CHANGES IN MARKET STRUCTURE AND FINANCIAL MARKET OUTCOMES

by

Yeon Kyeong Kim

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STATEMENT OF DISSERTATION APPROVAL

The following faculty members served as the supervisory committee chair and members for the dissertation of **Yeon Kyeong Kim** .

Dates at right indicate the members' approval of the dissertation.

Hendrik Bessembinder, Chair	**April 10, 2014** Date Approved
Michael Cooper, Member	**April 10, 2014** Date Approved
Elena Asparouhova, Member	**April 10, 2014** Date Approved
Feng Zhang, Member	**April 10, 2014** Date Approved
Richard Carrizosa, Member	**April 10, 2014** Date Approved

The dissertation has also been approved by **William Hesterly**, Chair of the Department/School/College of by **David Eccles School of Business** , and by David B. Kieda, Dean of The Graduate School.

ABSTRACT

This dissertation consists of two essays. Each essay measures how changes in particular market rules and structure affect financial market outcomes. The essays assess two of the most debated regulatory issues that have arisen in recent years, speculative trading and transparency, respectively. The implication of the empirical results obtained in both essays is that the financial market reacts to regulatory changes and that regulations designed to improve the financial market do not necessarily yield the expected outcome. Both studies provide useful policy implications in terms of improving the quality of financial markets.

In the first essay, I evaluate how increased speculator participation in the commodity futures market affects market outcomes, including trades' price impacts, price volatility, and market quality. The results indicate that speculators either have no effect or stabilize prices during periods of substantial price movement. Speculators on average sell during periods of large price appreciation, consistent with the interpretation that speculators' trades dampen rather than accentuate price increases. My analysis also reveals that futures speculation reduces spot price volatility and that futures speculation either has no effect or improves liquidity and short-term efficiency in the commodity market. Recent policy changes under the Dodd–Frank Act aim to regulate speculative trading in the futures market to bring order to the commodity markets. My study suggests that these regulatory changes may well be counterproductive to that goal.

The second essay examines the effect of enhanced transparency on firm value and liquidity by studying the introduction and subsequent discontinuation of the NextPrime and NextEconomy market segments on the Euronext stock market. I document positive effects on firm value and liquidity for the firms that opted into the segments, thereby committing to enhanced transparency and improved reporting quality. However, when similar market regulations were imposed on all listed firms, I document negative valuation effects, on average. My analysis offers an important implication regarding rules governing market transparency: firms' self-regulation to improve transparency can be more effective than marketwide mandatory regulation.

To my family.

TABLE OF CONTENTS

ABSTRACT..... iii

LIST OF TABLES..... viii

ACKNOWLEDGEMENTS..... x

Chapters

1. INTRODUCTION..... 1

2. DOES FUTURES SPECULATION DESTABILIZE COMMODITY MARKETS?..... 4

2.1 Abstract..... 4
2.2 Introduction..... 4
2.3 Literature Review and Contributions..... 9
2.4 Data..... 14
2.5 Empirical Methods..... 19
2.5.1 The Effect of Futures Speculation on Commodity Prices..... 19
2.5.2 The Effect of Futures Speculation on Spot Volatility..... 20
2.5.3 The Effect of Futures Speculation on Market Quality..... 25
2.5.3.1 The Effect of Futures Speculation on Liquidity..... 25
2.5.3.2 The Effect of Futures Speculation on Short-term Price Efficiency..... 27
2.6 Empirical Results..... 29
2.6.1 The Effect of Futures Speculation on Price Changes..... 29
2.6.2 The Effect of Futures Speculation on Spot Volatility..... 33
2.6.3 The Effect of Futures Speculation on Market Quality..... 35
2.6.4 Analysis Using the DCOT and CIT Reports..... 36
2.7 Conclusion..... 40
2.8 Appendix..... 42
2.9 References..... 43

3. THE VALUE OF FIRMS' VOLUNTARY COMMITMENT TO IMPROVE TRANSPARENCY: THE CASE OF SPECIAL SEGMENTS ON EURONEXT..... 63

3.1 Abstract …… 63
3.2 Introduction…….. 64
3.3 Institutional Background..…… 69
3.4 Relevant Literature and Hypothesis Development…….. 71
3.5 Data and Sample Construction..…….. 75
3.6 Empirical Methods and Results……... 77
3.6.1 Analysis Around the Launch of Two Market Segments……..... 77
3.6.1.1 Event Study…… 77
3.6.1.2 The Effect on Firms' Liquidity…… 81
3.6.2 Analysis of Segment Firms While Staying in the Segments……. 87
3.6.3 Analysis Around Segment Discontinuation……... 91
3.7 Conclusion…… 97
3.8 Appendix: Variable Definitions…….. 98
3.9 References…… 101

LIST OF TABLES

2.1. Information on Commodity Prices and Commodity Futures…… 50

2.2 The Effect of Futures Speculation on Commodity Price Changes……..... 52

2.3 The Effect of Futures Speculation on Spot Volatility……... 54

2.4 The Effect of Futures Speculation on Liquidity……..... 55

2.5 The Effect of Futures Speculation on Short-term Price Efficiency…….. 56

2.6 The Effect of Futures Trading on Spot Volatility by Trader Type…..…....… 57

2.7 The Effect of Futures Trading on Liquidity by Trader Type…… 58

2.8 The Effect of Futures Trading on Price Efficiency by Trader Type……. 59

2.9 Analysis Using the CIT Reports…….…….. 60

2.10 GARCH (1,1) Estimation Result for Crude Oil……..... 61

3.1 Number of Segment Firms in Euronext…… 104

3.2 Market Valuation of Being Included in the Segments: Event Study…… 105

3.3 Summary Statistics for Nonsegment and Segment Firms in 2001……... 106

3.4 The Effect of Being in the Segments on Firm Liquidity……... 107

3.5 Propensity Score Matching and Matched Sample Analysis…….……..... 109

3.6 Firm Valuation for Segment Firms from 2002 to 2007……. 111

3.7 Summary Statistics for Nonsegment and Segment Firms in 2007……..... 112

3.8 Market Reaction at the Announcement of Segment Discontinuation…….. 113

3.9 The Effect of Segment Discontinuation on Firm Liquidity…….. 114

3.10 Analysis of Matched Firms Around Segment Discontinuation……..... 115

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CHAPTER 1

INTRODUCTION

This dissertation consists of two essays. The purpose of each essay is to assess how changes in market rules and structure affect financial market outcomes. The essays assess two of the most debated regulatory issues that have arisen in recent years, speculative trading and transparency, respectively.

In the first essay, I examine how the process of "financialization" of commodities has affected commodity prices and assess whether the proposed regulatory changes are effective in stabilizing the commodity market. The recent fluctuation of commodity prices accompanied by a substantial increase in trading activity in the futures market has led to a renewed interest in the effect of commodity futures trading on the spot market. The perception of the general public, policy makers, and practitioners is that increased participation of speculators in the futures markets has made an important contribution to commodity price fluctuations. Consistent with this view, several regulatory changes under the Dodd–Frank Wall Street Reform and Consumer Protection Act (Dodd–Frank Act) aim to stabilize the asset market by restricting speculative trading activity in the futures market. In the academic literature, debate continues over whether commodity price fluctuation is due to futures speculation or economic fundamentals.

Motivated by recent regulatory changes and renewed academic interest in

understanding the effect of futures speculation, I provide empirical evidence to assess whether speculator trading in the futures market has a destabilizing effect on the commodity market. Using comprehensive lists of commodity futures included in the popular commodity indices, I investigate whether futures speculation relates to large price changes. More specifically, I assess whether futures speculation explains the movement of commodity prices during periods of substantial price increases or decreases. I also examine whether the speculative trading activity in the futures market is related to increased spot price volatility and lowering market quality.

The empirical results show that speculators either have no effect or stabilize prices during periods of substantial price movement. Speculators on average sell during periods of large price appreciation, consistent with the interpretation that speculators' trades dampen rather than accentuate price increases. My analysis also reveals that futures speculation reduces spot price volatility and that futures speculation either has no effect or improves liquidity and short-term efficiency in the commodity market. My study suggests that regulating speculative trading in the futures market may well be counterproductive to bring order to the commodity markets.

By studying the introduction and discontinuation of the NextPrime and NextEconomy market segments on Euronext, the second essay examines the effect of enhanced transparency on a firm's value and liquidity. I document positive valuation effects for the firms that opted into the segments and committed to enhance transparency and improve reporting quality. The empirical tests show that when firms decided to join the two market segments, their liquidity improved compared to firms that did not join the segments. These results suggest that transparency affects firm liquidity, which is

consistent with the findings of existing literature.

When similar market regulations are imposed on all listed firms and replace the functions of the voluntary market segments, results reveal negative valuation effects for all firms. In addition, firms that did not join the segments experienced lower liquidity compared to those that joined segments, even after the segments discontinued. A marketwide regulation that mandates similar requirements does not seem to yield the expected outcomes when similar channels provided by a local exchange are eliminated.

My empirical results in the second essay provide several interesting insights. First, the benefit of exchanges' provisions for firms to improve transparency is not confined to developing financial markets but is also applied to more developed financial markets, where the effect of bonding mechanisms is not clearly a priori relative to less developed financial markets. Second, my results suggest which types of rules and regulations are more likely to produce their intended outcome. It seems that firms' self-regulation to improve transparency is more effective than is marketwide mandatory regulation. Finally, this study documents that improved transparency affects liquidity, providing strong support for the positive relation between transparency and liquidity.

The implication of the empirical results obtained in each essay is that the financial market reacts to regulatory changes and that regulations designed to improve the financial market do not necessarily yield the expected outcome. The findings in both studies provide useful policy implications in terms of improving the quality of financial markets.

CHAPTER 2

DOES FUTURES SPECULATION DESTABILIZE COMMODITY MARKETS?

2.1 Abstract

This paper examines how increased speculator participation in the commodity futures market affects market outcomes, including trades' price impacts, price volatility, and market quality. Contrary to the popular belief that speculators are responsible for the recent commodity price fluctuation, my analysis finds no evidence that speculators destabilize the commodity spot market. Instead, speculators contribute to lower price volatility, enhanced price efficiency, and better liquidity in the commodity markets. More importantly, I show that speculators either have no effect or stabilize prices during periods of large price movement. My findings suggest speculators have had a significant and in fact positive influence on the commodity market during the recent "financialization" period, implying that restricting speculative trading in the futures market is not an efficient way to stabilize the commodity market.

2.2 Introduction

The recent fluctuation of commodity prices accompanied by a substantial increase in trading activity in the futures market has led to a renewed interest in the effect of commodity futures trading on the spot market. Fig. 2.1 displays the time series of

crude oil prices, open interest in oil futures, and the ratio of speculative positions in the crude oil futures market. The perception of the general public, policy makers, and practitioners is that increased participation of speculators in the futures markets has made an important contribution to commodity price fluctuations.[1] Consistent with this view, several regulatory changes under the Dodd–Frank Wall Street Reform and Consumer Protection Act (Dodd–Frank Act) aim to stabilize the asset market by restricting speculative trading activity in the futures market. In the academic literature, debate continues over whether commodity price fluctuation is due to futures speculation or economic fundamentals.[2]

Motivated by recent regulatory changes and renewed academic interest in understanding the effect of futures speculation, I provide empirical evidence to assess whether speculators' trading in the futures market has a destabilizing effect on the commodity market. Using 21 commodity futures that are widely traded in the U.S. futures market, I investigate whether futures speculation relates to large price changes. More specifically, I assess whether futures speculation explains the movement of commodity prices during periods of substantial price increases or decreases. Next, I examine the effect of futures speculation on spot price volatility and market quality. For this analysis, I use 14 agricultural and energy commodities: crude oil, heating oil, gasoline, natural gas, wheat, corn, soybeans, Kansas wheat, cocoa, coffee, cotton, sugar, lean hogs, and live cattle. These commodities have experienced a substantial increase in

[1] For example, Joseph Kennedy II, a former U.S. representative from Massachusetts, expressed concern over speculative trading in the oil market. He claimed that speculators drive commodity price fluctuation and futures trading should be limited. ("The High Cost of Gambling on Oil," April 10, 2012, *The New York Times*). Masters (2008) also argues that the commodity price spikes were the result of price bubble created by speculators in the commodity futures markets.

[2] Fattough et al. (2012) and Cheng and Xiong (2013) provide a comprehensive literature review of the debate over whether commodity price fluctuation is due to futures speculation or economic fundamentals.

speculators' participation in the futures market and a recent boom-and-bust cycle in prices. Additionally, these commodities are contained in the Standard & Poor's Goldman Sachs Commodity Index (S&P−GSCI) and the Dow Jones−UBS Commodity Index (DJ−UBSCI), the most popular commodity price indices. Passive index investors tend to hold long positions in commodity indices, using strategic asset allocations between commodities and other traditional assets. Tang and Xiong (2012) note that such trading patterns can create large price impacts and volatility spillovers across commodities.

I use the Commitments of Traders (COT) report provided by the U.S. Commodity Futures Trading Commission (CFTC) to construct speculators' positions in the commodity futures. The COT report separates traders into commercial (hedgers) and noncommercial traders (speculators). To mitigate the limitations of relying on the COT data set, I also use the CFTC's Disaggregate Commitments of Traders (DCOT) report and the Supplemental Commodity Index Traders (CIT) report to construct the futures positions that are held by various types of traders. The DCOT report separates traders into the following four categories: producer/merchant/processor/user, swap dealer, managed money, and other reportables. The managed money trader type includes hedge funds and professional managers, which are *de facto* speculators to whom I pay special attention in my analysis. The CIT report is available for selected agricultural commodity futures and divides traders into index traders, nonindex speculators, commercial traders, and nonreportables. The long-only index traders have become the center of debate among politicians and practitioners as their speculative buying is believed to create bubbles in commodity prices (Irwin et al., 2009). I provide detailed information regarding these reports in the Data section.

I study periods during which prices rose or fell substantially and assess in a cross-

sectional analysis whether the magnitude of price changes is related to changes in speculative positions. If speculators destabilize the markets, the effects of speculators should be most notable during periods where price changed substantially, ex post. Therefore, examining the periods with substantial price changes provides a relatively powerful test compared to other empirical methods that focus on return predictability. I find that speculative trading in general is not related to large price changes over the 5-, 10-, and 20-week intervals. More importantly, the long positions of speculators are not related to large price increases and even help suppress extreme price increases. This finding provides clear evidence that futures speculation is irrelevant to the large increase in commodity prices, especially in the energy commodity market. I employ a novel approach, distinct from the existing studies that primarily depend on the Granger (1969) causality tests. In competitive markets, past trading is not a reliable predictor of future price changes. In addition, weekly returns have fat tails; therefore, Granger causality tests tend to be misspecified.

My analysis reveals that futures speculation contributes to reducing spot price volatility. This result holds when I construct speculative positions using either the COT or the DCOT report. The stabilizing effect is dominant during the post-2003 period, during which increased participation by speculators in the commodity futures market is considered responsible for the substantial spot market price fluctuation. My empirical results also indicate that financialization does not relate to increased commodity price volatility, which is consistent with the findings of recent papers (Buyuksahin and Harris, 2011; Irwin and Sanders, 2012c; Aulerich et al., 2013; Brunetti et al., 2013).[3]

[3] The process of commodity futures having become a popular asset class for portfolio investors is referred to as the financialization of commodity markets (Cheng and Xiong, 2013).

Furthermore, I document how different types of traders in the futures market affect commodity price volatility. For example, among speculators, traditional speculators (e.g., hedge funds or floor traders) appear to stabilize spot prices and provide liquidity to the commodity markets. Using the CIT report, I show that commodity index traders do not destabilize the prices of agricultural commodities, contrary to the concerns raised by policy makers and practitioners.

I also assess the effect of futures speculation on market quality using liquidity and price efficiency measures. When liquidity increases, information is better incorporated into prices, thus enhancing information efficiency. I use the Roll (1984) liquidity measure to assess whether futures speculation contributes to enhanced information efficiency in commodity prices. In addition, I conduct a variance ratio test to assess how the futures trading activity of speculators relates to short-term efficiency in the spot market. Efficiency implies an approximate random walk in prices over short horizons, which in turn implies that the variance ratio should be very close to 1. To be more specific, if the price is very close to random walk over 1 week, the ratio of daily return variance to the return variance over 1 week should be very close to 1. A variance ratio above or below 1 indicates a deviation from the random walk; therefore, I use the absolute value of (1−variance ratio) to measure deviations from the random walk in either direction. My analysis shows that futures speculation either has no effect or improves liquidity and short-term efficiency in the commodity market. Combined with an analysis of volatility, the analysis of liquidity and price efficiency provides strong evidence that speculators in the futures market contribute to an improvement in market quality in the commodity market.

A growing number of studies examine the effect of speculation on prices and how it alters the relation between equity markets and the futures market. In addition to supporting the findings of these studies, my paper provides strong evidence for the stabilizing effect of speculation by employing empirical methods that are distinct from existing studies. Instead of focusing on the effect on the futures prices, I show that the presence of speculators in the futures market lowers price volatility and prevents extreme price movement in the spot market. Moreover, I find that futures speculation contributes to short-run price efficiency and liquidity, which has been neglected in the existing literature. Finally, by employing comprehensive data on speculators' positions in the futures markets, I provide robust empirical evidence that futures speculation stabilizes the commodity market.

In the next section, I provide a through literature review and discuss how my findings differ from the existing studies. Section 2.4 describes the data sets that are employed in my analysis. Section 2.5 discusses the empirical methods. Section 2.6 reports the empirical findings and Section 2.7 concludes.

2.3 Literature Review and Contributions

In theory, the futures market contributes to market completion, an increase in market depth, and information dissemination (Danthine, 1978; Kyle, 1985; Grossman, 1988; Froot and Perold, 1995). These theoretical studies predict that trading in the futures market stabilizes the spot market. Peck (1976) shows that the commodity futures market dampens price fluctuations by facilitating the markets for storage. Silber (1985) discusses the economic benefits of speculators such as risk sharing and price discovery in

agricultural commodity futures. These models suggest the crucial role of speculative trading in stabilizing spot prices. Futures trading attracts speculators, who trade on future expectations and information about assets. These expectations are incorporated into the spot prices, which makes spot prices more informative about economic fundamentals. In addition, the presence of speculators makes it possible for hedgers to transfer their risk, which is the most important function of the futures market.

Other models argue that once badly informed speculators trade in the futures market to take advantage of lower transaction costs and higher leverage, the benefits of futures markets diminish. Hart and Kreps (1986) and Stein (1987) document that rational speculators can destabilize the spot market for storable commodities. De Long et al. (1990b) argue that noisy traders' beliefs can move prices away from their fundamental value. Chari et al. (1990) show that the introduction of the futures market can destabilize the spot market when there is no information friction in the market. Shalen (1993) argues that futures trading can increase volatility because uninformed traders cannot identify fundamental information and liquidity needs. Harris and Raviv (1993) share a similar prediction that the positive relation between volume and volatility is stronger when there are more disagreements among traders.

A large number of empirical studies examine the impact of futures trading on the cash market (Figlewski, 1981; Bhattacharya et al., 1986; Edwards, 1988a, 1988b; Schwert, 1990; Weaver and Banerjee, 1990; Bessembinder and Seguin, 1992; Chang et al., 1997; Kocagil, 1997; Chatrath and Song, 1999; Fleming and Ostdiek, 1999; Kyriacou and Sarno, 1999; Gulen and Meyhew, 2000; Kim et al., 2004; Bohl et al., 2011; Chen et al., 2012). Most of these studies focus on how the introduction of the futures market

affects spot prices, using various futures products and futures markets in different countries. The results are inconclusive. This may imply that futures products differ in their characteristics, and it may imply that different model specifications prompt conflicting conclusions. In addition, as pointed out by Bessembinder and Seguin (1992), a crucial reason for the differing conclusions may be the confounding effects of other economic events surrounding the introduction of the futures market. Similar to my study, some studies assess the effect of futures trading on spot market volatility, but they do not distinguish the effects of different types of traders, nor do they examine the recent surge in speculation.[4] Moreover, no studies assess the effect of speculation on short-run price efficiency or liquidity.

With the rapid growth in index investment in commodity futures and the financialization of commodity futures, several papers study the comovement between commodity futures and other assets and across different commodity futures (Buyuksahin at el., 2009; Tang and Xiong, 2012). Other studies also look at how different types of investor positions are related to price changes. Irwin and Sanders (2012a) discuss current empirical findings on the effect of index traders and conclude that index trading in the futures market is unrelated to a futures price bubble. Using detailed individual positions taken by traders, Brunetti and Buyuksahin (2009) show that financial investors' flow does not affect price volatility in the oil futures market. Stoll and Whaley (2010) test whether index fund trading causes commodity futures price changes. Singleton (2014) argues that information friction and its associated speculative activity can lead to commodity price fluctuation. Brunetti at el. (2013) and Buyuksahin and Harris (2011)

[4] Daigler and Wiley (1999) and Wang (2003) investigate the effect of speculators and hedgers, but they test the relation between futures volume and volatility.

find no evidence that speculators destabilize financial markets and find instead that speculative trading reduces volatility in the futures market. Hamilton and Wu (2013) document that there is no relation between the notional value of commodity futures contracts held by index traders and the expected returns on futures contracts for 12 agricultural commodities. Several papers provide a theoretical explanation for the effect of speculative trading on prices using the model of feedback trading (Sockin and Xiong, 2013), supply and demand (Knittel and Pindyck, 2013), or quantity competition (Banerjee and Jagannathan, 2013). Basak and Pavlova (2013) and Cortazar et al. (2013) integrate financialization into the asset pricing model.

