Determinants of Trading Activity on the Single-Stock Futures Market: *Evidence from the Eurex Exchange*

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A number of exchanges around the world have attempted to introduce single-stock futures, but only a few have succeeded. In this article, the authors argue that this situation can be attributed to the use of inadequate selection criteria for the underlyings. Therefore, the authors investigate the determinants of trading activity on the Eurex derivative exchange and look beyond systematic reasons extensively examined in prior research. They find that trading activity is higher for single-stock futures on stocks characterized by low institutional ownership and high volume and volatility on the spot market. The mispricing between the spot and futures markets also attracts investors to the single-stock futures market. Moreover, factors such as the size of contract, tick size, and age of contract on a particular stock significantly contribute to the increase of open interest and traded volume. Furthermore, evidence is found that single-stock futures become more efficiently priced around an ex-dividend date for the underlying stock. This is due to dividend-stripping trading, which allows a reduction in the tax burden. The findings have important implications for investors who have an interest in that segment of the derivatives market. These implications should also be taken into consideration by market regulators and tax authorities.

A single-stock futures (SSF) contract is a derivative product with a number of desirable features. It offers investors the ability to hedge against changes in the value of the underlying stock. In the case of a short hedge, it provides an opportunity to postpone the sale of the underlying security and thus secure the right to dividends and the ability to vote. This derivative product offers undisputable benefits to a speculator who can easily leverage his or her position in a given stock by taking a short position instead of using a short sale. There is also evidence that market efficiency improves for the underlying stocks once SSFs are introduced (see Ang and Cheng [2005a]).

Opponents of the SSF instrument argue, however, that the introduction of single-stock futures contributes to excess volatility in the spot market. Despite the fact that there is mixed evidence for this premise, many regulators have imposed constraints on this new derivatives segment. The so-called Shad–Johnson accord repealed in 2000 in the U.S. market is a good example of such a policy (see Johnson and Hazen [2004]).

Even so, in many markets it appears that the potential risks related to the introduction or reintroduction of single-stock futures were outweighed by perceived benefits for market participants. Moreover, the introduction of single-stock futures in the developed markets has not attracted much investor attention. For example, in November 2002, single-stock futures contracts were supposed to be traded on three U.S. exchanges: Nasdaq Liffe, One Chicago, and Island Futures Exchange. Today, trading takes place only on the floor of the Chicago exchange. In contrast, the Hong Kong Futures Exchange, Euronextliffe, and more recently, Eurex have been more successful in the introduction of SSFs. Therefore, many previous studies have focused on the reasons why the SSF market did not attract the projected attention of investors. Gibson [2002] suggested that a lack of education together with the novelty of the product led to the low trading activity. The fact that at the time of introduction of SSFs in the U.S. there were differences between the tax treatment of SSFs and other futures contracts seemed to contribute to a situation in which many investors avoided investing in the single-stock futures market (see Simmons [2002]; Jones and Brooks [2005]). The high level of initial and maintenance margins was pointed out by Dutt and Wein [2003] and Partnoy [2002] as a factor reducing activity in that segment of the derivatives market. Finally, the fact that in the first years after introduction, open interest and volume traded on SSFs were nowhere near that of the underlying stock became a self-fulfilling prophecy. Potential investors avoid a market that is unable to meet their expectations in terms of liquidity.

Instead of focusing on the reasons behind the introduction's failure, Ang and Cheng [2005b] pointed out three factors that facilitate the launch of a single-stock futures market. Their results suggest that the contracts on stocks characterized by high capitalization, high volume, and high volatility attract the attention of market participants. Moreover, all three factors are taken into account by U.S. and European exchanges in selecting a stock to be the underlying for a futures contract.

Nonetheless, an analysis of trading activity observed on Eurex SSF markets reveals that proxies of trading differ considerably across stocks. This suggests that the key to understanding trading patterns on SSF markets can lie in other properties of an underlying and the specification of the futures contract. Consequently, our study focuses on the question as to what extent the properties of the underlying instrument for a single-stock futures contract determine its popularity among investors. We examine whether the specification of the contract influences volume and open interest. In order to answer those questions, we identify factors affecting trading both globally and locally.

The investigation into trading patterns is warranted on at least three grounds. First, understanding what types of characteristics of the underlying security attract the attention of investors in single-stock futures is of a vital interest to exchanges. Second, it is informative for market regulators, as it provides direct evidence on the development of single-stock futures markets. In the post–global financial crisis era, market regulators are required to pay special attention to the stability of financial markets; the improvement and growth of hedging instruments such as SSFs can help to achieve this goal. Third, our study can be of interest to tax authorities, as it shows how equity derivatives can be used for dividend trading and can lead to a reduction in investors' tax burden.

INSTITUTIONAL BACKGROUND AND PRELIMINARY DATA ANALYSIS

In October 2005, the Eurex launched a single-stock futures market, primarily as a response to the Undertakings for Collective Investments in Transferable Securities III (UCITS III) Act of the European Union. This new regulation gave mutual fund managers the authority to take short positions in derivatives products. Candidates for underlying securities initially came from indices like the German DAX 30, Swiss SMI, and Dow Jones STOXX 600, and so far, the exchange has chosen companies based on their market capitalization and turnover. Since the initial introduction of SSFs, the Eurex has been continuously expanding its product range, and by 2008, the number of underlying securities for single-stock futures exceeded 500. The Eurex and Euronextliffe are the most liquid markets for single-stock futures in Europe. The average open interest and notional value traded for the 2006–2007 period reached 1.95 million contracts and USD 217 billion, respectively. The Eurex has also been among the world's top five markets in terms of the number of single-stock futures contracts traded during this period.

In an attempt to create a broad sample, we compiled information on the stocks of 420 companies that became the underlyings for single-stock futures traded on the Eurex. The majority of companies are registered in western European countries, for example, France, Germany, Switzerland, Spain, Italy, and the Netherlands. The remaining 23% of examined firms come from 11 other countries, including developed and emerging markets. For each company, variables including the closing stock prices, market-to-book ratio, market capitalization, volume, turnover, and beta were obtained from Thomson Reuters Datastream. The past performance of companies was measured by annualized log returns calculated from daily closing prices. For each company, we also calculated annualized realized volatility of returns. Both measures are the most natural proxies of return and risk.

Data on institutional ownership were obtained from the Osiris database, compiled by Bureau van Dijk Electronic Publishing. The share of institutional ownership is defined by summing the stock direct holdings of all reporting institutions for each stock for each quarter. We manually extracted quarterly holdings starting from the third quarter of 2005 and ending in the first quarter of 2008. In our study, we proceed with non-adjusted data. The study by Gompers and Metrick [2001] points out that companies with high capitalization also have a high percentage of institutional ownership. Therefore, they suggested that the level of institutional ownership needs to be adjusted to avoid a multicollinearity problem. In our sample, the correlation coefficient between institutional ownership and company value has a value of 0.1436 and a corresponding P-value equal to 0.3731; thus, we use non-adjusted data. All correlation coefficients between variables taken into consideration in our analysis are reported in Exhibit 2. Finally, for all companies, we gathered data on dividends, such as yield, ex-dividend dates, and dividend payment dates.

Data on single-stock futures markets were also sourced from Datastream. We collected variables describing the contract specification and market activity; these include contract size, age, and allowed tick size. In turn, activity was measured by open interest and the number of contracts traded. We have followed the convention of previous studies on futures markets by excluding all data within the delivery month to avoid the possibility of noise during the last trading month. Thus, our continuous futures price series are constructed in the following way. Prices for the nearby futures contract are selected until the contract reaches the first day of the delivery month. On that day, there is a change of contract to the next one nearest to delivery, and its prices are recorded. The mispricing is computed as the difference between the market futures price and the theoretical price of a contract divided by the spot price, where the theoretical price is given by the cost-of-carry formula defined by the following equation:

$$F_T = (S_0 - I_0^T)e^{rT} \qquad (1)$$

where

S_0 = today's price of underlying,
T = time to expiration of futures contract,
I_0^T = the present value of all dividends to be paid between today and time T,
r_0 = today's risk-free rate for the period between 0 and T.

