

The Role of Alternative Lending Markets for Short Selling: Liquidity, Price Discovery and Market Surveillance

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ABSTRACT

Contributing to the debate whether securities lending should move to central counterparties (CCP), we examine short selling from centralized versus over-the-counter (OTC) lending markets. We also differentiate between domestic versus offshore OTC lending where the offshore lending is effectively unknown to regulators. This lack of transparency in the offshore market is likely to be preferred not only by traders with private information but also by rouge traders. Interestingly, we find that the offshore market is not disruptive rather it is the most efficient information provisional channel, as stocks with high level of OTC shorting experience -1.7% lower returns in the subsequent month. Such underperformance is not prevalent in stocks with high shorting from the centralized market. Rather shorting via CCP facilitate transient price discovery and liquidity, where a 1% increase in shorting is associated with 7% higher liquidity. Overall, our results suggest that the centralized and the OTC lending markets complement each other, as we find that stocks with non-trivial short selling from all three alternative lending markets exhibit the highest pricing efficiency, with the lowest skewness, kurtosis and price delays.

Keywords: Short selling, Equity lending, Pricing efficiency, Liquidity provision

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Regulators have just begun to mention requiring CCPs for securities lending transactions, and the facilities already exist in the US, Europe, Latin America and several Asian countries. In Europe, regulators have discussed the idea of moving all securities loans onto a CCP. However, this is largely impractical; adding the cost of a CCP onto a general collateral trade at current borrowing levels would make those loans uneconomical for the lender.
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With the exponential increase in short selling from the burgeoning hedge fund industry, there is an increasing need for efficient securities lending market. In the U.S. and Europe, short selling mostly relies on over-the-counter (OTC) lending, where the bilateral contracts are non-transparent; the lending fees and the contractual terms are largely unknown to the market and regulators. In these decentralized, oligopolistic market settings, short sellers can incur high search costs and/or simply are unable to short given the lack of loan supply or high lending cost. Despite its inefficiencies, institutions prefer the OTC setup as they can potentially get discounted fees from their prime brokers and do not have to be concerned with free-riders by revealing their trades in a centralized market.¹

In Asia, regulators have been actively involved in securities lending, as these markets had to catch up with the developed stock exchanges to attract investors from abroad. Centralized lending markets have been relatively active for years in Japan, Taiwan and Singapore (among others), thus far, without major system breakdowns. Although the centralized lending market can reduce the search costs, the lending fees can still be high.² One of the major benefits of the centralized lending market is that it provides transparency and when directly managed by the exchange could aid timely regulatory intervention in short selling.

¹ The information is inferred from industry studies and from informal conversation with staff of prime brokerages that actively participate in the lending market.

² Since 2002 the Singapore Stock Exchange has developed its centralized securities lending market gradually. By 2010 with the enhanced service, over 80% of the total listed stocks on SGX become eligible for lending or borrowing via the Central Depository (CDP). In 2011, the SGX announced further development, especially in terms of determining fees in the market where lenders could earn higher fees (instead of the fix annual 4%) if the demand is high.

In the aftermath of the financial crisis, regulatory concern about short selling increased. Given that short-sale bans and other restrictions generally proved to be inefficient if not harmful, regulators shifted their focus to promote centralized derivative and securities lending markets.³ The expected major benefits of a centralized lending market is naturally the transparency it can offer not only to regulators but also to all market participants. However, the centralized system may not be supportive of large trades because with standardized contracts and fees, the large traders cannot benefit from economies of scale or may not be feasible at all. The increased transparency may also deter informed institutional trading in concern of free riders, which in turn would reduce liquidity and information in the market.

In this study, we contribute to the ongoing regulatory debate on short selling by reviewing the role of alternative lending channels for short sellers. We examine how short selling via the centralized (CCP), the local OTC, and the offshore OTC markets contribute towards price discovery, liquidity and market surveillance on the Tokyo Stock Exchange (TSE) from 2006 to 2009. We choose the TSE as our testing ground, because it is a stable and developed exchange, with large volume and market capitalization, active foreign investment and long history of active centralized and OTC equity lending markets. Specifically, we examine three important questions: (1) Do the centralized and the OTC lending markets complement each other in promoting pricing efficiency, by catering to different investor groups? (2) Does the centralized market speed up price discovery and promote liquidity? (3) Do short sales from the non-transparent OTC market destabilize prices and hinder information dissemination?

In general, we show that stocks with limited short selling (short selling only on one lending channel) are similar in that they are shorting somewhat smaller stocks with low turnover, high skewness and kurtosis. Consistent with Boehmer et al (2010), we find that

³ Regulators may need to be aware of the limitations of the efficacy of short sale regulations on the exchanges. With active over the counter trading, and after hour trading, the recently introduced US circuit breakers are also shown to be ineffective.

short selling promotes pricing efficiency, as stocks, which are shorted via at least two channels, are more liquid and exhibit lower skewness and kurtosis. But the beneficial role of short selling is mostly prevalent in stocks with short selling established in all three lending channels. These stocks have median daily turnover of 0.36%, 0.12% higher than that of stocks with short selling from solely two channels. Also these stocks have the lowest skewness (0.04) and kurtosis (2.29) and highest turnover (0.36%).

Short sellers established in the three markets follow different trading strategies and focus on different stocks. In the centralized market, traders prefer somewhat larger stock, with extreme returns suggesting trend chasing or contrarian trades. In fact the shorting volume from the centralized market is prevalent in promoting liquidity rather than conveying new information. A 1% increase in short selling relative to shares outstanding significantly increases turnover, reducing illiquidity by 7%. This is consistent with anecdotal evidence that the centralized market is dominated by retail traders that are known to follow price trends and trade on order imbalance (which is public information in Japan). While the shorting via the centralized market primarily facilitates liquidity, there is also evidence that it contributes to other aspects of pricing efficiency by reducing skewness and kurtosis.

Short sellers from the offshore (non-transparent) OTC market are more likely to trade on private information focusing on non-transparent stocks, with high insider ownership. But the traders seem to be aware of the trading risk and shy away from stocks with high short term volatility (high pricespread). While both the local and offshore OTC are considered to facilitate informed institutional trading, high short selling from the offshore OTC channel, in particular, is associated with significant future negative return, suggesting informational trades. More importantly, contrary to regulatory concern, on average short selling via OTC market do not destabilize prices, rather reduce extreme price swings. We also find evidence

that some short sellers in the nontransparent lending market trade on private information and impound information revealed around analyst downgrades.

Overall, the results from Japanese securities market from 2006 to 2009 suggest that the coexistence of the OTC and centralized (regulated) securities lending market is favorable in developing a liquid securities market with active institutional trading. The OTC markets by facilitating foreign and domestic institutional short selling allows price discovery as institutional convey new negative information to the market. The centralized lending market increases liquidity, and in combination with an OTC markets, improves price discovery and efficiency.

A. Review of the Securities Lending Market

A.1. General Review

In most countries naked short selling is prohibited; and thus, prior to shorting a specific equity, the short seller must be able to borrow the stocks from a broker/dealer. In case of trading on time sensitive information, the short seller is not only exposed to short sale costs, but also timing risk. If the short seller's primary broker is unable to locate the shares, the short seller has to find another broker with the specific shares in inventory to be able to maintain its short position. These search costs (forgone profit by late trade execution) can be significant burden for the short sellers and hinder or slow the information dissemination to the market.

The US securities lending primarily operates as an OTC activity among investment banks, who are members of the Depository Trust Company (DTC), the central securities depository. Kolasinski, Reed and Thornock (2010) testing Duffie et al.'s (2002) search model in the US equity lending market find that search costs (information heterogeneity) allow lenders to charge high loan fees. The lending fees are especially sensitive to demand for already highly

shorted stocks, where traders likely identified significant mispricing (Cohen, Diether, and Malloy, 2007) slowing price correction potentially. In the OTC market, the ownership structure is also crucial because limited ownership (limited supply) or high concentration of institutional ownership increase lending fees, recall risk and arbitrage risk (Saffi and Sturges, 2010) in turn show that lower lending supply and higher fees are associated with greater downside risk and higher total volatility.

In the aftermath of the financial crisis besides the potentially high search costs and lending fees, increasing concern arose about counterparty risk (from borrowers and lenders) and lack of transparency (from regulators). The Central Counterparty (CCP) services have been considered a solution on both sides of the Atlantic to address the counterparty risk which become acutely prevalent in the collapse of the Lehman Brothers. CCPs can also facilitate meeting new regulatory requirements about reporting, capital allocation and balance sheet usage and reduce systemic risk while supporting the growth in the security lending industry (SecFinex, 2010).

Interestingly, centralized securities lending market on the NYSE was active in the 1930s which provided market clearing and information via daily published fees in the Wall Street Journal. The centralized market could alleviate some of the short sale constraints by facilitating short selling of stocks with high demand (exceeding the supply from normal channels) where the excess demand was reflected by high fees. Jones and Lamont (2002) study the cost of borrowing equities in the “loan crowd”, the centralized stock loan market on the NYSE floors from 1926 to 1933. They show that loan crowd stocks (with binding short-sale constraints) experienced price increase that peaked as the stock entered the loan list and fall as the demand met and the overpricing corrected via selling and shorting.

Overall, short selling is found to increase market efficiency, in terms of speed of price discovery and liquidity as Bris, Goetzmann and Zhu (2007) show that prices incorporate

negative information faster in countries where short sales are allowed and practiced. At the stock level Saffi and Sigurdsson (2010) and Boehmer and Wu (2010) find that the ability to short sell stocks increases the informational efficiency of market prices. In addition, in the context of the recent financial crisis, Kolasinski, Reed and Thornock (2010), and Beber and Pagano (2012) show that the short sale restrictions (i.e., emergency order) had a strong adverse effect on liquidity.