The empirical analysis of how speculative futures trading affects the spot market provides additional insights into the role of speculation. Studies that investigate the effects of speculators' futures trading on price destabilization do exist, but most of the recent studies focus on futures prices (Brunetti and Buyuksahin, 2009; Stoll and Whaley, 2009; Gilbert, 2010; Buyuksahin and Harris, 2011; Hamilton and Wu, 2013; Henderson et al., 2012; Brunetti et al., 2013).[5] When futures speculation is blamed for destabilizing prices, the concern is most typically with regard to the spot price for the commodity. Also, even though futures prices and spot prices are closely related through convenience yield and storage costs, the no-arbitrage condition need not hold as precisely in commodity futures as in equity index futures (see Knittel and Pindyck (2013) for detailed discussion). Futures speculation leads to changes in futures prices, which in turn leads to price changes in the spot market. However, the effects can be altered by changes in

[5] One exception is Bohl and Stephan (2013), who analyze how expected and unexpected speculative open interest affects conditional volatility in six heavily traded futures markets. My study is closely related to their study, though my analysis is more comprehensive. I also test how futures speculation relates to price changes, which their study does not analyze.

inventory or production levels. Because activities in the market for storage vary, futures speculation can affect spot price changes and volatility differently from how it affects futures prices.

Recent studies investigate the effect of speculative trading in the futures market on the changes in commodity prices (Stoll and Whaley, 2010; Buyuksahin and Harris, 2011; Aulerich et al., 2013). Using the Granger causality test, these studies examine how speculators' positions in the futures markets affect the magnitude of price changes. However, in competitive markets, past trading would unlikely forecast price changes; therefore, it is not clear that a conclusion can be drawn using the lead-lag variable relationship. Instead, I focus on the periods during which prices rose or fell substantially and assess in a cross-sectional analysis whether the signed price changes are related to changes in speculative positions, controlling for futures volume and other economic factors that would affect prices. I document that speculative trading in general is not related to large price changes over the 10- and 20-week intervals.

In addition to examining whether futures speculation induces increased spot volatility, I analyze whether futures trading contributes to improved short-term market efficiency and liquidity. Existing studies have neglected the analysis of market quality in the spot market so far. The finding that futures speculation contributes to maintaining short-run price efficiency and liquidity is clear evidence that futures speculation benefits the commodity market. Moreover, in my analysis of energy and agricultural markets, I control for several economic variables that are important to the spot price and its volatility. I include information on commodity inventory and production as well as other macroeconomic variables to mitigate concerns about omitted variables relevant to spot volatility.

2.4 Data

I use 21 commodity futures that are traded in the U.S. futures market with reliable spot price data in the analysis on the relationship between price changes and speculative trading activity. I obtain daily spot prices, the total open interest, and the futures trading volume from the Commodity Research Bureau (CRB). "Open interest" refers to the number of outstanding futures contracts that are not yet offset by a transaction. Futures volume reflects the overall trading activity in the futures market and is measured in the number of futures contracts. In assessing whether futures speculation affects volatility and market quality, I use 14 widely traded agricultural and energy commodities and their futures contracts: wheat, soybean, corn, Kansas wheat, cotton, cocoa, coffee, sugar, lean hogs, and live cattle for agricultural commodities and crude oil, heating oil, gasoline, and natural gas for energy commodities. These commodities experienced large price fluctuations and a substantial increase in open interest over the entire period in the analysis, especially during the later period of my sample. Additionally, production and inventory data are available for these commodities.

To construct the positions that are held by each trader type, I use several position data sets available from the CFTC. In constructing speculators' positions, I use the weekly COT report. Since 1986, the CFTC has provided the outstanding positions of traders. The weekly reports, which start in October 1992, are released on Fridays and reflect positions as of the preceding Tuesday. If trade size exceeds certain thresholds set by the CFTC, each trader is required to report the positions that they hold. The traders' reported positions are categorized as either commercials (hedgers) or noncommercials (speculators). If futures contracts are primarily used for hedging purposes, the trader is

is classified as commercial; otherwise, traders are categorized as noncommercial. The CFTC staff evaluates the trader classifications and can reclassify the trading entity if necessary. If trade size does not exceed the threshold set by the CFTC, the trade is classified as the nonreportable position. Following Irwin and Sanders (2010), I calculate the total futures positions held by each trader type as following:

(i) Gross speculative positions = long noncommercial open interest + short noncommercial open interest + 2 × spread[6]

(ii) Gross hedging positions = long commercial open interest + short commercial open interest

(iii) Gross nonreportable positions = long nonreported open interest + short nonreported open interest

Table 2.1 provides information on commodities and their futures contracts that are used in my analysis. I use data from October, 1992, when the weekly open interest data became available from the CFTC, to July, 2012. Panel A displays futures contract specifications such as contract size, the exchanges on which the futures contracts are traded, and their expiration months. Panels B and C provide information on prices and speculators' market shares in commodity futures that have inventory data. As shown in Panel B, the commodity prices substantially increased over time, and they are more volatile in the later period in the sample. Panel C indicates that the increases in the commodity price level and volatility are accompanied by a large increase in speculators' market share in the commodity futures market.

[6] For more detailed information, refer to COT Explanatory Notes, available at the CFTC's webpage, http://www.cftc.gov/MarketReports/CommitmentsofTraders/ExplanatoryNotes/index.htm. Spread is the amount each noncommercial trader holds in equal long and short futures positions. For example, if a noncommercial trader holds 2,000 long contracts and 1,500 short contracts, 500 contracts will appear in the long position. Spread is 1,500 in this case. Spread is reported only for noncommercial traders.

I also use the DCOT report that has been available since June, 2006. The DCOT report separates traders into the following four categories: producer/merchant/processor /user, swap dealers, managed money, and other reportables. The first two groups of traders are comparable to the commercial traders in the COT report. The producer/merchant/processor/user trader type consists of traditional hedgers, such as the producers and consumers of the commodities who primarily use futures markets for hedging purposes. Swap dealers use the futures market to hedge the risk from swap trading. Because their trading counterparts include speculators, swap dealers can bring speculative activity to the market. In addition, swap dealers often take positions for index funds, whose herding behavior and tendency to hold long-only positions in commodity futures can affect the futures market and hence the spot market. Money managers and other reportables are comparable to the noncommercial traders in the COT report. Specifically, money managers are the classical types of speculators, such as hedge funds or floor traders, who trade on behalf of their clients. The analysis using these data sets provides additional information on how different types of traders' trading activity affect the spot market.

Studies have raised concerns about solely relying on the COT report. Those who claim to have a cash position in the underlying assets can report themselves as being commercial traders; therefore, a commercial position can include speculators' positions. Several researchers also argue that this limitation is one of the reasons why hedging pressure measures, which are constructed from the weekly COT data, produce different results among studies (Ederington and Lee, 2002; Buyuksahin and Harris, 2011; Gorton et al., 2012; Acharya et al., 2013; Dewally et al., 2013).

One advantage of using the DCOT report is that the distinction between speculators and hedgers is clearer than in the COT report. The DCOT data are available since mid-2006, which overlaps with the financialization period in which I am interested. They also provide a more distinct classification of hedgers and speculators, which helps me to produce robust results in my analysis. The CFTC also acknowledges that this data set is more transparent about trader classification.[7]

I also employ the CIT report to construct the futures positions that are held by index traders for agricultural commodities. The CIT report is available from 2006 for selected agricultural futures. The CIT report divides traders into index traders, nonindex speculators, commercial traders, and nonreportables. The "index trader" category of the CIT report includes swap dealers as well as pension and other investment funds that place their index investment directly into the futures markets. According to Irwin and Sanders (2010), the majority of index trader positions come from the long positions of commercial traders. In the agricultural futures market, the positions taken by swap dealers from the DCOT report are very close to the positions taken by index traders from the CIT report; however, this is not the case for energy futures (CFTC, 2008; Irwin and Sanders, 2010). The use of this data set reduces the limitations of relying on the COT report, and it allows me to assess the effect of index traders on the commodity market.

I collect several variables that are known to influence commodity price changes and volatility. The quarterly and monthly inventory data on agricultural commodities are obtained from the United States Department of Agriculture (USDA) Economic Research Service. For cocoa, coffee, cotton, and sugar futures contracts, I collect inventory data

[7] Buyuksahin and Harris (2011) and Brunetti et al. (2013) use nonpublic position data and report similar results for the effects of speculators' trading on futures prices.

from the historical certified warehouse stocks available from the Intercontinental Exchange (ICE). The weekly inventory data on energy commodities are from the U.S. Energy Information Administration (EIA) website. Inventories act as buffers that absorb shocks to demand and supply, thus affecting spot prices. Deaton and Laroque (1992) show that at low inventory levels, both the risks of a stock-out and spot price volatility increase. Gorton et al. (2012) document that commodity inventory is an important economic factor that determines futures prices.

To control for the supply effect on price volatility, I obtain U.S. production data for each commodity from the USDA Economic Research Service and EIA energy production database. One might argue that because commodities are traded in multiple parts of the world, I should use production and inventory data at the global level. The primary reason for using U.S. data is the data quality, which reduces noise in my estimation. In addition, the center of debate is the speculative trading activity in the U.S. futures market. Frankel (2013) and Knittel and Pindyck (2013) also discuss the validity of using U.S. data instead of global data in terms of crude oil. Moreover, Kilian and Murphy (2013) use global data and find results that are similar to those obtained using U.S. data in other studies.

I include macroeconomic indicators to capture the effect of supply and demand shocks, which are shown to be important determinants of commodity prices during the past decade (Kilian, 2009; Kilian and Murphy, 2012). I use the quarterly gross domestic product (GDP) growth rate and changes in the monthly production growth and inflation rate. These variables are constructed by using the data available from the Federal Reserve Economic Data (FRED) of the Federal Reserve Bank of St. Louis website.

2.5 Empirical Methods

2.5.1 The Effect of Futures Speculation on Commodity Price Changes

I study periods when prices rose or fell substantially and assess whether the signed price changes are related to changes in speculative positions. I use a cross-sectional analysis to assess whether futures speculation is related to extreme, signed price changes and whether speculators' long or short position is driving commodity price changes. The sample period starts in October, 1992 when the weekly COT report became available.

I divide the daily time series of commodity prices into nonoverlapping 5-, 10-, and 20-week intervals and construct speculators' total positions and speculators' long and short positions using the COT report. I use Tuesday-to-Tuesday price changes because of the weekly frequency of the COT data. For each interval, I calculate the percentage changes in commodity prices and the percentage changes in speculators' total, long, and short positions. I pool all commodities with at least 10% and 20% changes in prices over 5-, 10-, and 20- week intervals and conduct the following cross-sectional regression with commodity fixed effects. Following Petersen (2009), the standard errors are clustered by time:

$$\%\Delta P_{it} = \alpha + \beta \%\Delta \text{Speculation}_{it} + \delta_1 \%\Delta TFV_{it} + \delta_2 \%\Delta INV_{it} + \delta_3 \%\Delta INF_{it} \quad (2.1)$$
$$+ \delta_4 \%\Delta GDP_{it} + \delta_5 \%\Delta PROD_{it} + \sum_{j=1}^{3} \varphi_j s_{jt} + (\text{commodity fixed effects})_i + \varepsilon_{it}$$

ΔP denotes the commodity price changes over the 5-, 10-, and 20-week intervals and *ΔSpeculation* is the changes in futures positions held by speculators: the aggregate, long, and short positions of speculators in each commodity futures contract. *ΔTFV* is the changes in futures trading volume, *ΔINV* is the changes in inventory, *ΔINF* is the changes in inflation rate, *GDP* is the GDP growth rate, and *PROD* is changes in the production

growth rate. For inventory data, I first deseasonalize them by regressing the inventory level on each month (or quarter) and use the residuals as a measure of inventory changes. The three macroeconomic variables are included to control for commodity demand and aggregate economic conditions that would affect the commodity price changes. s_{it} is the seasonal dummy variable. I provide a separate analysis for the 15 commodities that have available inventory data. I also conduct a separate analysis for energy and agricultural commodities, considering that commodity futures are distinct among sectors, and more attention has been paid to the price changes in energy and agricultural commodities.

The coefficient on *Speculation (β)* indicates whether futures speculation is related to the signed changes in commodity prices. The dependent variables are the price changes in both directions; therefore, when the dependent variables are positive (negative) price changes, the negative (positive) or insignificant sign of β implies that on average speculators' position in commodity futures is unrelated to large spot price increases (decreases).

2.5.2 The Effect of Futures Speculation on Spot Volatility

I adopt a generalized autoregressive conditional heteroskedasticity (GARCH) model to investigate the effect of futures trading activity by speculators and hedgers on spot volatility.[8] The conditional mean is constructed as a first-order auto-regressive (AR) process with various control variables. Hong and Yogo (2012) and Gorton et al. (2012)

[8] Compared to more complicated models, the GARCH (1,1) model is shown to work well in describing financial time series. Hansen and Lunde (2005) report that among various GARCH models, nothing outperforms GARCH(1,1). I also use the exponential GARCH (EGARCH) and The Glosten–Jagannathan–Runkle GARCH (GJR-GARCH) (Glosten et al., 1993) models to capture the asymmetric volatility clustering in the commodity prices. The results are similar across different model specifications. I report the estimation results using the GARCH (1,1) model.

document open interest and inventories are strong predictors of commodity price changes. Therefore, I include the changes in open interest and inventories in the conditional mean equation. Following Gallant et al. (1992), I control for day-of-the-week effects to capture the daily shocks to returns and volatility. I also control for inflation to capture the effects of interest rate on price changes. In the conditional variance equation, I include open interest held by speculators and hedgers, noncategorized trades, and total trading volume. This is similar to Bessembinder and Seguin (1993), who control for aggregate trading activity in the futures market. Although my analysis focuses on the effect of speculators, I provide a separate analysis on the effect of hedgers to see if their position in the futures market has a distinct effect on the spot market. I interpret the coefficient of each trader type as the partial effect of each trader type on the spot volatility.

Unlike most existing studies, which include only trading activity variables in the analysis, I employ a wide set of variables that are known to be related to spot price changes. I include the changes in total U.S. production to control for the supply shocks in the commodity markets. Motivated by the theory of storage, I also control for changes in inventory level for each commodity. Moreover, I include macroeconomic variables to capture the aggregate economic conditions and demand effects on spot volatility. To control for the effect of the contract life cycle, I include days to expiration in the conditional volatility equation. As the Samuelson hypothesis (1965) states, for certain commodity futures, volatility increases near the time of contract expiration dates. As a contract is approaching its expiration date and investors adjust their positions to roll over their contracts or close them for portfolio balancing, more futures trading takes place,

increasing volatility. Some commodities are in high demand or low in inventory during certain seasons. To capture the daily and seasonal variations, I include daily and seasonal dummy variables in the conditional volatility equation.

The analysis on spot volatility is based on the following GARCH (1,1) model:

$$\begin{aligned} \mathrm{r}_{it} &= a_0 + a_1 r_{t-1} + \sum_{i=1}^{4} b_i d_{it} + c_0 \Delta OPEN + c_1 \Delta INV_t + c_2 INF_t + e_t \\ h_t &= \omega + \alpha r_{t-1}^2 + \beta h_{t-1} + \sum_{i=1}^{N} \theta_i (\text{decomposed positions}_{it}) + \gamma_1 NCR_t + \gamma_2 TFV_t + \delta_1 \Delta INV_t \\ &\quad + \delta_2 \Delta SUP_t + \delta_3 GDP_t + \delta_4 INF_t + \delta_5 PROD_t + \delta_6 DTE_t + \sum_{i=1}^{4} \phi_i d_{it} + \sum_{i=1}^{3} \varphi_i s_{it} \end{aligned} \qquad (2.2)$$

Eq. (2.2) is estimated using the maximum likelihood method with robust standard errors. I calculate continuously compounded daily returns as $r_t = \log(P_t / P_t) \times 100\%$. *ΔOPEN* refers to the changes in total open interest, *ΔINV* to the changes in inventories, and ΔSUP to the changes in the commodity production level. *GDP* is the quarterly GDP growth rate, *INF* is the monthly inflation rate, and *PROD* is the monthly production growth rate. d_i is a dummy variable for each trading day, and s_i is a seasonal dummy variable. *NCR* is the noncategorized traders, and *TFV* is the natural log of total futures trading volume. *DTE* is the square root of days to expiration. Whenever necessary, I first remove the time trend from the control variables and use the detrended data in the estimation.

The main variables of interest are $\sum_{i=1}^{N} \theta_i (\text{decomposed positions}_{it})$, the decomposed positions of speculators and hedgers. The sign of θ_i reflects the directional effect of the partitioned position of each trader type. Following Bessembinder and Seguin (1992), I partition each trader's position into three components: expected, unexpected, and long-term variation. Trading variables have a strong time trend in the futures market;

therefore, I first detrend the logged trading activity variables by deducting a 100-day moving average for positions held by speculators and hedgers as well as for nonreportables. Then, I partition the detrended data into expected and unexpected data using the following multivariate vector autoregression (VAR) model:

$$V_t = a + \sum_{j=1}^{p} b_j V_{t-j} + \text{Controls}_t + e_t \tag{2.3}$$

where V_t is the transpose of a vector, [Speculators' position, Hedgers' position, Nonreportables, Futures volume]. Control variables include daily effects, *GDP*, *INF*, *PROD* and *DTE*.

The above detrending procedure generates the expected, unexpected, and long-run variation (MA) components for speculators and hedgers. The fitted value is the expected value for each trader type, and the residuals from the multivariate *VAR* model are the unexpected portion. The 100-day moving average series are the long-term shifts, the expected position is the forecastable short-run time-varying position, and the unexpected part reflects the information shock. Therefore, in the conditional volatility equation from Eq. (2.2), $\sum_{i=1}^{N} \theta_i(\text{decomposed positions}_{it})$, is specified as,

$$\theta_1 ESP_t + \theta_2 USP_t + \theta_3 MASP_t + \theta_4 EH_t + \theta_5 UH_t + \theta_6 MAH_t \tag{2.4}$$

where ESP (EH) is the expected speculators' (hedgers') position, USP (UH) is the unexpected speculators' (hedgers') position, and MASP (MAH) is the long-term variation component in speculators' (hedgers') position.

I confirm that each trading activity variable is stationary using the modified Dickey–Fuller test proposed by Elliott et al. (1996), and I use the first-differenced data when the detrended variable is not stationary. Instead of using the univariate autoregressive

integrated moving average (ARIMA) model used in previous studies, I estimate expected and unexpected trading activity conditioning on its own past trading activity and that of its correlated market. In the process, I control for daily effects, time to expiration, and macroeconomic variables. The reason for this partition method is that both futures volume and open interest respond to the same information shock; therefore, past volume and open interest have predictive ability in the current trading activity variables. The optimal lag was chosen by the Bayesian information criterion (BIC). I employ a similar decomposition method when using the DCOT and the CIT reports in the volatility analysis.

In assessing the effect of trading activity on spot volatility, I calculate the net effect of each trader type. I multiply each estimated coefficient of the decomposed position by the average value of each component of open interest and sum up the resulting products. To be more specific, the net effect of speculators on spot volatility is

$$\begin{aligned} &\text{Speculators' net effect on spot volatility} \\ &= (\theta_1 \times \text{mean of ESP}) + (\theta_2 \times \text{mean of USP}) + (\theta_3 \times \text{mean of MASP}) \end{aligned} \tag{2.5}$$

The negative or insignificant net effect implies that the speculative position does not increase conditional spot volatility, controlling for the aggregate trading activity in the futures markets and economic variables that are used in Eq. (2.2). The negative or insignificant net effect also supports the stabilizing theory of futures speculation: speculators' trading in the futures market lowers price volatility in the spot market via increased information diffusion from the futures market to the spot market. Hedgers' net effect on volatility is similarly defined as

Hedgers' net effect on spot volatility (2.6)

$= (\theta_4 \times \text{mean of EH}) + (\theta_5 \times \text{mean of UH}) + (\theta_6 \times \text{mean of MAH})$

I split the sample into two periods, pre- and post-2003. The later period overlaps with the financialization period, when speculators' trading activity is believed to be responsible for the fluctuations in the spot price of the major commodity markets. If destabilizing effects dominate the later period, my analysis would support the recent regulatory changes that limit speculative trading in the commodity futures market. However, if speculators' increased participation in the futures market helps lower spot volatility, this would indicate that futures speculation stabilizes the spot market. If this is the case, the regulatory changes to restrict speculators will not be effective in stabilizing the commodity market.

2.5.3 The Effect of Futures Speculation on Market Quality

In addition to analyzing the effect of speculation on spot volatility, I investigate the contemporaneous relation between futures speculation and market quality. I use liquidity and short-term price efficiency as market quality measures. If speculators not only lower the spot volatility but also contribute short-term market efficiency and liquidity, the result would provide strong evidence that speculators stabilize the spot market.

