MEMORANDUM

TO: File
FROM: Division of Trading and Markets
RE: Meeting with representatives from Oliver Wyman
DATE: February 8, 2012

On February 8, 2012, staff from the Division of Trading and Markets, Division of Investment Management, Division of Corporation Finance, Division of Risk, Strategy, and Financial Innovation, and Office of the General Counsel met with representatives of Oliver Wyman (John Lester and Dylan Walsh).

The purpose of the meeting was to discuss the proposed implementation of the Volcker Rule. The discussion primarily focused on the exemption to the prohibition on proprietary trading for market making-related activity and the attached study conducted by Oliver Wyman.

OLIVER WYMAN

Financial Services

THE VOLCKER RULE RESTRICTIONS ON PROPRIETARY TRADING

IMPLICATIONS FOR MARKET LIQUIDITY

FEBRUARY 2012

MARSH & McLENNAN COMPANIES

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Background and purpose of this study

Section 619 of the Dodd-Frank Wall Street Reform and Consumer Protection Act (commonly known as the Volcker Rule) was introduced into law in July 2010. The Volcker Rule was proposed as a means of ensuring the safety and soundness of the US financial system by restricting proprietary trading[1] by US banking entities, institutions with access to both insured deposits and the Federal Reserve's discount window. The five regulatory agencies charged with implementing the statute have now released formal notices of proposed rulemaking that contain draft regulations to implement the Volcker Rule.[2]

The central challenge presented by the statute is differentiating prohibited proprietary trading from permitted activity related to market making. This study focuses on one major aspect of this challenge – examining the risk the proposed rule could pose to market liquidity by establishing a regulatory regime that directly or indirectly constrains dealers' ability to make markets for investors, issuers, and other participants. We do not address other potential consequences of the proposed rule, such as implications for firms' strategies and operations, its interaction with other major regulatory changes, or knock-on effects on the structure of global capital markets.

This study builds on an analysis conducted for the Securities Industry and Financial Markets Association (SIFMA), which focused on quantifying the potential effects on market participants of a reduction in liquidity in one asset class – US corporate bonds.[3] For this we drew on the most recent and robust analysis of the effects of liquidity on US corporate bond values, conducted by Jens Dick-Nielsen, Peter Feldhütter, and David Lando (DFL).[4] We expand on our work for SIFMA with empirical tests of hypothetical limits on dealer inventories, a review of potential liquidity effects in additional asset classes, and a broader discussion of how specific features of the proposed rule contribute to the risk of harming market liquidity.

We have prepared this report with support and information from several large institutions subject to the statute. All findings and recommendations below are solely our own.

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[1] The statute also restricts banking entities' investments in vehicles such as hedge funds and private equity funds. This study only addresses the statutory restrictions on proprietary trading.

[2] All references made throughout this document to the "proposed Volcker Rule" or "proposed rule" refer to the Notice of Proposed Rulemaking, "Prohibitions and Restrictions on Proprietary Trading and Certain Interests in, and Relationships with, Hedge Funds and Private Equity Funds" posted to the Federal Register by the OCC, Board, FDIC, and SEC in November 2011. All references to the "statute" refers to Section 619 of the Dodd-Frank Wall-Street Reform and Consumer Protection Act passed by Congress in July 2010.

[3] Oliver Wyman, "The Volcker Rule: Implications for the US Corporate Bond Market," (Dec. 14, 2011), available at http://www.sifma.org/issues/item.aspx?id=8589936887

[4] "Corporate bond liquidity before and after the onset of the subprime crisis" (Dick-Nielsen, Feldhütter, Lando 2011)

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Summary findings

The proposed Volcker Rule represents a significant risk to market liquidity in a wide range of asset classes

- The implications of the Volcker Rule for ring-fenced proprietary trading by banking entities are clear – these businesses will be, and to a great extent already have been, wound down

- The implications for permitted activities, such as market making, that Congress explicitly allowed are less clear. If implemented, the proposed regulations would rely on several prescriptive criteria and mandatory processes to distinguish market making from prohibited speculative trading. This is an exceptionally difficult endeavor that could significantly impair liquidity provided by market makers