In order to achieve consistency in a dataset, all variables are denominated in euros (EUR), using exchange rates sourced from the European Central Bank. As a proxy of risk-free rate, we use the three-month EUR LIBOR.

Exhibit 1 reports descriptive statistics at the company level for the variables discussed above. The mean of daily absolute mispricing per company is 16.99 basis points (bps), with the standard deviation equal to 25.74 bps. The high variation of daily absolute mispricing per company can be attributed to the fact that stock futures of some companies are rarely traded. This applies especially to those from emerging markets.

The sizes of contracts available on the Eurex are 1, 10, 50, 100, 500, and 1,000 shares. Row 2 of Exhibit 1 indicates that more than half of the futures contracts included in the sample have a size of 100 shares or more. The tick size in our sample ranges from 0.0005 to 0.2, with the mean equal to 0.0177. At least half of the single-stock futures contracts were introduced 20 months or more before the beginning of January 2008, while just less than 10% of contracts were traded for a period shorter than 1.41 years. Both market capitalization and beta reveal that the Eurex is biased towards the stock of well-established companies. The average market capitalization of firms is around 1.16 billion euros, and beta is close to 1. The average institutional ownership is 56.65%, and at least 50% of companies have the institutional ownership variable greater than 61.67%.

For companies included in our sample, the mean and median of annualized volatility (*Ann_Volatility*) are 27.23% and 28.48%, respectively. The 90th percentile on the level of 34.18%, together with a rather low mean and median, suggests that companies whose stocks are underlyings for single-stock futures are characterized by relatively low volatility. Exhibit 1 also reports basic statistics for annualized daily returns (*Ann_Return*). In the 2005–2007 period, the mean and median of annual-

EXHIBIT 1
Descriptive Statistics for Examined Dataset

	Mean	Standard Deviation	10th Percentile	Median	90th Percentile
Abs_Mispricing (bps)	16.9962	25.7400	0.4300	7.3600	36.8100
Size_lot	139.3741	190.3674	50	100	500
Tick_size	0.0177	0.0342	0.0100	0.0163	0.1007
Age	1.6111	0.3410	1.4109	1.5671	2.1863
Ln_Market_Value	7.0565	1.6208	5.0378	6.9848	9.1549
Beta	0.9775	0.5707	0.3418	0.8747	1.7219
Inst_ownership	56.6497	28.6728	11.7653	61.6731	91.9364
Ln_volume	9.2438	2.3691	5.6480	9.7196	11.9618
Ann_Volatility	0.2773	0.0563	0.1941	0.2848	0.3418
Ann_Return	0.1041	0.2429	–0.1971	0.0967	0.3738
Ln_NS_EUR	3.6781	0.6777	2.4849	3.7135	4.3820
MVGDP	1.1506	0.7265	0.5100	1.0800	3.0700
Futures Spread (bps)	36.1535	8.1681	13.1535	30.0032	54.5615
Spot Spread (bps)	14.6653	4.6967	6.2163	12.5446	23.2651

Notes: The sample consists of data for 420 companies on which stocks are underlying for single-stock futures in the period between October 2005 and January 2008. Abs_Mispricing is defined as absolute value of the difference between the market futures price and the theoretical price of a contract divided by spot price, where theoretical price is given by the cost-of-carry formula. Size_lot denotes the size of single-stock futures for a given company. Tick_size measures the smallest amount by which a price of contract can change. Age denotes the number of years since introduction of SSFs on a stock of a given company. Ln_Market_Value the natural logarithms of market capitalization for a given company. Beta is the stock beta calculated for a five-year period. Inst_ownership measures percentage of institutional holding in a given company on a quarterly basis. Ln_volume is the natural logarithm of volume observed on the spot market for a given company. Ann_Volatility measures realized annual volatility for a given stock, calculated from daily log returns. Ann_Return is a daily log return translated into annual return. Ln_NS_EUR is the natural logarithm of a number of stocks from a given country for which single stocks are available. MVGDP is the total capitalization of a country's stock market as a percentage of its total GDP. Futures Spread and Spot Spread are defined as ratios of the difference between the respective ask and bid prices to the midpoint of the respective ask and bid prices. Both spreads are expressed in basis points (bps).

ized daily returns for the examined sample of companies is 10.41% and 9.67%, respectively.

In addition to the variables describing an underlying and single-stock futures contract, we consider two variables that might have any explanatory power of trading activity. Those are *Ln_NS_EUR* as the logarithm of the number of stocks from a particular country and *MVGDP* as the total capitalization of a country's stock market as a percentage of its total GDP. In the next section, we explain the hypotheses related to each of the variables we have described.

HYPOTHESES DEVELOPMENT

In an effort to find the determinants of trading on the SSF market, we need to look beyond the standard criteria of underlying security selection. According to prior work in this area, exchanges focus on turnover, market capitalization, and volatility. However, large dispersion in the popularity of single-stock futures on different underlying securities suggests that other factors are associated with trading activity. In this section, we identify variables that may affect the trading level and briefly discuss the reasons for including a particular factor in our analysis. Later in the article, we will discuss how each of the elements of a contract's specification may influence trading activity.

Contract Specification

We consider four variables characterizing a contract. The variable *Size_lot* measures the size of the contract. Karagozoglu and Martell [1999], Huang and Stoll [1999], and Bollen et al. [2003] have pointed out that a smaller contract size can increase the popularity of a product among investors. First, investors with less capital can obtain better accessibility to the futures market. Second, even larger investors may prefer smaller contracts. An

EXHIBIT 2
The Pearson Correlation Coefficients for Examined Variables

Day Relative to Event	(I)	(II)	(III)	(IV)	(V)	(VI)	(VII)	(VIII)	(IX)	(X)	(XI)	(XII)
Abs_Mispricing (I)	1	0.0219	-0.0533	–0.1650	0.1251	0.0108	0.0708	0.3096	0.0425	-0.0689	0.0804	-0.1284
		(0.6544)	(0.2757)	(0.0007)	(0.0103)	(0.8253)	(0.1478)	(0.0001)	(0.0038)	(0.0016)	(0.0999)	(0.0084)
Size_lot (II)		1	-0.1087	–0.0176	-0.0977	0.0765	0.0076	0.3477	0.1500	-0.1060	0.0811	0.2844
			(0.0259)	(0.7190)	(0.0453)	(0.1171)	(0.8762)	(0.0001)	(0.0020)	(0.0299)	(0.0972)	(0.0001)
Tick_size (III)			1	0.4121	0.1251	0.1437	-0.0997	0.1538	0.1029	0.0329	0.0838	0.0418
				(0.0001)	(0.0103)	(0.0032)	(0.0410)	(0.0016)	(0.0349)	(0.5017)	(0.0860)	(0.3925)
Age (IV)				1	0.1347	0.0537	0.0938	0.2162	0.2579	0.0110	0.3435	0.0311
					(0.0057)	(0.2726)	(0.0548)	(0.0001)	(0.0001)	(0.8220)	(0.0001)	(0.5205)
Ln_Market_Value (V)					1	0.1105	0.1436	0.0440	0.0337	0.0071	0.0373	-0.1025
						(0.2350)	(0.3731)	(0.3684)	(0.4906)	(0.8847)	(0.4454)	(0.0358)
Beta (VI)						1	0.0849	0.1975	-0.1943	0.0267	0.0578	0.0506
							(0.0820)	(0.0001)	(0.0001)	(0.5851)	(0.2374)	(0.3012)
Inst_ownership (VII)							1	0.0779	0.0013	0.0227	0.1090	-0.2086
								(0.1106)	(0.9782)	(0.6431)	(0.0255)	(0.0001)
Ln_volume (VIII)								1	0.1529	0.1125	0.1393	0.0222
									(0.0017)	(0.0211)	(0.0042)	(0.6500)
Ann_Volatility(IX)									1	0.0554	0.0659	0.0915
										(0.2573)	(0.1771)	(0.0610)
Ann_Return (X)										1	0.0190	0.0788
											(0.6975)	(0.1070)
Ln_NS_EUR (XI)											1	0.0067
												(0.8917)
MVGDP(XII)												1

Notes: For variable definitions of see Exhibit 1 notes. In each case the null hypotheses that a correlation coefficient is equal to 0 is tested. The t-statistics are in parentheses.

application of large-size contracts to hedging or to speculation can result in less precision in matching positions. However, reduction of the contract size increases trading costs, as both brokerage commissions and exchange fees are typically quoted per contract, independently of size.