2.5.3.1 The Effect of Futures Speculation on Liquidity

I assess how futures speculation affects liquidity in the spot market. I use Roll's (1984) liquidity measure by employing daily spot price data. Roll's liquidity measure uses the serial covariance of the price changes as estimates of spreads, and it is useful

when intradaily price or trading volume data are not available.

Following Goyenko et al. (2009), I construct the Roll's liquidity measure as the following way:

$$\text{Roll}_t = \begin{cases} 2 \times \sqrt{-Cov(\Delta P_t, \Delta P_{t-1})} & \text{when } Cov(\Delta P_t, \Delta P_{t-1}) < 0 \\ 0 & \text{when } Cov(\Delta P_t, \Delta P_{t-1}) \geq 0 \end{cases} \tag{2.7}$$

Using the following equation, I assess how futures speculation affects liquidity:

$$\text{Roll}_t = \hat{\theta}_0 + \hat{\theta}_1 ESP_t + \hat{\theta}_2 USP_t + \hat{\theta}_3 MASP_t + \hat{\theta}_4 EH_t + \hat{\theta}_5 UH_t + \hat{\theta}_6 MAH_t + \sum_{i=1}^{5} \hat{c}_i \text{controls}_t + e_t \tag{2.8}$$

ESP (EH) is the expected speculators' (hedgers') position, *USP (UH)* is the unexpected speculators' (hedgers') position, and *MASP (MAH)* is the long-term variation in speculators' (hedgers') position. I partition each trader's position using the multivariate VAR model (Eq. (2.3)) that I used in the previous analysis. *Controls* include futures trading volume, nonreported position, changes in inventory and production level, GDP growth, production growth, inflation, and seasonal dummy variables. The control variables are defined identically from the data I used in the analysis on spot volatility in section 2.4.2. Newey–West standard errors are used to control for autocorrelation and heteroskedasticity.

A higher Roll's measure means lower liquidity, and thus the positive sign of each $\hat{\theta}$ indicates that each component of the trader's position has a negative effect on liquidity. The liquidity measure is detrended whenever strong time trends are observed; that is, I regress the liquidity measure on time trend and use the residual as the dependent variables.

I calculate the net effect of speculators' position as

Speculators' net effect on liquidity (2.9)

$$= (\hat{\theta}_1 \times \text{mean of ESP}) + (\hat{\theta}_2 \times \text{mean of USP}) + (\hat{\theta}_3 \times \text{mean of MASP})$$

The net effect of hedgers is defined similarly. The positive net effect implies that future speculation has a negative effect on liquidity in the commodity market. I divide my sample into pre- and post-2003 periods, paying special attention to the later period.

2.5.3.2 The Effect of Futures Speculation on Short-term Price Efficiency

I analyze how speculators' futures trading is related to short-term price efficiency using a variance ratio test. Efficiency implies an approximate random walk over short horizons, and variance ratio tests can indicate whether price changes have deviations from random walk.

Several empirical studies use the variance ratio test to capture market liquidity and information efficiency (Bessembinder, 2003; Chordia et al., 2008; Griffin et al., 2010).[9] If futures trading activity helps information to be reflected in the spot market more efficiently and increases its market depth, spot returns would behave close to random walk. In contrast, if trading activity in the futures market attracts poorly informed traders and hinders information transfer and price discovery, the variance ratio would move away from the benchmark. For example, if a large number of momentum traders trade on unexpected price changes, positive autocorrelations will occur, which will cause price continuation. Alternatively, if less informed traders trade on nonfundamental information, prices will move away from the equilibrium path. As traders learn fundamental information, prices will move back to the equilibrium level, leading to a price reversal.

[9] Time-varying expected return can cause autocorrelation. The use of nonoverlapping weekly measures in my study reduces this concern.

Specifically, the variance ratio (*VR*) is defined as

$$VR_t(q) = \frac{Var[r_t(q)]}{q \times Var[r_t]} \tag{2.10}$$

where r_t is the return series, q is the number of lags in returns, and *Var* stands for the variance estimate. For example, the variance ratio on Tuesdays is defined as the ratio of weekly variance to five times the daily variance. I calculated the variance ratio using the Wednesday-to-Tuesday interval because the futures positions are reported to the CFTC every Tuesday. Also, the nonoverlapping weekly measure can mitigate the fact that the variance ratio is persistent over time. I follow Lo and MacKinlay (1988) and Campbell et al. (1997) to produce a heteroskedasticity-consistent estimator.

To assess the effect of futures speculation on short-term price efficiency, I use the following regression for each commodity:

$$\begin{aligned} |1 - VR_t| \;=\; & \tilde{\theta}_0 + \tilde{\theta}_1 ESP_t + \tilde{\theta}_2 USP_t + \tilde{\theta}_3 MASP_t + \tilde{\theta}_4 EH_t + \tilde{\theta}_5 UH_t + \tilde{\theta}_6 MAH_t \\ & + \sum_{i=1}^{5} \tilde{c}_i \text{controls}_t + e_t \end{aligned} \tag{2.11}$$

ESP (EH) is the expected speculators' (hedgers') position, *USP (UH)* is the unexpected speculators' (hedgers') position, and *MASP (MAH)* is the long-term variation in speculators' (hedgers') position. I partition each trader's position using the multivariate VAR model (Eq. (2.3)) that I used in the previous analysis. *Controls* include futures trading volume, nonreported positions, changes in inventory and production level, GDP growth, production growth, inflation, and seasonal dummy variables. The control variables are identical to those in the previous analysis. I use Newey–West standard errors to control for autocorrelation and heteroskedasticity.

The dependent variable, *(1−variance ratio),* captures deviations from the benchmark in either direction because both negative and positive autocorrelation implies departure

from the random walk benchmark. The positive sign of the $\tilde{\theta}$s implies that each component of the trader's position lowers the short-term price efficiency measure in the short term. I focus on the net effect of futures speculative activity in assessing whether futures speculation relates to short-term price efficiency in the spot market.

The speculators' net effect on price efficiency is calculated as

$$\text{Speculators' net effect on short-term efficiency} \tag{2.12}$$
$$= (\tilde{\theta}_1 \times \text{mean of ESP}) + (\tilde{\theta}_2 \times \text{mean of USP}) + (\tilde{\theta}_3 \times \text{mean of MASP})$$

The net effect of hedgers is defined similarly for each measure. Similar to the previous analysis, I focus on the post-2003 period.

2.6 Empirical Results

2.6.1 The Effect of Futures Speculation on Price Changes

I examine whether large price changes are related to speculation in the futures market. Table 2.2 reports the estimation results using the cross-sectional test described in Eq. (2.1). I test separately the effect of speculators' total positions, long positions, and short positions in commodity futures. I divide the time series of commodity price changes into nonoverlapping 5-, 10-, and 20-week intervals, and consider only periods with minimum 10% price movements. To conserve space, only the coefficients of the changes in speculator positions are reported.[10]

Panel A of Table 2.2 reports the cross-sectional analysis of the 5-, 10-, and 20-week intervals for all commodities when prices increase by at least 10% and 20%. The second, fourth, and sixth columns present the results when prices go up by at least 10% during

[10] The entire estimation results are available upon request.

the 5-, 10-, and 20-week intervals, respectively, and the third, fifth, and seventh columns present the results when prices go up by at least 20% for each given interval. The results indicate that there is a negative or no cross-sectional relation between large price increases and changes in the speculative positions in commodity futures. Additionally, when prices increase by at least 20%, the relation between increase of prices and changes in the speculators' positions is more negative and statistically significant than in those cases where prices increase by at least 10%. For example, in the cross-sectional analysis of the 20-week interval, the estimated coefficient of the changes in speculative position is −2.389 for the 10% price changes, whereas the estimated coefficient is −7.180 for the 20% price changes, a three-fold increase. This result indicates that speculation has more prominent stabilizing effects when there are larger commodity price movements. The estimated coefficients for speculators' long and short positions are either negative or statistically insignificant, which suggests that there is no evidence that speculators' long and short positions accentuate large price increases. The estimated result also shows that the coefficients on speculative long positions are either negative or insignificant, implying price increases tend not to occur during periods when speculators are buying. This result is in contrast to opinions among policy makers and practitioners that speculators accumulate long positions in commodity futures and therefore substantially affect prices. In terms of control variables, inflation has the most significant effect on commodity price increase; however, the effect is modest.

Panel B reports the cross-sectional analysis during the 5-, 10-, and 20-week intervals for all commodities when prices decrease by at least 10% and 20%. The second, fourth, and sixth column present the estimation result when prices go down by at least 10%,

during the 5-, 10-, and 20-week interval, respectively, and the third, fifth and seventh columns present the result when prices decrease by at least 20% for each interval. The results indicate that there is no significant cross-sectional relation between large price decreases and the changes in the speculative position in commodity futures: when prices go down substantially, it seems that speculators in the future market do not intensify large decline in the commodity prices. Compared to the results reported in Panel A, the stabilizing effect is less significant during periods of price increases. Instead, the changes in macroeconomic conditions have a stronger relation with price decline. Moreover, relative to price increases, there are fewer incidences of price decreases during the sample period.

At the bottom of Panel A and B, I also report the analysis for the 15 commodities with available inventory data. The results are similar to the results for all the commodities: speculators either have no effect or stabilize the commodity prices during periods of large price changes. In the process, I expected that inventory changes would have significant effects because, according to the theory of storage in commodity markets, inventory is directly related to price levels. However, I find that inventory changes generally are not significantly related to large price changes, and estimated coefficients on inventory changes are statistically significant only when the commodity prices continue to decline during each interval. Additionally, the relation between price decline and inventory changes is negative, indicating that prices decrease as more inventories are built up during the intervals.

Much attention has been paid to studying price changes in the energy and agricultural sectors (Brunetti and Buyuksahin, 2009; Irwin and Sanders, 2012b; Aulerich et al., 2013;

Brunetti et al., 2013). Although the sample size decreases, I provide additional analysis for these two sectors in the rest of Table 2.2. Panel C reports the analyses for energy and agricultural commodities when prices change by at least 10% during each interval. The left-hand side of Panel C reports the regression results when price goes up by at least 10% during each interval, and the right-hand side presents the results when prices go down by at least 10% in each interval. The estimated coefficients of the speculative positions indicate that there is no evidence that speculators' positions are related to the extreme price movements for energy commodities. Similar to what is reported in Panel A and Panel B, speculation seems to have stronger stabilizing effects when prices increase. Moreover, macroeconomic variables have more significant effects on price changes in case of price increases. Additionally, inflation has the most significant effect on price changes of energy commodities. Compared to the energy commodities, the seasonal effect, although not reported, is more important for the price changes of the agricultural commodities.[11]

The results imply that futures speculation is not related to large price changes in the commodity markets. My analysis also indicates that extreme price increases tend not to occur during periods when speculators are buying, which is consistent with the interpretation that speculators' trades alleviate rather than accentuate price increases. Additionally, economic fundamentals, such as inflation, are an important factor that influences commodity price changes, suggesting it is necessary to include marketwide information when studying the commodity market.

[11]I also estimate the effect of futures speculation on commodity prices using the 20-week interval, obtaining similar conclusions.

2.6.2 The Effect of Futures Speculation on Spot Volatility

I assess whether speculators' trading in the futures market destabilizes the commodity market using the conditional volatility model described in Eq. (2.2). In addition to analyzing the effect of speculators' trading, I also examine how hedgers' trading activity in the futures market affects spot volatility.[12] Table 2.3 reports the estimation results. To conserve space, I only report the net effect of speculators' and hedgers' on spot volatility.[13] I calculate the net effect of speculators and hedgers on spot volatility by multiplying the coefficient of each partitioned trading activity variable by its mean and sum up the resulting products. A negative or insignificant net effect implies that futures trading activity does not destabilize the spot market price. The net effect in bold indicates that it is significantly different from zero. For each trader type, *F*-tests are performed to test whether the coefficients of each partitioned trading activity are jointly zero. The bold numbers in Table 2.3 indicates the statistical significance of the net effect of each trader type at 1%, 5%, or 10%.

The net effects reported in Table 2.3 indicate there is no evidence that futures speculation destabilizes the spot price. For the full sample period, except for live cattle, the net effect of speculative trading is negative or insignificant. For energy commodities, the net effect of speculative trading is negative for the full sample period and for the two subsample periods. For all agricultural commodities except wheat, the net effect of

[12] The recent working paper by Bohl and Stephan (2013) studies a similar question. However, they include only speculators' trading activity and do not control for other variables that are relevant to spot volatility. In addition, the speculators' position is part of total open interest; therefore, Bohl and Stephan's estimation controls for two redundant variables in the conditional variance equation. My method is different in that I do not include total open interest but instead include aggregate trading activity by speculators, hedgers, and small traders. Trading volume captures total trading activity in the futures market in my estimation. Last, by providing an analysis of market quality, I find stronger results, consistent across commodities.

[13] The complete estimation results for Crude oil and Soybeans are reported in the Appendix 2.C. The entire results are available upon request.

speculators' trading is negative during the post-2003 period. During the pre-2003 period, the net effect of speculative trading is negative or insignificant, except for soybean and live cattle. This finding is contrary to the view that speculators' increased participation in the commodity futures market is the reason for the price fluctuations in the energy and agricultural markets in the last decade. Instead, speculators seem to stabilize the price volatility in the commodity market, especially during the most recent decade. In particular, speculators in the futures market are the center of a policy debate on the crude oil prices. I show that speculators actually help lower the volatility in oil prices. In terms of hedgers' effects in energy commodities, the patterns are less clear than for those of speculators. In agricultural markets, the trading activity of hedgers seems to be more destabilizing than that of speculators.

The empirical analysis in this section suggests there is no evidence that speculators in the futures markets destabilize the spot market. Speculators in the agricultural and energy futures markets have been blamed for making pricing more volatile and unsustainable. In contrast, at least for the commodities I study, I show that speculators stabilize the commodity prices. These commodities are mostly liquid and are included in the two major commodity indices that reflect most speculative trading in futures markets. Particularly during the post-2003 period, there is no evidence that speculators are responsible for increasing commodity price volatility. My empirical findings indicate that futures speculation has a stabilizing effect, especially during the recent period, when commodities have become financial assets that have attracted diverse types of speculators.

2.6.3 The Effect of Futures Speculation on Market Quality

In this section, I examine how futures speculation affects spot market quality using Eqs. (2.8) and (2.11). The dependent variables are the Roll (1984) liquidity measure and the absolute value of (1-variance ratio). They are constructed using the spot price in nonoverlapping weekly frequency to mitigate the fact that they are persistent over time. In addition, the weekly measure coincides with the reporting frequency of the COT reports. To save space, I report only the net effect of each trader type.[14] There is a strong time trend in the liquidity measure. Therefore, I regress the Roll measure on the time trend and use the residual as the dependent variable.[15]

Table 2.4 reports how futures speculation affects liquidity in the commodity market. The Roll measure gauges illiquidity; a higher Roll measure indicates lower liquidity. Therefore, the negative net effect implies that speculators' trading in the futures market increases spot market liquidity.

The net effect of futures speculation is either insignificant or negative, indicating that speculative trading either has no effect or has a positive effect on liquidity. The same results are found regardless of the sample period. Clearly, speculative trading in the futures market does not lower liquidity in the commodity market; in fact, for some commodities, futures speculation improves liquidity in the commodity market. There is no clear pattern in the hedgers' net effect. In contrast to the net effect of speculators' trading, during the post-2003 period, the net effect of hedgers, whenever significant, tends to be positive.

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[14] The full estimation result is available upon request.

[15] It is possible that increasing speculation causes the time trend. I use the Roll measure without filtering the time trend and obtain qualitatively identical results. In fact, when I use the Roll measure without detrending, I obtain stronger results.

Using the variance ratio test, I conduct a similar analysis to assess the effect of futures speculation on short-term price efficiency. Table 2.5 displays the result. The dependent variable measures deviations from the random walk benchmark over short horizons. Therefore, the positive net effect implies that futures trading by each trader type is negatively associated with the short-term price efficiency. Most of the net effect is insignificant, implying that the weekly variance ratio is a noisy measure. Although I do not find strong statistical power to establish a clear conclusion, during the post-2003 period, it seems that speculative trading does not decrease the price efficiency, at least. This is important because it is during the post-2003 period that policy makers believe speculators harmed the market. For other periods, I do not find any clear pattern for the effect of futures speculation on market quality. Relative to speculators, the net effects of hedgers tend to be more positive. For example, for heating oil and live cattle, the net effect is significant and positive during the entire sample periods.

The analysis of liquidity and short-term price efficiency suggests that speculators in the commodity futures market not only stabilize the spot market, but also help maintain market quality. The results are consistent with stabilizing theory of futures speculation, supporting Working (1960) who argue that speculators benefit the market by providing liquidity and risk-bearing capacity for hedgers.

2.6.4 Analysis Using the DCOT and CIT Reports

In this section, I provide additional analysis on how the trading activity of speculators affects spot volatility and market quality using the DCOT report. Instead of classifying traders as commercials and noncommercials as in the COT report, this data set

provides more detailed information on the trader types. Although the data are available from mid-2006, the sample period is long enough to produce a stable GARCH estimation. Also, this period includes the time during which commodity markets experienced substantial increases in speculators' participation as well as price fluctuations. The more detailed information on trader type can provide additional information on which types of traders destabilize the commodity markets. Using the DCOT report, I repeat a similar exercise on volatility and market quality. Each trader type's position is partitioned into expected, unexpected, and long-term variation via the multivariate VAR model that I used previously. The control variables are also identical to those of previous analysis.

Table 2.6 reports the net effect of each trader type on spot volatility using the GARCH (1,1) model. Money managers and other reportables are comparable to speculators in the previous volatility analysis; among speculators, money managers hold greater positions in the commodity futures than do the other trader type. Product merchant and swap dealer groups are comparable to hedgers in the previous analysis. In all commodities, traders labeled as money managers have a negative or insignificant net effect on spot volatility. These types of traders are hedge funds or commodity trading advisers, representing the traditional class of speculators (Irwin and Sanders, 2010). In contrast, there is no clear pattern for the other type of speculators: the speculators who are categorized as "nonreportables," it seems, are distinct from the traditional type of speculators in the futures market.

Among commercial traders, I do not find a systematic pattern for the product merchant trader type; for agricultural commodities, however, the net effect of this trader

type is negative or insignificant, indicating that traditional hedgers in agricultural markets do not increase commodity price volatility. In terms of swap dealers, the net effect is significant and positive in all energy commodities, implying that these trader groups increase price volatility in this market. Swap dealers include (i) dealers who trade with speculators and use the futures market to hedge their risk and (ii) index traders who hold long-only positions in commodity futures. It is shown that index traders compose most of the swap dealers in agricultural commodity markets, but this distinction is not clear in energy futures markets (CFTC, 2008; Irwin and Sanders, 2010). There is no clear pattern for the effect swap dealers have on the agricultural markets. For wheat and sugar, the result indicates that swap dealers destabilize the spot market; for corn, however, swap dealers have a significant stabilizing effect on price volatility.[16]

In Table 2.7 and Table 2.8, I report the net effect of each trader type on liquidity and short-term price efficiency, respectively. Much as the previous analysis, the dependent variables are the Roll's liquidity measure and the absolute value of (1-variance ratio), both are at nonoverlapping weekly frequency. For the managed money trader type, I find negative or insignificant net effects on liquidity and short-term price efficiency for all commodities. For other reportables, I again find a negative and insignificant effect for energy commodities, but no systematic pattern for agricultural commodities. For commercial traders, I cannot reach a clear conclusion about their effect on liquidity and price efficiency, although I find weak evidence that the net effect is positive in terms of the product merchant group. For swap dealers, there is no clear pattern, either.

Overall, the analysis using the DCOT report suggests that the classical type of

[16] Brunetti et al. (2013) report that swap dealers do not have a significant effect on market volatility in crude oil, natural gas, and corn using unique position data over 2005 to 2009. When I use the same period, I also obtain an insignificant effect on volatility for swap dealers.

speculators, such as hedge funds or floor traders, stabilize commodity markets and improve market quality. These traders seem to be informed traders, who provide liquidity and risk-bearing capacity for hedgers. Furthermore, the analysis partially indicates that swap dealers are the type of traders who destabilize the spot market. Swap dealers usually offer their clients an over-the-counter (OTC) product that mimics some futures-based index. The swap dealers are thus implicitly short in futures contracts arranged by an OTC, and hedge with an offsetting long position on organized exchanges that are reported to the CFTC. If the swap dealer trader type destabilizes the commodity markets, it is possible that index traders similarly destabilize the commodity markets. To assess this possibility, I conduct additional analysis using the CIT report.

The CIT report is available only for selected agricultural commodities beginning in 2006. In Panel A of Table 2.9, I report the effects of futures trading on spot volatility for index traders, nonindex speculators, and commercial traders (hedgers) groups. The net effects of index traders on spot volatility are all negative or insignificant, indicating that the futures trading of this trader type does not destabilize the spot price. Instead, the destabilizing effect of swap dealers reported in the previous section seems to be driven by the nonindex traders included in the swap dealer category.