A.2. Securities Lending and Short Selling in Japan

The unique feature of the Japanese lending market is that it consists of a two tier system, a OTC and a centralized lending market. The negotiated market, or OTC market, existed from the late 1980s for institutional investors, where both local and foreign institutions have been active in convertible bond arbitrage. The market has been formally regulated since 1998, where the terms are negotiated between the lender and the borrower (or the borrower's broker) like the one in the US. The Japan Securities Finance Co. (JSFs) launched its securities lending services in 1977 and gradually increased the number of eligible issues. Today, JSFs manages a centralized facility for margin trading securities lending (stock and bond) where the lending rate calculated daily by using the lending rate and the appraised value of stock-lent will be paid. There are two types of lending rate: a predetermined one, based on the period of the loan and on other factors; and a second type, determined by negotiation (offer-bid stock borrowing and lending transactions).⁴

In the last decades, the foreign investment gradually increased in Japan, to about 28% of the ownership by 2008 (Jiang and Yamada, 2011). The significant foreign ownership may have negative effect on the Japanese market if it magnifies the impact of spreading of market shocks from other US and European markets. More importantly, the foreign institutional

⁴ Japan Securities Finance Co. Ltd. Corporate website. <http://www.jsf.co.jp/english/bu/bu0301.html>

involvement is prevalent in trades. According to Bee, Yamada, and Ito (2008), foreign institutions account for 25% and 22% of the total buy and sell volume during 1991 to 1999. Like in the U.S., in Japan, institutions dominate the shorting market but retail investors are also active in short selling in Japan because shorts can be easily executed via the centralized market. Anecdotal evidence suggests that institutions prefer the negotiated market because they can use their bargaining power and reduce borrowing costs, while in the standardized market the same fees apply for each transaction irrespective of loan size, making it mostly attractive for individual investors to short stocks.

In this study, we examine the role of the centralized (CCP) and the decentralized, bilateral OTC, lending markets in conjunction with information provision, liquidity and pricing efficiency. Specifically, whether the beneficial role of short selling—increased pricing efficiency and liquidity provision can be associated with one specific market, or the co-existence of the markets.

B. Data

Our primary dataset, obtained from Factset, contains daily trading information such as share prices, volume, daily high and low prices from July 2006 to Dec. 2009 for all stocks from the Tokyo Stock Exchange (first section only). We also obtain the annual financial information data, such as market capitalization, book-to-market ratio, institutional ownership and insider ownership, and analyst recommendation (dates and ratings) from Factset.⁵

Information on the centralized and negotiated equity lending market from Japan is obtained from Nikkei. The dataset includes weekly margin reports that reflect the number of stock on loan (implying the outstanding short volume) at the end of the week both in the local centralized and the local OTC lending market. This unique two tiered Japanese lending

⁵ FactSet Research Systems Inc., <http://www.factset.com/>

market facilitates this differentiation between retail and institutions traders, since institutional investors dominate the decentralized negotiated market where retail (small investors without important brokerage connections) cannot access the potentially cheaper negotiated market. Takahashi (2010) states that in Japan, three companies act predominantly as market makers in the stock lending markets. The Japan Securities Finance Company is the largest market maker of the three. His data covers the centralized market, does not reflect positions from the negotiated market that is mostly dominated by institutions (see page 2406).

We also use information from Data Explorers on the Japanese lending market. Data Explorers as a leading data provider on the equity lending market collects information from all major brokerages while the Nikkei data captures primary the lending market activity initiated within Japan.⁶ Thus, we consider the difference in the lending market activity from the two data sources (number of shares shorted in the Data Explorers database – number of shares outstanding on loan from Nikkei for a particular stock) as implied short sale volume by foreign institutions, that is short selling using stock borrowing from outside of the Japanese market (Offshore lending). The key variable of interest is daily shorting flow measured as a stock's weekly shares borrow scaled by the shares trading volume, similar to Boehmer and Wu (2009). The advantage of standardizing using trading volume is that it allows us to compare borrowing activity across stocks with different trading volumes.

There are cross-sectional differences among stocks shorted through the various markets. The majority of stocks are shorted in the foreign OTC market. In panel A of Table 1 we calculate the summary statistics for stocks exclusively shorted only on one lending channel (the centralized, or the Local OTC, and the Offshore OTC market). These stocks are quite similar in size and exhibit systematically low turnover. Interestingly, institutional short sellers focus on high Market-to-book ratio (MtoB) stocks in the OTC markets, as stocks with

⁶ Data Explorers provides about 85% percent coverage of all securities lending transactions globally.

shorting from OTC markets have on average MtoB about 1.39 and 1.45 compared to 0.93 of stocks with shorting only in the centralized market. Stocks that are shorted only in the Offshore OTC have more transactions (average 10), higher utilization, and lending fee, compared to the stocks which are shorted only on the centralized and the Local OTC market. Consistent with evidence of higher short sale constraints, stocks only shorted on the Offshore OTC market have lower pricing efficiency, measured by higher kurtosis and price spread.

In comparison, stocks with lending activity in both the centralized market and one of the OTC market (either the local or the offshore) are slightly larger and more liquid stocks. The lending fees and the utilization rates are not significantly lower, while skewness and kurtosis is slightly lower. Important to note is that the local OTC market is relatively inactive. In case of stocks that are shorted both on the Centralized and the Local OTC market, the shorting is three times higher (0.61% compared to 0.21% of the shares outstanding). In these stocks the low utilization rate (16%) is unlikely to explain the low activity in the OTC market. More likely, is that these stocks are shorted by retail investors, who rely on the Centralized market.

Most importantly, we find that the lending fees and the utilization rates are the highest for stocks that are shorted only on the OTC markets (no centralized lending). These stocks have 2.2% average lending fee and 31.8% utilization compared to 1.15% and 25.4% for stocks with shorting in all three lending markets. These summary statistics suggest that the centralized lending market could alleviate some for the short sale constraints by creating alternative channel when the institutional lending supply is limited or the cost is high. More importantly, we find that stocks with lending activity in all three channels are the most liquid (0.53% average daily turnover) with the lowest levels of skewness and kurtosis. Following the conjecture that the short sellers in the alternative lending markets are different (retail versus institutions, local versus foreign) we formally test the determinants of shorting demands in the three channels.

C. Empirical Analysis

C.1. Short Sale Determinants

In Table 2, we first examine the demand determinants for the alternative channels. We estimate a system regression that explains the level of shorting flow in each lending market in which the error terms are assumed to be correlated across the equations. Instead of general OLS regression framework, we use seemingly unrelated regressions (SUR) allowing for the error terms to be related across the regressions. Also, some market characteristics from one segment maybe not be relevant to the other market, such as the information on lending supply (availability of shares from institutional beneficial owners) and lending costs measured by Data Explorer is expected to influence traders in the OTC market and not in the centralized market.

The results show that short sellers follow very different trading strategies in the centralized and the OTC markets. The first regression of the weekly outstanding shorts from the centralized market relative to trading volume on past returns, shows that centralized shorts are negatively related to insider ownership, pricespread and market capitalization. More importantly, after controlling for past shorting volume (the outstanding short position from the week prior), there is some evidence of both momentum and contrarian trading.⁷ That the shorting demand increases with illiquidity and smaller size also weekly suggest that the centralized shorts may provide liquidity where it is most needed, in smaller, illiquid stocks.

While institutional ownership (IO) is not relevant for centralized shorts (as the shorting demand is met from margin stocks), both local and offshore OTC shorting demand is positively related to IO as without IO there is no (very limited) supply in the bilateral market.

⁷ Numerous evidence shown that Asian retail traders are more likely to be contrarians (Karolyi, 2002; Kamesaka, Nofsinger, Kawakita, 2003, Richards, 2005).

For each 1% increase in IO, the shorted volume increases by 3.1 relative to total trading volume in the offshore OTC market. As institutional traders, especially foreign traders in the OTC market, are likely to be active traders, short term price volatility may posit large risk. Consistent with the result that a stock with 10% higher price spread is expected to have a 66.31% lower shorted shares relative to trading volume in the offshore OTC market.

Stocks with returns from the top (*D_Winner*) and bottom decile (*D_Loser*) during the previous week have 1.45 (column 2) and 4.5 times more centralized trading volume, when controlling respectively for past two or one week of short sale volume.

In contrast, over-the-counter short sellers avoid shorting the top and bottom return decile and when accounting for the past volume solely short winner stocks. While centralized short selling appear to actively promotes liquidity by supporting the buying pressure, this benefit can also be associated with over-the-counter shorts. While over-the-counter shorts are not targeting poor performing stocks as centralized shorts do. The results of Diether, Lee and Werner (2007) that short sellers are contrarian appear particular to short sellers that borrow in the centralized and off shore loan market.

C.2. Information Provision and Information Source of Short Sellers

After establishing that short sellers in the alternative lending markets follow different trading strategies, next we are interested in the information content of their trades and examine the future stock returns in relation with the shorting demand in the alternative lending markets. We perform a Fama-Macbeth regression analyses of next week returns, stock characteristics and lagged values of shorting demand from the alternative lending markets in Table 3. We adopt the Fama-MacBeth procedure to address time effect (cross-sectional dependence) and obtain unbiased standard errors with a time effect.

With the exception of the Local OTC market, short selling provides negative information as the higher shorting demand from the centralized and the Offshore OTC markets are associated with lower future returns. The lack of informativeness of the local OTC market is potentially not surprising as that market has significantly decreased in importance during our sample period. Looking at the one week horizon (in model 2 of Table 3), stocks that are highly shorted in the centralized market on average experience 2.7% lower returns, while stocks that are highly shorted in the Offshore OTC market on average experience 0.8% lower return during the next week.

More importantly, there is evidence of slow information diffusion as we find that stocks that are highly shorted on the Offshore OTC market experience significant negative abnormal returns about -1.7% over the next month (model 6 of Table 3). While this long term return persistence suggest significant new information from the offshore market, the transient nature of the negative abnormal return on highly shorted stocks from the centralized market suggest rather price impact and price discovery trades. These result are consistent with Beohmer, Jones and Zhang (2008) who show that large institutional short sales are the most informative, which type of trades more likely to be arranged on the OTC markets.

Next we address the regulatory concern of whether short sellers attempt to hide their trades and focus on stocks that do not attract much attention in the centralized market to ensure that high short selling may go unnoticed. In Table 4, we show that stock with high shorting activity in in the offshore market experience significant negative future return, about -2% monthly. But, we do not find evidence that the negative information (i.e., the significantly underperforming stocks) are concentrated in stocks with low shorting activity in the centralized market. In fact, our analysis show no evidence of interaction of the two markets, further suggesting (as out Table 2 results) that the alternative lending markets cater to different investor groups.

Lastly in Table 5, we examine the source of short sellers information advantage. Christophe, Ferri and Hsieh (2009) document that short sellers are informed and exploit profitable opportunities contained in the downgrade announcement of analysts. Table 5 present the regression analyses results from the price impact surrounding the analyst recommendation revisions. We are particularly interested in whether the price impact of the downgrade is stronger for highly shorted stocks, that is whether short sellers reinforce analyst recommendation. We measure this by including an interaction between highly shorted stocks, measured as belonging to the decile of short sale volume in each respective lending market and the analyst revision dummy. First, we find that the dummy variable on high Offshore OTC shorts and analyst downgrades are significantly negative. Thus both analyst and short sellers provide negative information. Furthermore, the interaction of the analyst downgrade and the Offshore shorts is significantly negative in relation to the next week return. This suggest that the Offshore OTC shorting flow facilitates price discovery around analyst downgrades as well as reinforcing the information.