Tick_size quantifies the smallest allowed change of contract price. A larger tick size reduces the number of possible prices at which trade could take place, thereby improving the way the market operates. At the same time, larger tick size means higher revenue for the market maker at the expense of investors (see Seppi [1997], Brown et al. [1991], Bollen et al. [2003]). These studies, however, do not leave us with a clear indication of what type of specification receives great acceptance from market participants. The fact that Eurex offers products characterized by different contract sizes and tick values makes it an ideal environment to explore these issues further.

Finally, the variable *Age* indicates the number of years since futures contracts on a particular stock were first offered to investors. We put forward a hypothesis that financial products that have been available on the market longer may receive more attention from investors.

Characteristics of the Underlying Security

In this study, we consider six variables that characterize the properties of underlying securities. Volume, market capitalization, and volatility were discussed earlier, and we know that the exchanges tend to select underlying securities for single-stock futures based on the magnitude of those three variables. It is not clear whether variables such as *Ln_volume, Ln_Market_Value, and Ann_Volatility* have any remaining explanatory power of trading activity. Based on the findings of previous studies, however, all three factors are expected to have a positive impact on trading activity.

Of course, investors would like to trade single-stock futures only if they offer an advantage in comparison with instruments already available in the market. Limitations on the ability to short sell could be one such reason, as taking a short position in a futures contract can substitute exposure given by a short position in a given stock on the spot market. Nagel [2005] and D'Avolio [2002] document a positive relationship between the percentage of direct institutional ownership and the ability to short sell stocks. D'Avolio [2002] has found that the level of institutional ownership explains the majority of the short sale loan supply. In order to understand that this is the case, we should refer to studies by Duffie [1996] and Krishnamurthy [2002] first. Both authors have shown that the rebate rate is strictly positive in an environment where acting investors refrain from selling an overpriced asset.[1] The institutional owners are assumed to be rational, thus they should not stick to overpriced assets. Therefore, in the case of overpriced stock characterized by low institutional ownership, we expect a significant number of investors will keep the overpriced asset. As a result, there is a lower supply of shares of stock available for short sale. This results in a higher cost of a short sale and increased attractiveness of single-stock futures. Thus, we consider the *Inst_ownership* variable as a proxy of short sale accessibility to investors. We put forward the hypothesis that futures contracts on an underlying stock with low institutional ownership are more popular among investors. One can argue, however, that a high level of institutional ownership is a factor facilitating trading because institutional investors are believed to be better prepared to trade on spot and futures markets (Falkenstein [1996]; Dennis and Weston [2001]). Thus, our study can shed light on which of the presented hypotheses are supported by trading patterns observed on the Eurex exchange.

The studies by Black, Jensen, and Scholes [1972], Frazzini and Pedersen [2010], and Baker, Bradley, and Wurgler [2011] document that despite expectation, high-beta stocks have substantially underperformed low-beta stocks. Thus, we put forward the hypothesis that high-beta stocks might be better candidates for an underlying security for single-stock futures, because investors can apply an SSF instrument to hedge against stock-specific underperformance. Finally, we address the question as to what extent the performance of a stock influences the status of futures contracts among investors. *Ann_Return* is annualized daily returns for the whole examined period, and it is our proxy of stock performance for the period under consideration.

Mispricing between Spot and Futures Markets

Prior research on stock index futures has shown that mispricing tends to become smaller and less volatile for well-established contracts (see, e.g., MacKinlay and Ramaswamy [1988]; Chung [1991]; Kempf [1998]; Puttonen [1993]; Białkowski and Jakubowski [2008]). Thus, mispricing is often used as the benchmark for efficiency in a particular futures market. Consequently, we can expect that its magnitude can be negatively correlated with trading activity. In the case of our dataset, the correlation between *Age* and *Mispricing* equals −0.1650 and is statistically significant at the 1% level.

Nevertheless, it seems reasonable that some level of mispricing facilitates trading. The high mispricing gives an arbitrageur the possibility of making a profit and so encourages trading. In our study, we explore which of the previously stated hypotheses are confirmed by trading patterns recorded by the Eurex exchange.

Characteristics of the Domestic Stock Market for Underlying

In our analysis, we took into consideration two additional variables: *Ln_NS_EUR*, defined as the logarithm of the number of stocks in our sample from a particular country, and *MVGDP*, defined as the total capitalization of a country's stock market as a percentage of its total GDP. The latter variable is often used as a proxy of development of capital markets. In comparison with mature markets, emerging capital markets are characterized by a lower value of *MVGDP*. It is a well-established fact that stock markets in emerging economies are more volatile than in mature ones (see Bekaert and Harvey [2003]; Harvey [1991, 1995]). Therefore, we put forward the hypothesis that derivatives on stocks from emerging markets can be more popular among investors, as they use them for hedging purposes more often due to higher risk.

The studies on stock exchange integration by Nielsson [2009] and on cross-listing for European companies by Pagano et al. [2001] show that companies listed on markets on which several companies from their industry/country are already listed enjoy higher volume and liquidity. In other words, previous research provides evidence that companies that are the only representative of a country or industry on a given market are probably less popular among investors. Therefore, in the case of the Eurex, we also would like to verify whether a number of stocks from a particular country in which single-stock futures are available has any impact on the trading volume of each of them. We expect it will have a positive impact on them, because better representation in a stock market means a much broader scope of strategies and purposes to trade single-stock futures. As there is a higher incentive to trade on a derivatives exchange in which derivatives products are available for most stocks from a given stock market rather than on an exchange where only a few products are offered. In order to verify this hypothesis, we included the variable *Ln_NS_EUR* in the following analysis.

Trading Activity around Ex-Dividend Dates

In addition to conducting a global analysis of the factors affecting SSF trading, we would like to gain a better understanding of the reasons behind local spikes in trading activity as observed, for example, around ex-dividend dates. To illustrate why this might be the case, we consider the motivations of German investors. In the 2005–2008 period, the German tax environment created incentives for high-income earners with German tax residency to avoid dividend payments. In the following paragraphs, we briefly describe the tax regulations in the period under consideration.

The so-called half-income taxation method of dividends (*Halbeinkünfteverfahren*) was put in place in the tax reforms of 2001. According to the tax rule applied to individual investors, half of cash dividend income was subject to a withholding tax rate determined by the personal income rate, which ranged from 15% to 42%. In addition, long-term capital gains from stock held for non-speculative reasons were tax exempt for individual investors with non-substantial interest in a company. In the years 2005–2008, non-substantial ownership was defined as being at a level less than 1% of capitalization.

In the same time, for corporate investors only 5% of dividend income was taxed (see §8b Abs 1 and 5 Koerperschaftsteuergesetz [KStG]). Therefore, 95% of cash dividends were effectively tax-exempt.

