

# The effects of short-selling public disclosure regimes on equity markets

A comparative analysis of US and European markets

The attached report (the “Report”) reflects the results of the project regarding short-selling (the “Survey”) which was conducted by Oliver Wyman, Inc. (“Oliver Wyman”) at the request of its client, Managed Funds Association (“MFA”). The following terms govern the preparation, use and distribution of the Report. Any distribution or reproduction of all or any portion of the Report shall include the following terms (without modification).

#### **Preparation of Report Results**

The data for the Survey were collected by Oliver Wyman from certain data providers (the “Data Sources”). The data was then aggregated and analyzed by Oliver Wyman. The results of Oliver Wyman’s analysis are set forth in the Report.

#### **Use of Report Results**

The Report contains “blind information” presented in a manner such that a reasonable person could not attribute the information, finding, data point or observation to any particular Data Source. With respect to such blind information, recipients of the Report should not attempt, by correlation of data or otherwise, to ascertain the identity of any Data Source. If such identification is inadvertently made, it must be kept confidential and not used for any purpose whatsoever.

The Report may not be used for marketing purposes or for purposes of pegging, increasing, stabilizing, or decreasing prices, costs or expenses, or making any investment decision.

The Report may not be used as a means for competing companies or firms to reach any understanding, express or implied, which restricts competition or in any way impairs the ability of any person to exercise independent business judgment regarding matters affecting competition.

#### **No Warranties**

The Report is based solely upon the data provided by the Data Sources. No representation or warranty is made as to the accuracy or completeness of such data and the Report is being provided “as is” without warranty of any kind, express or implied. Oliver Wyman will not be liable to any person for any action taken or omitted to be taken by it under or in connection with the Survey or the Report.

#### **Note on Independence of Oliver Wyman’s Work**

Oliver Wyman prepared the Report at the request of MFA and MFA members underwrote the cost of preparing the Report. The Report was commissioned because MFA sought to understand whether a public disclosure requirement for short selling would have any effects on trading activity in securities markets. Oliver Wyman performed this work entirely independently. Oliver Wyman designed the study methodology and identified the types of data gathered for the Survey. It obtained data for the Report from the independent Data Sources. Oliver Wyman analyzed those data and reached its own, independent conclusions. Neither MFA nor its members influenced the analytical processes nor the conclusions that Oliver Wyman drew from its analysis.

## Executive Summary

The Report examines the effects of manager-level public short-selling disclosure requirements (“public SSDR”) on the equity markets they impact. We hypothesize that the public nature of such requirements, depending on the thresholds and frequencies of the disclosure requirement, would negatively impact equity investors’ inclination to engage in short-selling. We further posit that such a withdrawal of liquidity would have detrimental impacts on equity markets.

Our analysis is conducted on US and European equities. We defined UK and other European test groups of equities that were subject to short-selling disclosure requirements. We then defined control groups of US, UK and European equities with which to compare our test group.

We conducted our analysis over time such that we examine each group (test and control) under various market conditions and regulatory frameworks. We measure the relative performance of each group and seek to draw conclusions as to the impact of the imposition of a public SSDR.

In our analysis we used data from a wide variety of sources. We incorporate data from traditional data providers (i.e. Bloomberg, Reuters, Data Explorers), from certain large global financial institutions that short-sellers depend on to facilitate their short-sales and from individual fund managers.

Our analysis of the effects of manager-level public disclosure requirements is divided into two components. First, we assess the impact of a public SSDR on short-selling liquidity as a function of market participants’ willingness to trade short and the capacity of the stock loan markets to support normal levels of short selling activity. Second, we observe the potential impacts of a reduction in short-selling liquidity. Our key observations and conclusions include the following:

- Reduction of short-sale liquidity – In markets subject to public SSDR, liquidity provided by short sellers is impaired due to the combined effects of both a lack of willingness of investors to disclose short interest and a reduction in market capacity to support short selling.
  - Using a short interest ratio we find that a public SSDR significantly impairs short-selling liquidity. Over the relevant time periods, short-selling liquidity in those securities subject

to a public SSDR contracted by 25% while in the control groups there was a symmetric 25% increase in liquidity.

- Additionally, we received information from large global financial institutions that confirms our analysis of short interest ratios. Using this sell-side information, we find that liquidity in test group securities is impaired by approximately 20% while the control groups show no signs of impairment and in some cases show increased short-selling liquidity.
- Finally, the imposition of a public SSDR results in beneficial owners reducing the lendable equity supply and thus reducing market capacity for stock lending.
- Negative impacts on metrics of market efficiency – Public SSDRs have materially negative impacts on market liquidity, bid-ask spreads, price discovery and intraday volatility.
  - The UK test group, subject to a public SSDR, experienced a 13% decrease in trading volumes, while both the US and UK control groups experienced increases in trading volumes. Importantly, this indicates that when short-selling liquidity comes out of equity markets it does not return as liquidity on the long side.
  - Bid-ask spreads for the UK test group widened by over 45% while the UK control group widened spreads by only 2%, and the US control group saw a material tightening of spreads. A widening of bid-ask spreads of this magnitude indicates a significant increase in transaction costs that will be incurred by all market participants, not just short sellers.
  - Two metrics of price discovery efficiency, co-movement and abnormal returns, indicate that stocks of the European test group subject to public disclosure requirements performed significantly worse than did the European control group. A material decrease in the efficiency of the price discovery process has the impact of increasing the likelihood that investors are not paying “fair-value” for securities.
  - Intraday volatility for the test group of European stocks experienced a relative increase of twice that experienced by the control group of European stocks. Like less efficient price discovery, increased volatility increases the likelihood that market participants are not paying “fair-value” when investing in equity securities. Additionally, as prices move more quickly, it becomes increasingly difficult for investors to execute trades at a desired price.

- Minimal or no impact on other metrics of market efficiency – Public short-selling disclosure regimes seem to have minimal to no impact on a variety of other market structure metrics including trade size, time between trades, top-of-the-order-book size and velocity of fills.

## Conclusions

Our analysis leads us to conclude that the impacts of manager-level short-selling public disclosure requirements are two-fold. First, public SSDRs decrease short sellers' participation in equity markets by approximately 20-25%. This finding is confirmed both by the use of a short interest ratio as well as by proprietary data sourced from sell-side institutions. Second, as short-selling liquidity decreases there are material impacts to the markets for the affected securities:

- Trading volumes decrease
- Bid-ask spreads widen
- Price discovery becomes less efficient
- Intraday volatility increases

The combined effect is that markets adopting public SSDRs become more expensive and difficult venues for all investors to execute both purchases and sales of securities.

# 1. Background and hypothesis

## 1.1. Importance of short-selling liquidity to equity markets

While market observers generally agree that short sellers play an important function in equity markets, many do not appreciate the magnitude or unique nature of their involvement. Some estimates have short sellers responsible for between 20-30% of equity trading volume. Short-selling liquidity is beneficial not only because it increases overall market liquidity but because it benefits markets in a different way than long liquidity. Because fundamental short sellers trade in a manner unlike that of other investors (e.g. long-only, merger-arbitrage, etc.), their participation increases the heterogeneity of beliefs in equity markets. For markets to function most efficiently it is important that they be able to quickly incorporate both positive and negative information into share prices. Such participation has the following benefits<sup>1</sup>:

- Increased market liquidity and depth
- Decreased transaction costs (e.g. smaller bid-ask spreads)
- More efficient price discovery and decreased occurrences of price bubbles/crashes

## 1.2. Short-selling regulatory landscape

During the fall of 2008, global regulators sought to provide relief to financial-sector equity markets that they believed were under significant pressure from short-sellers. In late September, regulators in the US, the UK and on the European continent (as well as in other global jurisdictions) moved to ban or significantly restrict the short-selling of selected equity securities.