In Panels B and C of Table 2.9, I report the effect of index traders on market quality using methods similar to those I have used in the previous analysis. The net effects of index traders on liquidity and short-term price efficiency are all negative or insignificant, indicating that index traders in the futures market do not lower market quality in the agricultural commodity market. This result is consistent with the findings of recent studies that document that index traders do not cause price effects in the agricultural

commodity market (Stoll and Whaley, 2010; Irwin and Sanders, 2012b; Irwin and Sanders, 2012c; Brunetti et al., 2013). The findings that index traders do not destabilize the commodity markets seem to be robust to different methods among studies, including mine.

The analysis using the DCOT and CIT reports suggests that certain types of speculators, such as hedge funds and floor traders, have a stabilizing effect on the commodity market. Additionally, I find no evidence that index traders in the agricultural market destabilize commodity prices. Instead, I find that index traders in the futures market lower volatility and sustain market quality. This finding is important because it is popular perception that index traders make commodity prices too volatile.

Overall, using several publicly available position data from the CFTC, I find strong evidence that speculators lower price volatility in the commodity market. In addition, I show that speculators do not lower price efficiency, nor do they reduce liquidity, supporting the stabilizing theories of futures speculation. The results presented here are consistent with the analysis on price changes in the previous section that futures speculation is not related to large price changes. In addition, my empirical findings suggest that more detailed data on commodity futures trading can provide useful information about the effects of different types of traders on the commodity market.

2.7 Conclusion

In this paper, I assess whether futures speculation destabilizes the commodity market. I study periods during which prices rose or fell substantially, and assess in a cross-sectional analysis whether the magnitude of price changes is related to changes in

speculative positions. As a sharp contrast to the public perception that speculators cause higher commodity prices, I find no such evidence. My analysis indicates that speculators either have no effect or dampen prices during periods of large price movement. Speculators seem to sell during periods of large price appreciation, consistent with the interpretation that speculators' trades dampen rather than accentuate price increases.

I show that speculators in the futures market contribute to reducing spot price volatility, supporting the results of existing literature that futures trading activity stabilizes the spot markets. Contrary to the popular belief that increased futures speculation has been destabilizing the commodity market in the most recent decade, my findings show that speculators have a stronger stabilizing effect on commodity markets during the financialization periods.

In the analysis on market quality, I find that speculators provide liquidity and support short-term price efficiency in the commodity market, providing strong supporting evidence that speculators in the futures market benefit the commodity market. In addition, using detailed position data available from the CFTC, I document that more traditional types of speculators and index traders have a stronger stabilizing effect on the commodity market during the recent decade.

Finally, my study details useful policy implications. Recent policy changes aim to regulate speculative trading in the futures market to bring order to the commodity markets. My analysis suggests that these regulatory changes would not effectively reach the goal. In future research, I plan to extend my analysis to investigate the fundamental forces that drive commodity price fluctuations.

2.8 Appendix

In this section, I discuss in detail the results of GARCH (1,1) estimation reported in Section 2.5.2, and provide the complete estimation result for Crude Oil. The results reveal that the effects of futures trading activities and other conditioning variables on spot volatility are heterogeneous among the commodities, which is consistent with previous studies documenting that commodity futures are distinct from each other (Erb and Harvey, 2006; Gorton and Rouwenhorst, 2006). There are some common features, though. In the conditional mean equation, changes in the open interest are significant and positive in almost all commodity markets in all sample periods. Karpoff (1987) documents a positive relation between price changes and trading volume changes. Hong and Yogo (2012) also report the growth in open interest as a strong predictor of commodity returns. Inflation has significant effects for energy markets; however, these effects are not significant for most of the agricultural commodities. The changes in inventory are not significant in most cases, either.

In the conditional volatility equation, the estimated coefficient for future volume is positive for almost all commodities, consistent with the findings in Bessembinder and Seguin (1993). Also, the coefficients on nonreportables are always negative or insignificant for all commodities. I expected the changes in supply and inventory to lower spot volatility, but there is no clear pattern in these variables across commodities. Compared with agricultural commodities, macroeconomic variables are more significant for energy commodities, but this is expected because energy commodities are inputs for production, which is closely related to the overall economic condition. The negative sign of the macroeconomic variables implies that lower demand for commodities is negatively

related to spot volatility in the commodity market. Although not reported, the seasonable dummy variables are significant for most energy and agricultural commodities that have different seasonal demand and harvest cycles.

In Table 2.10, I report the GARCH estimation result for Crude oil for the full sample periods and two-subsample periods.

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Table 2.1 Information on Commodity Prices and Commodity Futures

This table provides information on commodities and their futures contracts. Panel A presents futures contract specifications, Panel B reports commodity price information for the full sample period and two subsample periods, and Panel C display the market share for each commodity futures contract. Panel B and Panel C display 15 commodities that have inventory data. The data span from October, 1992 to July, 2012. For natural gas futures, price data are available from November, 1993, and for lean hogs futures, the COT report starts in April, 1996. In Panel A, * indicates commodities with inventory data. The market share of speculators in the commodity futures market is calculated as the gross speculative position divided by twice the total open interest.

Panel A: Futures contract specifications

Contract	Contract Size	Contract Months	Exchange
Energy			
Crude Oil*	1,000 Bbl	All	CME
Heating Oil*	42,000 Gal	All	CME
Gasoline*	42,000 Gal	All	CME
Natural Gas*	10,000 Mmbtu	All	CME
Grain			
Wheat*	5,000 Bushels	3,5,7,9,12	CME
Soybean*	5,000 Bushels	1,3,5,7,8,9,11	CME
Corn*	5,000 Bushels	3,5,7,9,12	CME
Kansas Wheat*	5,000 Bushels	3,5,7,9,10	CME
Soybean Oil	60,000 Pounds	1,3,5,7,8,9,10,12	CME
Soybean Meal	100 Tons	1,3,5,7,8,9,10,12	CME
Soft			
Cocoa*	10 Metric tons	3,5,7,9,12	ICE
Coffee*	37,500 Pounds	3,5,7,9,12	ICE
Cotton*	50,000 Pounds	3,5,7,10,12	ICE
Sugar*	112,000 Pounds	3,5,7,10	ICE
Livestock			
Feeder Cattle*	50,000 Pounds	1,3,4,5,8,9,10	CME
Lean Hogs*	40,000 Pounds	2,4,5,7,8,10,12	CME
Live Cattle*	40,000 Pounds	2,4,6,8,10,12	CME
Metal			
Gold	100 Troy oz.	2,4,6,8,10,12	CME
Silver	5,000 Troy oz.	1,3,5,7,9,12	CME
Copper	25,000 Pounds	3,5,7,9,12	CME
Platinum	50 Troy oz.	1,4,7,10	CME

Table 2.1 Continued

Panel B: Information on Commodity Prices						
	Full Sample		Pre-2003		Post-2003	
	Mean	Stdev	Mean	Stdev	Mean	Stdev
Crude Oil	44.01	29.71	21.22	5.22	68.97	25.05
Heating Oil	1.25	0.87	0.58	0.15	1.96	0.76
Gasoline	1.24	0.83	0.61	0.15	1.93	0.71
Natural Gas	4.34	2.44	2.75	1.30	5.87	2.31
Wheat	404.41	156.68	325.96	82.18	488.56	173.09
Soybean	738.36	278.95	580.29	113.64	907.84	303.14
Corn	318.92	142.27	254.10	64.36	373.53	166.40
Kansas Wheat	472.32	176.56	375.72	88.02	575.81	188.59
Cocoa	1.966.62	741.23	1,487.17	318.85	2,480.77	720.05
Coffee	137.38	61.74	122.97	52.12	153.45	67.14
Cotton	64.53	24.49	62.74	17.16	67.08	30.30
Sugar	13.16	6.56	10.13	2.40	16.41	7.92
Feeder Cattle	98.45	20.08	84.62	11.59	113.21	16.37
Lean Hogs	56.78	15.48	46.93	10.17	67.27	13.08
Live Cattle	80.11	15.64	68.20	5.64	92.81	12.60

Panel C: Speculators Market Share in Commodity Futures			
	Full Sample	Pre-2003	Post-2003
Crude Oil	0.24	0.13	0.35
Heating Oil	0.17	0.11	0.24
Gasoline	0.18	0.13	0.23
Natural Gas	0.30	0.11	0.48
Wheat	0.32	0.27	0.36
Soybean	0.29	0.25	0.32
Corn	0.25	0.19	0.30
Kansas Wheat	0.20	0.13	0.28
Cocoa	0.23	0.18	0.29
Coffee	0.31	0.24	0.35
Cotton	0.26	0.22	0.31
Sugar	0.20	0.15	0.26
Feeder Cattle	0.35	0.31	0.38
Lean Hogs	0.34	0.28	0.39
Live Cattle	0.31	0.24	0.38

Table 2.2 The Effect of Futures Speculation on Commodity Price Changes

This table reports the effect of futures speculation on commodity price changes (β in Eq. (2.1)). Panel A reports the cross-sectional analysis of the 5-, 10-, and 20-week intervals for all commodities when prices increase by at least 10% and 20% for all commodities and commodities with inventory data. Panel B reports the cross-sectional analysis of the 5-, 10-, and 20-week intervals for all commodities when prices decrease by at least 10% and 20% or all commodities and commodities with inventory data. Panel C reports the analyses for energy and agricultural commodities when prices change by at least 10% during the 5-, 10-, and 20-week intervals. %ΔTotal position is the % changes speculators aggregate futures position, %ΔLong position is the % changes of the speculators' long position, and %Δ Short position is the % changes of the speculators' short positions.

Panel A: The Effect of Futures Speculation on Price Increases						
	5-week intervals		10-week intervals		20-week intervals	
	10% increase	20% increase	10% increase	20% increase	10% increase	20% increase
All Commodities						
%ΔTotal Position	−0.083	−3.356**	−0.052	−2.716*	−2.389***	−7.180***
%ΔLong Position	−0.035	−4.221**	0.312	−0.282	−0.110	−2.868***
%ΔShort Position	0.376	0.516	0.804	3.802	−0.986	2.686
Commodities with Inventory Data						
%ΔTotal Position	−0.317	−7.746	−0.006	−2.944	−2.396***	−8.708**
%ΔLong Position	−0.233	−3.763*	0.397	0.438	−1.316	−2.698*
%ΔShort Position	0.549	4.036	0.836	2.927	−0.893	0.605

Table 2.2 Continued

Panel B: The Effect of Futures Speculation on Price Decreases						
	5-week intervals		10-week intervals		20-week intervals	
	10% decrease	20% decrease	10% decrease	20% decrease	10% decrease	20% decrease
All Commodities						
%ΔTotal Position	0.719	−0.633	1.021	2.371	1.957	3.604
%ΔLong Position	−0.345	3.404	0.826	2.480	0.698*	1.499
%ΔShort Position	0.292***	−2.159	0.005	−0.018	−0.106	0.119
Commodities with Inventory Data						
%ΔTotal Position	−0.125	−1.834	0.543	1.575	−1.070	−0.298
%ΔLong Position	−0.947	0.736	1.166	0.942	1.140	−0.914
%ΔShort Position	0.382*	0.947	−0.034	−0.021	−0.095	0.737

Panel C: The Effect of Futures Speculation on Price Changes for Commodity Specific Regression						
	10% increase			10% decrease		
	5-week	10-week	20-week	5-week	10-week	20-week
Energy						
%ΔTotal Position	−1.013*	−1.126**	−2.705*	0.654	1.715	2.823
%ΔLong Position	−0.830	−1.363*	−0.227	1.432	1.826	5.520
%ΔShort Position	−0.329	3.405	1.457	0.344	−0.172	−0.074
Agriculture						
%ΔTotal Position	−0.166	0.021	−0.187**	1.122	1.138	2.030
%ΔLong Position	−0.382	−0.075	−0.141	0.934	0.649	1.398
%ΔShort Position	2.089	0.446	−0.441	0.147	0.724	0.758

Table 2.3 The Effect of Futures Speculation on Spot Volatility

This table reports the net effect of futures speculation on spot volatility. The sample period is from October, 1992 to July, 2012, except for natural gas, for which the data start in November, 1993; lean hogs, for which the Commitments of Traders (COT) report starts in April, 1996; and coffee, for which the inventory data start in 1997. The net effect of speculators' and hedgers' positions is calculated by multiplying the coefficient of each partitioned trading activity by its mean value. The bold numbers indicate the statistical significance of the net effect for each trader type.

	Speculators			Hedgers		
	Full Sample	Pre-2003	Post-2003	Full Sample	Pre-2003	Post-2003
Crude Oil	**−12.348**	**−5.213**	**−22.360**	−0.423	**2.432**	4.414
Heating Oil	**−11.491**	**−6.905**	**−18.184**	-3.334	**10.557**	**−7.359**
Gasoline	**−8.574**	**−6.423**	**−14.130**	−0.145	3.816	−5.354
Natural Gas	**−1.055**	**−24.358**	**−23.792**	**12.128**	**13.017**	36.999
Wheat	**−5.767**	**−12.369**	**12.679**	1.812	**8.412**	1.565
Soybeans	**−7.768**	**4.648**	**−22.650**	−6.526	**−11.214**	5.601
Corn	**10.816**	**−10.174**	**−22.946**	**8.463**	8.739	**17.434**
Cotton	**−3.712**	−0.580	**−9.310**	**1.961**	0.336	**7.357**
Kansas Wheat	**−2.033**	**−4.048**	−1.001	3.707	5.382	**14.995**
Cocoa	**−4.375**	**3.736**	**−9.000**	−1.636	0.725	−5.140
Coffee	**−9.431**	**−5.092**	**−17.059**	−2.723	6.727	−4.341
Sugar	−2.017	−2.086	**−24.864**	−5.223	4.111	**21.353**
Lean Hogs	6.472	6.607	−0.069	−5.920	**−11.494**	9.220
Live Cattle	**15.189**	**12.885**	−9.214	**−26.396**	**−18.729**	**−13.994**

Table 2.4 The Effect of Futures Speculation on Liquidity

This table reports the effect of futures speculation on liquidity. Weekly nonoverlapping Roll's (1984) liquidity measure is used to calculate liquidity. The sample period is from October, 1992, to July, 2012, except for natural gas, for which the data start in November, 1993; lean hogs, for which the Commitments of Traders (COT) report starts in April, 1996; and coffee, for which the inventory data start in 1997. The net effect of speculators' and hedgers' positions is calculated by multiplying the coefficient of each partitioned trading activity by its mean value. The bold numbers indicate the statistical significance of the net effect.

	Speculators			Hedgers		
	Full Sample	Pre-2003	Post-2003	Full Sample	Pre-2003	Post-2003
Crude Oil	**−3.256**	0.883	−0.715	4.952	**−0.439**	0.897
Heating Oil	0.044	−0.062	0.116	**−0.148**	−0.024	−0.188
Gasoline	−0.032	−0.193	0.020	0.000	**0.187**	0.047
Natural Gas	0.288	−4.401	−6.489	−0.238	**1.502**	15.174
Wheat	1.174	**−26.235**	−0.971	−5.529	19.470	−3.735
Soybeans	−6.834	−1.929	**−19.574**	4.293	−1.124	**21.221**
Corn	**−3.798**	−1.531	0.610	3.431	**−1.005**	**9.152**
Cotton	**−3.874**	−2.137	−3.196	5.197	0.448	**12.667**
Kansan Wheat	**0.678**	0.622	0.634	−1.070	−1.550	**−0.338**
Cocoa	**9.684**	**9.044**	2.582	**−2.285**	−7.051	**−4.002**
Coffee	**−2.392**	−1.625	**−2.865**	**2.889**	1.373	**4.155**
Sugar	−1.637	−0.639	−3.614	**1.945**	−0.399	**5.361**
Lean Hogs	0.327	2.722	0.893	**0.133**	**−2.953**	0.091
Live Cattle	2.019	0.914	**−11.607**	−2.073	−3.411	9.338

Table 2.5 The Effect of Futures Speculation on Short-term Price Efficiency

This table reports the effect of futures speculation on liquidity. The absolute value of (1-variance ratio) is used to calculate the short-term price efficiency. The sample period is from October, 1992, to July, 2012, except for natural gas, for which the data start in November, 1993; lean hogs, for which the Commitments of Traders (COT) report starts in April, 1996; and coffee, for which the inventory data start in 1997. The net effect of speculators' and hedgers' positions is calculated by multiplying the coefficient of each partitioned trading activity by its mean value. The bold numbers indicate the statistical significance of the net effect.

	Speculators			Hedgers		
	Full Sample	Pre-2003	Post-2003	Full Sample	Pre-2003	Post-2003
Crude Oil	0.288	0.883	−0.715	−0.232	**−0.439**	0.897
Heating Oil	0.229	**0.978**	−1.155	**0.624**	**0.085**	**0.889**
Gasoline	0.064	−0.980	−1.315	0.205	**1.633**	1.096
Natural Gas	0.288	**−0.450**	−0.615	−0.226	−0.445	0.897
Wheat	**1.070**	1.510	0.676	**−0.798**	**−0.912**	−0.984
Soybeans	0.840	1.072	8.670	−0.481	−0.106	−0.618
Corn	**−0.137**	0.353	−0.345	−0.172	**−1.641**	1.173
Cotton	**0.603**	**1.017**	1.161	−0.545	−0.850	−0.217
Kansan Wheat	1.031	0.102	**−2.634**	−2.643	−3.353	−5.251
Cocoa	0.505	**0.356**	0.034	−0.356	0.047	0.144
Coffee	−0.732	0.676	−0.586	1.105	0.731	1.522
Sugar	−0.138	0.277	−1.446	1.462	−0.280	1.537
Lean Hogs	0.338	0.139	0.893	0.287	0.047	0.091
Live Cattle	−0.261	**−0.768**	0.036	**1.722**	**2.828**	**1.546**

Table 2.6 The Effect of Futures Trading on Spot Volatility by Trader Type

This table reports the net effect of futures speculation on spot volatility by trader type. The sample period is from June, 2006, to July, 2012. The net effect of each trader type is calculated by multiplying the coefficient of each partitioned trading activity by its mean value. The bold numbers indicate the statistical significance of the net effect.

	Product Merchant	Swap Dealers	Money Managers	Other Reportables
Crude Oil	**−12.682**	**30.103**	**−26.626**	**−7.665**
Heating Oil	0.828	**11.214**	**−51.588**	−3.984
Gasoline	**−0.543**	**21.088**	−7.481	**−9.520**
Natural Gas	**109.850**	**56.231**	−26.941	**7.231**
Wheat	3.785	**3.739**	**−11.032**	**−24.121**
Soybeans	−0.323	1.960	−22.207	**54.232**
Corn	**−81.368**	**−139.119**	**143.098**	**91.567**
Kansas Wheat	**−20.011**	1.296	**−5.854**	**−9.969**
Cocoa	**−1.984**	9.773	**−44.646**	**−30.043**
Cotton	−6.184	7.575	**−26.152**	**4.937**
Coffee	16.417	−4.905	**−1.177**	**−14.305**
Sugar	14.319	**33.587**	**−48.546**	−11.410
Lean Hogs	0.747	4.323	**−13.152**	13.296
Live Cattle	0.060	8.515	−21.994	**2.156**

Table 2.7 The Effect of Futures Trading on Liquidity by Trader Type

This table reports the net effect of futures speculation on liquidity by trader type. Weekly nonoverlapping Roll's (1984) liquidity measure is used to calculate liquidity. The sample period is from June, 2006, to July, 2012. The net effect of each trader type is calculated by multiplying the coefficient of each partitioned trading activity by its mean value. The bold numbers indicate the statistical significance of the net effect.

	Product Merchant	Swap Dealers	Money Managers	Other Reportables
Crude Oil	−11.291	**46.130**	**−5.445**	**−16.882**
Heating Oil	**0.647**	0.000	0.055	−0.268
Gasoline	0.321	−0.231	0.146	−0.020
Natural Gas	**18.176**	**−6.738**	0.346	**−8.442**
Wheat	5.526	16.565	**−8.466**	−5.563
Soybeans	74.157	−44.668	−13.213	**−17.167**
Corn	**10.979**	−10.172	24.771	−13.653
Kansas Wheat	3.682	5.542	−8.402	−8.800
Cocoa	3.287	−3.154	**−6.655**	−3.046
Cotton	12.227	−9.406	−5.199	−0.350
Coffee	21.727	13.131	−6.732	**−21.013**
Sugar	−6.505	**13.417**	**−10.280**	−1.022
Lean Hogs	**12.323**	**−19.651**	8.697	**9.688**
Live Cattle	**−2.323**	**5.465**	−4.358	**−17.694**

Table 2.8 The Effect of Futures Trading on Price Efficiency by Trader Type

This table reports the net effect of futures speculation on liquidity by trader type. The absolute value of (1-variance ratio) is used to calculate the short-term price efficiency. The sample period is from June, 2006, to July, 2012. The net effect of each trader type is calculated by multiplying the coefficient of each partitioned trading activity by its mean value. The bold numbers indicate the statistical significance of the net effect.