Important to note that we do not find significant evidence that short sellers front-run analyst in Japan during our sample period. Thus, consistent with Engelberg, Reed, Ringgenberg, (2011) our results suggest that short sellers are efficient information processors, or are the first to receive the information and trade about the same time as analyst recover the new information, enforcing the information rather than discovering.

C.3. Liquidity and Price Discovery

C.3.1. Liquidity and Alternative Lending Channels

Numerous recent studies show that short selling in the aggregate increase liquidity and improves price discover, but there is little evidence that addresses the heterogeneity of short

sellers (from alternative lending markets) in connection with liquidity and pricing efficiency. First we examine the relation between alternative liquidity measures and shorting demand from the three markets (in Table 6), then we focus on alternative pricing efficiency measures (in Table 7). We also consider the role of the coexistence of the alternative lending markets as we previously show that these channels cater to different investors groups.

To address potential multicollinearity, instead of the daily trading volume, we use the number of shares for scaling. In the first specifications (in models 1, 3, 5) we include period fixed effects and subsequently (models 2, 4, 6) also stock fixed effects. In Table 6, to address the lognormality of the illiquidity measures, following Karolyi, Lee, and van Dijk (2012) and take the natural log of one plus the price impact proxy introduced by Amihud (2002).

$$Illiquidity = 1000000 * abs(ret) / (abs(price) * dailyvol);$$

$$Adopted\ illiquidity = \log(1 + illiquidity)$$

In models 1 and 2, the economically and statistically significant negative coefficient on shorting from the centralized and the OTC markets suggest that shorting demand from both market improves illiquidity. A 10 percent increase in the shorted volume in the centralized market (relative to shares outstanding) is associated with 1.45% decrease in the stocks illiquidity, while a 10% increase in the shorted volume in the offshore lending market associated with 2.18% decrease in illiquidity. However, looking at the alternative liquidity proxies, number of zero return days and monthly turnover, the results are less consistent. Only the shorting demand from the centralized market is associated with lower level of illiquidity or higher liquidity with all three alternative measures. Overall, our results from Table 6 are consistent with previous evidence that the centralized market caters to less informed contrarian traders that promote liquidity. On the other hand the informational trades on the Offshore OTC market more likely to be large trades where traders are concerned about recall risk and illiquidity and are therefore more likely to demand (rather than provide) liquidity.

C.3.2. Pricing Efficiency and Alternative Lending Channels

Centralized shorts lead to less illiquidity as measured by the Amihud illiquidity measure, less number of zero return days within a week and more turnover. Particularly, when including the stock fixed effects. The domestic and foreign OTC borrowings have very different influences on liquidity. Domestic OTC shorts reduce the number of zero return days and turnover, while the foreign counterpart leads to more zero return days and turnover.

Next, we focus on price discovery. Following Bris, Goetzmann and Zhu (2007) and Pagano and Berber (2011), we examine pricing efficiency measures such as stock cross-correlation, price delays, standard deviation, skewness and kurtosis in relation with activity of the alternative lending channels. Not only, we consider the aggregate shorting demand from the alternative markets but also examine the role of coexistence of OTC and centralized market to address regulatory debate whether to further promote centralized lending market in Europe and in the U.S.

We compute cross-autocorrelations between individual stock returns and market returns (Nikkei) lagged by one week, separately for negative lagged market returns and then compute the mean values of these groups of stock level statistics for stocks shorted in the OTC and centralized market. We also compute the mean values for the groups of stocks that are exclusively shorted in one of these markets. Price Delay is measured as in Hou and Moskowitz (2005). The delay measure is based on the regression of weekly stock returns on the contemporaneous returns of a world index, and the local index (Nikkei) and four lags of the local index. We then estimate this equation after imposing the constraint that coefficients of lagged local returns are zero. The larger this measure, the greater is the variation in stock returns captured by lagged market returns, implying a higher price delay in responding to market information.

$$\text{Price Delay} = \frac{\sum_{n=1}^4 |\delta_i(-n)|}{|\beta_1| + \sum_{n=1}^4 |\delta_i(-n)|}$$

This measure captures the magnitude of the lagged coefficients relative to the magnitude of all market return coefficients. We use the absolute values of each coefficient regardless of their estimated signs, because price efficiency is smaller as these measures deviate from zero. Finally, we compute how much of the cross-sectional variation in returns is explained by the market return. More precisely, we calculate a “downside Rsq” and upside Rsq for each stock using negative and positive observations on market returns, respectively. The stock return distribution variables are calculated on a rolling window using daily returns over a year interval.

Table 7 results show that both the average cross-correlation and price delay are larger for stocks exclusively shorted in the offshore OTC market. Stocks shorted in the centralized and with domestic OTC agreements have a significantly lower cross-correlation. In terms of price delay, for stocks exclusively shorted in the centralized the variation in stock returns captured by lagged market returns, implying a higher price delay in responding to market information is the lowest. Stocks exclusively shorted with foreign OTC borrowing have the most volatile and have the highest skewness and kurtosis values.

Next, we aim to determine whether the different lending channels have a different influence on price discovery or whether any particular channel is market destabilizing. Following Saffi and Sigurdsson (2010) in Table 8, we use pooled time-series cross-sectional regression of annual price efficiency measures to examine the relation between short sales through the alternative lending channels, and price inefficiency measures (while controlling for stock characteristics). The variables are measured using rolling windows at an annual frequency so we use annual averages of the control variables in the estimation.

Centralized shorts significantly reduce the cross-correlation between returns and lagged market returns, suggesting that more shorting flow is associated with fewer price delays.

Stocks borrowed in foreign over-the-counter agreements also have a lower cross-correlation. Nonetheless, stocks that are solely shorted through a foreign OTC agreement have a higher cross-correlation. The coexistence of the various lending channels significantly reduces the cross-correlation with 5.22% and lowers skewness. While the coefficient estimates on the three channel dummy is insignificant in the price delay and the kurtosis regression, we present weak evidence that the coexistence of alternative lending market promotes pricing efficiency by facilitating short selling from various groups of market participants.

D. Conclusion

In this study, we contribute to the ongoing regulatory debate on short selling by reviewing the role of alternative lending channels for short sellers on the Tokyo Stock Exchange (TSE) from 2006 to 2010. The TSE provides an excellent testing ground because traders can short by borrowing securities via an active centralized (CCP) or via the OTC markets for decades, attracting trades not only from Japan but globally. While partly the OTC market (i.e., the local OTC) is transparent to regulators as local brokerages and the Japanese Securities Co. provide information, the offshore OTC lending market is effectively unknown to regulators which may be a concern if rouge traders exploit this opaqueness in the market.

Using sorting demand in the alternative lending market, we examine the trading behavior of short sellers in the alternative market, and the market impact of those trades to address pricing efficiency implications. In general, we show that stocks with limited short selling (short selling only on one lending channel) are similar as they tend to be smaller stocks with lower turnover, high skewness and kurtosis. Consistent with Boehmer et al (2010), we find that short selling promotes pricing efficiency, as stocks, which are shorted via at least two channels, are more liquid and exhibit lower skewness and kurtosis. But the beneficial role of

short selling is mostly prevalent in stocks with short selling established in all three lending channels.

Short sellers from the three lending markets follow different trading strategies and focus on different stocks. More importantly, we find that the shorting volume from the centralized actively promoting liquidity rather than conveying new information. A 1% increase in short selling relative to shares outstanding significantly increases turnover, reducing illiquidity by 7%. The information provisional role of short selling is prevalent in the offshore (non-transparent) OTC market. In exploring the informational role of short sellers, we find that short sellers in the nontransparent lending market trade on private information and impound information revealed around analyst downgrades. Contrary to regulatory concern, we do not find evidence of price destabilization via OTC shorting on average.

Overall, the results from Japanese securities market from 2006 to 2009 suggest that the coexistence of the OTC and centralized (regulated) securities lending market is favorable in developing a liquid securities market with active institutional trading. The OTC markets by facilitating foreign and domestic institutional short selling allows price discovery as institutional convey new negative information to the market. The centralized lending market increases liquidity, and in combination with an OTC markets, improves price discovery and efficiency.

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Table 1**Summary Statistics of Tokyo Stock Exchange (TSE) First Session Stocks for July 2006 to December 2009.**

Logmcap is the natural logarithm of the firm's stock market capitalization in ¥. *Turnover (in %)* is the daily turnover in percentage and *Ret (in %)* is the weekly average raw returns in percentage. *MtoB* is the firm's stock market capitalization relative to the firm's book value of equity. *IO (in %)* and *Insider (in %)* are the relative number of shares owned by institutions and insiders, respectively. *Pricespread (in %)* is the daily price spread as the difference of the high price and low price relative to the daily high price. *Skewness* and *Kurtosis* are calculated using daily returns over a year interval (252 days). *Lendingfee* is the annualized lending fee in basis points. *Lendable (shares)* and the *Lendable (value)* are the number of shares available for borrowing relative to the total shares outstanding or to the monthly trading volume in percentage. *#Transaction* is the number of new borrowing transaction a day. *Utilization (%)* is the percentage of the supply currently on loan. *Central_DTCR*, *Local OTC_DTCR* and *OffshoreOTC_DTCR* (*Central_SIR*, *LocalOTC_SIR* and *OffshoreOTC_SIR* in %) are the number of shares shorted on the local centralized, on the local OTC and on the offshore OTC lending market relative to the daily trading volume (relative to the total shares outstanding), respectively.

Panel A. Summary statistics for stocks with lending activity explicitly on one market, on the centralized, Local OTC or on the Offshore OTC market.