The studies by Wagner and Wagner [2001], Bergsteiner et al. [2001], and recently Haesner and Schanz [2011] have shown that long-term individual investors, whose capital gains are tax exempt, have an incentive to sell stock before the ex-dividend date to corporate/institutional investors and repurchase it after the ex-dividend date. Such a strategy, known as dividend stripping, allows individual investors to avoid or reduce dividend taxation.[2] The high-income individual German investor indeed has reasons to avoid dividend payments, as the effective dividend tax rate for such investors under the half-income tax regime was 22.16%.[3] In other words, he or she received an after-tax dividend of EUR 0.7784 per each EUR 1 of nominal dividend. When a price-drop ratio (PDR)—defined as the cum-dividend day closing price minus the ex-dividend day closing price divided by the dividend amount—is higher than EUR 0.7784, the high-income German investor experienced a loss; his or her dividend payment was not sufficient to compensate for the price drop due to the dividend payment.

Panel A and Panel B of Exhibit 3 present descriptive statistics for cash dividends and historical PDRs for all companies and German companies only, respectively. On average, a price drop on the ex-dividend date is in the range of 0.90–0.97; thus it is 16%–25% higher than after the tax dividend payment for high-income German investors. The analysis reveals that cash dividends are

EXHIBIT 3

Descriptive Statistics for Nominal Dividends and the Ex-Dividend Day-Price-Drop Ratio

	Mean	Standard Deviation	10th Percentile	Median	90th Percentile
A. All companies					
Dividend (in EUR)	1.5988	1.7753	0.0876	0.8500	2.5000
PDR	0.8987	2.9810	−0.5900	0.9245	2.6641
B. German companies					
Dividend (in EUR)	1.4732	1.3099	0.5000	1.1350	3.1000
PDR	0.9675	1.6080	−0.0296	0.9350	2.0000

Note: This exhibit reports descriptive statistics for nominal dividends and the price-drop-ratio defined as the cum-dividend day closing price minus the ex-dividend day closing price divided by the dividend amount.

EUR 1.59 and EUR 1.47 for all companies and German companies, respectively.

Young and Sidey [2003], Dias de Sousa [2008], and Baldwin [2010] have shown that SSFs, due to the fact that they do not pay dividends, can be a useful instrument for investors engaged in dividend stripping. An investor who sells a dividend-paying stock prior to the ex-dividend date can maintain exposure to the fluctuations of the stock itself by opening a long position in futures on the stock. Moreover, investors who would like to capture a dividend by buying the stock prior to the ex-dividend date can remain neutral to variability of the stock by taking a short position in SSFs. Therefore, we expect that individual German investors and mutual funds have an incentive to open a long position in SSFs and that corporate and institutional investors who enjoy a favorable tax treatment of dividends have reason to sell futures contracts.

In order to better understand the details of the above trading strategy, we analyze the example of a cash dividend of EUR 4 per ordinary share paid by Deutsche Bank on May 25, 2007. We consider two investors holding 100 ordinary shares each. The personal income tax rates for those investors are 42% and 15%, respectively. Exhibit 4 shows that investor A's tax burden is more than three times as high as investor B's. Previous empirical studies by Elton and Gruber [1970], Dubofsky [1992], and Frank and Jagannathan [1998] have provided evidence that, on an ex-dividend date, a stock price is expected to drop by an amount smaller than the actual dividend size.

Indeed, the closing price of Deutsche Bank stock the day before the ex-dividend date was EUR 115.85, and on the ex-dividend date it dropped to EUR 112.13. So, the decrease in the stock price was EUR 3.72. The after-tax dividend is worth EUR 3.7044 for low-income tax investor B and EUR 3.1136 for high-income investor A. Thus, due to the high level of tax and the significant decrease of the stock price around the ex-dividend date, investor A might experience a loss. This creates a strong incentive for him or her to avoid dividend payments. In order to achieve this, high-income investors apply the dividend-stripping strategy.

Panel A of Exhibit 5 presents an example of the dividend-stripping strategy. It also shows an application of SSFs as part of this strategy. Investor A sells 100 Deutsche Bank shares one day before the ex-dividend date at EUR 115.85 each (we assume that investor A has held the shares for more than one year and so is exempt from the capital gains tax). Next, the same investor deposits proceeds from the sale at overnight EUR LIBOR and opens a long position in one futures contract on 100 Deutsche Bank shares with a future price EUR 111.87. The interest payment to high-income individuals as A is taxed at a 42% rate. One day after the ex-dividend date, Investor A closes his or her position on the futures market by selling a futures contract with a price of EUR 112.25. In case of individual investor a profit from futures trading is a subject to a withholding tax. The rate is determined by the personal income rate, for investor A's rate is 42%.[4] Finally, investor A uses his or her deposit to buy back the 100 Deutsche Bank shares at EUR 112.37 each. The total profit from the strategy is EUR 371.47. The implementation of this dividend-stripping strategy depends upon individual tax circumstances; nevertheless, this description provides a clear illustration of the strategy.

Panel B of Exhibit 5 contrasts the outcome above with one where investor A simply continues to hold his 100 shares and does not engage in futures trading. Again, we analyze the period between one day before and one day after the ex-dividend date. Investor A experiences a drop of the stock price from EUR 115.85 to EUR 112.37 and receives a nominal dividend of EUR

EXHIBIT 4

Taxation of Cash Dividend under the Half-Income Taxation Method of Dividends (*Halbeinkünfteverfahren*)

	Investor A	Investor B
Cash dividend	400.00	400.00
Income from capital assets (50% taxpayer)	200.00	200.00
Income tax (A: 42%, B: 15%)	84.00	28.00
Solidarity surcharge on income tax 5.5%	4.62	1.54
Remaining after taxes (net dividend)	311.38	370.46
Effective dividend tax rate	22.16%	7.39%

Notes: This exhibit presents the example of a cash dividend of EUR 4 per ordinary share paid by Deutsche Bank on May 25, 2007. We consider two investors holding 100 ordinary shares each. The personal income tax rates for those investors are 42% and 15%, respectively. The exhibit shows that investor A's tax burden is almost three times higher than investor B's. This creates a strong incentive for him or her to look for a tax savings around an ex-dividend date.

E X H I B I T 5

Trading Strategies around the Ex-Dividend Date for German Investors

	Opening Position (day before ex-dividend date)	Closing Position (day after ex-dividend date)	Profit/Loss from Each Position	Total Profit/Loss
A: Dividend stripping for high-income investor				
Spot Market	Sell all 100 shares for EUR 115.85 each.	Buy back 100 shares for EUR 112.37 each.	348 EUR	
Futures Market	Long position in one futures contract on 100 shares with price of EUR 111.87.	Short position in one futures contract on 100 shares with price of EUR 112.25. Profit taxed at 42% rate.	22.04 EUR	371.47 EUR
Deposit	Deposit EUR 11,585 for two days at 3.84% overnight euro LIBOR rate.	Accrued interest deposit of EUR 2.47 is taxed at 42% rate.	1.43 EUR	
B: High-income investor's strategy buy and hold dividend paying stock (dividend tax rate 22.16%)				
Spot Market	Hold all 100 shares. The current price is equal to 115.85 per share.	Hold all 100 shares. The post ex-dividend price is equal to 112.37. Receive after-tax dividend equal to EUR 311.36 (EUR 400 before tax).	EUR −348 (drop of stock price) + EUR 311.36 (after-tax dividend)	36.64 EUR
C: Low-income investor's strategy buy and hold dividend paying stock (dividend tax rate 7.39%)				
Spot Market	Hold all 100 shares. The current price is equal to 115.85 per share.	Hold all 100 shares. The post ex-dividend price is equal to 112.37. Receive after-tax dividend equal to 370.44 EUR (400 EUR before tax).	EUR −348 (drop of stock price) + EUR 370.44 (after tax dividend)	22.44 EUR

Notes: The bid and ask prices are used to calculate the profit/loss from a sale and buy transaction.