	Product Merchant	Swap Dealers	Money Managers	Other Reportables
Crude Oil	1.405	0.096	0.919	0.286
Heating Oil	**5.715**	**−2.016**	**−0.419**	−0.915
Gasoline	1.198	0.121	0.382	−0.737
Natural Gas	−8.641	−2.595	**−10.127**	21.803
Wheat	−6.487	−5.591	4.846	13.098
Soybeans	0.970	−2.940	1.471	−0.485
Corn	**11.253**	6.314	−5.370	−12.644
Kansas Wheat	−2.356	0.874	0.921	0.884
Cocoa	0.624	1.615	**−3.322**	0.122
Cotton	−1.602	1.570	−0.848	**1.071**
Coffee	−2.017	1.628	−1.562	2.026
Sugar	−1.243	**0.732**	0.335	1.592
Lean Hogs	−0.023	0.055	−0.776	**3.390**
Live Cattle	**2.693**	−0.208	0.812	**−3.123**

Table 2.9 Analysis Using the CIT Reports

The table reports the effect of futures trading activity by trader types on volatility, liquidity, and short-term efficiency using the CIT report. The sample period is from January, 2006, to July, 2012.

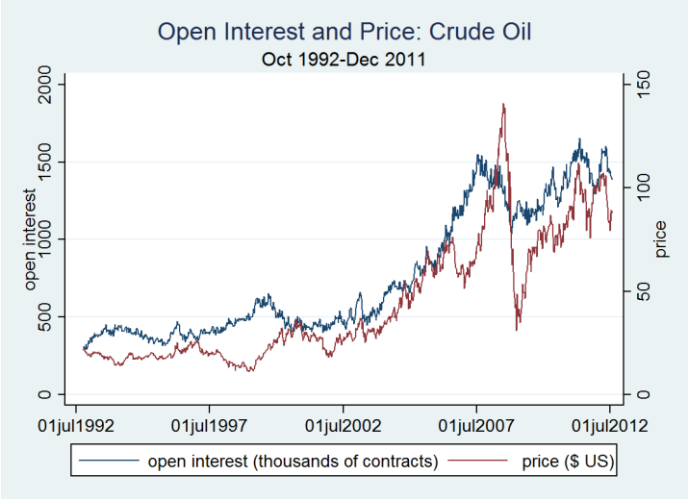
	Index Traders	Speculators	Hedgers
Panel A: The Effect on Spot Volatility			
Wheat	−5.193	**13.587**	**−11.369**
Soybeans	**−14.668**	17.179	−4.822
Corn	−10.351	−1.806	2.619
Kansas Wheat	1.436	**−18.600**	**17.825**
Cocoa	−9.031	18.934	−4.038
Cotton	**−42.646**	8.723	15.983
Coffee	**−2.600**	**−6.802**	5.408
Sugar	**−3.046**	**56.621**	**−29.744**
Lean Hogs	**−5.157**	3.691	4.683
Live Cattle	4.226	−20.034	6.175
Panel B: The Effect on Liquidity			
Wheat	18.906	1.148	**−9.697**
Soybeans	−1.513	**6.577**	**−3.571**
Corn	2.347	16.288	−1.714
Kansas Wheat	**−1.336**	−3.709	−4.139
Cocoa	0.069	2.587	−4.371
Cotton	**−3.394**	0.629	**1.961**
Coffee	7.659	**−32.627**	34.496
Sugar	−1.011	**27.084**	**−25.514**
Lean Hogs	−4.039	5.300	**10.028**
Live Cattle	1.159	**−18.053**	**23.158**
Panel C: The Effect on Short-term Price Efficiency			
Wheat	−2.065	−3.200	−0.012
Soybeans	**−1.064**	0.013	−1.656
Corn	1.147	1.481	0.084
Kansas Wheat	1.132	1.033	**0.954**
Cocoa	**−2.533**	**−4.176**	1.521
Cotton	1.657	1.493	**−2.292**
Coffee	0.173	0.941	−1.361
Sugar	0.227	1.087	−0.203
Lean Hogs	1.301	**3.011**	−0.418
Live Cattle	**−1.253**	−0.623	2.220

Table 2.10 GARCH (1,1) Estimation Result for Crude Oil

In this table, I report the GARCH (1,1) estimation results for Crude Oil. *MA* stands for long-term variation in the positions of each trader type. *ΔOpen Interest* is the daily change in open interest. *ΔInventory* and *ΔSupply* are the changes in the commodity inventory and commodity production level, respectively, using available data with the highest frequency. *Futures Volume* is the natural log of daily future volumes, and *Nonreportables* is the natural log of nonreportable positions. Inflation and Production Growth are monthly measures, and *GDP* is quarterly growth rate calculated with data obtained from the Federal Reserve Economic Data (FRED). *DTE* is the square root of days to expiration. ***, **, and * stand for statistical significance at the 1%, 5%, and 10% levels, respectively.

	Full Sample	Pre-2003	Post-2003
Conditional mean			
AR(1)	−0.077***	−0.087***	−0.097***
ΔOpen interest	0.187***	0.120***	0.245***
ΔInventory	−0.010	−0.037*	0.086**
Inflation	0.344***	−0.013	0.402**
Constant	0.073	0.081	0.118
Conditional variance			
Arch	0.111***	0.131***	0.088***
Garch	0.093*	0.146***	0.286***
Speculators			
Expected	−4.292**	−0.490	−0.755
Unexpected	−1.388*	−0.600	−4.822*
MA	−0.986***	−0.449**	−1.657***
Hedgers			
Expected	−4.292***	−0.442	−0.854
Unexpected	−0.031	−5.306***	−1.258
MA	−0.423	0.183	0.315
Futures Volume	1.562***	2.262***	1.529***
Nonreportables	−0.554***	−0.160	−0.815***
ΔSupply	0.010*	0.015*	0.013*
ΔInventory	0.022	0.049	−0.013
GDP	−0.043	0.410***	−0.508***
Production Growth	−0.320***	−0.186*	−0.292***
Inflation	−0.385***	0.059	−0.029
DTE	0.137***	0.213***	0.081
Constant	0.947	−22.019***	9.347**

Panel A



Panel B

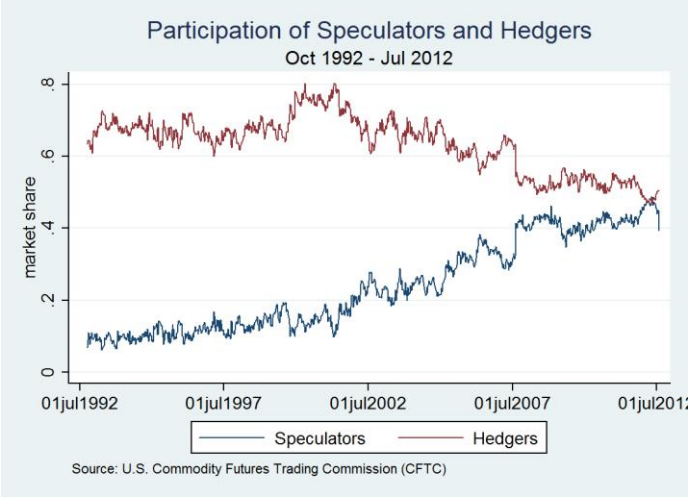


Figure 2.1 Market Structure for Crude Oil

Figure 2.1 describes the market structure for crude oil spot price and crude oil futures. Panel A displays the time series of spot price and total open interest. Panel B presents the time series of market share of speculators and hedgers in the crude oil futures market.

CHAPTER 3

THE VALUE OF FIRMS' VOLUNTRARY COMMITMENT TO IMPROVE TRANSPARENCY: THE CASE OF SPECIAL SEGMENTS ON EURONEXT[17]

3.1 Abstract

This paper examines whether a firm's commitment to increase transparency affects firm value and liquidity by studying firms' voluntary decision to be listed in "special segments" created by Euronext. The empirical analysis finds positive valuation effects for firms that opted into the special segments and documents positive effects on the liquidity of these firms. In contrast, when similar market regulations are imposed on all listed firms and the segments become unavailable, I find marketwide negative valuation effects. The findings suggest that stock exchanges can provide an effective channel that improves firms' liquidity and value; however, when a regulation with similar requirements is imposed on all firms in the market, the effect is less likely to be recognized, at least in the short term.

[17] Reprinted from Journal of Corporate Finance, 25, Abby Kim, The value of firms' voluntary commitment to improve transparency: the case of special segments on Euronext, 342–359, Copyright 2013, with permission from Elsevier.

3.2 Introduction

By using special segments created by Euronext, this paper examines whether a firm's voluntary commitment to increase transparency affects its stock market liquidity and value. At the beginning of 2002, Euronext launched two special segments, NextPrime and NextEconomy, to improve listed firms' transparency, thereby offering investors a broader menu of options in terms of firms' disclosure policies. To be included in either of the segments, firms had to satisfy requirements related to corporate governance, liquidity, and reporting quality, in addition to abiding by the standard listing requirements of Euronext. Joining the segments was voluntary; therefore, when a firm decided to join a segment, it committed to self-regulation to enhance its quality.

When the two segments were subsequently discontinued, firms had to follow disclosure requirements similar to all firms listed on Euronext. The discontinuation occurred following the European Union's Transparency Directive (EU TPD) (see Christensen et al., 2011, for detailed information), which mandated enhanced transparency and disclosure for all publicly traded firms in the European equity market. Consequently, this prevented firms from voluntarily distinguishing themselves by committing to high-quality standards. This event demonstrates how market responses to voluntary self-regulation and the effects of self-commitment by firms differ from similar mandatory requirements imposed as marketwide directives. I assess how the discontinuation of rules differently affects firms that adopted self-regulation and those that did not.

Unlike existing studies that focus on listing choices of firms (Doidge et al., 2004; Lel and Miller, 2008; Hail and Leuz, 2009; Bris et al., 2012), I examine the effect of firms'

efforts to increase transparency, given that firms already had to satisfy the listing requirement mandated by Euronext. The timing of segment creation followed the merger of Europe's regional exchanges. By creating the two special segments, Euronext provide a cost-effective way for self-regulating firms to distinguish themselves from non-self-regulating firms. Creating the segments was also to Euronext's benefit because it allowed the exchange to attract firms and maintain its competitiveness by providing alternative mechanisms that provided firms an opportunity to appeal to a broader group of market participants. Another advantage of joining the segments was that firms enjoyed enhanced visibility via the introduction of two indices comprising the securities in each segment, which offered them the potential to attract more investors.[18] Existing studies provide evidence for the positive effect of being included in the index (Harris and Gurel, 1986; Shleifer, 1986; Chen et al., 2004).

Using this institutional setting, I investigate whether there are differential effects between firms that join the segments to improve transparency and those that do not put any additional effort into signaling their quality to the market. I assess whether there were positive effects on firm value when the exchange launched the two segments. The launching of a voluntary channel through which firms can commit to improving their quality is expected to be positive news for the market. Additionally, it is likely that a firm's announcement that it is joining such a voluntary program is value-increasing news. Overall, my analysis shows that the decision to join the segments has a positive valuation effect for the firms that have committed to self-regulation. My results reveal a negative

[18] According to *Euronext Annual Report 2002* (2002, p. 40): "The segment indices are capitalization indices, in which the weighting of each constituent is based on its total capitalization, subject to a 10% ceiling. Companies included in the Euronext100 index are excluded so that the indices reflect movements specific to the segments as precisely as possible."

valuation effect when firms are removed from the exchange because they do not meet the requirements to stay in the segments.

I also conduct a difference-in-difference test to assess the effect of a firm's voluntary self-regulation on liquidity. Comparing firm liquidity around the time the new segments were launched, I find that the liquidity, as measured by the yearly average of bid-ask spread and the proportion of zero-return days, improves more for firms that opted into the segments versus those that did not. One concern about this methodology is that the decision to be included in either the NextPrime or NextEconomy market segments is a firm's endogenous decision. Therefore, the result may be driven by differences in firm characteristics that already exist. To mitigate the endogeneity problem, I use a propensity score matching method to form samples with similar observable characteristics. The relative differences in liquidity improvement between the two groups of the firms are valid after propensity score matching.

Furthermore, I assess the valuation effect of firms while they were in the segments using the implied cost of capital and Tobin's Q. Although there is a reduction in sample size, I find a lower cost of capital for firms that opted in and stayed in the segments compared to those that did not. Similarly, I find higher Tobin's Q for segment firms than for nonsegment firms. This result implies that the positive effect of committing to improve firm quality continued after a firm has realized the initial benefits of liquidity improvement.

Last, using the segment discontinuation event, I examine the valuation effect when self-selecting opportunities became a mandatory requirement. I find negative valuation effects both for firms that were in the segments and for those that were not. One possible

reason for the negative returns is that the discontinuation removed the tools that distinguished firms that commit to improve transparency and corporate governance from those that do not. When segments existed, it was easier for investors to recognize which firms put effort into improving transparency and accounting quality by checking which were included in the segments. Additionally, the segment indices increased the visibility of segment firms, helping investors distinguish between the two types of firms. With the segment discontinuation, this tool became unavailable to investors, making it difficult to differentiate between firms that had committed to improving firm transparency and reporting quality versus those that had not. The negative valuation effect for nonsegment firms implies that these firms did not opt in presumably because the marginal costs of joining the segments exceeded the marginal benefits. Although there were potential benefits to firm value and liquidity, joining the segments was not the optimal choice for these firms.

Additional difference-in-difference tests reveal that firms that did not opt in to the segments experience worsening liquidity relative to those that did opt in. Although the regression using the matched sample lowers the magnitude, the negative effect for nonsegment firms remains valid. This implies that the effect of mandatory regulatory changes observed around the segment discontinuation was not as effective as it originally was intended to be. Considering that the financial crisis hit right after the segment discontinuation, the result also implies that low-quality firms that did not invest in improving transparency previously were affected by market conditions more severely.

My empirical findings reveal the benefits of voluntary commitment to improve firm transparency, via exchange regulations that require increased firm disclosure and

corporate governance, are also observed in well-developed capital markets. Existing studies focus on firms in less developed capital markets in which investor protection is weaker and the expected benefit of increased transparency is substantial (Dewenter et al., 2010; De Carvalho and Pennacchi, 2012). In contrast, the empirical results I provide are more directly applicable to exchanges in well-developed, more integrated financial markets and potentially provide policy implications for effects of imposing regulations to improve transparency.

My study provides new insight into which types of regulations are more likely to produce the desired results. I take advantage of the segments Euronext offered, which has a starting point and a period when a policy once voluntary became mandatory. My findings suggest that stock exchanges can provide an effective channel that improves firms' liquidity and value; however, when a regulation with similar requirements is imposed on all firms in the market, the effect is less likely to be recognized, at least in the short term. Additionally, my results suggest that the intended outcome of marketwide regulation is not necessarily realized. This finding is consistent with Bushee and Leuz (2005), who document that once the Securities and Exchange Commission (SEC) applied stricter disclosure requirements to all over-the-counter (OTC) firms, there was a substantial negative effect in firm value and liquidity for the firms that did not voluntarily comply with SEC rules previously.

I add to the literature by providing evidence that the increased transparency induced by firms' voluntary disclosure and information production positively affects firm liquidity. This goes beyond merely finding a positive association between transparency and liquidity.

The remainder of this article consists of descriptions of institutional background, the relevant literature that leads to hypothesis development, data description and sample construction, empirical methods and results, and conclusions.

3.3 Institutional Background

At the beginning of 2002, Euronext created two special segments, NextEconomy, designed for companies related to technology sectors, and NextPrime, designed for companies active in traditional sectors, such as manufacturing. The intention was to provide an opportunity for firms, regardless of their size, to increase their visibility to investors. The exchange also indicated that the purpose of creating these two segments was to provide more liquidity and transparency to investors, thereby providing investors with more choices regarding a firm's quality.

Any firm that is listed on Euronext could voluntarily join either of the two segments by signing an inclusion agreement with Euronext and by adopting the following additional requirements:[19]

(i) Meet the liquidity requirement at the time of inclusion: continuous trading with or without the presence of a liquidity provider.

(ii) Publish financial documents in English for shareholders and investors.

(iii) Hold an analyst meeting at least twice each year and provide a description of the general policy on corporate governance in the annual report.

(iv) Adopt international accounting standards (or reconcile existing information with those standards).[20]

[19] The information is based on *Euronext Annual Report 2001, 2002* and *Euronext Annual Factbook 2003*.
[20] Segment firms are required to use International Financial Reporting Standards (IFRS) for the 2005 fiscal year.

(v) Publish quarterly financial report.[21]

To determine eligibility of a firm for inclusion in NextEconomy or NextPrime, the Segmentation Committee, appointed by Euronext, provided its recommendations, which include the future prospects and sustainability of the firm. The Committee also advised whether a firm should be removed from a segment because of its failure to comply with requirements specified in the Inclusion Agreement. Following the Committee's recommendations, Euronext had the option of removing the firms from the segments. If certain requirements in the Inclusion Agreement were violated, firms could be removed without consulting with the Committee.[22] A firm's removal from a segment was made public in Euronext announcements, and the information in such announcements is available from the Euronext archive. Termination from the segment did not affect the listing status of the firm on Euronext.

Euronext actively promoted the two segments by holding meetings with investors, providing a specialized website and information for the segment firms, and organizing special road shows. In addition, Euronext created accompanying market indices, which comprised firms in each segment. The exchange also featured these firms in a special section of its website and provided detailed firm information to investors. These efforts provided an incentive for firms seeking more visibility and enhanced liquidity to join the segments.

On October 23, 2007, Euronext announced the discontinuation of NextPrime and

[21] With the development of EU TPD, this was no longer a requirement but a matter of best practice from 2004.

[22] When a firm violated the conditions described in Article 11.1 (i), (ii), and (iv) of the Agreement, Euronext removed the firm without consulting with the Committee. For example, Euronext announcement 2006-033 reports the removal of Athlon Holding N.V. from NextPrime: "In accordance with article 11.1 (i) of the Inclusion Agreement, the following company will be removed from the NextPrime segment and index with effect from 7 August 2006."

NextEconomy segments and the accompanying indices.[23] According to Euronext, termination occurred because of the EU TPD's requirements for enhanced transparency and disclosure for all publicly-traded firms in Europe, making these special segments unnecessary. Four transnational market directives have been developed in Europe; TPD was the specific directive that focused on corporate disclosure and transparency. TPD was adopted in May 2004; however, each EU member country has the discretion to choose its own enforcement date.[24] According to the rules mandated by TPD, all listed firms must adopt standards similar to those that were previously required for inclusion in the two segments. In other words, the discontinuation of NextEconomy and NextPrime prohibited firms from distinguishing themselves by voluntarily committing to these high-quality standards. In addition, firms lost their increased visibility in the special index designed for the segments.

3.4 Relevant Literature and Hypothesis Development

Two channels through which firms can improve their transparency and information quality, thereby enhancing liquidity, are mandated regulation and voluntary disclosure. First, mandated capital market regulation can require firms to improve disclosure quality and market transparency. This mechanism is often imposed after a financial market

[23] NYSE Euronext Corporate event notice: Suppression des segments Nextprime et NextEconomy (Termination of NextPrime and NextEconomy segments) reports that "Changes to EU regulations, more specifically regarding contents and deadlines for publications by listed companies following the Transparency Directive, entail that Euronext no longer needs to maintain the quality-based segments Nextprime and Nexteconomy, introduced by Euronext on January 1st, 2002 with the aim of meeting the highest standards in terms of communications. Certain requirements that applied at the time the companies were admitted, now apply to all listed companies under the new regulatory framework."

[24] The actual enforcement dates are provided by Christensen et al. (2011). They find that the effect of security regulation is more prevalent in countries where there are stricter implementation and enforcement mechanisms. Most of the actual enforcement dates for the countries in my study come after the discontinuation of the segments.

experiences a major corporate scandal. For example, the Sarbanes-Oxley Act (SOX), a marketwide regulation, attempts to improve corporate governance and to increase transparency among firms through enhanced standards in reporting financial statements and auditing. A second channel through which firms can improve their transparency is by voluntarily providing information to their investors. In a theoretical model, Diamond and Verrecchia (1991) show that managers who commit to voluntarily disclosing information beyond what is mandated reduce information asymmetry and lower firms' cost of capital.

Firms that commit to improving transparency and to providing high-quality information via inclusion of market segments reduce information asymmetry between firms and their investors. As modeled in Glosten and Milgrom (1985), less information asymmetry lowers trading costs and enhances liquidity. Previous studies establish a positive relation between firm liquidity and transparency (Leuz and Verrecchia, 2000; Lang et al., 2012). Existing studies also support a positive relation between voluntary disclosure and liquidity (Brown et al., 2004; Ali et al., 2007). Consistent with the intuition of Diamond and Verrecchia (1991), these studies imply that managers increase the disclosure level to mitigate information asymmetry between firms and markets. Recently, Balakrishnan et al. (2013) document that managers can actively influence liquidity via voluntary disclosure. Using brokerage closures as exogenous shock to the supply of public information, Balakrishnan et al. construct a causal relation between voluntary disclosure and liquidity.