Variable	Shorted Stocks (with lending only in the Centralized Market) (20209 obs)				Shorted Stocks (with lending only in the Local OTC Market) (4543 obs)				Shorted Stocks (with lending only in the Offshore OTC Market) (20051 Obs)			
	Mean	25th %	Median	75th %	Mean	25th %	Median	75th %	Mean	25th %	Median	75th %
Logmcap	16.32	15.75	16.25	16.81	16.82	16.11	16.76	17.51	16.44	15.74	16.33	17.01
Turnover (in %)	0.37%	0.06%	0.11%	0.24%	0.17%	0.04%	0.07%	0.16%	0.32%	0.06%	0.13%	0.29%
Ret (in %)	0.31%	-2.58%	0.00%	2.63%	-0.24%	-2.63%	-0.33%	1.86%	0.87%	-3.16%	-0.21%	2.47%
MtoB	0.93	0.54	0.75	1.04	1.45	0.84	1.12	1.57	1.39	0.59	0.85	1.26
IO (in %)	5.34%	1.78%	3.77%	6.68%	6.63%	2.01%	4.68%	8.40%	10.90%	1.79%	5.91%	15.10%
Insider (in %)	44.76%	33.81%	44.57%	55.09%	47.80%	39.08%	46.72%	58.44%	41.03%	29.69%	42.51%	54.25%
Pricespread (in %)	2.96%	1.48%	2.36%	3.70%	2.69%	1.35%	2.17%	3.41%	3.53%	1.64%	2.64%	4.32%
Skewness	0.18	-0.23	0.15	0.57	0.24	-0.14	0.18	0.61	0.31	-0.21	0.13	0.58
Kurtosis	5.76	2.31	4.02	7.07	5.36	2.36	3.75	6.42	6.93	2.20	3.62	6.59
Lendingfee (in bps)	159.73	29.00	78.87	237.50	175.95	57.52	141.44	265.32	204.90	50.00	175.00	307.20
Lendable (shares)	1.87%	0.44%	1.36%	2.60%	1.66%	0.42%	0.99%	2.06%	1.65%	0.30%	0.93%	2.22%
Lendable (value)	23.28	2.35	10.14	28.24	28.25	4.37	13.69	31.86	19.60	1.63	5.89	19.13
#Transactions	6.43	1.00	3.00	6.00	7.51	2.00	4.00	9.00	10.38	2.00	5.00	13.00
Utilization (in %)	8.08	0.00	0.00	2.01	8.18	0.00	1.02	6.54	13.86	0.00	1.07	13.65
Central_DTCR	2.30	0.60	1.20	2.55	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
OTC_DTCR	0.00	0.00	0.00	0.00	4.34	0.73	2.00	5.02	0.00	0.00	0.00	0.00
OffshoreOTC_DTCR	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.72	0.23	0.71	2.07
Central_SIR (in %)	0.44%	0.06%	0.12%	0.35%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
LocalOTC_SIR (in %)	0.00%	0.00%	0.00%	0.00%	0.24%	0.08%	0.28%	0.28%	0.00%	0.00%	0.00%	0.00%
Offshore OTC_SIR (in %)	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.38%	0.02%	0.10%	0.38%

Panel B. Summary statistics for stocks with some lending in two lending platforms : Centralized and one of the alternative OTC markets

Variable	Shorted Stocks (with lending only in the Central and Local OTC Market) (50,958 Obs)				Variable	Shorted Stocks (with lending only in the Central and Offshore OTC Market) (21,503Obs)			
	Mean	25th %	Median	75th %		Mean	25th %	Median	75th %
Logmcap	17.66	16.86	17.53	18.32	Logmcap	16.78	16.17	16.72	17.30
Turnover (in %)	0.57%	0.11%	0.22%	0.49%	Turnover (in %)	0.25%	0.07%	0.14%	0.28%
Ret (in %)	0.28%	-2.75%	0.00%	2.82%	Ret (in %)	-0.51%	-3.24%	-0.44%	2.18%
MtoB	1.37	0.77	1.08	1.61	MtoB	0.90	0.56	0.78	1.06
IO (in %)	9.25%	2.84%	6.90%	13.52%	IO (in %)	8.35%	3.09%	5.56%	10.89%
Insider (in %)	38.65%	27.50%	36.82%	49.83%	Insider (in %)	41.61%	31.36%	41.84%	52.09%
Pricespread (in %)	2.98%	1.64%	2.46%	3.67%	Pricespread (in %)	3.05%	1.61%	2.50%	3.85%
Skewness	0.17	-0.20	0.14	0.49	Skewness	0.10	-0.29	0.06	0.43
Kurtosis	4.40	1.63	2.88	5.15	Kurtosis	5.11	1.94	3.41	6.06
Fee (in basis points)	156.86	34.59	95.91	231.62	Fee (in basis points)	194.95	60.43	156.86	293.75
Lendable (shares)	3.07%	0.77%	2.18%	4.29%	Lendable (shares)	2.94%	1.16%	2.40%	3.88%
Lendable (value)	18.40	3.01	9.59	22.10	Lendable (value)	27.21	6.23	15.12	31.55
# Transactions	18.84	5.00	12.00	25.00	# Transactions	19.82	5.00	11.00	25.00
Utilisation (in %)	16.04	0.61	3.50	17.19	Utilisation (in %)	20.13	1.88	8.26	29.87
Central_DTCR	2.02	0.45	0.99	2.24	Central_DTCR	1.21	0.26	0.58	1.26
OTC_DTCR	1.45	0.16	0.52	1.48	OTC_DTCR	0.00	0.00	0.00	0.00
OffshoreOTC_DTCR	0.00	0.00	0.00	0.00	OffshoreOTC_DTCR	4.91	0.44	1.38	4.26
Central_SIR (in %)	0.61%	0.09%	0.21%	0.59%	Central_SIR (in %)	0.20%	0.04%	0.08%	0.20%
LocalOTC_SIR (in %)	0.21%	0.05%	0.30%	0.30%	LocalOTC_SIR (in %)	0.00%	0.00%	0.00%	0.00%
OffshoreOTC_SIR (in %)	0.00%	0.00%	0.00%	0.00%	OffshoreOTC_SIR (in %)	0.61%	0.06%	0.23%	0.65%

Panel C. Summary statistics for stocks with some lending in two or three lending platforms : Stocks with two OTC markets and stocks with three lending markets

Variable	Shorted Stocks (with lending only in the two OTC markets) (23,042 Obs)				Variable	Shorted Stocks (with lending in all three markets) (128,512 Obs)			
	Mean	25th %	Median	75th %		Mean	25th %	Median	75th %
Logmcap	17.57	16.78	17.55	18.28	Logmcap	18.79	17.71	18.67	19.77
Turnover (in %)	0.45%	0.10%	0.23%	0.48%	Turnover (in %)	0.53%	0.19%	0.36%	0.63%
Ret (in %)	3.64%	-3.58%	-0.38%	2.71%	Ret (in %)	-0.20%	-3.34%	-0.36%	2.61%
MtoB	2.23	0.91	1.41	2.44	MtoB	1.49	0.86	1.23	1.81
IO (in %)	13.16%	3.88%	10.43%	19.88%	IO (in %)	15.26%	7.46%	13.79%	21.11%
Insider (in %)	45.52%	33.74%	46.25%	58.03%	Insider (in %)	35.18%	23.16%	32.78%	46.22%
Pricespread (in %)	3.49%	1.87%	2.85%	4.35%	Pricespread (in %)	3.13%	1.81%	2.61%	3.83%
Skewness	0.22	-0.16	0.17	0.53	Skewness	0.04	-0.24	0.04	0.32
Kurtosis	4.73	1.66	2.89	5.06	Kurtosis	3.54	1.25	2.29	3.99
Lendingfee (in bps)	220.10	61.10	188.77	337.27	Lendingfee (in bps)	115.69	23.13	50.00	157.76
Lendable (shares)	3.37%	0.85%	2.37%	4.68%	Lendable (shares)	6.02%	2.79%	5.19%	8.34%
Lendable (value)	19.86	3.82	10.29	22.80	Lendable (value)	19.74	7.44	14.16	24.83
#Transactions	56.08	11.00	29.00	64.00	#Transactions	93.49	26.00	54.00	106.00
Utilisation (in %)	31.85	6.34	23.33	52.41	Utilisation (in %)	25.44	6.16	16.82	38.51
Central_DTCR	0.00	0.00	0.00	0.00	Central_DTCR	0.88	0.19	0.42	0.96
LocalOTC_DTCR	1.28	0.11	0.40	1.10	LocalOTC_DTCR	0.79	0.10	0.30	0.82
OffshoreOTC_DTCR	4.95	0.90	2.44	5.58	OffshoreOTC_DTCR	4.01	0.66	1.81	4.49
Central_SIR (in %)	0.00%	0.00%	0.00%	0.00%	Central_SIR (in %)	0.29%	0.07%	0.15%	0.32%
LocalOTC_SIR (in %)	0.18%	0.03%	0.23%	0.23%	LocalOTC_SIR (in %)	0.19%	0.04%	0.26%	0.26%
OffshoreOTC_SIR (in %)	1.23%	0.17%	0.61%	1.40%	OffshoreOTC_SIR (in %)	1.25%	0.23%	0.66%	1.59%

Table 2. Short Sale Demand Determinants from the Alternative Channels (SUR Regression)

Seemingly unrelated regression (SUR) analysis results for explaining of the shorting demand from the alternative lending markets. The dependent variables are the total number of shorted shares outstanding in the centralized, local and the offshore OTC lending markets relative to the daily trading volumes, in columns 1-2, 3-4, and 5-6 respectively. *Logmcap* is the natural logarithm of the market capitalization. *MtoB* is the firm market capitalization relative to the book value of equity. *Lagpricespread* is the average price spread over the previous week (with a one week skipping) where the price spread is the difference of the daily high price and the low price relative to the daily high price. *Zeroretweek* is the number of trading days within a week with zero returns. *IO* (in %) and *Insider* (in %) are the relative number of shares owned by institutions and insiders, respectively. *D_Winner* and *D_Loser* are dummy variables that take on the value one if the stock is in the top or bottom decile based on its lagged return. *LagCentral_shorts*, and *LagLocalOTC_shorts* are the end of the week outstanding short positions relative to the corresponding trading volume from the centralized and the OTC markets as reported by Nikkei. *LagOffshoreOTC_shorts* is the total shares on loan from Data Explorers in excess of the shorting volume from Nikkei (that is the locally unobservable short selling). *Lendable* is the total number of shares available for borrowing while the *Laglendingfee* is the average lending fee during the previous week as reported by Data Explorer. The sample period is from July 2006 to December 2009. The coefficient estimates are displayed with the z-stats in parentheses, from a regression analysis including time fixed effects and clustering of the standard errors at the stock level.