4 with an after-tax value of EUR 3.1136. Overall, high-income investor A experiences a decreased value of his portfolio equal to EUR 36.64. It is worth highlighting that the same strategy applied by investor B does not result in a loss; Panel C presents such a case. The effective dividend tax rate for low-income investors under the half-income tax regime is only 7.39%. As a result, the after-tax dividend paid by 100 Deutsche Bank shares is equal to EUR 370.44, and investor B gains EUR 22.44 despite the stock price drop.

According to existing literature (Wagner and Wagner [2001], Bergsteiner et al. [2001], and recently Haesner and Schanz [2011]), dividend-stripping strategies have become an integral part of the half-income taxation system. SSF contracts are very useful financial instruments to facilitate implementation of such strategies. Therefore, we put forward the hypothesis that the trading activity of SSFs increases around ex-dividend dates. We also expect an increase in the efficiency of the derivative market measured by the level of absolute mispricing. Both can be attributed mostly to the activity of German investors, who by trading SSFs look for dividend tax savings.

EMPIRICAL RESULTS

Analysis of Factors Facilitating SSF Trading

In order to detect factors facilitating trading on the Eurex, we use linear regression on the company level (see Hao et al. [2010]). We use two proxies of trading activity: open interest and traded volume for single-stock futures. To test the consistency of the results reported in this section, we consider six specifications of the model applied to each proxy. Specification 1 (S1) is based on criteria used by the exchanges for selection of the underlying for single-stock futures. The exchanges seem to select stocks characterized by high capitalization and turnover. The level of volatility is also taken into account.

The next specification (S2) includes all variables from S1 plus the variables *Abs_Mispricing*, *Size_lot*, and *Tick_size*, all describing specifications of the SSF contract. Specification 3 (S3) contains all previous variables together with variables characterizing an underlying of the contract. Specification 4 (S4) has the same components as S3 and also includes variables that measure the return–risk profile, such as annualized log returns, annualized realized volatility, and a stock's beta. Specifications 5 and 6 (S5 and S6) contain all the variables mentioned previously as well as those describing the domestic market for the underlying, that is, *Ln_NS_EUR* and *MVGDP* are added. Due to the high correlation between the age of the contract and tick size equal to 0.4121 with P-value below 1%, we decided to consider two separate model specifications. So S5 takes into consideration tick size and S6 takes into consideration age of contract. Variance inflation factors (not reported) indicate that multicollinearity is not present in the reported regressions.[5]

Exhibit 6 contains the results of regression for all specifications. The dependent variable is the average daily log open interest per company, and it is used as a proxy of market activity. We find strong evidence that a high level of institutional ownership has a negative impact on the popularity of single-stock futures among investors. The coefficient for institutional ownership in regression S6 is −0.0181, and it is statistically significant at 1% (see Exhibit 6). This result is consistent with the hypothesis that investors trade SSFs on stocks characterized by the limited access to short sale more often. The coefficients reported in Exhibit 6 indicate that market participants prefer smaller futures contracts with larger tick values; that is, contracts that can be easily used for hedging and those that have a limited number of possible prices receive more market acceptance. The coefficient for the tick size variable is significantly different than zero at 1% for all specifications.

We also found evidence on the positive relationship between time since the introduction of the SSF and

EXHIBIT 6

Results of Regressions with Log Open Interest as the Dependent Variable

	Model Specifications					
	S1	**S2**	**S3**	**S4**	**S5**	**S6**
Intercept	3.2186	1.7578	2.9737	2.9722	−0.4365	−1.8127
	(1.47)	(1.51)	(1.53)	(1.30)	(−0.29)	(−1.29)
Abs_Mispricing		0.0121**	0.0131**	0.0147***	0.0188***	0.0210***
		(2.08)	(2.35)	(2.48)	(3.16)	(3.92)
Size_lot		−0.0119***	−0.0119***	−0.0117***	−0.0117***	−0.0114***
		(−5.58)	(−4.87)	(−5.70)	(−5.54)	(−5.52)
Tick_size		15.9481***	14.5390***	14.7348***	12.8189***	
		(5.39)	(4.87)	(4.61)	(4.17)	
Age						3.7302***
						(8.46)
Ln_Market_Value	0.0284	0.1078	0.0993	0.0926	0.1124	0.0519
	(1.44)	(1.10)	(1.04)	(0.96)	(1.16)	(0.58)
Beta				−0.2615	−0.3957	−0.3716
				(−0.90)	(−1.37)	(−1.35)
Inst_ownership			−0.0188***	−0.0194**	−0.0221***	−0.0181***
			(−4.02)	(−4.15)	(−4.46)	(−3.99)
Ln_volume	−0.0050	0.3198***	0.3089***	0.3390***	0.4024***	0.3003***
	(−0.12)	(4.18)	(4.04)	(4.26)	(5.12)	(3.93)
Ann_Volatility	10.4549***	13.7130***		13.4607***	12.1743***	7.9307***
	(3.25)	(4.94)		(4.56)	(4.06)	(2.94)
Ann_Return				1.3223**	1.4888**	1.2938**
				(2.14)	(2.34)	(2.12)
Ln_NS_EUR					0.8991***	0.2855*
					(4.43)	(1.84)
MVGDP					0.0086	0.0733
					(0.50)	(0.42)
Adj. R^2	0.0294	0.3323	0.3494	0.3536	0.3759	0.4486

Notes: For definitions of variables see notes to Exhibit 1.

****, **, * denote statistical significance at the 1%, 5%, and 10% levels, respectively. All t-statistics are corrected for heteroskedasticity using White's [1980] procedure and are in parentheses.*

the recorded level of open interest. Only volatility and volume on the spot market, out of the three variables previously used by exchanges in selecting underlying stocks for futures contracts, have a statistically significant positive association with the dependent variable. We did not find evidence that market capitalization is useful for selection of the underlying for single-stock futures. Following previous studies, we measure efficiency of the single-stock futures market with a level of mispricing. Our results show that the absolute value of mispricing attracts the attention of market participants to particular single-stock futures. The high level of open interest for SSFs characterized by a high-level value of absolute mispricing can be attributed to investors exploiting arbitrage opportunities. Our analysis has revealed that SSFs on well-performing stocks enjoy higher open interest. This suggests that market participants use SSFs to lock in returns from well-performing stocks. We also showed that SSFs on stocks from markets that are well represented on the Eurex are characterized by higher open interest. In other words, the more SSFs on stocks from a given market, the higher the trading activity is for each of them. The adjusted R-square is 0.3759 and 0.4486 for specifications 5 and 6, respectively. None of the other considered variables, such as logarithm of market value, beta, or total capitalization of a country's stock market as a percentage of its total GDP, have statistically significant explanatory power. The adjusted R-squares for model specifications 2 to 6 range between 0.3323 and 0.4486. It is worth highlighting that the model's specification 1 based on three factors has an adjusted R-square rate equal to 0.0294 only. Those three factors are primarily taken into account in the selection process performed by exchanges. The results reported for the model's specifications 2 to 6 show that there is a need to consider explanatory variables other than traded volume on the spot market, volatility, and market capitalization of the underlying security.