This is not the first study to use the segment creation in Euronext. Pownall et al. (2013) study the changes in accounting quality and liquidity for firms after the European stock market merger and document that the benefits of the merger only accrue to segment

firms if they comply fully with the requirements to be included in the segments. I find similar results showing that the creation of NextPrime and NextEconomy has a positive effect on the liquidity of firms that opt into the segments. Pownall et al. focus on the effect of compliance with the requirement and an analysis on accounting quality. I focus on the valuation effects of joining the segments and examine the effects on liquidity. Moreover, I assess the valuation effect of firms while they were in the segments. I further examine announcement returns upon the discontinuation of market segments and analyze the effects on firm liquidity after the segments ceased to exist.

Two closely related studies use stock markets in less developed capital markets to examine the effect of local exchanges' efforts to improve the quality of listed firms. Dewenter et al. (2010) study the competition between two regional Korean stock exchanges to increase their disclosure and governance standards, and they document that competition between the two resulted in more stringent rules and better protection for minority shareholders. De Cavalho and Pennachi (2012) study the Brazilian stock exchange, Bovespa, which created three premium exchange listings that held a higher listing standard for shareholder protection than do traditional listings. They find that the choice of these premium listings had a positive effect on firms in terms of trading volume and positive market reactions. These studies demonstrate that local exchanges can provide a mechanism for listed firms to improve firm quality via regulatory decisions to create a channel for credible commitment, substituting a firm's cross-listing in exchanges with greater disclosure requirements.[25]

[25] For example, firms that cross-list in the United States are subject to SEC requirements and are likely to face legal ramifications if their behavior conflicts with shareholders' benefits. By cross-listing in the United States, corporate insiders are restricted from diverting resources for their own discretion and expropriating minority shareholders (Doidge et al., 2004; Hail and Leuz, 2009; Reese and Weisbach, 2002).

Another related study by Gerakos et al. (2013) shows that firms listed on the London Alternative Investment Market (AIM), which has less a restrictive listing standard than does the regulated market, perform poorly compared to those listed on a more regulated exchange. In their study, the role of self-regulation falls to private entities, "Nomads," who are selected by the firms. Their findings suggest that when the firm delegates the role of improving its quality to a third party, many aspects of the firm's performance worsen. My study differs in that instead of moving the incentive of self-regulation to the private sector, as in Gerakos et al., firms had a self-selection opportunity to increase transparency within Euronext, and the exchange retained the regulatory oversight over listed firms.

The results of existing studies predict a positive valuation effect for firms that join the segments. My study looks at a situation in which a private exchange provides an opportunity for firms to increase information flow to the market and examines how a firm's decision to take that opportunity influences its liquidity and value. Because voluntary inclusion in the market segments required actions that improve transparency firms that joined the segments should experience a positive market reaction and improved liquidity. However, the decision to join the segments also reflects the firm's optimal choice for the level of liquidity and transparency. In my study, firms that joined the segments were already more liquid and had been operating in a better disclosure environment. In this case, being in the segments would have no additional benefits for firm value. Simply put, joining the segments can be used as a cost-effective tool for firms to signal their high quality that already existed.

When Euronext decided to discontinue its segments because of the marketwide

regulation mandating higher reporting standards for all firms, liquidity should have improved for firms that had not joined the segments, and no significant changes should have occurred for firms that were in the segments. The reason is that because segment firms were already following the higher transparency standards, they would not have had to make any major changes. However, firms that had not joined the segments did have to make major changes to their reporting quality and transparency. Upon segment discontinuation, therefore, investors could expect higher quality information and enhanced transparency from firms not previously in the segments. Accordingly, the market should have reacted positively to the segment discontinuation announcement, and the firms not previously in the segments should have experienced greater improvement in liquidity than segment firms. The fact that Euronext decided to discontinue the segments implies that it expected the marketwide regulation to have effects similar to those brought about by the standards previously required of segment firms. However, marketwide directives mandating a higher level of disclosure could move firms away from value-maximizing disclosure decisions, which would lead to a negative market reaction. Empirical evidence does not make a clear prediction of the effect of marketwide rule changes on firm value. Several studies investigate the effect of SOX on firm valuation (Engel et al., 2007; Leuz et al., 2008), but the results are mixed, and the effect varies depending on firm size and degree of compliance.

3.5 Data and Sample Construction

I use Euronext's monthly statistics available on the NYSE-Euronext website to extract firm names, firm identification codes, status as a segment firm or not, industry

codes (ICB), trading information, and countries in which firms operate.[26] I obtain firm characteristics, information on reporting standards, trading volume, bid and ask prices, stock returns, and cross-listing information from Datastream. To be included in the sample, firms must not have been dropped within a year and should have data on yearly average of bid-ask spread, stock returns, trading volume, country information, and industry codes. In addition, firms with zero volatility are deleted from the sample. Furthermore, for the analysis around the segment introduction, each firm must have stayed on the exchange from 2001 to 2003. To be classified as a segment firm, the firm must have remained as a segment firm at the end of both 2002 and 2003 and not have been dropped from the segment. Similarly, for the analysis around segment discontinuation, firms must have stayed on the exchange from 2006 to 2009 and segment firms must have remained in the segments in both 2006 and 2007.[27]

A firm is categorized as a segment firm if it was marked as such by Euronext at the end of each year and if it stayed in a segment for at least 6 months within a year. A firm is dropped from the sample if it switched from a segment firm to a nonsegment firm. For the periods during which I analyze the effects on firm liquidity, only a small number of firms dropped or switched. Table 3.1 reports the number of segment firms during the periods segments existed. Panel A shows that except for 2004 and 2006, a small number of firms dropped from the segments.[28] Furthermore, most of the firms that were dropped from the segments or switched do not meet the data requirements. As displayed in Panel

[26] The monthly statistics are available from 2002, https://europeanequities.nyx.com/en/resource-library/reports-and-statistics. For firm data before 2002, I rely on Datastream.
[27] Relaxing some of the restrictions does not change the results.
[28] Panel A shows that a large number of firms dropped from the segments in 2004 and 2006; however, I did not compare liquidity between segment and nonsegment firms for these periods. In addition, most firms that were dropped from the segments remained in the segments for fewer than 3 to 4 months.

B, when firms are classified as segment firms, they remained in the segments in the following year as well. Finally, Panel C displays that firms are more likely to switch their membership in segments when they dropped from the segments in 2004 or 2006.

The liquidity measures are yearly mean bid-ask spread, median bid-ask spread, and a proportion of yearly zero-return days. These liquidity measures are chosen because the highest frequency data available in Datastream are daily frequencies. The bid-ask spread is calculated as (ask price − bid price) / ((ask price + bid price) / 2), and zero-return days are the number of zero return days divided by the total yearly trading days. Lesmond et al. (1999) propose zero-return days as a proxy for liquidity because investors trade less for illiquid stocks, which induces zero trading volume and zero returns. Both measures are widely adopted as liquidity proxies especially in studies using international firm data (Lang et al., 2012; Pownall et al., 2013).

3.6 Empirical Methods and Results

3.6.1 Analysis Around the Launch of Two Market Segments

In this section, I conduct an analysis of the introduction of NextPrime and NextEconomy. First, I examine how the market reacted to the Euronext's announcement that it was launching two new segments. Next, I evaluate whether a firm's voluntary decision to join the segment had an effect on its liquidity.

3.6.1.1 Event Study

On December 18, 2001, Euronext announced that it would be launching two segments on January 2, 2002, (the first trading day) and the accompanying indices. Additionally,

the exchange released a list of 139 qualified firms that were included in the two segments.[29] These firms had already met the financial and liquidity requirements for the two segments at the time of the announcement. The announcement of the creation of two segments was likely to have been value-increasing news from shareholders' perspectives, especially for firms included in the segments. Firms had to meet additional requirements such as enhancing transparency and corporate governance upon joining the segments, which are known to be related to greater firm value (Lemmon and Lins, 2003; Baek et al., 2004; Lang et al., 2012). Therefore, I expect the announcement returns to be positive, especially for firms initially included in the segments.

I use a market model to calculate the cumulative abnormal returns (CARs) around the announcement date. I use Euronext100 index returns as market returns and (−256, −46) days before the announcement date as the estimation window. I construct daily returns using Datastream and include only firms with sufficient return data within the estimation window and around the event window (−1, +1). I calculate CARs separately for firms that were included on the Euronext list released on the announcement date and for the firms that were not included.

Panel A of Table 3.2 reports event-study results for the announcement day of the segment creation and the corresponding release of firm names initially included in the two segments. The two-day CARs for event window (0, +1) are 0.44% (p-value < 0.001) for firms included in the segments and −0.18% (p-value < 0.001) for firms not included. The positive announcement return for the included firms indicates that the market viewed inclusion in the segments as positive. The negative two-day returns for nonincluded firms

[29] I am grateful to the Euronext Index division for providing me with a list of firms the exchange included in the initial roster of segments.

contrast with my expectation. I expected the creation of the two segments to be good news to the market as a whole, including nonincluded firms, although I did expect the positive effect to be lower for nonincluded firms than for included firms.

The three-day CARs are, to my surprise, negative for both groups of firms, though insignificant for firms included on the list. This can be attributed to a large negative abnormal return on day -1. The negative return on the day before the announcement date possibly indicates that news of the announcement leaked, and the market mistakenly perceived it as bad news. It is also plausible that the market did not immediately realize the benefit of having such a voluntary program. Another possibility is that a marketwide negative shock affected all firms before the announcement date. Finally, the negative returns may be due to confounding effects from previous events. In December 2001, Euronext made several announcements before revealing the introduction of the two segments, such as a financial agreement related to the merger with BLVP (the Portuguese exchange organization) and a cooperating agreement with another trading facility.[30] In addition, Euronext had just completed mergers with several European regional exchanges in the preceding year. The new environment may have created additional uncertainty or mixed signals about the exchange's marketwide announcements.

To provide more specific evidence to corroborate the previous results, I conduct an event study using the announcements of firms added to the segments throughout 2002.[31] Unlike the marketwide announcement of segment introduction, the announcement dates differ for firms added to the segments during 2002, and I therefore examine the

[30] *Euronext Annual Report 2001* provides a detailed timeline of major announcements made by Euronext during 2001.

[31] Again, the Euronext Index division kindly provided the names of firms added to the segments during 2002 and their announcement dates.

announcement returns across different event dates. Using a market model, I calculate the 3-day CARs around the announcement dates of firms' inclusion in the segments. Panel B of Table 3.2 reports that the 3-day CARs are 1.51% (p-value < 0.001), supporting the idea that adopting a voluntary program to enhance firm's transparency is positive news to shareholders.

I conduct an additional event study to provide stronger support for the previous results. I collect all of the announcement dates during 2002 for firms that were removed from the segments for violating the specific conditions that allowed Euronext to remove firms without the recommendation of the Segmentation Committee. The removal announcements should have been negative news for the firms because they implied the firms were not meeting the standards required for inclusion in the segments. Moreover, these firms lost the visibility they had while on the associated market indices. Although there are a small number of such announcements, examining whether the market viewed the involuntary removal as value-decreasing news can provide additional support for the previous results.

Following a similar event-study method that I used earlier, I use a market model to calculate the cumulative abnormal returns (CARs) around the announcement date. I use Euronext100 index returns as market returns and (−256, −46) days before the announcement date as the estimation window. I find that the CARs around the announcement of firms' removal from the segments are negative and statistically significant. Panel C of Table 3.2 reports that the three- (two)-day CARs are −1.16% (−1.06%), with (p-value < 0.001) for both cases. This result suggests that investors viewed the removal of firms from the segments negatively, supporting the previous

results.

Overall, the event-study results suggest that the creation and inclusion of the segments that were intended to provide investors with additional information and to enhance firms' transparency and liquidity were value-increasing news to investors.

3.6.1.2 The Effect on Firms' Liquidity

Existing studies document that increased transparency is positively related to higher liquidity. Because voluntary inclusion in the segments requires actions that improve transparency, it is likely that a firm's decision to join the segment has a positive effect on liquidity and therefore enhances a firm's value. To examine this possibility, I conduct an analysis of whether liquidity improved for firms after joining the segments around the time the segments were introduced. First, I provide information about segment and nonsegment firms around the launching of the two segments.

Table 3.3 reports summary statistics for firm variables in 2001 around the time the segments were launched. In Appendix 3.A, I provide the definitions of all variables. As mentioned in the data section, I include firms that did not drop from the exchange from 2001 to 2003, and I require that segment firms not switch their position in the segments during 2002 and 2003. Therefore, segment firms are those that decided to be in the segments in 2002 and 2003, and nonsegment firms are those that did not choose to be in the segments. All measures are Winsorized at the 1% and 99% levels, and firm variables are scaled by total assets when necessary.

The first two rows of Table 3.3 show that segment firms have narrower mean spread and fewer zero-return days than do nonsegment firms before segments were initiated in

Euronext. In addition, segment firms have higher trading volume; however, volatility is also higher for segment firms. These variables indicate that firms that are already liquid and have higher trading volume are likely to choose to be segment firms. Even though segment firms have better liquidity, firms choose to be in the segments presumably because there is a marginal net benefit to doing so.

The rest of Table 3.3 compares firm characteristics between segment and nonsegment firms. Segment firms are smaller in size than nonsegment firms, reflecting that the segments were intended to benefit relatively small and midsized firms (see *Euronext Annual Report 2001*, 2001). Segment firms also have higher market-to-book ratio and higher sales growth than those of nonsegment firms. This is expected because most firms included in NextEconomy operate in the technology sector, which has higher growth opportunities than that of other industry sectors. Segment firms also have higher leverage; however, other characteristics such as profitability and capital expenditure are very similar to nonsegment firms, on average. These firm characteristics show that smaller firms that are in need of more growth opportunity opt to join the segments, possibly to benefit from more visibility and lower information asymmetry.

The bottom part of Table 3.3 provides information related to the firm's accounting quality, reporting standards, and cross-listing status. Following Dechow et al. (2010), I use measures of accounting quality such as the absolute value of accrual magnitude and the ratio of standard deviation of earnings to the standard deviation of operating cash flows for the past 3 to 5 years based on available data. There are no significant differences in these measures between the two groups of firms.

I also compare the proportion of firms that are cross-listed in the United States or

Germany.[32] Being listed on multiple exchanges increases visibility to investors, affecting liquidity. Segment firms are listed in other major European exchanges more frequently than are nonsegment firms. Furthermore, I compare the reporting standard between the two groups. I obtain local accounting standard information from Datastream and measure the ratio of firms that use U.S. Generally Accepted Accounting Principles (GAAP) or International Financial Reporting Standards (IFRS). I also calculate the ratio of firms whose auditor is affiliated with Big4 accounting firms. The accounting literature documents that these variables are closely related to accounting quality and corporate governance standards, which also affect liquidity (Fan and Wong, 2005; Lang et al., 2012; Daske et al., 2013). Very few firms adopted the international standard in 2001, and there is no difference in this measure between the two groups. In contrast, segment firms use more auditors affiliated with Big4 accounting firms.

Another interesting point is that nonsegment firms have a higher ratio of ownership concentration than do segment firms. Insiders are expected to favor joining the segments only when a firm's growth opportunities are sufficiently valuable. Considering that segment membership requires a higher level of transparency and corporate governance measures, it is likely that controlling shareholders do not have an incentive to join the segment. The higher growth opportunities of segment firms imply that one of the reasons a firm joins a segment is that there are high growth opportunities that offset the loss of insiders' private benefits, a consequence of committing to provide greater transparency and improving corporate governance.

[32] Cross-listings in the United States are mainly via OTC in Datastream; therefore, I do not present a separate measure for U.S. cross-listings in the analysis. Additionally, the proportion of cross-listed firms in the United States is less than 5% based on Datastream. When I consider cross-listings in Germany only, I obtain very similar results.

The cost of adopting new rules or marking extra efforts to modify reporting quality is a larger burden for smaller firms (Engel et al., 2007; Leuz et al., 2008). As such, it is possible that the decision to join the segments is driven by firm size. However, given that segment firms are smaller, this concern does not apply here. Moreover, the comparison of firms' accounting information suggests that segment firms are more often subject to higher reporting standards and have already adopted the tools needed to improve liquidity and corporate governance. Therefore, the net costs of adopting additional requirements to be included in the segments seem to be smaller for segment firms.

To examine whether there are differential effects on liquidity between segment and nonsegment firms around the segment introduction, I conduct a difference-in-difference test on firm liquidity. Specifically, I run the following regression:

$$\text{Liquidity}_{i,t} = \alpha + \beta_1 \text{Post}_{i,t} + \beta_2 \text{Treat}_{i,t} + \beta_3 \text{Post}_{i,t} \cdot \text{Treat}_{i,t} + \sum_{i=1}^{N} \gamma_i \text{Controls}_{i,t} + (\text{Fixed effects}) + \varepsilon_{i,t} \quad (3.1)$$

Post is a dummy variable equal to one for either year 2002 or 2003. The treatment groups (*Treat* = 1) are segment firms and the control groups (*Treat* = 0) are nonsegment firms. I compare each group's liquidity between 2001 and 2002 and between 2001 and 2003. As explained in the data section, the liquidity measures are the bid-ask spread and the percentage of zero-return days. The bid-ask spread and zero-return measures are inverse measures of liquidity; therefore, a negative sign on the interaction term (*Post·Treat*) implies that being in the segments has a positive effect on firm liquidity. Control variables are firm size, volatility, cross-listing status, and firms' reporting standards. I also include country and industry fixed effects. All variables are in yearly measures. Following Petersen (2009), standard errors are clustered at the firm level.

Panel A of Table 3.4 reports the difference-in-difference test results using Eq. (3.1) for 2001–2002 firm pairs, and Panel B reports results for 2001–2003 firm pairs. The first and fourth columns of both panels report the treatment effects without any control variables for mean spread and zero returns. The interaction term is economically and statistically significant, and the sign is negative. This implies that segment firms experience a more positive effect on their liquidity relative to nonsegment firms. The coefficient of *Post* is positive, implying that overall, the liquidity worsened in the following years, consistent with Pownall et al. (2013). The rest of the columns report regression results including other control variables. For both the 2001–2002 and 2001–2003 comparisons, the interaction terms from the full specification remain negative and statistically significant, confirming the findings that liquidity improved more for segment firms than for nonsegment firms.

The coefficient of *Volatility* is positive, consistent with the existing literature, which documents a positive relation between liquidity and volatility (Ho and Stoll, 1983; Stoll, 2000). The coefficient on *Size* is also negative and significant, indicating that smaller firms have lower liquidity. Furthermore, the sign of *Cross-listing* is negative, implying that being traded in multiple exchanges is positively correlated with liquidity. The negative coefficient for *Reporting* indicates that better reporting standards have a positive effect on liquidity.[33] The effects of the control variables are consistent with existing studies using international data (Lang et al., 2012; Daske et al., 2013).

As Table 3.3 shows, there are differences in some of the firm characteristics such as volatility, trading volume, size, growth opportunities, and several variables related to

[33] I use either Accounting Standard or Audit for the reporting variable. The results do not vary qualitatively regardless of which variable is used.

accounting quality. Therefore, the difference in changes in liquidity of segment firms relative to nonsegment firms may capture some of the differences in firms' observable characteristics that influence the outcome. To mitigate the endogeneity problem, I use the propensity score matching method described in Heckman et al. (1998).[34] For each firm, I estimate the predicted probability of being in the segment in both 2002 and 2003 based on observable firm characteristics in 2001, using the following probit model:

$$\text{Segment}_i = \beta_0 + \sum_{i=1}^{I} \beta_i (\text{Firm characteristics}_i) + (\text{Fixed effects}) \qquad (3.2)$$

The dependent variable is a dummy variable that equals one for segment firms, and zero otherwise. Control variables are trading volume, firm size, market-to-book ratio, sales growth rate, profitability, leverage, dummy variables indicating the use of leading auditors, cross-listing status, and the accounting standard of the country in which the firms is operating.[35] Country and industry fixed effects are also included. In addition, I include changes in liquidity between 2000 and 2001 to capture the trend in liquidity for each firm.[36] To use the difference-in-difference regression, the parallel trend assumption should be met. Table 3.3 reveals that there is a significant difference in changes in liquidity over the preceding years; therefore, the difference-in-difference estimators may overestimate the effect on liquidity if the parallel trend assumption is invalid. As such,

[34] This method is used to mitigate endogeneity issues in the corporate finance literature. Lemmon and Roberts (2010), Bharath et al. (2011), and Saretto and Tookes (2013) are examples of recent studies using the propensity matching method.

[35] Similar to the methodology used in Bharath et al. (2011) and Pownall et al. (2013), the dependent variables in the difference-in-difference regression (i.e., mean spread and zero-return days) are not included in the probit model. The main purpose of the liquidity analysis is to compare the effect of being segment firms on the changes in liquidity relative to nonsegment firms; therefore, it is not necessary to match the level of liquidity before the introduction of the segments on Euronext. In fact, the segment firms already have narrower spread and a fewer number of zero-return days than do nonsegment firms. The purpose and interpretation of the difference-in-difference regression are different from other studies that match the level of dependent variables (Lemmon and Roberts, 2010; Saretto and Tookes, 2013).