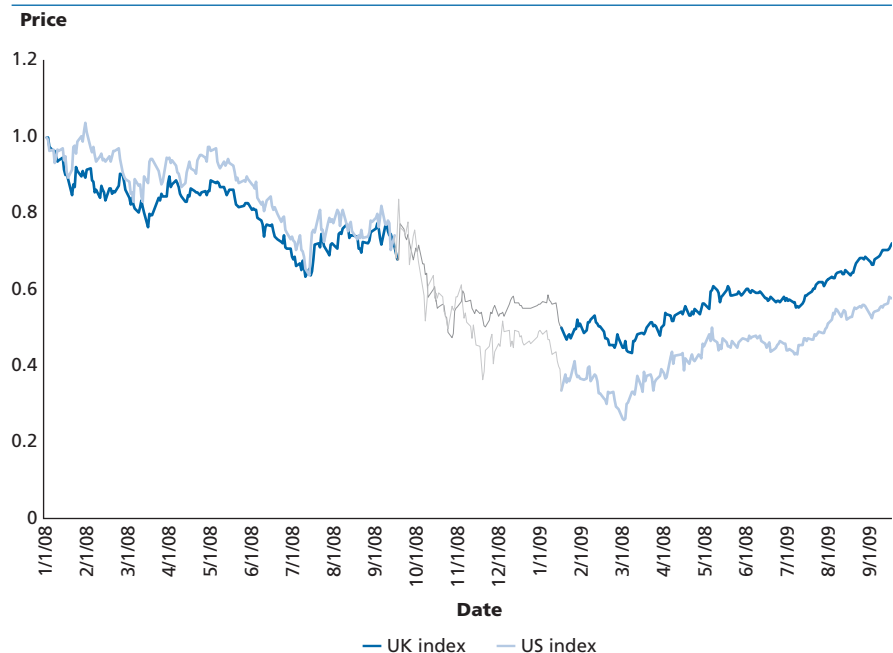
The short-selling bans in the UK and some other countries prohibited investors from increasing any net short exposure in an equity that was subject to the ban. In other countries, action was taken to impose significant restrictions on naked, uncovered or other forms of short sales and/or to discourage lending of stock to short sellers. In many cases, regulators imposed public disclosure requirements that required individual fund managers or other investors to disclose short positions above a certain threshold. In most jurisdictions, however,

<sup>1</sup> SEC Securities Lending and Short-selling Roundtable 9/29/09-9/30/09

there were some exemptions for activities such as genuine market making. The regulatory thinking behind short-selling bans was based on widespread speculation and rumor that hedge fund shorting was responsible for the declining prices of financial stocks and the concern that declining stock prices would undermine confidence in the financial sector, exacerbating the risks of bank runs and other similar behavior. However, it has since been shown by major broker-dealers that hedge funds were most likely net long position holders of the affected equities prior to the ban and that the downward pressure was a result of the selling off of long positions by traditional managers.

Subsequent to the bans, numerous studies have found that the restrictions failed to have the desired effects. In fact, empirical research existed for years before the short-selling bans were put in place which suggested that at a broad market level, short-selling restrictions would provide no relief to market declines. In 2008, instead of stopping or slowing the declines in financial equity prices, the short-selling bans had at best a neutral effect on prices. A significant amount of academic work has concluded that short-selling bans in reality decreased liquidity, impaired price discovery and widened bid-ask spreads.

**Exhibit 1: Failure of short-selling bans to stop price declines<sup>2</sup>**



<sup>2</sup> Bloomberg

**Table 1: Summary of short-selling bans**

	<b>US</b>	<b>UK</b>
<b>Start date</b>	9/19/2008	9/18/2008
<b>End date</b>	10/8/2008	1/16/2009
<b>Sector</b>	Financial services	Financial services
<b>Number of equities</b>	799 <sup>3</sup>	34

In the US, the short-selling ban lasted for only 14 trading days. After removing the ban the SEC did not put in place a public short-selling disclosure requirement. However, in the UK, and in other European countries, when the ban was lifted regulators kept in place requirements that sought to increase transparency in equity markets by requiring the public disclosure of short positions. When the UK ban was lifted on January 16, 2009, the FSA kept in place rules requiring investment managers to make public disclosure of short interest in any of the financial service equities that were part of the prior ban on shorting. The UK rules require investors to publicly disclose any net short interest above 0.25 percent of the market capitalization of a given equity, followed by additional disclosures at 0.1 percent increments. The public disclosure regime requires an individual manager fund manager or other investor to identify itself as having the relevant short position. These disclosures are made at the time that an investor acquires a net short position in excess of the thresholds (or reduces its net short position below one of the thresholds).

### **1.3. Hypothesis**

Based on our extensive work in capital markets and our interactions with fund managers, we posit that a disclosure regime which is overly restrictive will have similar effects as the short-selling bans of 2008. If investors find regulatory intervention to be too restrictive, they will reduce their level of short-selling activity and, in doing so, diminish the benefits short-selling liquidity provides to equity markets. Such effects, however, would almost certainly be diminished in magnitude relative to the effects observed during a short-selling ban.

<sup>3</sup> Number of equities is the number included at the beginning of the ban on short selling. Some of the equities initially included ceased to be traded for various reasons during the ban period (e.g. bankruptcy, merger, privatization, etc.)

## 2. Methodology

### 2.1. Data sources

Our assessment of the impacts of regimes imposing manager-level public short-selling disclosure requirements (“public SSDR”) draws on data from multiple sources. The complexity of the impact of short-selling on equity markets is evidenced in the dispersion of the data relevant to gaining a full understanding. Over the course of our work, we sourced data from five distinct sources. We gathered market data from two sources, stock borrow/loan data from one source and absolute metrics of short-selling liquidity from two sources:

- Bloomberg – for basic metrics of market structure and efficiency
- Reuters (provided by Deutsche Bank) – for more complex metrics of market structure and efficiency
- Data Explorers<sup>4</sup> – for data pertaining to stock borrow/loan markets
- Sell-side financial institutions
  - Electronic execution – for indications of short liquidity in US names
  - Prime brokerage – for indications of liquidity in UK names

For the entirety of our analysis we examine data in an aggregate fashion to ensure that the majority of our conclusions are drawn from high-level observations of raw data rather than from subsets of data (e.g. subsets that exclude outliers, etc.).

### 2.2. Defining the control and test groups

To control for as many of the changing variables as possible, we created control groups of carefully selected stocks we believe would have responded to changing variables in a similar fashion.

For the Bloomberg and Data Explorers sourced data, we designed two control groups – one US and one UK – and one UK test group. These similarly sized groups were all constructed of equity securities issued by companies in the financial services and banking sectors that exhibited similar characteristics and behavior (e.g. similar market capitalization,

<sup>4</sup> Data Explorers is an independent financial data provider based in London, England. Data Explorers collects stock borrow/loan data from a variety of securities lending market participants (e.g. custodians, prime brokers and funds, etc.)

liquidity, sub-sectors, etc.) in the pre-ban period. The US control group was constructed of securities which were included in the short-selling ban and that were also constituents of the Dow Jones Financials Index. The UK control group was constructed of securities that were constituents of the FTSE 100<sup>5</sup>, but were not included in the short-selling ban or subject to the requirements of the disclosure regime. The test group consisted of 34 UK financial service equities that were first subject to a short-selling ban and, subsequently, to the short-selling public disclosure regime.

For the Deutsche Bank market data, they provided us with the outputs of their proprietary analysis of the STOXX 600<sup>6</sup>. In a similar fashion to the Bloomberg data, Deutsche Bank's test group securities were examined in comparison to a control group. While Deutsche Bank's data was designed to test the same variable as the Bloomberg-sourced data, Deutsche Bank alone was responsible for the design and methodology of their analysis.<sup>7</sup> We made use of Deutsche Bank as a secondary data source for metrics of market efficiency because they have the ability to reconstruct the limit order book and examine metrics we otherwise would not be able to measure (e.g. limit order book depth, time to fill orders, median trade size, etc.).

When engaging with financial institutions, we interacted with two different desks within the institutions due to the varying market structures in the US and the UK. To solicit metrics of the robustness of short-selling liquidity in the US, we engaged with electronic execution desks. Electronic execution desks have ready access to such information due to the "short-sale" order marking that exists in US equity markets. To do the same in the UK, we engaged with the prime brokerage divisions because there is no "short-sale" order marking. Additionally, the short market in the UK is predominantly a synthetic market and prime brokerage groups have the best view of the volume of swaps executed short.

5 The FTSE 100 is a share index of the 100 most highly capitalized companies in the United Kingdom

6 The STOXX 600 is derived from the Dow Jones STOXX Total Market Index. STOXX 600, the most widely used benchmark for European stocks, includes a fixed number (600) constituents from 18 countries of the European region: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, the Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom

7 Deutsche Bank obtained the list of all stocks subject to short selling regulation from the respective country regulators and the timeframe when they were banned/subject to a disclosure requirement from disclosures on regulators' websites. Deutsche Bank only included equities that were explicitly banned by European regulators (i.e. in some jurisdictions where the scope of short selling regulation was less defined stocks were excluded from the test group). For ease of comparability they take the time period of the UK ban as the overall ban period and use this to define three time periods for analysis, the pre-ban period, the ban period and the post-ban/disclosure period. Deutsche Bank believes the application of the UK time period across continental Europe is appropriate as the bans on short selling for all equities in the test group ended over a short time period and thus the impact of common periods on the analysis is minimal. The "all STOXX" sample should be considered the control group and the "banned" stocks as the test group compared against it to identify any excessive changes in the measures for these stocks above and beyond the changes seen among all stocks in the STOXX 600. It is important to note the post-ban/disclosure time period does not uniformly test the regulatory variable as different countries employed various disclosure regimes (e.g. thresholds, reporting periods, etc.) after removing their short-selling bans.