The results of regressions for log traded volume are generally consistent with those reported for log open interest (see Exhibit 7). The minor difference is that, in the case of some variables such as *Ann_Return*, the level of significance slightly changes. The adjusted R-squares for model specifications 2 to 6 are lower and lie between 0.2587 and 0.3759. Overall, our results, reported in Exhibit 6 and Exhibit 7, indicate that 9 out of 12 variables have statistically significant explanatory power of trading activity measured by open interest and volume. Those variables are the size of the contract, the value of tick, the age of contract, the level of institutional ownership, the volume on the spot market, the annualized volatility, the annualized return for the sample under consideration, and the mispricing between futures and spot markets. Finally, our study provides evidence that the number of SSFs from a particular country available on the Eurex has a positive impact on the trading volume of each of the SSFs—that is, the greater the number of SSFs from a given country, the more frequently those SSFs will be traded.

Analysis of Open Interest, Volume Traded, and Mispricing around Ex-Dividend Dates

In order to verify the hypothesis relating dividend taxation to trading of single-stock futures, we have examined the behavior of open interest, volume traded, and mispricing around ex-dividend dates for the underlying of contracts. We find evidence that open interest, volume traded, and mispricing significantly change around the ex-dividend date. Exhibit 8 presents the behavior of mispricing and both indicators of investors' trading activity. The efficiency benchmark sharply decreased at the ex-dividend date. The mean of mispricing for 20 days preceding the ex-dividend date was 7.75 bps. For 20 days after the ex-dividend date, the mean was just −3.5 bps. We observed that two weeks before the ex-dividend date, the open interest steadily increases and then after the event date it gradually decreases. The traded volume is characterized by a few high peaks before and after the ex-dividend date. Their distribution around the ex-dividend date suggests increased trading activity.

In order to obtain a further insight into the dynamics of the market, we test whether the traded volume and open interest are indeed higher around the event day. The results are reported in Exhibit 9. All panels present the average level of open interest, volume traded, and mispricing for selected days relative to the event. In addition, each of the reported means is tested to determine whether it is lower than the minimum of global arithmetic mean and the median for the examined variable. The first part of the exhibit shows the results for the whole sample, which consists of 990 ex-dividend dates spread out across companies. The middle panel provides results for the companies with dividend yield lower than the reported median. The last panel reports results for the companies with institutional ownership higher than the

Exhibit 7

Results of Regressions with Log Volume Traded as the Dependent Variable

	Model Specifications					
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Intercept	2.0432	0.9834	1.9403	1.2323	–1.8189	–2.8485
	(1.59)	(0.91)	(1.64)	(1.06)	(1.33)	(–1.03)
Abs_Mispricing		0.0116*	0.0124**	0.0145***	0.0178***	0.01952***
		(1.78)	(2.00)	(2.36)	(2.57)	(3.06)
Size_lot		–0.0091***	–0.0091***	–0.0090***	–0.0094***	–0.0091***
		(–5.22)	(–5.28)	(–5.28)	(–5.34)	(5.27)
Tick_size		18.6525***	17.5432***	16.6667***	14.4450***	
		(5.64)	(5.29)	(4.87)	(4.34)	
Age						2.8830***
						(6.64)
Ln_Market_Value	0.0902	0.0569	–0.0635	–0.0536	–0.0548	0.1028
	(0.94)	(–0.66)	(–0.75)	(–0.63)	(–0.64)	(–1.25)
Beta				0.0587	0.0543	–0.0407
				(0.23)	(–0.21)	(–0.17)
Inst_ownership			–0.0148***	–0.0151**	0.0195***	–0.0164***
			(–3.23)	(–3.39)	(4.37)	(–3.81)
Ln_volume	–0.0349	0.2060***	0.1973***	0.2209***	0.2930***	0.2128***
	(–0.43)	(2.86)	(2.80)	(3.05)	(4.10)	(3.01)
Ann_Volatility	6.9094***	9.0931***		9.7144***	9.0167***	5.6914***
	(2.46)	(3.64)		(3.72)	(3.48)	(2.51)
Ann_Return				2.0747***	2.2645	2.1108***
				(3.73)	(4.17)	(4.14)
Ln_NS_EUR					0.8971***	0.4365**
					(4.39)	(2.10)
MVGDP					–0.2743	0.2494
					(–1.26)	(1.34)
Adj. R^2	0.0661	0.2587	0.2715	0.2874	0.3207	0.3759

Notes: For definitions of variables see notes to Exhibit 1.

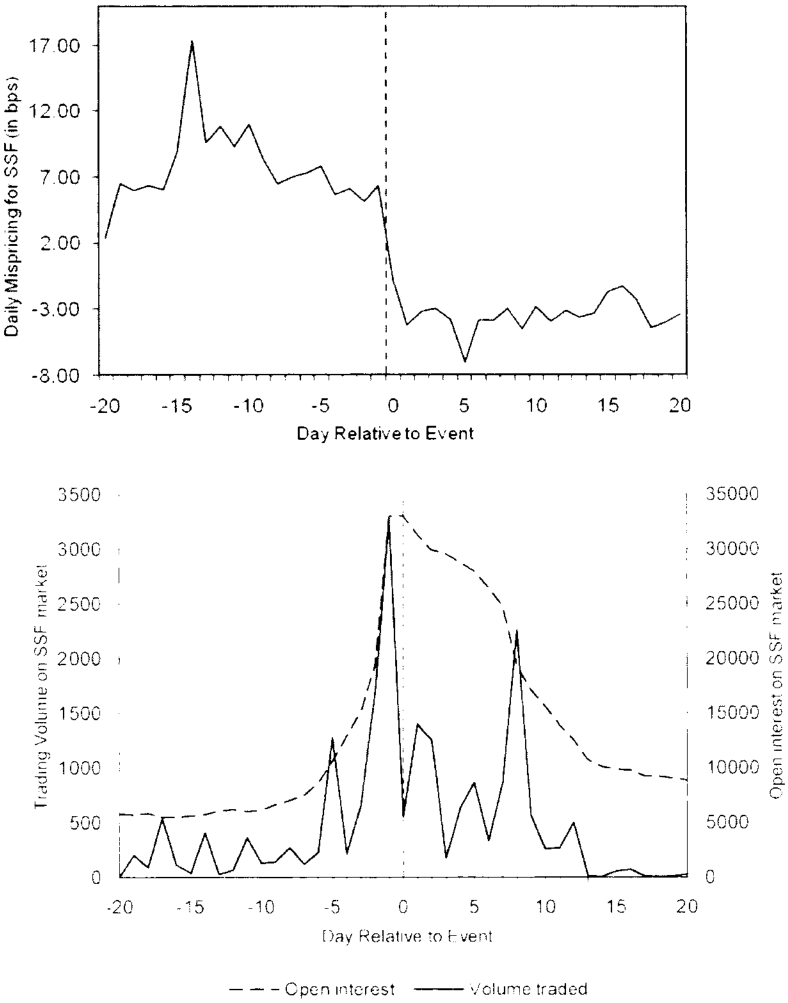
****, **, * denote statistical significance at the 1%, 5%, and 10% levels, respectively. All t-statistics are corrected for heteroskedasticity using White's [1980] procedure and are in parentheses.*

median. We observed a statistically significant change of open interest around the ex-dividend date independently of the sample selection. The traded volume changes only within the trading week before or after the event date. The three panels provide clear evidence that the Eurex single-stock futures market becomes more efficient after ex-dividend dates. We also test the null hypothesis that a mispricing is lower than the minimum of the arithmetic mean and the median for mispricing. This hypothesis cannot be rejected after ex-dividend dates. It indicates improvement in the efficiency of SSF markets around ex-dividend dates. Thus, we think that the results reported by Exhibits 8 and 9 provide evidence to support the hypothesis discussed in the subsection on trading activity around ex-dividend dates. Therefore, the explanation of high activity combined with increased efficiency lies in the difference in taxation of cash dividends paid to German investors.

ROBUSTNESS CHECKS

In order to examine the sensitivity of results to the sample selection, we perform a number of robustness checks. The results of some of them are worth a brief discussion. Our sample consists of firms from different countries. In order to address potential concerns related to the possibility that reported results are driven by firms from a particular country or region/organization, we apply our model to different compositions of the sample.

