 (0.0000)***
28	OMN	Omnia Holdings Limited	81 503.2 (0.0000)***	-222.15 (0.0000)***	17 707.26 (0.0000)***
29	PCN	Paracon Holdings Limited	172 809.2	353.01	21 137.59

The results from a dummy variable regression that checks for an underlying trend that may have resulted in the trading volume of a share naturally increasing (or decreasing) between the periods. The dummy tests for a structural break in the trend around the initial trading of single stock futures. The equation  $V_{it} = \alpha_i + \beta_1 T_{it} + \delta D_F + \varepsilon_{it}$  included a time series variable (T) that checked for a trend and a dummy variable to differentiate between the two periods.

No	JSE Code	Company	Constant	Trend	Change
			(0.0000)***	(0.0000)***	(0.0007)***
30	PIM	Prism Holdings Limited	560 205.7 (0.0000)***	-17.19 (0.0016)***	16 990.66 (0.0000)***
31	PWK	Pick And Pay Holdings Limited	198 642.5 (0.0000)***	-337.35 (0.0000)***	14 920.04 (0.5087)
32	SGG	Sage Group Limited	127 997.1 (0.0000)***	-105.90 (0.0401)**	-43 728.75 (0.0035)***
33	SHP	Shoprite Holdings Limited	991 653.3 (0.0000)***	22.86 (0.0000)***	-4 739.76 (0.0007)***
34	SIM	Simmer and Jack Mines Ltd	398 052.0 (0.0410)**	-3 566.00 (0.0031)***	3 641 565.00 (0.0000)***
35	SLM	Sanlam	4 807 648.0 (0.0000)***	-1 033.15 (0.0048)***	-572 519.10 (0.0000)***
36	SPG	Super Group Limited	546 217.5 (0.0000)***	1 289.45 (0.0000)***	-80 435.78 (0.0074)***
37	UCS	UCS Group Limited	207 701.9 (0.0000)***	79.77 (0.0000)***	-6 948.04 (0.0000)***
38	WNH	Winhold Limited	103 075.0 (0.0000)***	23.79 (0.0000)***	-2 832.91 (0.0000)***

(p-value)\*\*\* 1% significance; (p-value)\*\* 5% significance; (p-value)\* 10% significance

#### Appendix A: Industry and trading date information

No	INDUSTRY (abbreviation): Supersector – Sector – Subsector	Introduction	Trade date
<b>BASIC MATERIALS (BM)</b>			
<b>Basic Resources – Mining – Gold Mining</b>			
2	AFLQ The Afrikander Lease Limited	06/02/2003	10/02/2003
13	DURQ Durban Roodepoort Deep	07/11/2001	08/11/2001
20	JCDQ JCI Limited	13/08/2003	14/08/2003
34	SIMQ Simmer and Jack Mines Limited	09/01/2006	09/01/2006
<b>Basic Resources – Mining – Platinum &amp; Precious Metals</b>			
26	LONQ Lonmin PLC	19/11/2003	19/11/2003
<b>Chemicals – Chemicals – Speciality Chemicals</b>			
1	AFEQ AECI Limited	28/06/2004	13/07/2004
28	OMNQ Omnia Holdings Limited	22/07/2003	22/07/2003
<b>CONSUMER GOODS (CG)</b>			
<b>Food &amp; Beverage – Beverages – Distillers &amp; Vintners</b>			
24	KWVQ KWV Investments Limited	14/11/2006	14/11/2006
<b>Personal &amp; Household Goods – Leisure Goods – Consumer Electronics</b>			
4	AMAQ Amalgamated Appliance Holdings Limited	05/07/2005	06/07/2005
<b>CONSUMER SERVICES (CS)</b>			
<b>Media – Media – Broadcasting &amp; Entertainment</b>			
23	KGMQ Kagiso Media Limited	13/05/2005	13/05/2005
<b>Retail – Food &amp; Drug Retailers – Food Retailers &amp; Wholesalers</b>			