	Centralized Shorts		Local OTC Shorts		Offshore OTC Shorts	
	(1)	(2)	(3)	(4)	(5)	(6)
	DTCR	DTCR	DTCR	DTCR	DTCR	DTCR
Logmcap	-0.252*** (-10.03)	-0.092*** (-7.28)	-0.014 (-0.63)	-0.012 (-1.47)	-0.494*** (-4.09)	-0.349*** (-4.77)
MtoB	0.052 (1.39)	0.017 (1.24)	0.007 (0.52)	0.003 (0.58)	0.046 (1.12)	0.030 (1.38)
Lagpricespread	-1.658** (-2.29)	-0.395 (-1.15)	-7.009*** (-8.33)	-2.444*** (-6.27)	-13.089*** (-5.80)	-6.631*** (-4.98)
Zeroretweek	0.182*** (6.14)	0.117*** (7.65)	0.095*** (5.28)	0.062*** (7.45)	0.384*** (5.26)	0.226*** (6.63)
IO (in %)	0.130 (0.52)	0.141 (1.48)	1.416*** (5.45)	0.550*** (5.54)	5.689*** (6.65)	3.107*** (6.69)
Insider (in %)	-2.370*** (-6.86)	-0.855*** (-5.57)	0.174 (0.52)	0.008 (0.06)	3.002 (1.44)	0.250 (0.23)
D_Winner	-0.037* (-1.80)	0.145*** (9.26)	-0.255*** (-12.06)	-0.016 (-1.04)	-0.470*** (-6.93)	0.132** (2.03)
D_Loser	-0.112*** (-4.67)	0.045*** (2.85)	-0.227*** (-10.19)	-0.025** (-2.02)	-0.359*** (-3.98)	-0.004 (-0.06)
LagCentral_shorts		0.627*** (29.09)		-0.034*** (-5.73)		-0.029 (-0.89)
LagLocalOTC_shorts		-0.036*** (-6.86)		0.636*** (30.22)		-0.006 (-0.25)
LagOffshoreOTC_shorts		-0.005** (-2.36)		-0.006*** (-3.60)		0.508*** (15.55)
Lendable (shares)			-2.548*** (-4.30)	-0.783*** (-3.22)	44.912*** (4.86)	31.012*** (5.20)
Laglendingfee			0.004 (1.59)	0.002* (1.93)	0.067** (2.51)	0.035** (2.45)
Constant	6.141*** (12.00)	1.474*** (5.32)	1.363*** (3.27)	-0.038 (-0.22)	9.203*** (4.32)	4.697*** (3.31)
Observations	260,723	260,723	260,723	260,723	260,723	260,723
R-squared	0.07	0.43	0.04	0.43	0.05	0.30

Table 3. Stock Return and Short Sale Demand Relationship from Alternative Lending Channels

The dependent variables are the next week, two week, or four week cumulative returns. *LagCentral_shorts*, *LagLocalOTC_shorts* are the end of the week outstanding short positions relative to the corresponding trading volume from the centralized and the local OTC markets as reported by Nikkei. *LagOffshoreOTC_DTCR* is the total shares on loan from Data Explorers in excess of the shorting volume from Nikkei (that is the locally unobservable short selling). *High_Central_shorts*, *High_LocalOTC_shorts*, and *High_OffshoreOTC_shorts* are dummy variables that take on the value one if the stock is in the highest decile based on shorting in the corresponding lending market. *Logmcap* is the natural logarithm of the market capitalization. *MtoB* is the firm market capitalization relative to the book value of equity. *Lagpricespread* is the average price spread over the previous week (with a one week skipping) where the price spread is the difference of the daily high price and the low price relative to the daily high price. *Zeroretweek* is the number of trading days within a week with zero returns. *IO* (in %) and *Insider* (in %) are the relative number of shares owned by institutions and insiders, respectively. *D_Winner* and *D_Loser* are dummy variables that take on the value one if the stock is in the top or bottom decile based on its lagged return (during the previous 5 days). *Laglendingfee* is the average lending fee during the previous week as reported by Data Explorer. The sample period is from July 2006 to December 2009. The coefficient estimates are displayed with the z-stats in parentheses, from a regression analysis including time fixed effects and clustering of the standard errors at the stock level. The coefficient estimates are estimated using Fama-Macbeth analysis with Newey West (lag 6) std errors.

	Ret _{t+1} (1)	Ret _{t+1} (2)	Ret _{t+2} (3)	Ret _{t+2} (4)	Ret _{t+4} (5)	Ret _{t+4} (6)
LagCentral_shorts	-0.003* (-1.70)		-0.004 (-1.57)		-0.006 (-1.56)	
LagLocalOTC_shorts	-0.002 (-1.43)		-0.004 (-1.31)		-0.005 (-1.36)	
LagOffshoreOTC_shorts	-0.001** (-2.09)		-0.001* (-1.83)		-0.002* (-1.80)	
High_Central_shorts		-0.027* (-1.70)		-0.042 (-1.57)		-0.057 (-1.56)
High_LocalOTC_shorts		-0.019 (-1.43)		-0.037 (-1.31)		-0.053 (-1.36)
High_OffshoreOTC_shorts		-0.008** (-2.09)		-0.013* (-1.83)		-0.017* (-1.80)
Logmcap	-0.003 (-0.84)	-0.003 (-0.84)	-0.003 (-0.80)	-0.003 (-0.80)	-0.003 (-0.97)	-0.003 (-0.97)
MtoB	0.015 (1.26)	0.015 (1.26)	0.015 (1.31)	0.015 (1.31)	0.016 (1.41)	0.016 (1.41)
ZeroretWeek	-0.007 (-0.83)	-0.0071 (-0.83)	-0.011 (-1.04)	-0.011 (-1.04)	-0.013 (-1.05)	-0.013 (-1.05)
Pricespread	0.411* (1.67)	0.411* (1.67)	0.425* (1.71)	0.425* (1.71)	0.350 (1.23)	0.350 (1.23)
IO (in %)	0.023 (0.39)	0.023 (0.39)	0.023 (0.32)	0.023 (0.32)	0.043 (0.47)	0.043 (0.47)
Insider (in %)	0.067** (2.01)	0.067** (2.01)	0.085* (1.95)	0.085* (1.95)	0.117** (2.03)	0.117** (2.03)
D_Winner	-0.011** (-1.98)	-0.011** (-1.98)	-0.005 (-0.55)	-0.005 (-0.55)	0.001 (0.05)	0.001 (0.05)
D_Loser	0.037 (1.30)	0.037 (1.30)	0.036 (1.29)	0.036 (1.29)	0.031 (1.16)	0.031 (1.16)
Laglendingfee (shares)	0.000 (0.23)	0.000 (0.23)	0.001 (0.46)	0.001 (0.46)	0.001 (0.55)	0.001 (0.55)
Constant	0.019 (0.38)	0.019 (0.38)	0.016 (0.28)	0.016 (0.28)	0.022 (0.36)	0.022 (0.36)
Observations	264,426	264,426	264,425	264,425	264,424	264,424
R-squared	0.08	0.08	0.07	0.07	0.07	0.07

Table 4. Information Concentration

The dependent variables are the next week, two week, or four week cumulative returns. *HighTransparent* and *HighOffshore* dummyvariables take on the value one if the stock is highly shorted in terms of combined shorting volume from the centralized and local OTC versus the Offshore OTC market. In panel A, the dummy cutoffs are the top two deciles, while in panel B, the dummy cutoffs are the top decile. The *LowTransparent* and *LowOffshore* are defined similarly. *Logmcap* is the natural logarithm of the market capitalization. *MtoB* is the firm market capitalization relative to the book value of equity. *Lagpricespread* is the average price spread over the previous week (with a one week skipping) where the price spread is the difference of the daily high price and the low price relative to the daily high price. *Zeroretweek* is the number of trading days within a week with zero returns. *D_Winner* and *D_Loser* are dummy variables that take on the value one if the stock is in the top or bottom decile based on its lagged return (during the previous 5 days). *Laglendingfee* is the average lending fee during the previous week as reported by Data Explorer. The sample period is from July 2006 to December 2009. The coefficient estimates are displayed with the z-stats in parentheses, from a regression analysis including time fixed effects and clustering of the standard errors at the stock level. The coefficient estimates are estimated using Fama-Macbeth analysis with Newey West (lag 6) std errors.

	High >=8 & Low<3				High=9 & Low=1			
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
	Ret _{t+1}	Ret _{t+1}	Ret _{t+2}	Ret _{t+4}	Ret _{t+1}	Ret _{t+1}	Ret _{t+2}	Ret _{t+4}
Hightransparent	-0.010 (-1.48)	-0.001 (-0.45)	-0.001 (-0.255)	-0.003 (-1.16)	-0.009 (-1.14)	-0.009 (-0.98)	-0.012 (-1.04)	-0.017 (-1.13)
Lowtransparent	0.054 (1.60)	0.019 (1.16)	0.021 (1.17)	0.030 (1.44)	0.045 (1.41)	0.048 (1.41)	0.050 (1.40)	0.068* (1.67)
Doffhosrelo	0.034 (1.56)	0.018 (1.32)	0.025 (1.26)	0.034 (1.24)	0.001** (2.01)	0.001** (2.04)	0.001* (1.81)	0.001* (1.84)
Doffhosrehigh	-0.002 (-0.33)	-0.006** (-2.08)	-0.007** (-2.23)	-0.020*** (-2.6)	-0.016** (-2.15)	-0.015** (-2.06)	-0.018** (-2.11)	-0.023** (-2.16)
Highoffshore*Hightransparent		0.001 (0.29)	-0.000 (-0.09)	-0.000 (-0.01)		0.005 (0.68)	0.007 (0.79)	0.011 (0.94)
Lowoffshore*Hightransparent		-0.018 (-1.33)	-0.03 (-1.27)	-0.034 (-1.20)		-0.002 (-1.63)	-0.001 (-1.09)	-0.001 (-1.39)
Lowoffshore*Lowtransparent		0.136 (1.02)	0.124 (0.95)	0.09 (0.77)		0 ()	0 ()	0 ()
Highoffshore*Lowtransparent		-0.014 (-0.74)	-0.016 (-0.79)	-0.023 (-0.99)		-0.037 (-1.27)	-0.037 (-1.20)	-0.056 (-1.49)
Logmcap	-0.000 (-0.05)	-0.002 (-0.70)	-0.002 (-0.61)	-0.003 (-0.69)	-0.001 (-0.40)	-0.001 (-0.41)	-0.001 (-0.43)	-0.001 (-0.48)
Firm controls	YES	YES	YES	YES	YES	YES	YES	YES
Observations	264,426	264,426	264,425	264,424	264,426	264,426	264,425	264,424
R-squared	0.076	0.079	0.072	0.068	0.073	0.074	0.067	0.063
Number of groups	172	172	172	172	172	172	172	172

Table 5. Source of the Information Advantage of Short Sellers

High_Central_shorts, *High_LocalOTC_shorts*, and *High_OffshoreOTC_shorts* are dummy variables that take on the value one if the stock is in the highest decile based on shorting in the corresponding lending market (in the centralized, local OTC and the Offshore OTC market). *Logmcap* is the natural logarithm of the market capitalization, is the firm market capitalization relative to the book value of equity. *Lagpricespread* is the average price spread over the previous week (with a one week skipping) where the price spread is the difference of the daily high price and the low price relative to the daily high price. *Zeroretweek* is the number of trading days within a week with zero returns. *IO* (in %) and *Insider* (in %) are the relative number of shares owned by institutions and insiders, respectively. *D_Winner* and *D_Loser* are dummy variables that take on the value one if the stock is in the top or bottom decile based on its lagged return (during the previous 5 days). *Laglendingfee* is the average lending fee during the previous week as reported by Data Explorer. The sample period is from July 2006 to December 2009. The coefficient estimates are displayed with the z-stats in parentheses, from a regression analysis including time fixed effects and clustering of the standard errors at the stock level. The coefficient estimates are estimated using Fama-Macbeth analysis with Newey West (lag 6) std errors.