## 2.3. Defining the time periods

To test the impact of the short disclosure variable, we considered the time frames over which to conduct our analysis. For consistency and simplicity we chose to define the pre-ban, ban and disclosure periods in the same manner for all of the securities in the study regardless of their jurisdiction. Because the UK ban period was the longest in duration, we established the periods based on the UK's regulatory actions:

- Pre-ban period: 1/1/2008-9/17/2008
- Ban period: 9/18/2008-1/16/2009
- Disclosure/post-ban period: 1/17/2009-present

While the end point for each analysis within a given data source is the same, there is variation between the end dates of the analyses of different metrics depending on the data source.

## 2.4. Comparative analysis

In order to make meaningful observations and draw conclusions we compared the test and control groups to one another over the three time periods. We examined a variety of metrics to see if we found divergences in relative performance of the test group. If the test group performed appreciably worse than the control groups when comparing the pre-ban period to the disclosure/post-ban period, we would conclude there is a high likelihood the divergence is an impact (primary or secondary) of the short-selling public disclosure regime.

## 2.5. Difficulty in proving causality

When reading our analysis it is important to recognize that while the phenomena are easily discernible and the implications of the observations are grounded in widely held economic and financial relationships, causality is still difficult to prove. During the time periods under consideration, equity markets were in a relatively disordered state due to a broad flight to quality across asset classes as well as the many corporate and regulatory events that occurred. Volatile market conditions along with the passage of over four months, results in the changing of many variables that influence equity markets. Such extreme change in markets has the consequence of making it complicated to establish a control group of stocks such that all variables, except regulatory variables, remain constant. This, in effect, makes it difficult to attribute causality solely to the regulatory

variables. In our analysis we attempt to create control groups such that most variables other than regulatory variables would have remained as constant as is reasonably possible.

The remainder of the paper examines how short-selling volumes were affected by the disclosure regime and how equity markets performed across a variety of metrics of market quality and efficiency.

## 3. Impact of public disclosure on short-selling liquidity

### 3.1. Decrease in investor appetite

The primary reason that regulatory action can have a potentially negative impact on short-selling liquidity is a decrease in investor willingness to participate in short-selling markets. Investors indicate that they will reduce their short-selling activity in the presence of over-burdensome regulatory regimes due to a variety of concerns<sup>8</sup>:

- Loss of proprietary intellectual capital
- Risk of other investors “herding”, resulting in “crowded trades”
- Increased exposure of investors to short squeezes
- Reduced willingness of corporate managements to cooperate with analysts who are known to have short positions in the company’s equity
- Headline risk associated with taking publicly or politically unpopular short positions
- Significant operational challenges for fund managers with substantial equity exposures
- Certain public disclosure regimes do not provide for adequate netting of hedging exposures (e.g. some regimes do not allow funds to net CDS versus equity, etc.)

A short-sale is a costly trade to execute. Traders not only pay fees to borrow stock or short using a synthetic product, they are also typically required to over-collateralize the stock loan with cash (or sometimes US Treasuries or other government bonds). Additionally, unlike owning a long position, short sellers are also potentially exposed to unlimited loss if a stock price moves against them and they are unable to cover a short position in a timely fashion. For these reasons liquidity traders are less likely to actively short stocks and the fundamental short-sellers who are most active are highly sensitive to any force that they feel will impair their ability to profit from a position.

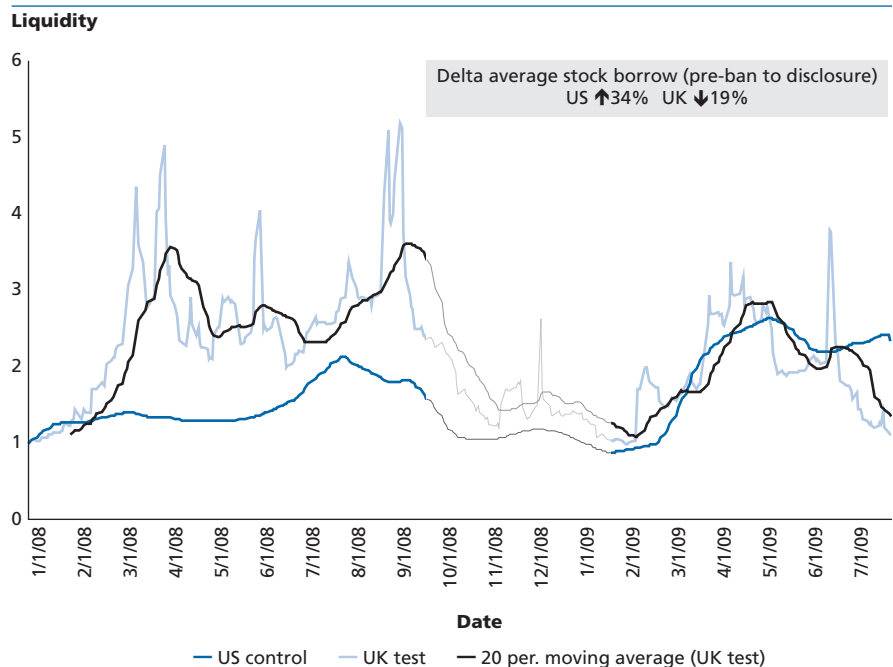
8 Oliver Wyman interviews with European and North American hedge fund managers. 2009

## 3.2. Measuring short-selling liquidity

### 3.2.1. Stock borrow/loan proxy

Measuring short sellers' contribution to market liquidity in some jurisdictions is more difficult due to varying market structures. The US requires marking, whereby short sellers must identify their sell order as a short transaction. However, in the UK and many other jurisdictions there is no order marking to allow observers to distinguish a short-sale from a long-sale. Because of this distinction, in these jurisdictions the only readily available method to quantify short interest is to use stock borrow/loan as a proxy. We make use of such a ratio in our analysis of both the US and UK equities subject to short selling regulatory intervention.

**Exhibit 2: Stock borrow in US and UK financial equities (normalized to 1/1/2008 = 1.0)<sup>9</sup>**



**Table 2: Stock borrow in US and UK financial equities (normalized to 1/1/2008 = 1.0)**

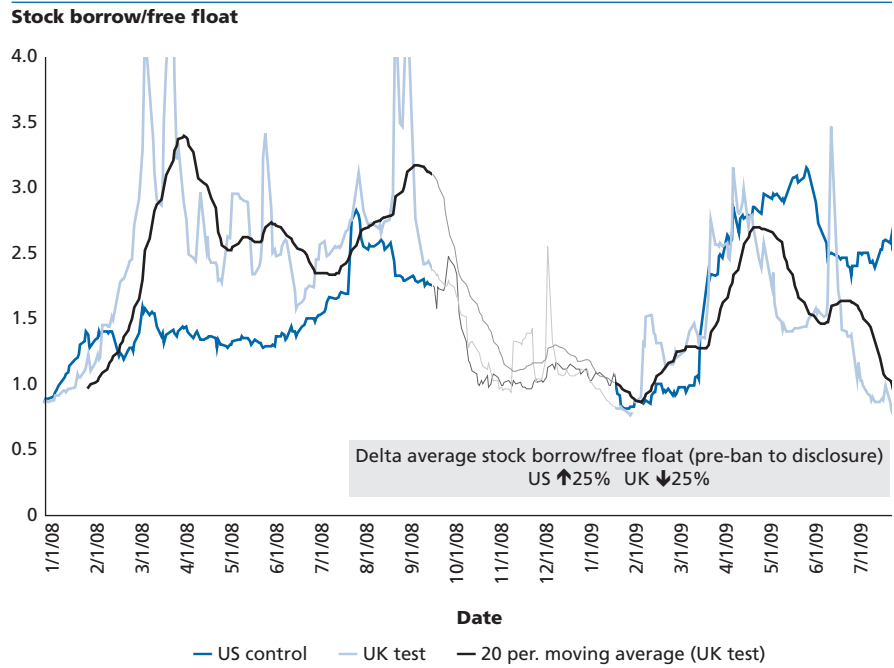
	Pre-ban	Ban	Disclosure	Δ Pre-disc
<b>US control group</b>	1.79	1.36	2.40	34%
<b>UK test group</b>	2.45	1.43	1.98	-19%

Using stock borrow as a proxy for the outstanding short interest in a given market, we can create a short interest ratio equal to stock

<sup>9</sup> Data Explorers. 2009. Figures incorporating stock borrow data use rolling averages to smooth the UK data. UK data has high volatility, relative to US data, because of the quantity of borrow for purposes other than short-selling.

borrow divided by the free float. Such a short interest ratio becomes our proxy for the short-selling demand in a given security.