[36] I use either $\%\Delta Spread_{\_01}$ or $\%\Delta Zero_{\_01}$ as the liquidity trend variable. The matching results are similar.

my matched firms are not only similar in firm characteristics but also in liquidity trend before the segments started. After estimating the propensity score for each firm, I use the nearest-neighbor matching method to obtain a matched firm pair. To be more specific, for each segment firm, I find a nonsegment firm with the smallest absolute differences in its estimated propensity score. This procedure gives me 161 pairs of matched firms. In Table 3.5, I report the result of probit estimation, summary statistics for the matched sample, and the result of difference-in-difference test for the matched sample.

Panel A of Table 3.5 reports the probit estimation used in the matching process and Panel B reports the sample statistics for the matched pair. All *t*-statistics confirm there are no differences in the observable firm characteristics. Panel C reports the difference-in-difference regression results using the matched samples employing the full specifications. The coefficient on the interaction term remains negative. Although the statistical significance decreased compared to what is reported in Table 3.4, there is a clear positive effect on firm liquidity for segment firms.

Overall, the results from the difference-in-difference regression for both the full and matched samples demonstrate that segment firms experience improvements in firm liquidity after they join the segments. When exchanges provide an opportunity for firms to signal their high quality to investors, firms can benefit from their decision to do so.

3.6.2 Analysis of Segment Firms While Staying in the Segments

The results from the previous section show that the decision to join the segments has a positive effect on firm value and its liquidity. If the positive effect is sustained for segment firms, I expect to observe higher firm value for these firms while they remain in

the segments. I measure the firm value using the implied cost of capital and Tobin's Q. I construct a data set comprising all firms from 2002 to 2007 that did not drop from the exchange. I also define segment firms as those that stayed in the segments for the entire 6 years. This process gives a total of 700 firms, with 167 segment firms before applying any data restrictions.

I first examine whether segment firms had lower required returns by estimating the implied cost of capital. As discussed in the accounting literature, there is no consensus on which method should be used to estimate the implied cost of capital (Gebhardt et al., 2001; Botosan and Plumlee, 2005; Lee et al., 2009; Hou et al., 2012; Barth et al., 2013): alternative methods differ in dealing with the terminal value of future cash flows. Among the alternatives, I use the Easton's (2004) price-earnings-growth (PEG) model, which assumes zero growth in abnormal earnings beyond the forecast horizon. Botosan and Plumlee (2005) and Easton and Monahan (2005) document that the PEG model is more robust than other alternatives in reflecting risk characteristics. Botosan and Plumlee (2005) assess how well the alternative estimates of cost of capital relate to firm-specific risk and show that the cost of capital calculated based on the PEG model is robust to model specification and produces results that are consistent with the predictions of existing theories.[37] Other alternatives are shown to be unstable and the direction of the relation with risk characteristics is the opposite to those predicted in existing theories. Moreover, the PEG model has fewer data restrictions than do other methods for the sample of European firms I use in estimating the cost of capital.

For each firm, I calculate the cost of capital using the following PEG model:

[37] Botosan and Plumlee (2005) document that the estimate developed in Botosan and Plumlee (2002) is another robust measure of cost of equity capital. I adopt the Easton (2004) method considering the popular use of the PEG model and data availability.

$$\text{Cost of equity capital}_t = \sqrt{\frac{eps_{t+2} - eps_{t+1}}{P_0}} \tag{3.3}$$

eps_{t+1} and eps_{t+2} are the analysts' forecasts of earnings per share for 1 and 2 years, respectively, and P_0 is the current price level. Analysts' forecasts are obtained from the international I/B/E/S database, and other firm variables are from Datastream. I hand-collect CUSIP to match the analysts' forecasts and Datastream and verify that the company name is identical between the two datasets.

After calculating the cost of capital, I examine whether firms in the segments have a lower cost of capital using the following panel regression:

$$\begin{aligned}\text{Cost of capital}_{i,t+1} = {} & \beta_0 + \gamma\text{Segment}_{i,t} + \beta_1\text{Volatility}_{i,t} + \beta_2\text{Size}_{i,t} + \beta_3\text{Leverage}_{i,t} \\ & + \beta_4\text{Sales Growth}_{i,t} + \beta_5\text{Book-to-market}_{i,t} + \beta_6\text{Capex}_{i,t} \\ & + (\text{Fixed effects}) + \varepsilon_{i,t}\end{aligned} \tag{3.4}$$

Segment is a dummy variable that equals to one if firms are defined as segment firms in the sample from 2002 to 2007. Following existing studies, I include volatility, firm size, leverage, sales growth, book-to-market, and capital expenditure as control variables (Botosan and Plumlee, 2005; Easton and Monahan, 2005; Lee et al., 2008; Lee et al., 2009). I also control for country, industry, and year fixed effects and cluster at the firm level following Petersen (2009).[38] I require all firms to have the required data; therefore, the sample size decreases to 109 nonsegment firms and 55 segment firms each year for the 6 years while the segments existed on Euronext.[39] On the left side of Table 3.6, I report the regression results for implied cost of capital. Controlling for firm characteristics and several fixed effects, the coefficient on *segment* (γ) is negative and

[38] Petersen (2009) suggests that when multiple effects are present in the sample, standard errors can be clustered on one dimension and dummy variables can be included to control for other dimensions.

[39] Lang et al. (2012) use both Tobin's Q and the cost of capital as measures of firm value in the international setting and discuss data restrictions similar to those in my analysis.

significant at the 10% level. This result indicates that segment firms had lower costs of capital while they were in the segments. In terms of other control variables, large firms with higher growth opportunities have a lower cost of capital. In addition, consistent with existing studies, the cost of capital is positively related to volatility, leverage, and book-to-market ratio.

Although this result shows that the implied costs of capital are lower for segment firms, the result is suggestive. Because of the availability of analyst forecast data and other firm-related variables, a significant number of firms are dropped in the estimation process, lowering the statistical significance. As an alternative measure of firm value, I use Tobin's Q and examine the relation between being in the segments and firm valuation. Tobin's Q is constructed as [(book value of assets + (market value of equity − book value of equity)) / book value of assets], using firm information obtained from Datastream. I use the following equation to assess the effect of being in the segments on Tobin's Q:

$$\begin{aligned}\text{Tobin's Q}_{i,t+1} = {} & \beta_0 + \lambda\text{Segment}_{i,t} + \beta_1\text{Size}_{i,t} + \beta_2\text{Leverage}_{i,t} \\ & + \beta_3\text{Sales Growth}_{i,t} + \beta_4\text{Cash}_{i,t} + \beta_5\text{Capex}_{i,t} \\ & + \beta_6\text{Div}_{i,t} + (\text{Fixed effects}) + \varepsilon_{i,t}\end{aligned} \tag{3.5}$$

Segment is a dummy variable that equals to one if firms are defined as segment firms in the sample from 2002 to 2007. I include control variables used in the prior studies, and country, industry, and year fixed effects, clustering at the firm level. Following Petersen (2009), robust standard errors clustered by firm level. The right-hand side of Table 3.6 shows the coefficient on *Segment* (λ) is positive and significant, suggesting that firms that decided to join and stayed in the segments experienced higher firm value while they were in the segments. Compared to the analysis on the cost of capital, using Tobin's Q to

assess firm value increases the sample size substantially.

Although there are data restrictions, and therefore the results are suggestive, the analysis in this section shows that firms had lower cost of capital and higher firm value measured in Tobin's Q while they were in the segments. Combined with the effect on liquidity discussed in the previous section, a firm's decision to join the segments is value increasing to investors. The evidence suggests that an exchange's effort to enhance transparency and a firm's voluntary effort to take advantage of such a channel have a positive effect on a firm's liquidity and value. Moreover, the empirical results suggest that the mechanism a private exchange provides to improve firm quality is effective even in a well-developed European market in which higher listing standards are already present compared to capital markets in developing countries.

3.6.3 Analysis Around Segment Discontinuation

In this section, I examine the valuation effects and the effect on liquidity when Euronext discontinued the two segments at the end of 2007. Specifically, I analyze the announcement effects of discontinuing the segments and compare firms' liquidity between 2007 and 2008 and between 2007 and 2009. The reason for ending the segments was that the requirements for TPD were very similar to the standards for the two segments. Therefore, for segment firms, the ability to distinguish themselves from other firms disappeared, making the segments redundant. TPD was first passed in December 2004. Several adjustments were made after that, and finally, its implementing directive was enacted in March 2007. Each country could use its own discretion in enforcing the directive, and most of the enforcement dates in my sample come from the end of 2007

and early 2008. The two market segment indices were deleted at the same time the segments were discontinued, and therefore investors may have noticed the disappearance of the indices. The crucial point is to investigate what happened to liquidity when (1) the two segments were discontinued because they were redundant of the newly implemented marketwide regulation and (2) the visibility via the customized indices disappeared. In addition, it is the enforcement that drives the actual changes for firms rather than the passge of transnational law. For this reason, I compare periods before and after the segment discontinuation.

Discontinuation of the segments coincides with the intention to require all firms in the stock exchanges to adopt standards to increase firm transparency and enhance accounting quality similar to standards already adopted by segment firms. Therefore, I expect to observe positive valuation effects and liquidity improvement for firms that were not included in the segments previously. However, for firms that were previously included in the segments, I expect to observe no announcement effects because these firms already had been making the effort to increase transparency and improve reporting quality as required by the segments.

Table 3.7 provides summary statistics for firms at the time of segment discontinuation. Similar to what is reported in Table 3.3, segment firms have lower bid-ask spread and fewer zero-return days relative to nonsegment firms. Segment firms also have greater trading volume and number of trades but lower volatility than do nonsegment firms. The bid-ask spread and the ratio of zero-return days were smaller than what is reported in Table 3.3: over time, the trading cost decreased, and Euronext unified the tick size to 0.01 euro in February 2007, leading to an overall improvement in liquidity

for the firms listed on the exchange. Compared to nonsegment firms, segment firms are smaller and more levered. Segment firms are more profitable and have higher growth opportunity (in median value). Additionally, segment firms are cross-listed more often than are nonsegment firms. Compared to the accounting standards reported in Table 3.3, more than 90% of all firms adopted IFRS or the U.S. GAAP, and segment firms use international reporting standards to a greater extent than do nonsegment firms. This shows that firms that joined segments were more likely to adopt more stringent reporting standards, which Euronext required for segment firms.

To understand how the market responded to the announcement of segment discontinuation, I use an event-study method to calculate announcement returns. I adopt a market model similar to the analysis in section 3.6.1.1.. Table 3.8 reports the results.

Contrary to my expectations, for both segment and nonsegment firms, the CARs around the time of the announcement are negative and significant, and for segment firms, the CARs are more negative. This is surprising because the purpose of the discontinuation was to impose similar requirements on all firms to enhance transparency and quality. Therefore, I expected insignificant abnormal returns for segment firms and positive returns for nonsegment firms. Because the standards required for segment firms became mandatory for all firms, which brought about the exchange's decision to cease the segments, I expected the market to see the discontinuation as positive news that expands the transparency requirements to all firms traded on Euronext, especially for nonsegment firms. Thus, it is surprising that the market responded negatively for both segment and nonsegment firms.

One possible reason for this result is that the segment discontinuation removed the

tools that distinguish firms with better transparency and corporate governance from the rest. When segments existed, it was easier for investors to recognize which firms put an effort into improving transparency and accounting quality by checking which were included in the segments. Additionally, the indices dedicated to the segments increased segment firms' visibility, helping investors distinguish between the two types of firms. With segment discontinuation, this tool became unavailable to investors, making it difficult to differentiate firms that had committed to improving firm transparency and reporting quality from those that had not. Furthermore, being included in the segments was a firm's voluntary decision, made because there were marginal benefits to doing so. If marketwide regulations remove firms' opportunities to obtain the benefits accrued to them and if such regulation removes selection tools for investors, the market would respond negatively to the Euronext announcement.

Analyses from previous sections indicate that firms experienced positive effects on firm value by choosing to be in the segments. Therefore, when regulations similar to the segments' requirements are imposed on all firms, the positive effect also likely accrues to nonsegment firms. The negative valuation effect for nonsegment firms presumably occurred because these firms were already operating at their optimal level of liquidity and transparency. It is possible that nonsegment firms did not opt in because the marginal costs of joining the segments exceeded marginal benefits. The negative valuation effect for nonsegment firms is consistent with the findings of Engel et al. (2007) and Ahern and Dittmar (2012). These studies document that when new regulations are imposed, the valuation effects are closely related to the firms' costs and benefits of implementing the new rules, and mandatory regulation can deter firms from operating at their optimal

levels.

In assessing the effect of segment discontinuation on firm liquidity, I conduct a difference-in-difference test between the two types of firms. After 2007, standards similar to those previously required for segment firms were applied to all firms; therefore, I expected to observe a positive effect of segment discontinuation on liquidity for the firms that were not included in the segment previously. Specifically, I use the following regression:

$$\text{Liquidity}_{i,t} = \alpha + \beta_1 \text{Post}_{i,t} + \beta_2 \text{Nonseg}_{i,t} + \beta_3 \text{Post}_{i,t} \cdot \text{Nonseg}_{i,t} + \sum_{i=1}^{N} \gamma_i \text{Controls}_{i,t} + (\text{Fixed effects}) + \varepsilon_{i,t} \quad (3.6)$$

Nonseg is a dummy variable equal to one for the firms that were not segment firms previously and had to adopt the mandatory requirements, and *Post* is a dummy variable equal to one for either year 2008 or 2009. Control variables are identical to those reported in Table 3.4. The first three columns of Table 3.9 report the results from the difference-in-difference regression between 2007 and 2008, and the last three columns report the regression results between 2007 and 2009. The results from the full-sample tests show that after the discontinuation of the segments, there was a negative effect on firm liquidity for nonsegment firms. The interaction terms are positive, which means that for nonsegment firms, the bid-ask spread widened and the number of zero-return days increased relative to segment firms. This is puzzling because nonsegment firms are now subject to greater disclosure and improved transparency due to marketwide regulation; therefore, they should experience more positive returns than segment firms that were already abiding by the requirements.

As Table 3.7 shows, nonsegment firms are less liquid and have higher volatility, and

follow different reporting standards. Therefore, the regression results from the full sample may capture differences in firm quality. To reduce this endogeneity, I employ propensity score matching to control for the firms' differences. The matching procedure is similar to the one used in section 3.6.1.2: firm characteristics, fixed effects, and liquidity trend variables are included in the probit equation. Using the probit model described in Eq. (3.2), I estimate the probability of firms being in the segments in 2007 given the firms' characteristics in 2006, and firms are matched using the absolute differences in propensity score.[40] As reported in Panel A of Table 3.10, there is no significant difference in matched firm characteristics.

In Panel B of Table 3.10, I report results from the difference-in-difference test using a matched sample. Compared to the full-sample tests, the statistical significance disappears for zero returns, although the sign of the interaction terms remains positive. All other control variables have the expected signs, although the significance of reporting standards disappears in the matched-sample regression. The regression results indicate that the effect of mandatory regulation observed around the time of the segment discontinuation is not as meaningful as it was originally intended to be. It is also possible that firms that did not invest in improving firm quality previously are affected by market conditions more severely, given the fact that the market experienced a financial crisis during the period used in this regression. Additionally, improving firms' disclosure practices may take time to develop, and the effect on market liquidity may manifest over a longer period.

Overall, the effect of the segment discontinuation had a negative effect on the firms listed on Euronext. Although the reason behind segment discontinuation was that

[40] The result of probit estimation in this section is available upon request.

marketwide regulation that replaced the rules provided by the segments would bring similar positive outcomes for all firms listed on Euronext, the actual outcome turned out to be different from what was expected. The existence of segments has been a way for better firms to differentiate themselves from the rest, and when this separating tool disappeared because of the alternative mandatory regulation, the market responded negatively. Furthermore, the effect of marketwide regulation that is similar to the standards for the segments firms does not seem to be effective. After the segments were discontinued, there was no positive effect on the liquidity of nonsegment firms. The results provide insights into whether an individual firm's voluntary decision to signal its quality to the market contributes to enhanced liquidity, compared to the case where improved transparency is mandatory for all listed firms.

Taken together, the results suggest that when firms voluntarily commit themselves to improving transparency through the channels provided by the exchange, positive effects on firm value and liquidity occur. However, when such channels disappear and mandatory regulation replaces them, the intended purpose of the effect is not necessarily realized.

3.7 Conclusion

In this paper, I study the effect of transparency on a firm's value and liquidity using the introduction and discontinuation of the NextPrime and NextEconomy market segments on Euronext. I document positive valuation effects for the firms that opted into the segments and committed to enhance transparency and improve reporting quality. The empirical tests show that, when firms decided to join the two market segments, their

liquidity improved compared to firms that did not join the segments. These results suggest that transparency affects firm liquidity, which is consistent with the findings of existing literature.

When similar market regulations are imposed on all listed firms and replace the functions of the voluntary market segments, results reveal negative valuation effects for all firms. In addition, firms that did not join the segments experienced lower liquidity compared to those that joined segments, even after the segments discontinued. A marketwide regulation that mandates similar requirements does not seem to yield the expected outcomes when similar channels provided by a local exchange are eliminated.

My empirical results provide several interesting insights. First, the benefit of exchanges' provision for firms to improve transparency is not confined to developing financial markets but is also applied to more developed financial markets, where the effect of bonding mechanisms is not clearly a priori relative to less developed financial markets. Second, my results suggest which types of rules and regulations are more likely to produce their intended outcome. It seems that firms' self-regulation to improve transparency is more effective than is marketwide mandatory regulation. Finally, this study documents that improved transparency affects liquidity, providing strong support for the positive relation between transparency and liquidity.

3.8 Appendix: Variable Definitions

Accmag: The absolute value of the difference between earnings and operating cash flows divided by total assets.

Acc. Standard: A dummy variable equal to one if the country where the firm is operating adopted IFRS or U.S. GAAP.

Accratio: The ratio of standard deviation of earnings to the standard deviation of operating cash flows during the past 3 to 5 years.

Auditor: A dummy variable equal to one if the firm is using auditors affiliated with Big4 auditing firms.

Book-to-Market: The ratio of book value of equity to market value of equity.

Cash: Cash and cash equivalent items divided by total assets.

Capex: Capital expenditure divided by total assets.

Cross-listing: A dummy variable equal to one if the firm is cross-listed in Germany or the United States.

Div: A dummy variable equal to one if the firm pays dividend.

Insider: The percentage of closely held shares.

Leverage: Total liabilities divided by total assets.

Ln (Volume): The natural log of trading volume.

Mean (Median) Spread: The yearly average (median) of daily percentage bid-ask spread.

Mtb: The ratio of market value of equity divided by book value of equity.

Nonseg: A dummy variable equal to one for the firms that were not segment firms previously upon the discontinuation of the two segments.

$\%\Delta Spread\_{01}$: The rate of change for mean spread between 2000 and 2001.

$\%\Delta Zero\_{01}$: The rate of change for zero-return days between 2000 and 2001.

$\%\Delta Spread\_{56}$: The rate of change for mean spread between 2005 and 2006.

$\%\Delta Zero\_{56}$: The rate of change for zero-return days between 2005 and 2006.

Reporting: A dummy variable equal to one if a firm has a high-quality reporting standard. I use either *Acc. Standard* or *Auditor* in the difference-in-difference regression for this variable. Using either of the two variables does not change the result qualitatively.

Roe: Return on equity.

Sales Growth: The growth rate of sales between year t and $t-1$.

Size: The natural log of total assets.

Post: A dummy variable equal to one for either year 2002 or 2003 (2008 or 2009) for the analysis around the segment introduction (discontinuation).

StdE: The earnings volatility calculated using available earnings data for the previous 5 years.

Trade: The natural log of number of trades.

Treat: A dummy variable equal to one for segment firms.

Volatility: The annualized standard deviation of daily returns.

Zero: Number of zero-return days divided by total number of trading days.

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Table 3.1 Number of Segment Firms in Euronext

This table displays the number of firms included in the NextEconomy and NextPrime segments of Euronext from 2002 to 2007. Firms that are dropped from Euronext are not included. The statistics presented here are the number of firms before the data restrictions used in the analysis were applied. Panel A shows the number of firms that stayed in the segments at least 1 month each year and the number of firms that dropped from the segments. Panel B reports firms that stayed in the segments in year *t* and dropped in year *t+1*. Panel C presents the statistics of firms that switched after they chose to be in the segments the previous year. The data are obtained from Euronext monthly statistics available from https://europeanequities.nyx.com/en/resource-library/monthly-statistics.