	(1)	(2)	(3)	(4)
	Ret _{t+1}	Ret _{t+1}	Ret _{t+2}	Ret _{t+4}
High_Central_shorts	-0.022*	-0.027*	-0.042	-0.057
	(-1.95)	(-1.70)	(-1.57)	(-1.56)
High_LocalOTC_shorts	-0.014	-0.019	-0.037	-0.053
	(-1.55)	(-1.43)	(-1.31)	(-1.36)
High_OffshoreOTC_shorts	-0.007*	-0.008**	-0.013*	-0.017*
	(-1.97)	(-2.09)	(-1.83)	(-1.80)
Analyst Downgrade	-0.010**	-0.005	-0.012***	-0.012***
	(-2.25)	(-1.50)	(-3.00)	(-2.63)
High_Central_shorts *Analyst Downgrade		0.001	0.001	0.002
		(0.77)	(1.47)	(1.18)
High_LocalOTC_shorts*Analyst Downgrade		-0.001	-0.001	-0.001
		(-1.00)	(-1.14)	(-1.15)
High_OffshoreOTC_shorts*Analyst Downgrade		-0.006**	-0.002	-0.007
		(-1.99)	(-0.61)	(-1.35)
Logmcap		-0.003	-0.003	-0.004
		(-0.84)	(-0.80)	(-0.97)
MtoB		0.015	0.015	0.016
		(1.26)	(1.31)	(1.41)
Lagpricespread		0.412*	0.426*	0.350
		(1.68)	(1.72)	(1.23)
Zeroretweek		-0.007	-0.011	-0.013
		(-0.83)	(-1.04)	(-1.05)
IO (in %)		0.023	0.023	0.044
		(0.39)	(0.32)	(0.47)
Insider (in %)		0.067**	0.085*	0.117**
		(2.01)	(1.95)	(2.03)
D_Winner		-0.011**	-0.005	0.001
		(-1.98)	(-0.55)	(0.05)
D_Loser		0.037	0.036	0.031
		(1.30)	(1.29)	(1.16)
Laglendingfee		0.000	0.001	0.001
		(0.23)	(0.46)	(0.55)
Constant	0.011	0.019	0.016	0.022
	(1.17)	(0.38)	(0.28)	(0.36)
Observations	264426	264426	264425	264424
R-squared	0.01	0.08	0.07	0.07
Number of groups	172	172	172	172

Table 6. Liquidity Provision (monthly)

The table shows the influence of the various lending market shorts on liquidity measured as the natural logarithm of the one plus Amihud illiquidity (Amihud, 2002) times a million (following Karolyi et al, 2012), the number of zero return days within a week and turnover. *LagCentral_shorts*, *LagLocalOTC_shorts* are the end of the week outstanding short positions from the centralized and the local OTC markets as reported by Nikkei relative to the total number of shares outstanding. *LagOffshoreOTC_shorts* is the total shares on loan from Data Explorers in excess of the shorting volume from Nikkei (that is the locally unobservable short selling). In the first specification we include period fixed effects and subsequently also stock fixed effects. The dummy variable *Threechannels* takes on the value one if there is shorting activity for the specific stocks in all three lending markets. *Offshore_only* takes on the value one if the stocks is shorted only on the Offshore OTC market. *Logmcap* is the natural logarithm of the market capitalization *Zeroretweek* is the number of trading days within a week with zero returns. *IO* (in %) and *Insider* (in %) are the relative number of shares owned by institutions and insiders, respectively. *Pricespread* is the daily intraday volatility measured as the difference of the daily high and low price relative to the daily high price. The sample period is from July 2006 to December 2009.

	(1)	(2)	(3)	(4)	(5)	(6)
	ln(1+amihud)	ln(1+amihud)	ln(1+zeroretweek)	ln(1+zeroretweek)	turnover	turnover
LagCentral_shorts	-14.526*** (-5.21)	-14.132*** (-5.26)	-2.027*** (-7.32)	-1.983*** (-7.26)	0.5176*** (10.43)	0.518*** (10.39)
LagLocal_shorts	-21.890*** (-2.68)	-21.485** (-2.35)	-0.761 (-0.81)	-0.390 (-0.42)	-0.157** (-1.97)	-0.151* (-1.83)
LagOffshore_shorts	0.0310 (0.03)	0.029 (0.03)	0.148 (1.23)	0.144 (1.22)	0.007 (0.64)	0.007 (0.63)
Threechannels		-0.227*** (-6.67)		-0.012*** (-3.34)		-0.000 (-1.04)
Offshore_only		-0.931 (-0.95)		0.011 (1.55)		0.000 (0.87)
Logmcap	-0.888*** (-10.34)	-0.911*** (-9.36)	-0.069*** (-10.17)	-0.068*** (-10.10)	0.001** (2.36)	0.001** (2.39)
MtoB	0.017 (0.52)	0.023 (0.73)	0.003 (1.29)	0.003 (1.25)	0.000*** (4.49)	0.000*** (4.42)
Lagpricespread	-0.165 (-0.09)	-0.115 (-0.07)	-0.564*** (-11.07)	-0.563*** (-11.12)	0.052*** (10.63)	0.052*** (10.64)
IO (in %)	2.211*** (3.94)	2.136*** (3.82)	-0.018 (-0.52)	-0.016 (-0.49)	-0.004 (-1.60)	-0.004 (-1.59)
Insiders (in %)	1.797*** (4.25)	1.898*** (4.15)	0.018 (0.47)	0.0187 (0.49)	-0.006*** (-3.49)	-0.006*** (-3.47)
Constant	15.689*** (10.63)	16.271*** (9.46)	2.062*** (17.16)	2.045*** (17.22)	-0.019** (-1.97)	-0.019** (-2.00)
Observations	213792	213792	264427	264427	264427	264427
R-squared	0.04	0.04	0.45	0.45	0.23	0.23

Table 7. Summaries of Annual Pricing Efficiency Measures by Lending Channels

This table reports annual mean price efficiency measures for the sample period July 2006 to December 2009. *Crosscorrelation* is the cross-autocorrelations between individual stock returns and market returns (Nikkei) lagged by one week, separately for negative lagged market returns and then compute the mean values of these groups of stock level statistics for stocks shorted exclusively in the shadow, OTC and Centralized market. We also compute the mean values for the groups of stocks that are highly shorted (top Decile) in one of these markets versus the rest of the deciles. *Price Delay* is measured as in Hou and Moskowitz (2005). The delay measure is based on the regression of weekly stock returns on the contemporaneous returns of a world index, and the local index (Nikkei) and four lags of the local index. We then estimate this equation after imposing the constraint that coefficients of lagged local returns are zero. The larger this measure, the greater is the variation in stock returns captured by lagged market returns, implying a higher price delay in responding to market information. This measure captures the magnitude of the lagged coefficients relative to the magnitude of all market return coefficients. We use the absolute values of each coefficient regardless of their estimated signs, because price efficiency is smaller as these measures deviate from zero. Finally, we compute how much of the cross-sectional variation in returns is explained by the market return. More precisely, we calculate a “downside Rsq” and upside Rsq for each stock using negative and positive observations on market returns, respectively. The standard deviation (*Stdev*), *Skewness* and *Kurtosis* are calculated using daily returns over a year interval (252 days). *Zero return weeks* is the frequency of zero weekly returns within a year.

Price Discovery measures	Cross correlation	Price delay	Rsq UP	Rsq Down	Stdev	Skeness	Kurtosis	#Zeroretweeks	Illiquidity
Stocks exclusively shorted in the Centralized Market	1.92%	41.78%	15.19%	24.84%	5.88%	0.18	5.76	0.57	55.99
Stocks exclusively shorted in the Domestic OTC Market	0.76%	43.02%	14.93%	21.69%	7.25%	0.24	5.36	0.49	31.98
Stocks exclusively shorted in the Offshore OTC Market	5.40%	45.96%	12.48%	20.41%	19.98%	0.31	6.93	0.57	316.75
Stocks shorted in 2 channels: the centralized and Local OTC market	-0.05%	39.63%	17.43%	25.17%	5.76%	0.17	4.40	0.47	17.65
Stocks shorted in 2 channels the centralized and Offshore OTC market	1.35%	41.99%	15.92%	22.74%	5.75%	0.10	5.11	0.51	24.52
Stocks shorted in 2 channels the Domestic and Off shore OTC market	1.46%	44.04%	13.04%	18.76%	14.97%	0.22	4.73	0.41	68.27
Stocks shorted in all three channels	0.13%	39.56%	18.49%	24.72%	6.82%	0.04	3.54	0.39	5.53