**Exhibit 3: Stock borrow/free float in US and UK financial equities (normalized to 1/1/2008 = 1.0)<sup>10</sup>**



**Table 3: Stock borrow/free float in US and UK financial equities (normalized to 1/1/2008 = 1.0)**

	Pre-ban	Ban	Disclosure	Δ Pre-disc
<b>US control group</b>	1.73	1.25	2.16	25%
<b>UK test group</b>	2.35	1.31	1.77	-25%

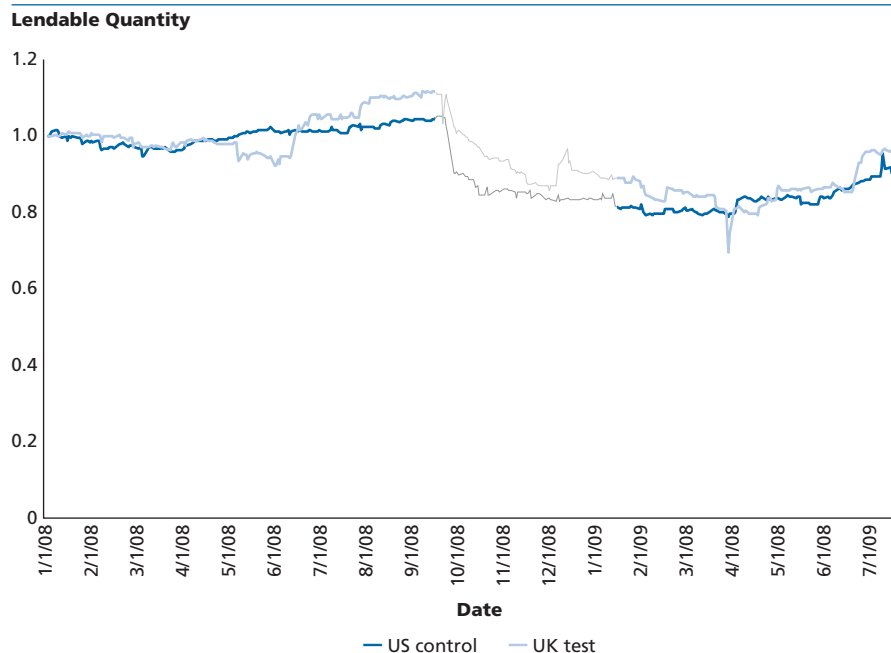
When we examine the change in the average short interest ratios for the US and UK securities from the pre-ban to the post-ban/disclosure period we find that the short-selling demand in the US names increased by approximately 25%, while in the UK the demand contracted by 25%. This represents a relative increase in short-selling liquidity in the US control group and a relative decrease in the UK test group. Thus, the UK’s public SDR appears to have significantly impaired short-selling in the test group of 34 securities.

<sup>10</sup> Data Explorers. 2009. Figures incorporating stock borrow data use rolling averages to smooth the UK data. UK data has high volatility, relative to US data, because of the quantity of borrow for purposes other than short-selling.

### 3.3. Reduced market capacity for shorting

In addition to the decrease in short-selling liquidity due to reduced investor appetite to short-sell securities subject to public SSDRs, short-selling regulation has a negative impact on the market's overall capacity for shorting. Imposing SSDRs has a secondary effect on the appetite of beneficial owners to put their securities on loan for use by short sellers. This effect was particularly prevalent during the short-selling bans, but it continued during the post-ban/disclosure time period.

**Exhibit 4: Lendable quantity of ban/disclosure-required equities (normalized to 1/1/2008 = 1.0)<sup>11</sup>**



The lendable quantity of equity securities quickly fell in both the US and the UK during the early ban period. During the short-selling ban the UK test group experienced a slightly less precipitous decline than the US control group, potentially due to the need for loan availability for purposes other than short-selling (e.g. scrip hedging<sup>12</sup>, etc.). In the period after the short-selling bans were removed, the US securities lending market remained relatively stable at ~85% of the pre-ban period level. However, after the imposition of a public SSDR, the available quantity for loan deteriorated a further 8% in the UK market. This additional decrease in lendable quantity is most likely due to an increased aversion of beneficial owners (e.g. pension funds,

<sup>11</sup> Data Explorers. 2009

<sup>12</sup> Scrip hedging is a practice where investors hedge exposure to a company when they are being paid a dividend in the form of shares rather than cash

long-only asset managers, etc.) to lend their stocks for the purpose of short selling. Despite strong evidence to the contrary, regulatory intervention again signaled to lenders that short-selling was responsible for declines in equity markets.

A decrease in lendable quantity has reciprocal implications because it not only impairs investors' ability to short stock, it also decreases beneficial owners' ability to generate additional yield in the form of stock borrow fees.

### 3.4. Stock borrow is an imperfect proxy

It is important to note that stock borrow is not a perfect proxy for short interest. That is not to say that stock borrow/loan data are either constructive or destructive interference relative to the absolute level of short interest in a market; merely, stock borrow/loan data incorporate a definite amount of noise that could be either constructive or destructive. In other words, using stock borrow/loan data as a proxy does not consistently over- or underestimate the volume of short interest in a given security.

Additionally, market participants and regulators alike have recognized the shortcomings of using stock borrow as a proxy for short interest; the FSA reached the same conclusion in its 2002-03 review of short-selling practices in the UK<sup>13</sup>. There are three main deficiencies in using stock borrow/loan data as a proxy for short interest:

- In certain jurisdictions (e.g. UK), equity securities can be borrowed without purpose, and therefore, there can be excess borrow in the system that is never executed as a short transaction (e.g. coverage of a failed delivery of long position or as a long hedge to derivative contracts, etc.). The excess stock borrow and the volatility of stock borrow (relative to US equities) in Exhibit 2 is a result of the alternative uses of borrowed securities.
- Stock borrow/loan data sources do not typically capture shorting that is done broker-to-broker or any synthetic transactions that are netted against other client orders, and therefore do not require a borrow.
- Due to the relatively high volume of scrip trading (for hedging of dividend payments) in the UK, there can be significant distortion during the time periods when scrip dividends are paid.

<sup>13</sup> Financial Services Authority. (2003). Short selling: Feedback on DP17. London: FSA

However, while stock borrow/loan is not an exact proxy for absolute short interest, in the absence of a market structure that provides for the reporting of short transactions (e.g. such as the order marking system in the US), it is an acceptable indicator of relative changes in short interest. Empirical research and the FSA have recognized the utility of examining relative changes in stock borrow/loan as a means of drawing conclusions about short-selling liquidity.

### 3.4.1. Solicited from brokers

In addition to our analysis of stock borrow levels, we have solicited information from four of the largest sell-side institutions that play an important role in facilitating short-selling. We requested metrics that would provide an indication of the portion of equity liquidity that was a result of short sellers' participation in markets.

From the broker-dealer data we found that in the pre-ban period the US and UK markets each received approximately 20-25% of their liquidity from short sellers<sup>14</sup>. Both markets experienced significant impairment of short-selling liquidity in affected securities during the bans. However, in the post-ban/disclosure periods there is a significant divergence in the participation of short sellers. In the US, in the absence of a public SSSDR, short-selling liquidity returned to pre-ban levels (and in some brokers' cases to greater levels of liquidity). In the UK, with a public SSSDR in place, short-selling liquidity recovered in the post-ban/disclosure period, but it did not recover as fully as the liquidity in the US markets. We estimate that short sellers' relative participation in equity markets was impaired by 20%<sup>15</sup>.

Importantly, we recognize the high level of statistical significance of the data we received from the sell-side. The data universally had very low statistical dispersion. The fact that the data we sampled from the sell-side institutions had low standard deviation increases its accuracy. In other words, because we saw very similar responses from virtually all the brokers we engaged, we have increased confidence in the accuracy of the data as well as of our conclusions.

These results from both short interest ratio analysis and broker surveying gives us increased confidence in our analysis and its conclusion. Both methodologies indicate that short-selling liquidity is impaired in the presence of a public short-selling disclosure regime.