EXHIBIT 8
Trading Patterns and Market Efficiency around Ex-Dividend Dates



Notes: The top panel plots the average mispricing abnormal volatility around 990 ex-dividend dates for 420 companies. The sharp decrease of mispricing indicates improvement in market efficiency. The lower panel depicts the average level of the open interest and the traded volume around ex-dividend dates. The left-hand scale corresponds to the traded volume and the right-hand one to open interest. The scales are different. Both magnitudes tend to increase, revealing the high market activity around the event date.

In particular, our attention is focused on samples consisting of the following:

A. Stocks listed on exchanges located in a country that is a member of the European Union;
B. All companies from the original sample except German companies;
C. All companies from the original sample except those from emerging economies.

Taking into account the most heavy trading observed for SSFs on stock from the EU zone, the choice of A seems to be obvious. We would like to check whether our results are confirmed for SSFs that are the most popular among investors. Sample B was chosen, as the investors from Germany are key players on the Eurex floor. In 2008, around 87% of trades were executed on behalf of German investors. Previous studies have provided evidence that German investors show signs of home bias (Oehler et al. [2006]; Gerke et al. [2005]). In consequence, by excluding German companies, we hope to check whether the same factors determine trading activity in an environment where German investors are not the most active ones. Sample C is an original sample of companies excluding those companies from emerging markets. Due to the low level of trading recorded for SSFs on the underlying from emerging markets and a different risk–return profile, we suspect that those SSFs can contaminate results presented in the article. The results obtained from regression applied to samples A, B, and C and reported in Exhibit 10 provided confirmation of the conclusions presented in the article.

In order to verify the results reported on ex-dividend trading of SSFs, we repeat the analysis reported by Exhibit 8 separately for companies registered in Germany, Spain, and Switzerland (see Exhibit 11). We have selected those countries, as investors from those countries are the most active players on the Eurex exchange. The well-known home bias phenomena were previously reported by a number of studies for different countries. The studies by Chan et al. [2005], Oehler et al. [2006], and Gerke et al. [2005] showed the existence of this phenomena on the German market. Thus, we expect that, due to the dominant position of German investors on the Eurex, ex-dividend trading for SSFs on stocks of German companies should be much more intense than trading of SSFs on stocks from other countries.

This scrutiny has confirmed that trading activity increases independently of the origin of the underlying for SSFs. We also observed a decline in mispricing

Exhibit 9

Daily Levels of Open Interest, Traded Volume, and Mispricing around Ex-Dividend Dates

Day Relative to Event	***−10***	***−5***	***−2***	***−1***	***0***	***1***	***2***	***5***	***10***
A: *Full sample N = 990*									
Open interest	6121.88	10622.23*	19324.13***	32987.75***	33028.79***	31319.93***	29920.22***	28003.71***	15643.78***
	(−0.64)	(1.66)	(3.62)	(4.59)	(4.62)	(4.47)	(4.28)	(4.01)	(3.21)
Volume traded	129.56	1273.87**	1669.55***	3282.03***	546.28***	1399.80***	1251.57***	865.96**	258.30
	(1.22)	(2.41)	(3.62)	(4.59)	(4.62)	(4.47)	(4.28)	(2.27)	(1.49)
Daily mispricing (bps)	11.0519***	7.8602**	5.1743**	6.3595***	−0.7803	−4.1802	3.1456	7.0256**	2.8264
	(2.92)	(2.47)	(2.04)	(2.50)	(−0.07)	(−0.76)	(0.85)	(−2.28)	(1.43)
B: *Low dividend yield < 2.26%, N = 445*									
Open interest	9243.16	16362.25**	28591.78***	39863.62***	40728.82***	38546.40***	36188.26***	33844.22***	21486.98***
	(1.34)	(2.80)	(3.02)	(3.59)	(4.62)	(3.55)	(3.40)	(3.21)	(2.94)
Volume traded	52.18*	2742.29**	2005.87**	5094.51***	344.27	1785.44*	180.26	12.05	572.96*
	(1.77)	(2.23)	(2.12)	(3.09)	(1.02)	(1.85)	(1.43)	(0.71)	(1.76)
Daily mispricing (bps)	10.4045***	7.6107**	2.8167	2.8999	−3.4770	−3.0028	4.6672**	5.0382	4.2928
	(2.67)	(2.23)	(1.07)	(1.11)	(−0.67)	(0.86)	(1.83)	(1.35)	(1.60)
C: *Institutional ownership > 61.67%, N = 451*									
Open interest	2832.97***	4480.3***	10824.47***	23767.69***	23923.61***	23101.74***	22392.27***	21020.56***	7827.86***
	(2.81)	(2.65)	(3.13)	(3.28)	(4.19)	(2.77)	(2.63)	(2.59)	(2.71)
Volume traded	9.91	16.02	1049.15***	604.19**	227.9	168.43	52.89	10.23	455.67*
	(1.43)	(1.19)	(2.43)	(2.03)	(4.19)	(1.49)	(0.86)	(0.99)	(1.86)
Daily mispricing (bps)	9.0283**	6.9136**	2.2279	2.3184	−3.5816	2.9193	4.7672*	5.1695	4.3013
	(2.35)	(2.08)	(0.94)	(0.98)	(−0.72)	(0.81)	(1.91)	(1.42)	(1.63)

Notes: This exhibit reports the arithmetic mean of open interest, traded volume, and mispricing calculated around the ex-dividend dates for 420 companies. The arithmetic means are calculated cross-day around the event date. Panel A reports means for the full sample of N = 990 events for 420 companies, whereas Panel B reports the results for companies with a dividend yield lower than median equal to 2.26%. Panel C of the exhibit reports means for the sample of companies with institutional ownership higher than the median. The null hypotheses that examined means are lower than the corresponding minimums of median and mean for the whole sample are tested.

****, **, * denote statistical significance at the 1%, 5%, and 10% levels, respectively. The t-statistics are given in parentheses.*

EXHIBIT 10

Results of Regressions with Log of Open Interest and Volume Traded as Dependent Variables

	Open Interest			Traded Volume		
	EU-Only	**Without DE**	**Without EM**	**EU-Only**	**Without DE**	**Without EM**
Intercept	1.2662	−1.8979	0.3661	−0.6310	−1.5142	−1.5299
	(0.78)	(−1.17)	(0.24)	(−0.43)	(−1.09)	(−1.13)
Mispricing	0.0210***	0.0185***	0.0191***	0.0236***	0.0200***	0.0201***
	(2.81)	(2.61)	(2.79)	(2.80)	(2.70)	(2.64)
Size_lot	−0.0119***	−0.0115***	−0.0116***	−0.0099***	−0.0091***	−0.0093***
	(−5.59)	(−5.51)	(−5.48)	(−5.66)	(−5.28)	(−5.32)
Tick_size	14.5714***	5.8919**	13.3719***	14.9947***	7.3016**	14.6894***
	(4.50)	(2.02)	(4.38)	(4.66)	(2.16)	(4.43)
Ln_Market_Value	0.1128	0.1297	0.0993	−0.0849	−0.0183	−0.0600
	(1.12)	(1.33)	(1.01)	(−0.94)	(−0.21)	(−0.70)
Beta	−0.4975	0.4027	−0.3618	−0.2234	−0.1634	−0.0611
	(−1.40)	(1.50)	(−1.23)	(−0.76)	(−0.69)	(−0.24)
Inst_ownership	−0.0202***	0.0214***	−0.0211***	−0.0171***	−0.0173***	−0.0192***
	(−3.48)	(−4.19)	(−3.73)	(−3.40)	(−3.58)	(−4.21)
Ln_volume	0.4033***	0.6794***	0.3697***	0.3468***	0.6364***	0.2857***
	(4.24)	(6.54)	(4.75)	(4.48)	(6.15)	(4.04)
Ann_Volatility	10.3821***	8.8285***	12.0289***	8.6794**	4.6714*	8.9389***
	(3.20)	(2.81)	(4.00)	(3.12)	(1.69)	(3.43)
Ann_Return	1.7101**	1.0098*	1.4394**	2.3689**	2.1404***	2.4328***
	(2.32)	(1.66)	(2.23)	(3.98)	(3.80)	(4.55)
Ln_NS_EUR	0.7476***	0.5024**	0.7752***	0.7986***	0.5119**	0.8490***
	(3.30)	(2.31)	(3.39)	(4.06)	(2.74)	(4.40)
MVGDP	0.8290	0.6091	0.0750	−1.3726	0.3826	−0.2907
	(1.56)	(3.00)	(0.04)	(−1.12)	(1.58)	(−1.53)
Adj. R^2	0.3550	0.4207	0.3670	0.3269	0.3637	0.3208

Notes: For definitions of variables see the notes to Exhibit 1.