Table 8. Annual pricing efficiency measures and short selling

The table examines the relation between short sales through the alternative lending channels, price inefficiency measures and characteristics of the stock return distribution. This table reports annual pooled time-series cross sectional regression results from July 2006 to December 2009. The dependent variables are: *Incross* is the cross-correlation between the stocks returns and lagged Nikkei index returns, Price Delay measure as in Hou and Moskowitz (2005), the standard deviation (*Stdev*), skewness (*Skew*) and kurtosis (*Kurt*) are calculated using daily returns over a year interval (252 days). *IO* (in %) and *Insider* (in %) are the relative number of shares owned by institutions and insiders, respectively. *Central_shorts*, *LocalOTC_shorts* and *Offshore_shorts* are the corresponding week outstanding short positions relative to the corresponding trading volume from the centralized, local over-the-counter market (OTC) as reported by Nikkei and by the residual OTC (Offshore) market as captured by Data Explorers. *OffshoreOTC_only* is an indicator variable that equals one if the stocks are solely shorted in the Offshore OTC market. *Three channel* is an indicator variable that equals one if the stock is shorted on the three channels. *Fee* is yearly average loan fee in basis points. *Zeroretweek* is the relative frequency of zero weekly returns within a year. *IO* is the institutional ownership variable and *Insider* is the fraction of shares held by insiders. The coefficient estimates are displayed with the t-stats in parentheses, from a regression analysis including firm and time fixed effects and clustering of the standard errors at the firm level.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	CrossCorrelation	CrossCorrelation	PriceDelay	PriceDelay	Stdev	Stdev	Skewness	Skewness	Kurtosis	Kurtosis
Central_shorts	-0.0079* (-1.90)	-0.0072* (-1.75)	-0.0013 (-0.78)	-0.0012 (-0.73)	-0.0001 (-0.47)	-0.0001 (-0.48)	0.0028 (0.12)	0.0046 (0.19)	-0.0912 (-0.54)	-0.0939 (-0.55)
LocalOTC_shorts	0.0029 (0.59)	0.0051 (1.04)	-0.0022 (-1.47)	-0.0020 (-1.29)	-0.0006*** (-2.89)	-0.0006*** (-2.87)	-0.0065 (-0.43)	-0.0010 (-0.07)	-0.1469* (-1.66)	-0.1532* (-1.75)
OffhsoreOTC_shorts	-0.0026** (-2.08)	-0.0028** (-2.21)	0.0007 (1.55)	0.0007 (1.50)	-0.0002** (-2.32)	-0.0002** (-2.32)	0.0033 (0.69)	0.0029 (0.61)	-0.0325 (-0.83)	-0.0320 (-0.81)
Lendable Supply	0.1822 (0.57)	0.1871 (0.59)	-0.1313 (-1.37)	-0.1318 (-1.38)	-0.0006 (-0.03)	-0.0006 (-0.04)	-0.2211 (-0.20)	-0.1962 (-0.18)	13.4705 (1.14)	13.5522 (1.14)
OffshoreOTC_only		0.0795*** (2.70)		0.0157 (1.40)		-0.0000 (-0.04)		0.1146 (1.12)		-0.8669 (-1.24)
AllthreeChannel		-0.0522*** (-3.19)		-0.0038 (-0.69)		0.0001 (0.22)		-0.1556*** (-2.74)		-0.0301 (-0.08)
Lending fee	0.0081** (2.35)	0.0081** (2.36)	0.0017* (1.91)	0.0017* (1.95)	0.0005*** (3.67)	0.0005*** (3.66)	0.0105 (0.91)	0.0101 (0.89)	-0.0130 (-0.18)	-0.0160 (-0.22)
Logmcap	-0.1487*** (-9.41)	-0.1441*** (-9.15)	0.0120** (2.37)	0.0125** (2.48)	-0.0033*** (-3.59)	-0.0033*** (-3.58)	0.2794*** (5.19)	0.2908*** (5.42)	-0.7792 (-1.55)	-0.7950 (-1.58)
Zeroretweeks	0.0032 (0.98)	0.0022 (0.67)	0.0006 (0.51)	0.0005 (0.44)	-0.0002 (-0.80)	-0.0002 (-0.79)	-0.0016 (-0.12)	-0.0045 (-0.32)	-0.1807 (-1.48)	-0.1797 (-1.48)
IO (in %)	-0.0993 (-0.78)	-0.0871 (-0.68)	-0.0666 (-1.55)	-0.0641 (-1.49)	0.0065 (1.19)	0.0065 (1.20)	-0.7335** (-2.07)	-0.7172** (-2.02)	6.0003** (2.23)	5.8579** (2.18)
Insider (in %)	0.1049 (0.81)	0.1112 (0.87)	0.0274 (0.68)	0.0269 (0.67)	-0.0030 (-0.75)	-0.0030 (-0.75)	0.1379 (0.29)	0.1682 (0.35)	-4.2979 (-1.19)	-4.2069 (-1.15)
LagMonthRet	-0.0003 (-0.02)	-0.0007 (-0.05)	0.0142** (2.06)	0.0141** (2.05)	0.0110 (0.54)	0.0110 (0.54)	-0.8024 (-1.34)	-0.8032 (-1.34)	-12.3346*** (-3.50)	-12.3320*** (-3.50)
Amihud	-0.4078 (-1.30)	-0.3935 (-1.26)	-0.0014 (-0.01)	0.0010 (0.00)	0.1451 (1.35)	0.1451 (1.35)	-10.127* (-1.79)	-10.101* (-1.78)	-49.2976 (-1.40)	-49.4186 (-1.40)
Constant	2.635*** (9.55)	2.574*** (9.37)	0.214** (2.43)	0.205** (2.33)	0.085*** (5.60)	0.085*** (5.59)	-4.60*** (-4.97)	-4.735*** (-5.12)	18.7144** (2.21)	19.0762** (2.25)
Stock Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Period Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	4831	4831	4831	4831	4831	4831	4831	4831	4831	4831
R-squared	0.21	0.22	0.07	0.07	0.36	0.36	0.10	0.10	0.14	0.14

Appendix
Summary statistics of analyst recommendation for TSE stocks for 2006 to 2010

Panel A.

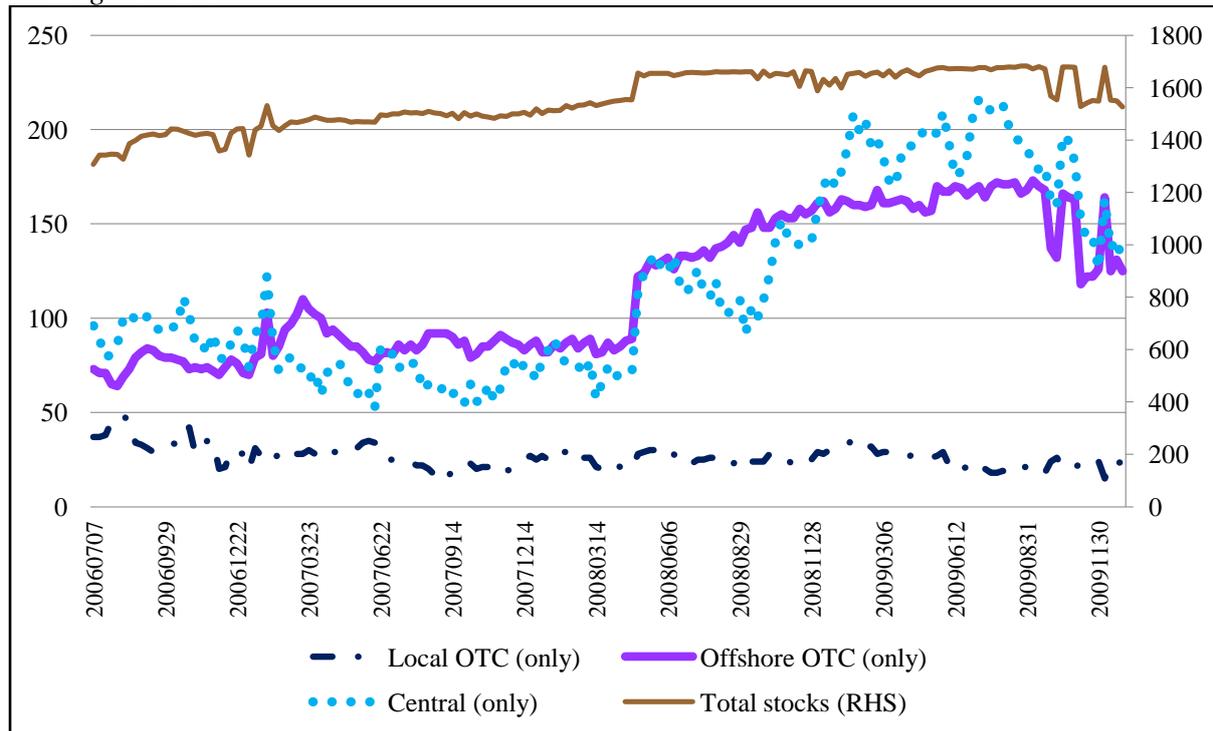
Year	Stocks with analyst coverage	Mean recommendation	Median recommendation	Stocks with rec. change	Mean rec. change	Median rec. change
2006	1104	1.704	1.750	756	0.003	0.010
2007	1270	1.675	1.670	861	0.003	-0.010
2008	1525	1.713	1.750	1041	0.015	0.020
2009	1639	1.744	1.790	1047	-0.009	-0.020
Average	1454.2		Average	935	0.002	-0.002

Panel B.

Year	Stocks with valid target price	Mean target price	Median target price	Stocks with target price change	Mean target price change	Median target price change*
2006	1104	39544	2310	573	-65.734	7.825
2007	1270	53935	2453	772	-70.710	1.000
2008	1525	46140	1800	809	-1502.520	-30.000
2009	1639	30257	1165	850	-72.773	4.000
2010	1733	29111	1350	902	-68.458	0.081
Average	1454.2		Average	781.2	-356.039	-3.419

* The Mean and Median Recommendation change is calculated only for those stocks that had a change in recommendation. Similarly, the mean and median change in target price is calculated based on only those stocks that had a change in the target price.

Panel A. Number of Tokyo Stock Exchange stocks with only one specific active alternative lending markets



Panel B. Number of Tokyo Stock Exchange stocks with multiple active alternative lending markets