<sup>14</sup> Oliver Wyman broker interviews and analysis. Q4 2009 – Q1 2010

<sup>15</sup> Oliver Wyman broker interviews and analysis. Q4 2009 – Q1 2010

## 4. Impacts of public disclosure on market structure and efficiency

### 4.1. Liquidity

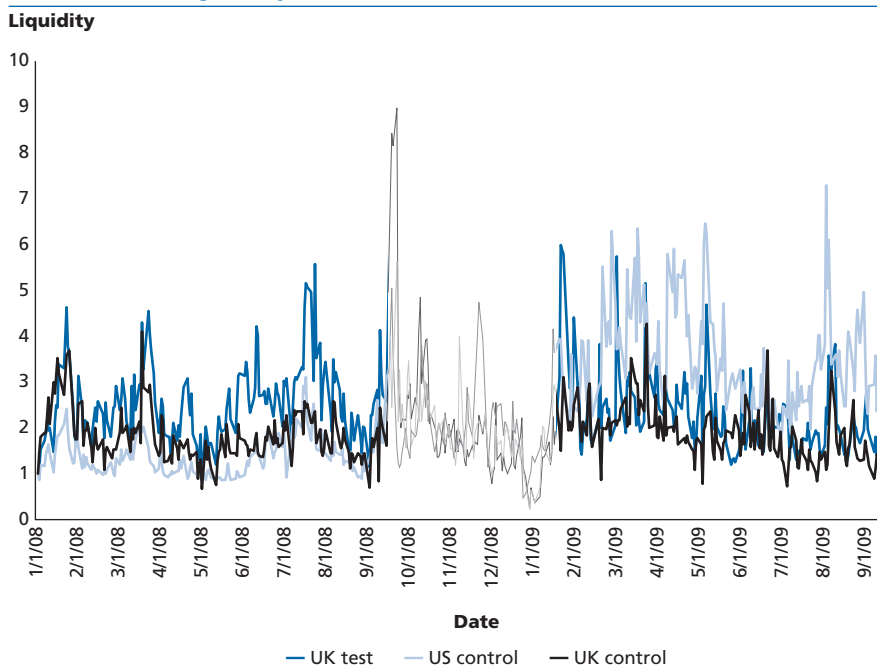
Market liquidity, as measured by average daily volume<sup>16</sup>, is an important metric because of the positive impacts it has on other aspects of efficiency and quality. Among other improvements in efficiency and quality, more liquid markets generally exhibit tighter bid-ask spreads, faster order fills and smoother/deeper liquidity in the order book. Liquid markets are ultimately easier and less costly for investors to trade.

Across the three primary markets that we examine, the UK financial equities subject to its public SDR experienced the only reduction in liquidity from the pre-ban to the post-ban period.

Importantly, the reduction in market liquidity is a direct impact of a reduction in short-selling liquidity. As short-selling liquidity is removed from a market, it does not come back in another form. Were investors to simply reallocate capital in the role of a long investor, the impacts of a short-selling disclosure regime might not be as substantial. However, this does not seem to be the case. Investors who have their short-selling activities impaired by a regulatory regime do not seem to simply redeploy that capital as a long investor. This effect is especially true for long-short equity managers. Long-short funds rely on their ability to short stocks in order to be able to take bigger exposures on the long side. Without sufficient short-side exposure long-short managers are unable to invest as meaningfully on the long side since a meaningful hedging tool would be denied to them.

<sup>16</sup> Average daily volume is the total number of shares traded on public exchanges

**Exhibit 5: Average daily volumes (normalized to 1/1/2008 = 1.0)<sup>17</sup>**



**Table 4: Average daily volumes (normalized to 1/1/2008 = 1.0)<sup>18</sup>**

	Pre-ban	Ban	Disclosure	Δ Pre-disc
<b>UK test group</b>	2.62	1.98	2.31	-13%
<b>UK control group</b>	1.84	1.92	1.87	2%
<b>US control group</b>	1.43	2.06	3.14	219%

## 4.2. Bid-ask spread

Bid-ask spreads<sup>19</sup> are an important metric because they, along with brokerage fees, determine transaction costs. For any given security, transaction costs increase as the bid-ask spread widens. Additionally, as bid-ask spreads widen investors must experience greater movements in price to be able to profit from an investment.

Bid-ask spreads for UK financial equities subject to a public SDR performed significantly worse than those of their financial peers in either of the control groups. Where the US and UK control groups experienced a tightening and slight widening of spreads respectively, the UK test group widened by 46%.

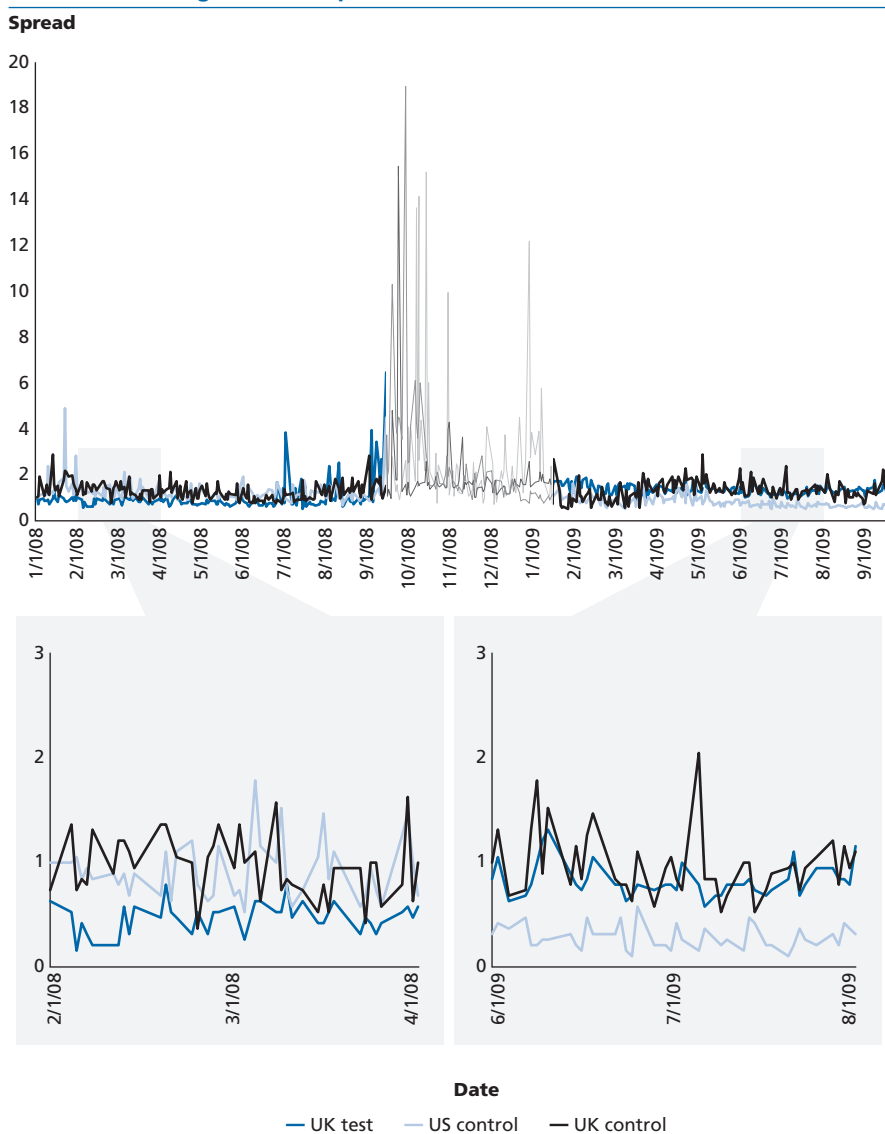
<sup>17</sup> Bloomberg

<sup>18</sup> Bloomberg

<sup>19</sup> Bid-ask spread is the amount by which the ask price exceeds the bid. This is essentially the difference in the highest price willing to be paid by a buyer and the lowest price that will be accepted by a seller

A significant widening of bid-ask spreads is an important event, as it is directly related to the cost associated with trading. Bid-ask spreads are one component of transaction costs (the other component being broker fees). Depending on the balance between spread costs and broker fees, a 46% widening of the bid-ask spread could represent a large relative increase in transaction cost. Investors requiring immediate liquidity would pay this cost to those market participants that provided liquidity<sup>20</sup>. This cost increase would likely impact investors that typically place market orders<sup>21</sup> (e.g. retail investors) moreso than those that place limit orders<sup>22</sup> (e.g. institutional and hedge fund investors).