****, **, * denote statistical significance at the 1%, 5%, and 10% levels, respectively. All t-statistics are corrected for heteroskedasticity using White's [1980] procedure and are in parentheses.*

variability after ex-dividend dates. Moreover, the analysis provides evidence that the magnitude of changes is the highest for German companies, which supports the home bias hypothesis. To sum up, all these tests allow us to draw the conclusion that the results presented in this article are robust to the sample selection.

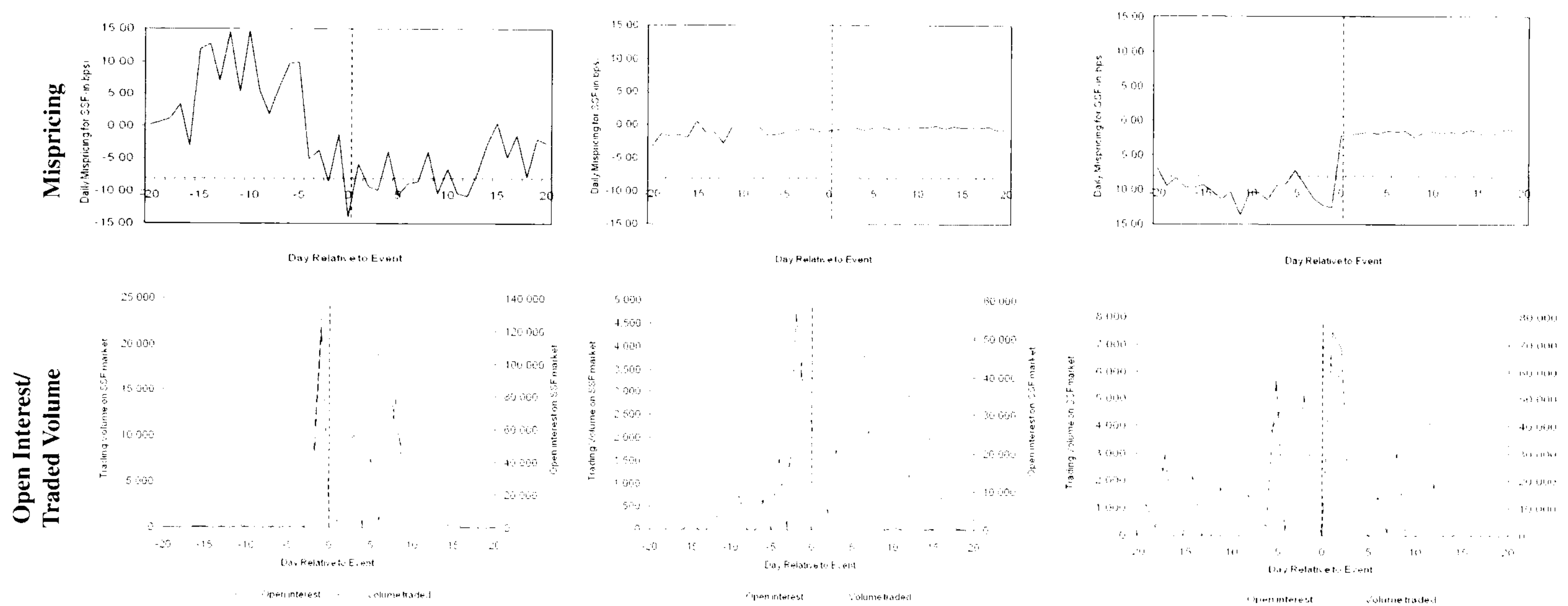
CONCLUSIONS

We provide a detailed examination of the determinants of trading activity on the single-stock futures market segment of the Eurex derivative exchange. In particular, our attention focuses on properties of underlying securities and contract specification. Our analysis has focused on factors affecting overall trading and on analysis of ex-dividend trading. In doing so, we also contribute to the literature by examining a new and extensive set of alternative explanatory variables.

Our findings indicate that apart from commonly used factors, such as market capitalization, share turnover, and volatility, one should consider other factors. We find a positive association between trading on the Eurex SSF market and the following variables: trading volume on the spot market, mispricing between the spot and futures markets, and tick size. Using either open interest or trading volume, we find a negative association between both direct institutional ownership and the size of the contract. Following the studies by Nagel [2005]

Exhibit 11

Trading Patterns and Market Efficiency around Ex-Dividend Dates of German, Swiss, and Spanish Companies



Notes: The first panel presents separately average mispricing around ex-dividend dates for companies from Germany, Switzerland, and Spain. The subsequent panels depict the average level of open interest and traded volume around ex-dividend dates. The left-hand scale corresponds to traded volume and the right-hand one to open interest. The scales are different. Both magnitudes tend to increase, revealing high market activity around the event date.

and D'Avolio [2002], in which a percentage of institutional ownership was used as proxy of short sale accessibility, we conclude that stocks characterized by a restriction in short sale and high trading volume on the spot market are good candidates for underlying securities for futures contracts. Furthermore, we find evidence that market participants in the Eurex prefer smaller contracts with higher tick sizes.

The study has also provided evidence that the SSF market for particular stocks increases its efficiency during the period following the ex-dividend date. Also, around that date, trading activity is substantially higher. Both observations are consistent with the view that trading of single-stock futures contracts can facilitate dividend-stripping, an integral part of the German half-income taxation method of dividends (*Halbeinkünfteverfahren*) that was in place during the period under examination.

The implications of this study for market regulators are tangible and important. The derivatives exchanges tend to select stocks for the underlying of futures contracts based exclusively on market capitalization, share turnover, and volatility. However, this study provides evidence that those factors are not sufficient to achieve the ultimate aim—namely, the attention of investors. The key variable previously overlooked is the company's ownership structure. An interesting extension of this study would be an analysis of factors determining trading on the option segment of the Eurex combined with a comparison to the factors reported here. Such an analysis would shed light on the broader reasons behind trading derivative products on a single stock.

ENDNOTES

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[1]In a short-sale transaction, the portion of interest or dividends earned by the owner (lender) of shares that are paid to the short seller (borrower) of the shares. Both parties usually negotiate the rate at which the short seller will be compensated.

[2]Baldwin [2010] discusses application of single-stock futures for dividend stripping on the U.S. market.

[3]The tax rate is higher than 21% due to solidarity surcharge on income. Both corporate and individual tax rates were increased by solidarity surge equal to 5.5%.

[4]In a case where an individual investor owned units of equity mutual fund that was engaged in trading of futures, there was no taxation of profit from such trading. To a large extent, individual investors were better off if the dividend-stripping strategy was implemented by mutual funds.

[5]These results are available from the authors upon request.

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