Panel A: Number of segment firms each year

Year	NextEconomy	NextPrime	Number of Firms Dropped
2002	116	144	2
2003	112	143	21
2004	50	67	264
2005	109	123	4
2006	70	76	154
2007	92	108	4

Panel B: Number of segment firms dropped between years

Segment firms in 2002 and not in 2003	1
Segment firms in 2003 and not in 2004	1
Segment firms in 2004 and not in 2005	0
Segment firms in 2005 and not in 2006	0
Segment firms in 2006 and not in 2007	11

Panel C: Number of segment firms that dropped or switched

Segment firms in 2003, not in 2004, and segment firms in 2005	104
Segment firms in 2003, not in 2004–2005, and segment firms in 2006	2
Segment firms in 2005, not in 2006, and segment firms in 2007	67

Table 3.2 Market Valuation of Being Included in the Segments: Event Study

This table reports cumulative abnormal returns (CARs) over event windows (−1, +1) and (0, +1) for three announcements: (1) the creation of segments, which occurred on December 18, 2001, with the release of the list of firms that joined the segments; (2) the inclusion of firms in the segments during 2002; (3) and the removal of firms from the segments by Euronext during the period segments existed. I calculate CARs based on a market model and use Euronext100 index returns as market returns. The estimation window is (−256, −46) days before each announcement date. Panel A presents CARs around the date of Euronext's creation of two segments, separately for firms that were included in the segments and for those that were not. Panel B reports CARs around the announcement dates of firms that were included in the segments throughout 2002. Panel C reports CARs around the announcement dates of firm removals from the segments over the period during which segments existed in Euronext. *** and ** indicate statistical significance at the 1% and 5% levels, respectively.

Panel A: Abnormal returns around announcement of two segments				
	Segment firms		Nonsegment firms	
CARs (−1, +1)	−0.75	N = 115	−0.79***	N = 878
CARs (0, +1)	0.44**		−0.18***	
Panel B: Abnormal returns around segment adoption throughout 2002				
CARs (−1, +1)	1.51***	N = 204		
CARs (0, +1)	1.21***			
Panel C: Abnormal returns around announcement of removal				
CARs (−1, +1)	−1.16***	N = 37		
CARs (0, +1)	−1.06***			

Table 3.3 Summary Statistics for Nonsegment and Segment Firms in 2001

This table displays summary statistics for nonsegment and segment firms in 2001. Segment firms are those that opted in and stayed in the segments in 2002 and 2003. See Section 3.8 for variable definitions. All variables are obtained from Datastream and Winsorized at the 1% and 99% levels. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels for differences in mean and median for each variable, respectively. Tests of mean differences are conducted by *t* test, and tests of median differences are based on nonparametric rank test.

	Nonsegment				Segment			
Variable	Mean	Median	Std	*N*	Mean	Median	Std	*N*
Mean Spread	0.05	0.03	0.07	575	0.03***	0.02***	0.04	173
Zero	0.30	0.19	0.27	575	0.15***	0.11**	0.15	173
Ln(Volume)	6.32	5.93	3.37	575	7.70***	7.49***	2.30	173
Volatility	0.51	0.46	0.27	575	0.57***	0.53***	0.25	173
$\%\Delta Spread_{\_01}$	0.39	0.13	1.12	569	0.29	0.05***	1.66	168
$\%\Delta Zero_{\_01}$	0.03	0.01	0.09	564	0.01***	0.01***	0.07	168
Size	12.42	11.90	2.31	575	12.01***	11.68*	1.85	173
Leverage	0.65	0.65	0.32	575	0.71**	0.65	0.38	173
Mtb	2.24	1.52	2.29	575	3.12***	2.27***	2.79	173
Roe	5.65	10.61	32.85	575	6.95	10.84	35.97	173
Sales Growth	0.34	0.17	0.80	575	0.61***	0.32***	1.00	173
StdE	0.08	0.03	0.84	556	0.06	0.04**	0.08	163
Capex	0.08	0.05	0.22	556	0.08	0.05	0.13	169
Accmag	0.09	0.06	0.12	569	0.10	0.07**	0.12	169
Accratio	1.73	0.57	7.80	450	1.29	0.55	2.64	159
Acc. Standard	0.01	0.00	0.11	551	0.02	0.00	0.13	164
Auditor	0.63	1.00	0.48	562	0.76***	1.00	0.43	169
Cross-listing	0.30	0.00	0.46	575	0.47***	0.00	0.50	173
Insider	59.67	63.68	23.60	435	52.11***	54.05***	20.08	138

Table 3.4 The Effect of Being in the Segments on Firm Liquidity

This table reports the effect of being in the segments on firm liquidity by estimating Eq. (3.1). Panel A and Panel B report results for the 2001–2002 and the 2001–2003 samples, respectively. See Section 3.8 for variable definitions. C and I denote country and industry fixed effects (FE), respectively. Following Petersen (2009), robust standard errors adjusted for firm-level clustering are reported in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Panel A: Difference-in-difference test for 2001–2002 sample

	Mean Spread	Mean Spread	Mean Spread	Median Spread	Zero	Zero	Zero
Constant	0.051***	0.150***	0.096***	0.061***	0.296***	1.033***	0.760***
	(0.003)	(0.020)	(0.026)	(0.017)	(0.011)	(0.054)	(0.073)
Treat	−0.024***	−0.034***	−0.022***	−0.014***	−0.151***	−0.175***	−0.115***
	(0.004)	(0.005)	(0.005)	(0.004)	(0.016)	(0.016)	(0.017)
Post	0.011***	0.012***	0.012***	0.010***	0.034***	0.042***	0.041***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.008)	(0.007)	(0.007)
Treat · Post	−0.012***	−0.011***	−0.011**	−0.010**	−0.040***	−0.042***	−0.040***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.014)	(0.013)	(0.013)
Volatility		0.076***	0.101***	0.082***		0.006	0.004
		(0.015)	(0.016)	(0.014)		(0.035)	(0.032)
Size		−0.011***	−0.010***	−0.008***		−0.057***	−0.049***
		(0.001)	(0.001)	(0.001)		(0.003)	(0.004)
Reporting			0.002	0.003			−0.022
			(0.005)	(0.004)			(0.017)
Cross-listing			−0.011*	−0.008			−0.103***
			(0.006)	(0.005)			(0.015)
FE	No	No	C, I	C, I	No	No	C, I
N	1496	1414	1414	1414	1496	1414	1414
R^2	0.03	0.25	0.31	0.28	0.08	0.30	0.44

Table 3.4 Continued

Panel B: Difference-in-difference test for 2001–2003 sample							
	Mean Spread	Mean Spread	Mean Spread	Median Spread	Zero	Zero	Zero
Constant	0.051***	0.110***	0.046***	0.031***	0.296***	0.996***	0.765***
	(0.003)	(0.022)	(0.028)	(0.022)	(0.011)	(0.058)	(0.074)
Treat	−0.024***	−0.037***	−0.023***	−0.016***	−0.151***	−0.178***	−0.114***
	(0.004)	(0.005)	(0.005)	(0.004)	(0.016)	(0.017)	(0.017)
Post	0.022***	0.021***	0.022***	0.018***	0.059***	0.056***	0.058***
	(0.004)	(0.004)	(0.004)	(0.003)	(0.009)	(0.008)	(0.008)
Treat · Post	−0.026***	−0.015***	−0.013**	−0.011**	−0.054***	−0.049***	−0.043***
	(0.005)	(0.005)	(0.005)	(0.004)	(0.015)	(0.014)	(0.015)
Volatility		0.121***	0.144***	0.115***		0.006	0.107***
		(0.019)	(0.019)	(0.017)		(0.035)	(0.030)
Size		−0.010***	−0.009***	−0.006***		−0.056***	−0.049***
		(0.001)	(0.001)	(0.011)		(0.003)	(0.004)
Reporting			0.004	0.002			−0.028*
			(0.005)	(0.004)			(0.017)
Cross-listing			−0.013***	−0.010			−0.107***
			(0.005)	(0.004)			(0.015)
FE	No	No	C, I	C, I	No	No	C, I
N	1496	1402	1402	1402	1496	1402	1402
R^2	0.04	0.33	0.40	0.37	0.08	0.32	0.46

Table 3.5 Propensity Score Matching and Matched Sample Analysis

This table displays the matched sample analysis around the segment introduction. Panel A presents the probit analysis using Eq. (3.2). Panel B shows the pairwise comparison of firm characteristics for nonsegment and segment firms after propensity score matching is performed. Panel C reports the difference-in-difference test result using the matched firms for the 2001–2002 and 2001–2003 samples. See Section 3.8 for variable definitions. C and I denote country and industry fixed effects, respectively. All variables are obtained from Datastream and Winsorized at the 1% and 99% levels. In Panel B, tests of mean differences are based on *t* test. In Panel C, following Petersen (2009), robust standard errors adjusted for firm-level clustering are reported in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Panel A: Probit analysis

Variable	Coefficient
Ln(Volume)	0.340***
	(0.073)
%ΔLiquidity1a	−0.122
	(0.093)
Volatility	−0.242
	(0.597)
Size	−0.424***
	(0.095)
Leverage	0.790**
	(0.3350)
Mtb	−0.010
	(0.028)
Roe	0.008***
	(0.003)
Sales Growth	0.151
	(0.134)
Accounting Standard	−0.349
	(0.850)
Auditor	0.667***
	(0.258)
Cross-listing	0.414
	(0.266)
Intercept	1.786
	(2.009)
FE	C, I
N	676
R^2	0.40

Table 3.5 Continued

Panel B: Summary statistics for matched sample

	Nonsegment		Segment		
Variable	Mean	N	Mean	N	t-diff
Ln(Volume)	7.53	161	7.79	161	−0.86
Volatility	0.56	161	0.57	161	−0.24
%ΔLiquidity1	0.23	161	0.25	161	−0.17
%ΔLiquidity2	0.01	161	0.01	161	−0.10
Size	12.37	161	12.08	161	1.20
Leverage	0.69	161	0.69	161	−0.19
Mtb	2.95	161	3.06	161	−0.33
Roe	5.49	161	7.65	161	−0.53
Sales Growth	0.48	161	0.59	161	−1.05
StdE	0.06	156	0.06	153	−0.34
Capex	0.08	145	0.08	158	0.02
Accmag	0.11	161	0.10	157	0.60
Accratio	1.58	128	1.23	150	0.92
Accounting Standard	0.03	154	0.02	156	0.73
Auditor	0.74	161	0.77	161	−0.65
Cross-listing	0.45	161	0.35	161	−0.67
Insider-holding	50.73	128	52.17	132	−0.54

Panel C: Difference-in-difference test for matched sample

	2001–2002		2001–2003	
	Mean Spread	Zero	Mean Spread	Zero
Constant	0.112***	0.681***	0.103***	0.673***
	(0.021)	(0.091)	(0.031)	(0.094)
Treat	−0.013**	−0.060***	−0.013**	−0.059***
	(0.005)	(0.019)	(0.005)	(0.019)
Post	0.007	0.039***	0.014**	0.043***
	(0.005)	(0.012)	(0.006)	(0.013)
Treat · Post	−0.007	−0.039**	−0.011*	−0.031*
	(0.006)	(0.017)	(0.006)	(0.018)
Volatility	0.055***	0.043	0.070***	0.075*
	(0.016)	(0.046)	(0.019)	(0.043)
Size	−0.010	−0.042***	−0.009***	−0.040***
	(0.002)	(0.005)	(0.002)	(0.005)
Reporting	0.001	−0.048**	−0.003	−0.060***
	(0.005)	(0.020)	(0.006)	(0.019)
Cross-listing	−0.007	−0.055***	−0.006	−0.053***
	(0.005)	(0.016)	(0.006)	(0.016)
FE	C, I	C, I	C, I	C, I
N	616	616	610	610
R^2	0.32	0.46	0.33	0.46

Table 3.6 Firm Valuation for Segment Firms from 2002 to 2007

This table reports the valuation effects of being in the segments from 2002 to 2007. The left-hand side of this table presents the panel regression result for Eq. (3.4), including country (C), industry (I), and year (Y) fixed effects (FE). The cost of capital is estimated using the price-earnings-growth (PEG) model following Botosan and Plumlee (2005) and Easton and Monahan (2005). The right-hand side of this table presents the panel regression result for Eq. (3.5), including country (C), industry (I), and year (Y) fixed effects (FE). See Section 3.8 for variable definitions. All variables are obtained from Datastream and Winsorized at the 1% and 99% levels. Following Petersen (2009), robust standard errors adjusted for firm-level clustering are reported in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Cost of capital		Tobin's Q	
Constant	0.135^{***}	Constant	0.168^{***}
	(0.027)		(0.204)
Segment	-0.013^{*}	Segment	0.122^{*}
	(0.007)		(0..062)
Volatility	0.131^{***}	Size	-0.040^{***}
	(0.027)		(0.013)
Size	-0.009^{***}	Leverage	0.230^{**}
	(0.002)		(0.101)
Leverage	0.043^{**}	Sales Growth	0.120^{**}
	(0.020)		(0.052)
Sales Growth	-0.023^{***}	Cash	0.976^{***}
	(0.007)		(0.222)
Book-to-Market	0.075^{***}	Capex	−0.006
	(0.013)		(0.007)
Capex	-0.057^{***}	Dividend	0.095^{*}
	(0.018)		(0.056)
FE	C, I, Y	FE	C, I, Y
R^2	0.40	R^2	0.21
N	984	N	3306

Table 3.7 Summary Statistics for Nonsegment and Segment Firms in 2007

This table displays summary statistics for nonsegment and segment firms in 2007. Firms in the sample stayed in Euronext from 2007 to 2009 and did not change segment status from 2006. See Section 3.8 for variable definitions. Firm characteristics are from Datastream and Euronext monthly statistics. All variables are Winsorized at the 1% and 99% levels. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels for differences in mean and median for each variable, respectively. Tests of mean differences are conducted by *t* test, and tests of median differences are based on nonparametric rank test.

	Nonsegment				Segment			
Variable	Mean	Median	Std	*N*	Mean	Median	Std	*N*
Mean Spread	0.03	0.01	0.05	547	0.01***	0.01***	0.01	133
Zero	0.22	0.11	0.26	547	0.08***	0.06***	0.09	133
Ln(Volume)	10.68	10.17	3.36	547	11.59***	11.41***	1.96	133
Trade	9.11	8.75	2.69	547	10.07***	9.73***	1.61	133
Volatility	0.35	0.29	0.20	547	0.30***	0.28*	0.09	133
%ΔLiquidity1	0.00	−0.03	0.45	547	−0.04	−0.01	0.23	133
%ΔLiquidity2	−0.01	−0.02	0.08	547	−0.02	−0.01***	0.16	133
Size	12.80	12.24	2.53	547	12.58	12.57	1.51	133
Leverage	0.86	0.64	3.12	547	0.60*	0.61	0.24	133
Mtb	2.49	1.69	3.40	547	2.56	1.90*	3.02	133
Roe	7.94	11.05	27.86	539	11.11**	12.40**	20.87	133
Sales Growth	0.30	0.09	2.59	547	0.22	0.12***	0.42	133
StdE	0.06	0.03	0.08	469	0.06	0.03	0.09	133
Capex	0.05	0.03	0.06	543	0.05	0.03	0.06	133
Accmag	0.15	0.05	1.71	534	0.06	0.04	0.07	133
Accratio	1.48	0.74	4.10	528	1.51	0.80	4.34	133
Acc. Standard	0.95	1.00	0.22	547	0.99**	1.00**	0.09	133
Auditor	0.66	1.00	0.47	498	0.72	1.00	0.45	133
Cross-listing	0.45	0.00	0.50	547	0.60***	1.00***	0.49	133
Insider Holding	55.47	59.04	25.41	448	47.69***	49.67***	22.68	118

Table 3.8 Market Reaction at the Announcement of Segment Discontinuation

This table reports cumulative abnormal returns (CARs) for the announcement of segment discontinuation on October 23, 2007. I use a market model, with Euronext100 index returns as market returns. The estimation window is (−256, −46) days before the announcement date. I construct daily returns using Datastream and include only firms with sufficient returns data within the estimation window and the event window (−1, +1). *** indicates statistical significance at the 1% level.

	CARs (−1, +1)	*N*
Segment firms	−0.70%***	133
Nonsegment firms	−0.57%***	487

Table 3.9 The Effect of Segment Discontinuation on Firm Liquidity

This table reports the effects of segment discontinuation on firm liquidity using the difference-in-difference regression for segment and nonsegment firms between 2007 and 2008 and between 2007 and 2009. See Section 3.8 for variable definitions. C and I denote country and industry fixed effects (FE), respectively. Country and industry information is obtained from Euronext monthly statistics. Following Petersen (2009), robust standard errors adjusted for firm-level clustering are reported in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

	2007–2008 sample			2007–2009 sample		
	Mean Spread	Median Spread	Zero	Mean Spread	Median Spread	Zero
Constant	0.135***	0.094***	0.838***	0.166***	0.143***	0.887***
	(0.047)	(0.036)	(0.095)	(0.052)	(0.037)	(0.095)
Treat	−0.002	−0.003	0.075***	0.002	−0.001	0.080**
	(0.004)	(0.003)	(0.012)	(0.004)	(0.004)	(0.013)
Post	−0.027***	−0.023***	−0.009	−0.009*	−0.007*	0.035***
	(0.005)	(0.004)	(0.010)	(0.005)	(0.004)	(0.011)
Treat · Post	0.029***	0.021***	0.017**	0.036***	0.028***	0.012
	(0.005)	(0.004)	(0.008)	(0.006)	(0.006)	(0.010)
Volatility	0.178***	0.139***	0.195***	0.125***	0.095***	0.122***
	(0.022)	(0.020)	(0.035)	(0.023)	(0.019)	(0.044)
Size	−0.007***	−0.004***	−0.042***	−0.008***	−0.007***	−0.044***
	(0.001)	(0.001)	(0.004)	(0.002)	(0.002)	(0.004)
Reporting	−0.046***	−0.041***	−0.129***	−0.058***	−0.058***	−0.135***
	(0.017)	(0.014)	(0.036)	(0.019)	(0.019)	(0.036)
Cross-listing	−0.023***	−0.017***	−0.137***	−0.022***	−0.022***	−0.141***
	(0.004)	(0.003)	(0.016)	(0.005)	(0.005)	(0.015)
FE	C, I	C, I	C, I	C, I	C, I	C, I
N	1360	1360	1360	1352	1352	1352
R^2	0.43	0.41	0.50	0.36	0.31	0.51

Table 3.10 Analysis of Matched Firms Around Segment Discontinuation

This table presents the analysis of matched firms around the segment discontinuation in 2007. Panel A presents summary statistics for the matched sample accompanied by the tests of mean differences. *t*-diff denotes the significance of tests of mean differences. Panel B reports the difference-in-difference test result for matched firms for the 2007–2008 and the 2007–2009 samples. See Section 3.8 for variable definitions. In panel B, C and I denote country and industry fixed effects (FE), respectively. In Panel B, following Petersen (2009), robust standard errors adjusted for firm-level clustering are reported in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Panel A: Summary statistics for matched sample

	Nonsegment		Segment		
Variable	Mean	N	Mean	N	*t*-diff
Ln(Volume)	11.52	133	11.59	133	−0.24
Trade	0.32	133	0.30	133	1.15
Volatility	15.23	133	15.44	133	−0.73
%ΔLiquidity1	−0.04	133	−0.04	133	−0.28
%ΔLiquidity2	−0.02	133	−0.02	133	−0.24
Size	12.57	133	12.57	133	−0.01
Leverage	0.62	133	0.60	133	0.42
Mtb	2.80	133	2.56	133	0.62
Roe	14.71	133	11.11	133	1.40
Sales Growth	0.19	133	0.22	133	−0.54
StdE	0.07	104	0.06	133	0.41
Capex	0.04	129	0.05	133	−1.19
Accmag	0.08	131	0..06	133	1.22
Accratio	2.37	129	1.51	132	1.12
Accounting Standard	0.97	133	0.99	133	−1.01
Auditor	0.73	115	0.72	133	0.76
Cross-listing	0.06	133	0.60	133	−0.25
Insider	51.73	112	47.69	118	1.32

Table 3.10 Continued

Panel B: Difference-in-differnece test for matched sample

	2007–2008 sample			2007–2009 sample		
	Mean Spread	Median Spread	Zero	Mean Spread	Median Spread	Zero
Constant	0.017	0.017	0.430***	0.027	0.079	0.442***
	(0.052)	(0.042)	(0.095)	(0.066)	(0.056)	(0.085)
Treat	0.002	0.001	0.032**	0.002	0.001	0.032**
	(0.003)	(0.003)	(0.014)	(0.003)	(0.003)	(0.014)
Post	−0.022**	−0.019***	−0.014	−0.013**	−0.007**	0.010
	(0.009)	(0.007)	(0.014)	(0.006)	(0.003)	(0.010)
Treat · Post	0.014**	0.012**	0.001	0.017***	0.010*	0.005
	(0.006)	(0.005)	(0.010)	(0.006)	(0.006)	(0.016)
Volatility	0.156***	0.121***	0.211***	0.145***	0.095***	0.252***
	(0.045)	(0.036)	(0.065)	(0.034)	(0.018)	(0.041)
Size	−0.005***	−0.004***	−0.027***	−0.001	−0.004**	−0.026***
	(0.002)	(0.001)	(0.004)	(0.002)	(0.001)	(0.004)
Reporting	0.020	0.008	−0.036	−0.048	−0.059	−0.076
	(0.035)	(0.028)	(0.071)	(0.058)	(0.051)	(0.064)
Cross-listing	−0.018***	−0.013***	−0.091***	−0.018***	−0.012***	−0.099***
	(0.006)	(0.004)	(0.018)	(0.005)	(0.004)	(0.016)
FE	C, I	C, I	C, I	C, I	C, I	C, I
N	532	532	532	528	528	528
R^2	0.49	0.50	0.42	0.50	0.48	0.49