**Exhibit 6: Average bid-ask spread (normalized to 1/1/2008 = 1.0)<sup>23</sup>**



<sup>20</sup> The biggest liquidity providers are broker-dealer institutions and large equity hedge funds

<sup>21</sup> A market order is an order to buy or sell a stock at the best available current price

<sup>22</sup> A limit order is an order placed with a brokerage to buy or sell a set number of shares at a specified price or better

<sup>23</sup> Bloomberg

**Table 5: Average bid-ask spread (normalized to 1/1/2008 = 1.0)<sup>24</sup>**

	Pre-ban	Ban	Disclosure	Δ Pre-disc
<b>UK test group</b>	0.99	1.91	1.45	46%
<b>UK control group</b>	1.28	2.75	1.31	2%
<b>US control group</b>	1.26	5.64	1.04	-17%

## 4.3. Volatility

A primary goal of global regulators is to reduce market volatility in an effort to have quoted prices more accurately reflect the “fair value” of a given security. We examined both inter-day (volatility in daily closing prices) and intraday (volatility within the executed prices on a given day) volatility.

### 4.3.1. Historical volatility

The impacts of a public SDR on historical volatility<sup>25</sup> are unclear from our analysis. In the UK, there was a correlation between the movement of the test group and the control group throughout the time periods we examined (both groups experienced 17% greater volatility in the disclosure time period than they did in the pre-ban time period). Additionally, the US control group was nearly 50% more volatile in the disclosure time period than it was in the pre-ban time period. Both of these observations suggest that the impact of a public disclosure regime on inter-day volatility may not be significant.

**Table 6: Average inter-day volatility (normalized to 1/1/2008 = 1.0)<sup>26</sup>**

	Pre-ban	Ban	Disclosure	Δ Pre-disc
<b>UK test group</b>	1.83	3.51	2.19	17%
<b>UK control group</b>	1.94	3.61	2.33	17%
<b>US control group</b>	1.75	4.02	2.57	47%

### 4.3.2. Intraday

There seems to be a more definitive relationship between the imposition of a public SDR and increased price volatility<sup>27</sup>. Stocks subject to a public SDR realized intraday volatility of only 20 bps higher than the control group in the pre-ban period; though in the disclosure period they realized volatility of over 200 bps higher than the control group.

An increase in intraday volatility is remarkable because intraday volatility is important to consider when executing trades. As volatility

<sup>24</sup> Bloomberg

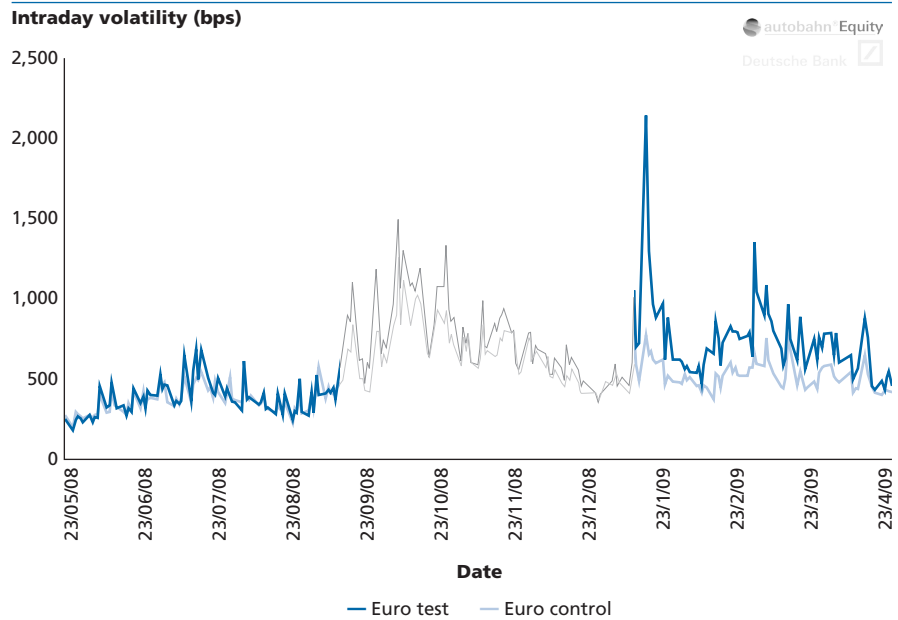
<sup>25</sup> Historical volatility is the statistical deviation of the price of a security over a period of time

<sup>26</sup> Bloomberg

<sup>27</sup> Intraday volatility is a measure of price volatility within a single trading day. It is computed as follows, (high price – low price)/closing price

increases it becomes increasingly difficult to execute at favorable prices. Increased intraday volatility is a substantial concern for investors who need to trade equity markets in sizeable trades. As intraday volatility increases for large investors, so does the likelihood that a trade will be made at a price other than the price at the time of execution (i.e. increased intraday volatility increases the chance of “slippage” when executing).

**Exhibit 7: Intraday volatility for the STOXX 600 (bps)<sup>28</sup>**



**Table 7: Average intraday volatility (bps)<sup>29</sup>**

	Pre-ban	Ban	Disclosure	Δ Pre-disc
<b>EURO control group</b>	378	657	520	38%
<b>EURO test group</b>	398	753	739	86%

## 4.4. Price discovery

An efficient market is characterized by quickly processing information and news such that it is accurately reflected in the share price. Empirical research has shown that informational efficiency in equity markets is reduced in the presence of short-sale constraints. Because an impairment of informed investors’ ability to short reduces the speed of price adjustment to information, we expect to see some reduction in the efficiency of the price discovery process as short liquidity in a market is reduced due to public disclosure regimes. We examined two principal metrics of the efficiency of the price discovery process, co-movement of stocks and abnormal price returns.

<sup>28</sup> Source Deutsche Bank using Reuters data. 26 November 2009

<sup>29</sup> Source Deutsche Bank using Reuters data. 26 November 2009

### 4.4.1. Co-movement

The co-movement<sup>30</sup> of stocks is an important metric of the efficiency of the price discovery process. Higher co-movement of stocks implies a more synchronous price discovery process and thus a more efficient price discovery process.

An examination of the broader European control group leads us to believe that the short-selling bans and disclosure regime had a minimal impact on equities markets as a whole. The negligible change in pricing efficiency during the ban period for the European control group indicates a negligible impact.

However, an effect on the test group is apparent. The price discovery process became 8% less efficient in the ban period (as measured by the metric of co-movement). The public disclosure regime seems to have had an impact of nearly the same magnitude as the ban; during the disclosure period the co-movement of stocks only regained less than 1%.

**Table 8: Co-movement of stocks with the index (percentage)<sup>31</sup>**

	<b>Pre-ban</b>	<b>Ban</b>	<b>Disclosure</b>	<b>Δ Pre-disc</b>
<b>EURO control group</b>	72.10	72.72	69.47	-4%
<b>EURO test group</b>	77.92	71.74	72.31	-7%

### 4.4.2. Abnormal returns

Another important metric of market efficiency is abnormal return<sup>32</sup>. In general, one would expect that the abnormal return of a sector (or in this case of the disclosure-required securities) to be less than the abnormal return of the larger index (e.g. STOXX 600). Relatively lower abnormal return is a result of the increased homogeneity of a sector relative to the index. In other words, because companies that comprise a sector are more like other companies in the same sector than other companies in a broader index, we would expect less abnormal returns within a sector than within an index.

In the pre-ban period we see that the test group exhibits a lower abnormal return than does the control group (2.3 versus 2.6). However, in the post-ban period the abnormal return of the test group more than doubles while the control group experiences less than a 50% increase.

30 Co-movement is defined as the percentage that indicates the number of equities that moved in the same direction (positive or negative return) as the broader sector/index on a particular trading day

31 Source Deutsche Bank using Reuters data. 26 November 2009

32 Abnormal return is the standard deviation of the constituent returns from the returns of the index

Similar to a decrease in co-movement, an increase in the abnormal return of a market indicates a decrease in market efficiency, and thus, an impairment of the price discovery process.

**Table 9: Abnormal returns (std. dev. of daily returns from market/index)<sup>33</sup>**

	<b>Pre-ban</b>	<b>Ban</b>	<b>Disclosure</b>	<b>Δ Pre-disc</b>
<b>EURO control group</b>	2.645	3.978	3.895	47%
<b>EURO test group</b>	2.362	5.064	5.086	115%

The price discovery process is important because it determines how quickly information is reflected in the price of a security. As the price discovery process becomes less efficient, the likelihood that an investor is over or under-paying for a security increases.

## 4.5. Order book quality

### 4.5.1. Median trade size

We find only a slight impact on average trade size in any of the relevant time periods. The difference in median trade size was less than  $\pm 4\%$  over the entire duration of analysis. In addition to the impacts being minimal, causality is hard to infer since the decrease in median trade size is significantly greater in the disclosure period than in the ban period.