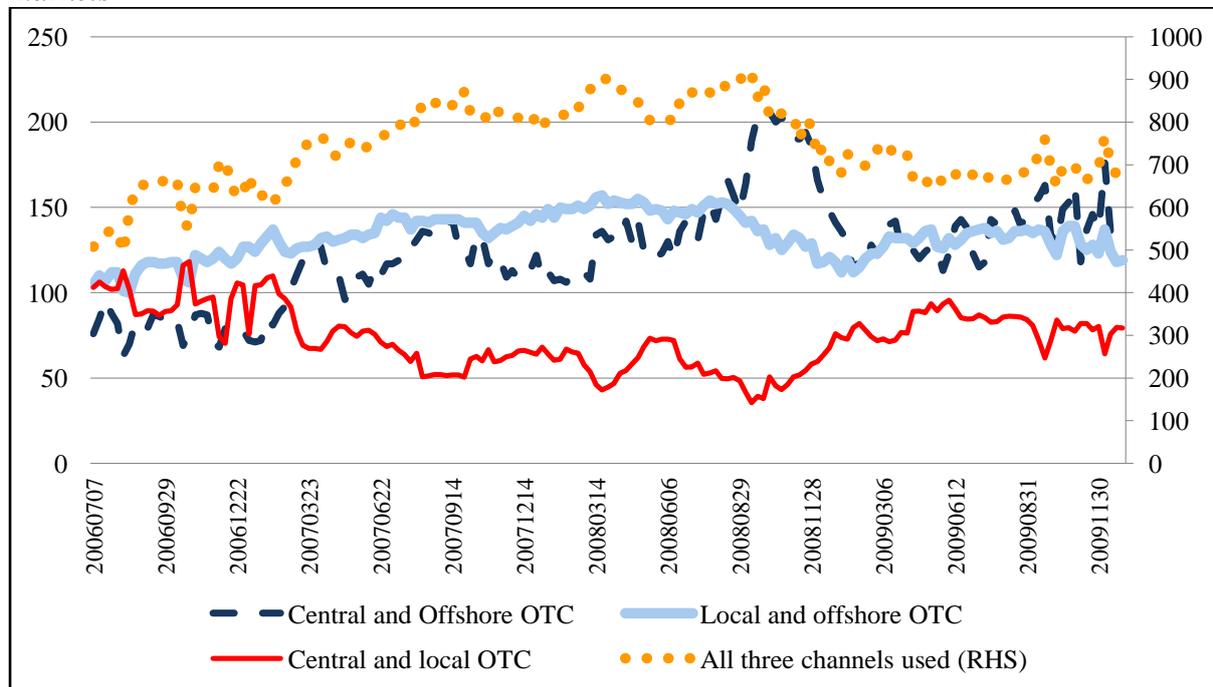
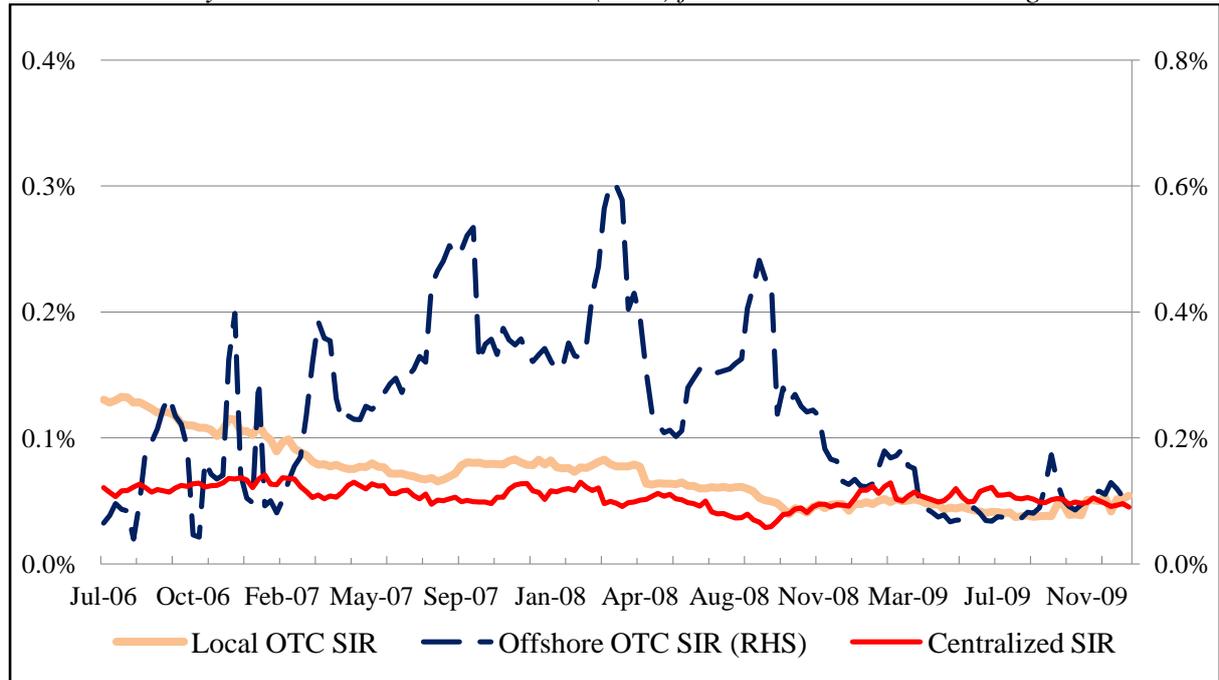


Figure 1. Time series of short selling market coverage by Nikkei weekly information (including local centralized and over-the-counter information)

Panel B. Weekly median short interest ratios (SIRs) from the alternative lending markets



Panel A. Weekly median outstanding shorts scaled by trading volume from the alternative lending markets

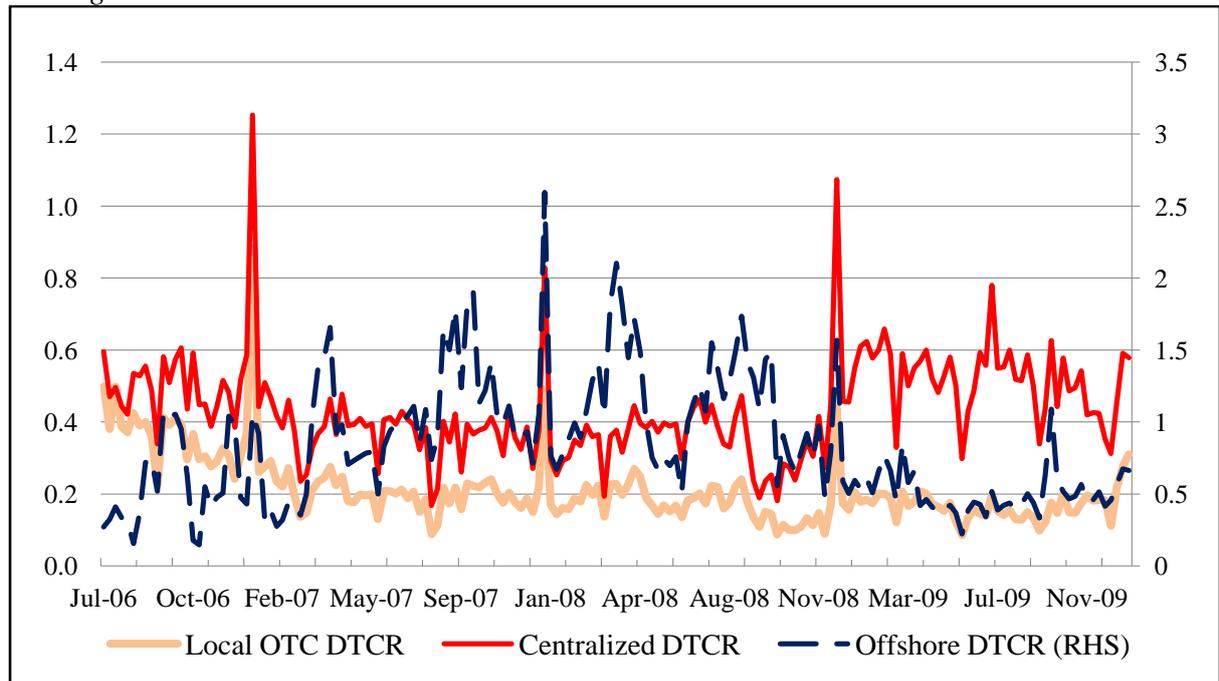


Figure 2.
Time series of lending (shorting) activity from the three alternative lending markets
 Panel A and Panel B shows the time series of the average of total short positions outstanding, scaled by the total number of shares outstanding or scaled by the daily trading volume, respectively.

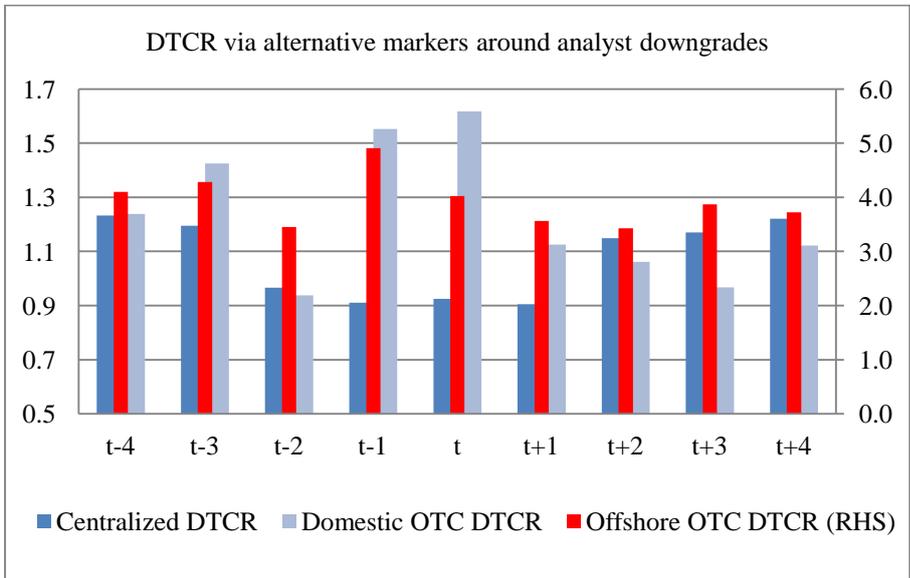
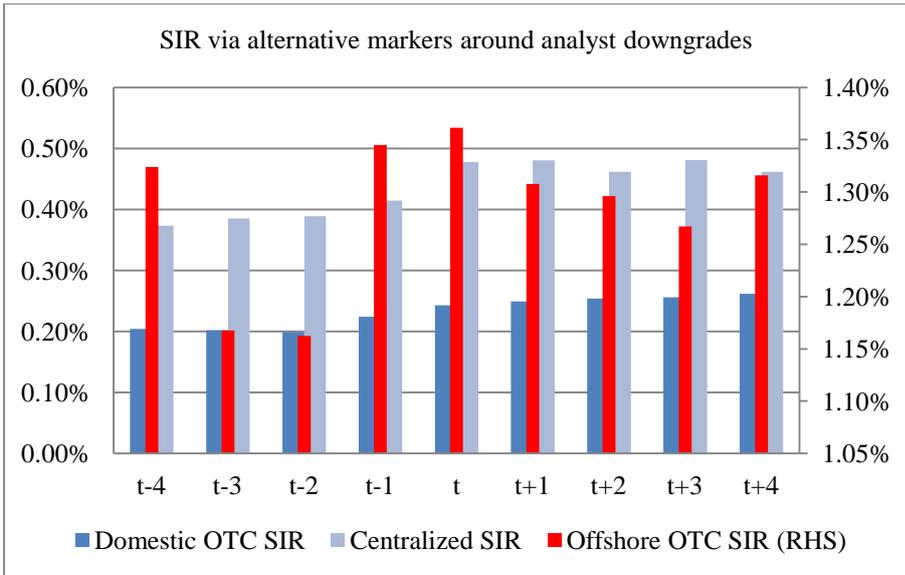


Figure 3. Shorting demand relative to shares outstanding and relative to trading volume around analyst downgrades from the three alternative lending markets