No	INDUSTRY (abbreviation): Supersector – Sector – Subsector	Introduction	Trade date
31	PWKQ Pick and Pay Holdings Limited	16/04/2005	19/04/2005
33	SHPQ Shoprite Holdings Limited	28/11/2002	28/11/2002

**Retail – General Retailers – Broadline Retailers**

7	BRCQ Brandcorp Holdings Limited	22/11/2004	23/11/2004
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**Retail – General Retailers – Home Improvement Retailers**

10	CSBQ Cashbuild Limited	22/02/2005	23/02/2005
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**Travel & Leisure – Travel & Leisure – Gambling**

16	GDFQ Gold Reef Casinos Resorts Limited	02/06/2004	04/06/2004
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**FINANCIALS (F)**

**Financial Services – General Financial – Investment Services**

8	CDZQ Cadiz Holdings Limited	03/08/2005	04/08/2005
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**Financial Services – General Financial – Speciality Finance**

15	ERMQ Enterprise Risk Management Limited	04/10/2005	06/10/2005
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**Insurance – Life Insurance – Life Insurance**

9	CPTQ Capital Alliance Holdings Limited	17/09/2003	17/09/2003
25	LBHQ Liberty Holdings Limited	06/10/2003	06/10/2003
32	SGGQ Sage Group Limited	21/01/2004	23/01/2004
35	SLMQ Sanlam	21/07/2000	03/08/2000

**INDUSTRIALS (I)**

**Industrial Goods & Services – Electronic & Electrical Equipment – Electrical Components & Equipment**

21	JSCQ Jasco Electronics Holdings	23/01/2006	23/01/2006
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**Industrial Goods & Services – Electronic & Electrical Equipment – Electronic Equipment**

12	DGCQ Digicore Holdings Limited	22/08/2005	22/08/2005
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**Industrial Goods & Services – General Industrials – Containers & Packaging**

5	APKQ Astrapak Limited	19/08/2004	19/08/2004
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**Industrial Goods & Services – General Industrials – Diversified Industrials**

6	ARTQ Argent Industrial Limited	22/09/2004	27/09/2004
22	KAPQ KAP International Holdings	18/01/2005	28/01/2005

**Industrial Goods & Services – Industrial Engineering – Industrial Machinery**

19	HDCQ Hudaco Industries Limited	04/04/2005	04/04/2005
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**Industrial Goods & Services – Industrial Transportation – Marine Transportation**

18	GNDQ Grindrod Limited	24/03/2004	24/03/2004
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**Industrial Goods & Services – Industrial Transportation – Trucking**

36	SPGQ Super Group Limited	26/02/2004	26/02/2004
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**Industrial Goods & Services – Support Services – Industrial Suppliers**

38	WNHQ Winhold Limited	14/08/2006	14/08/2006
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**TECHNOLOGY (T)**

**Technology – Software & Computer Services – Computer Services**

11	DDTQ Dimension Data Holdings Limited	08/02/1999	08/02/1999
14	EOHQ EOH Holdings Limited	07/02/2006	10/02/2006
17	GIHQ Gijima AST Group Limited	12/09/2005	13/09/2005
29	PCNQ Paracon Holdings Limited	23/11/2005	23/11/2005

No	INDUSTRY (abbreviation): Supersector – Sector – Subsector	Introduction	Trade date
<b>Technology – Software &amp; Computer Services – Software</b>			
30	PIMQ Prism Holdings Limited	10/11/2004	10/11/2004
37	UCSQ UCS Group Limited	14/12/2005	14/12/2005
<b>Technology – Technology Hardware &amp; Equipment – Computer Hardware</b>			
3	ALTQ Allied Technologies Limited	21/05/2003	22/05/2003
<b>TELECOMMUNICATIONS (TC)</b>			
<b>Telecommunications – Mobile Telecommunications – Mobile Telecommunications</b>			
27	MCEQ M-Cell Limited	08/08/2000	22/08/2000

Source: JSE Limited (2005)