**Table 10: Median trade size (shares)<sup>34</sup>**

	<b>Pre-ban</b>	<b>Ban</b>	<b>Disclosure</b>	<b>Δ Pre-disc</b>
<b>Mean</b>	607	606	582	-4%
<b>Standard Deviation</b>	47	47	51	9%
<b>Maximum</b>	704	778	926	32%
<b>Minimum</b>	375	502	388	3%

### 4.5.2. Top-of-the-book order size

Top-of-the-book order size is an important characteristic of order book quality because a significant reduction in top-of-the-book size results in an inability to transact in size at the best price available in the market. A decrease in the top-of-the-book size, coupled with the increase in spread costs, compound to result in further increases in transaction costs.

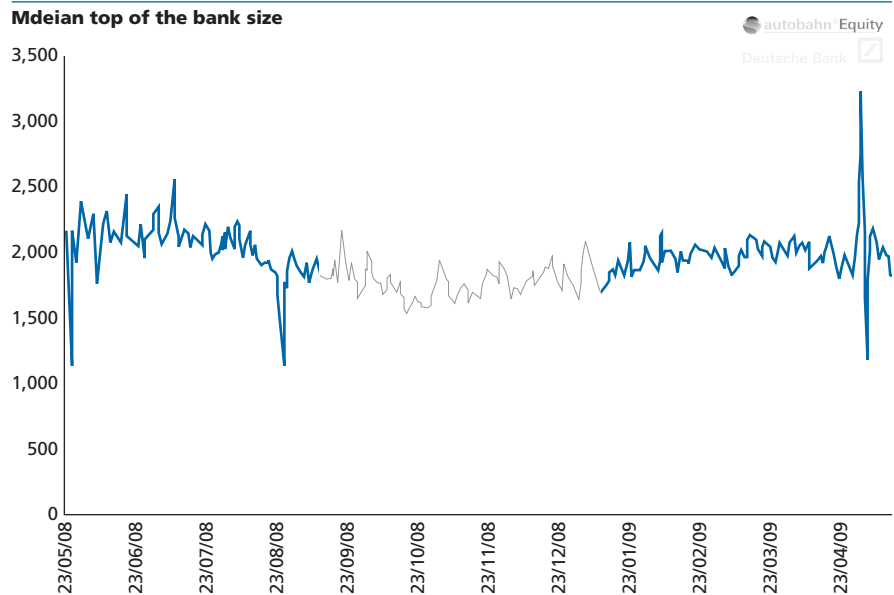
We find that the top-of-the-book size appears to be minimally impacted by a public short-selling disclosure regime. However, the top-of-the-book size for the STOXX 600 was materially impacted (~13% decrease) by the short-selling ban. Most of the lost liquidity

<sup>33</sup> Source Deutsche Bank using Reuters data. 26 November 2009

<sup>34</sup> Source Deutsche Bank using Reuters data. 26 November 2009

depth returns in the post-ban period where the top-of-the-book was only ~2% lower than in the pre-ban period. Furthermore, the maximum and minimum values in the disclosure period are higher than those in the pre-ban period, indicating that at certain points in time, top-of-the-book liquidity had more than fully recovered.

**Exhibit 8: Median top of the STOXX 600 book order size (shares)<sup>35</sup>**



**Table 11: Median top of the STOXX 600 book order size (shares)**

	Pre-ban	Ban	Disclosure	Δ Pre-disc
<b>Mean</b>	2029	1764	1984	-2%
<b>Standard Deviation</b>	219	117	189	-14%
<b>Maximum</b>	2543	2165	3223	27%
<b>Minimum</b>	1107	1529	1190	7%

### 4.5.3. Average time between trades

The average time between trades is lower during both the ban and the disclosure periods. While the decrease in average time between trades indicates an increase in the frequency of market activity by the participants, the reason for increased activity may not be desirable. In this instance, when combining a decrease in time between trades with the decrease in median trade size, a potential situation exists where market participants have to trade more frequently, at higher cost and in smaller size to execute in the regulated securities. Somewhat counterintuitively, a decrease in average time between trades could in fact be an indication of increased difficulty in trading the effected equities. Ideally, markets would not require participants to time markets and to “work” orders in order to minimize transaction costs.

<sup>35</sup> Source Deutsche Bank using Reuters data. 26 November 2009

Alternatively, there could be “seasonality” in the results and the decrease in time between trades may actually be less than would be expected during Q4 of any calendar year.

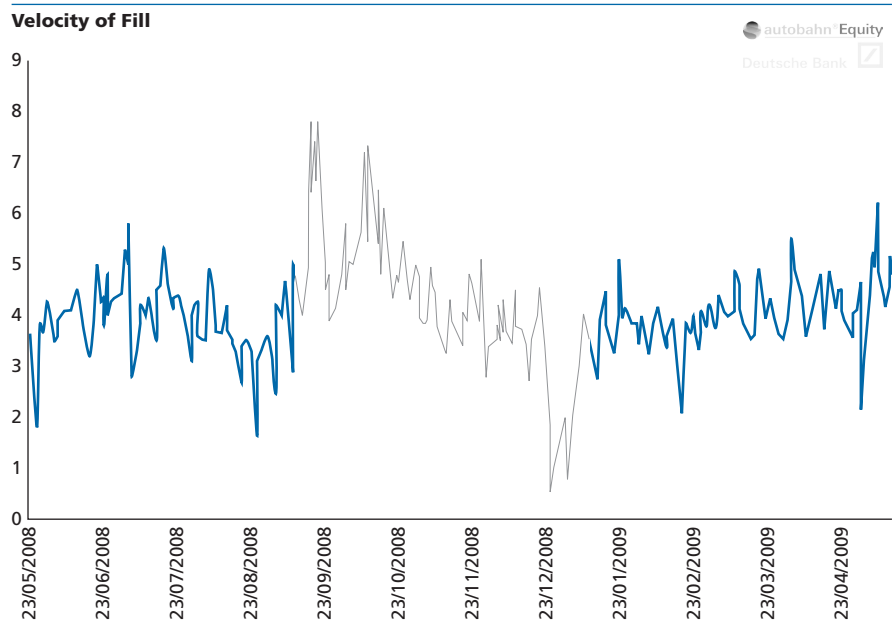
**Table 12: Average time between trades (seconds)<sup>36</sup>**

	Pre-ban	Ban	Disclosure	Δ Pre-disc
<b>Mean</b>	96.95	94.87	95.01	-2%
<b>Standard Deviation</b>	17.12	10.59	9.37	-55%
<b>Maximum</b>	190.18	152.72	122.44	-36%
<b>Minimum</b>	31.38	78.84	42.55	36%

#### 4.5.4. Velocity of fills

Velocities of fills exhibit similar behavior to the average time between trades. In markets, with all other variables being constant, an increase in the velocities of fills is a desirable phenomenon. An increase in these velocities indicates increased market participation by investors.

**Exhibit 9: Velocity of fill for the STOXX 600 (trades/minute)<sup>37</sup>**



**Table 13: Velocity of fills (trades/minute)<sup>38</sup>**

	Pre-ban	Ban	Disclosure	Δ Pre-disc
<b>Mean</b>	4.06	4.18	4.05	0%
<b>Standard Deviation</b>	0.91	1.21	0.61	-33%
<b>Maximum</b>	7.79	7.81	6.14	-21%
<b>Minimum</b>	1.63	0.61	2.14	31%

<sup>36</sup> Source Deutsche Bank using Reuters data. 26 November 2009

<sup>37</sup> Source Deutsche Bank using Reuters data. 26 November 2009

<sup>38</sup> Source Deutsche Bank using Reuters data. 26 November 2009



## 5. Conclusions

Our analysis leads us to conclude that regimes imposing manager-level short-selling public disclosure have materially negative impacts on their markets. Investors find the information they are required to disclose to be sufficiently sensitive that they limit their activities to avoid making disclosures. As relatively substantial participants in equity markets, short sellers play an integral role in providing liquidity and maintaining market efficiency. When short sellers' level of participation decreases, markets become less liquid, more expensive and more difficult to trade. These primary impacts affect all investors equally. If markets become more expensive and difficult to trade, all investors – retail, institutional and hedge fund – will be impacted by these changes.

There is also a macro/systemic risk associated with implementing over-burdensome short-selling regulation. As markets become less efficient and more expensive, parity among global equity markets begins to disappear. Were disclosure regulation to appreciably impair a market's ability to function efficiently, there exists a real risk that investors would invest less in affected markets and begin to allocate capital to equity markets with more palatable regulatory frameworks. If market participants begin to prefer to invest in more liberal capital markets based on their short-selling disclosure restrictions, the effects on capital formation and the ability of companies to finance themselves could be significant.

Due to short sellers' relatively high level of market participation, the unique benefits their liquidity provides to equity markets and the ineffectiveness of past regulatory intervention in short selling markets, it is important that regulators carefully consider all of the impacts of their actions. If and when they intervene, they should do so in a fashion that appropriately addresses their concerns.

# Bibliography

- Alexander, G. J., & Peterson, M. A. (2007). *The Effect of the Uptick Rule on Spreads, Depths, and Short Sale Prices*. University of Minnesota and Southern Illinois University.
- Asquith, P., Pathak, P., & Ritter, J. (2005). Short interest, institutional ownership, and stock returns. *Journal of Financial Economics*, 78, 243-276.
- Au, A., Doukas, J., & Onayev, Z. (2008). Daily short interest, idiosyncratic risk, and stock returns. *Journal of Financial Markets*.
- Australian Securities Exchange. (2008). *Short-selling: ASX Public Consultation*. Sydney, Australia: ASX.
- Barberis, N., Shleifer, A., & Wurgler, J. (2004). *Comovement*. Yale University, School of Management. Yale University.
- Barron, O., & Karpoff, J. *Information Precision, Transaction Costs, and Trading Volume*. Pennsylvania State University.
- Baur, D. (2003). *What is Co-movement?* European Commission, Joint Research Center, Ispra (VA). IPSC - Technological and Economic Risk Management.
- Beber, A., & Pagano, M. (2009). *Short-Selling Bans around the World: Evidence from the 2007-09 Crisis*. Centre for Studies in Economics and Finance. Fisciano, Italy: Centre for Studies in Economics and Finance.
- Bessembinder, H., & Venkataraman, K. (2009). *Bid-Ask Spreads: Measuring Trade Execution Costs in Financial Markets*. University of Utah, David Eccles School of Business. David Eccles School of Business.
- Bris, A., Goetzmann, W., & Zhu, N. (2003). *Efficiency and the Bear: Short Sales and Markets around the World*. Yale School of Management.
- Chen, M., & Zheng, Z. (2009). *The Impact of Short Selling on the Volatility and Liquidity of Stock Markets: Evidence from Hong Kong Market*. Xiamen University, Department of Finance. Xiamen University.
- Clifton, M., & Snape, M. (2008). *The Effect of Short-selling Restrictions on Liquidity: Evidence from the London Stock Exchange*. University of Technology, Sydney and University of Sydney, Capital Markets Cooperative Research Center. LSE.
- Clunie, J. *Market Imperfections, Securities Lending, and Short Selling*. University of Edinburgh. *Journal of Financial Transformation*.
- Coalition of Private Investment Companies. (2009). *Financial Detectives: Defending Shareholder Value by Demanding Accountability*.
- Cohen, K., Maier, S., Schwartz, R., & Whitcomb, D. (1981). Transactions Costs, Order Placement Strategy, and Existence of the Bid-Ask Spread. *Journal of Political Economy*, 89 (21).
- Cohen, L., Diether, K., & Malloy, C. (2006). *Supply and Demand Shifts in the Shorting Market*.
- Credit Suisse. (2008, October 13). *Examining the Wake of the Short Sale Restrictions*. AES Analysis.
- Credit Suisse. (2008, November 12). *The Blame Game: What Caused Spreads to Widen*. AES Analysis.
- Credit Suisse. (2008, September 30). *What Happened When Traders' Shorts Were Pulled Down*. AES Analysis.

David, A. (1991). *Effects of Bid-Ask Spread and Price Discreteness on Stock Returns*. The Wharton School - University of Pennsylvania, Rodney L. White Center for Financial Research. Philadelphia: University of Pennsylvania.

Desai, H., Ramesh, K., Thiagarajan, S. R., & Balachandran, B. V. (2002). An Investigation of the Informational Role of Short Interest in the Nasdaq Market. *The Journal of Finance*, LVII (5), 2263-2287.

Demsetz, H. (1968). The Cost of Transacting. *The Quarterly Journal of Economics*, 82 (1), 33-53.

Diamond, D., & Verrecchia, R. (1987). Constraints on short-selling and asset price adjustment to private information. *Journal of Financial Economics*, 18, 277-311.

Diether, K. (2008). *Short Selling, Timing, and Profitability*. Ohio State University, Fischer College of Business. Ohio State University.

Dupont, D. *The Effects of Transaction Costs on Depth and Spread*. Board of Governors of the Federal Reserve System. Federal Reserve System.

Financial Services Authority. (2003). *Short selling: Feedback on DP17*. London: FSA.

Frino, A. (1992). *An Empirical Study of the Effect of Short Selling on the Bid-Ask Spread*. University of Wollongong, Department of Accountancy. Wollongong: University of Wollongong.

Ghon Rhee, S. (2003). Short-Sale Constraints: Good or Bad News for the Stock Market? Fifth OECD Round Table on Capital Markets Reform in Asia. University of Hawaii.

Ghysels, E., & Pereira, J. (2003). *On Portfolio Choice, Liquidity, and Short Selling: A Nonparametric Investigation*. CIRANO: Centre interuniversitaire de recherche en analyse des organisations. CIRANO.

Hamson, D. (2008). *How the Short-selling Ban Reduced Liquidity in the Australian Stock Market?* Sydney, Australia: Plato Investment Management.

International Organization of Securities Commissions. (1999). *Securities Lending Transactions: Market Development and Implications*. Committee on Payment and Settlement Systems (CPSS). IOSCO.

International Securities Lending Association. (2009). *A Central Counterparty in the European Equity Securities Lending Market? Initial Report of an ISLA Working Group*. ISLA.

International Securities Lending Association. (2009). *Securities Lending and Short Selling*. ISLA.

Jarrow, R. (1990). *Heterogeneous Expectations, Restrictions on Short Sales, and Equilibrium Asset Prices*. *The Journal of Finance*, XXXV (5), 1105.

Lamont, O., & Stein, J. (2003). *Aggregate Short Interest and Market Valuations*. Yale University, School of Management. Yale University.

Manaster, S., & Mann, S. (1999). *Sources of Market Making Profits: Man Does Not Live by Spread Alone*. Pamplin College of Business. Virginia Tech.

Morgan Stanley. (2005). Comment letter on EC working document [ESC/20/2005].

Nomura Research Institution, Ltd. (2009). *The Folly of Demonizing Short-Selling*. NRI.

Plato Investment Management. (2008). *Has the Short Selling Ban Reduced Liquidity in the Australian Stock Market?* Sydney.

UBS Investment Research. (2008). *European Equity Strategy – 12th September 2008*. UBS AG.

Oliver Wyman is an international management consulting firm that combines deep industry knowledge with specialized expertise in strategy, operations, risk management, organizational transformation, and leadership development.

Bradley P. Ziff

Partner in Oliver Wyman's Finance & Risk and Corporate and Institutional Banking practices

Email: [bradley.ziff@oliverwyman.com](mailto:bradley.ziff@oliverwyman.com)

Thayer Moeller

Consultant in Oliver Wyman's Corporate and Institutional Banking practice

Email: [thayer.moeller@oliverwyman.com](mailto:thayer.moeller@oliverwyman.com)

For more information please contact the marketing department by email at [info-FS@oliverwyman.com](mailto:info-FS@oliverwyman.com) or by phone at one of the following locations:

North America

+1 212 541 8100

EMEA

+44 20 7333 8333

Asia Pacific

+65 6510 9700

Copyright © 2010 Oliver Wyman. All rights reserved. This report may not be reproduced or redistributed, in whole or in part, without the written permission of Oliver Wyman and Oliver Wyman accepts no liability whatsoever for the actions of third parties in this respect.

The information and opinions in this report were prepared by Oliver Wyman.

This report is not a substitute for tailored professional advice on how a specific financial institution should execute its strategy. This report is not investment advice and should not be relied on for such advice or as a substitute for consultation with professional accountants, tax, legal or financial advisers.

Oliver Wyman has made every effort to use reliable, up-to-date and comprehensive information and analysis, but all information is provided without warranty of any kind, express or implied. Oliver Wyman disclaims any responsibility to update the information or conclusions in this report. Oliver Wyman accepts no liability for any loss arising from any action taken or refrained from as a result of information contained in this report or any reports or sources of information referred to herein, or for any consequential, special or similar damages even if advised of the possibility of such damages.

This report may not be sold without the written consent of Oliver Wyman.