- Although the proposed rule sensibly avoids drawing bright lines between permitted market making and prohibited proprietary trading, we still see a significant risk of curtailing market making activity, as the proposed rule:

  - Is based on seven prescriptive criteria, all of which must always be met in order for the dealer's activity to fall within the definition of permissible market making activity

  - Requires each firm (and trading unit within it) to report a pre-defined list of metrics that may bias supervisors and dealers against allowing beneficial market making activities

- The combination of inflexible criteria for permissible market making and the mandatory collection of metrics risks driving significant changes to the level of market making that banking entities are able and willing to provide

  - The proposed rule does not include specific limits on core market making elements such as holding inventory and inter-dealer trading. However, it remains possible that explicit or implicit limits could be established by supervisors during or after the conformance period

  - Even if supervisors do not establish such limits, the proposed rule could induce behavioral changes in how banking entities conduct their market making activities. For instance, dealers may avoid some market making activities that contribute to “worse” results on the mandatory metrics reporting, to be certain that the criteria for permissible activity are met on a continuous basis

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  - The result would be an overly restrictive implementation of the statute, with (for example) effective limits on how long positions are held in inventory or how large dealer inventories are allowed to be

- The main providers of market making today are banking entities, so curtailing their principal market making activity would likely have significant negative effects on liquidity levels – with consequences for asset valuations, transaction costs, and ultimately yields demanded by investors

- While non-bank market participants (such as dealers not affiliated with banks or opportunistic providers of liquidity such as hedge funds) could eventually assume the principal-based market making activities currently provided by banking entities, any such transition would likely take years to achieve, would be costly and disruptive in the near term, and would push activity critical to the soundness of the US capital markets out of the most regulated and closely monitored financial institutions

  - Major bank-affiliated market makers have large capital bases, balance sheets, technology platforms, global operations, relationships with clients, sales forces, risk infrastructure, and management processes that would take smaller or new dealers years and billions of dollars to replicate

  - Hedge funds have a distinct business model that does not lend itself to client trading facilitation

The US corporate bond market provides a useful case study of the potential effects of an overly restrictive Volcker Rule regime

- The corporate bond market is highly fragmented (much more so than the parallel equities market). Each corporation typically has multiple bonds outstanding with different duration, yield, and collateralization characteristics. There were roughly 25,000 US corporate bond securities with a total market value of $8TN outstanding at the end of 2010; by contrast, there were only ~5,000 US equity listings with a total market value of $17TN

- This fragmentation means that trading activity and liquidity at the level of an individual bond is inherently low without the presence of a principal-based intermediary. Approximately 16,000 individual US corporate bonds were traded by institutional investors in 2009. For the majority of these bonds, trades occurred on fewer than 50 of the 252 trading days during the year (less than once per week on average). No single bond traded on every day of the year

- Investors require timely pricing and deal execution to be provided across the full spectrum of bonds to support liquidity. Dealers currently address these customer needs through principal-based market making – taking the other side of client trades, holding positions until they can be economically exited, and facilitating pricing. Buyers are rarely present when sellers want to sell and vice versa. Market makers thus play a key role by matching buyers and sellers through time – buying bonds from sellers and holding on to them until buyers appear. Without market makers intermediating through time, sellers would face

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more difficulty in selling in most cases, decreasing demand for the initial issuances of these instruments

- Using a database of all trades executed in the US corporate bond market during 2009, we find that placing hypothetical restrictions on inventory holding period, inventory size, or inter-dealer trading (all of which could plausibly follow from the current proposal) raise significant risks to liquidity:
  - A Volcker Rule regime that effectively limits dealers from holding inventory positions in individual securities for longer than one month would prevent ~30% of customer trades from being served
  - A Volcker Rule regime that effectively limits dealers from holding inventory in excess of the average daily volume traded across all US corporate bonds would prevent ~40% of customer trades from being served
  - The effect of the inventory size limit rises to ~70% under an environment in which no inter-dealer trading is permitted, demonstrating that a Volcker Rule regime that reduces the level (or efficiency) of inter-dealer trading would dramatically increase the proportion of customer trades that could not be served
- If liquidity is affected, the negative effects on market participants could be sizeable. Using the most recently available data on liquidity in the US corporate bond market from 2007-2009 (a period that includes both the financial crisis and more typical market conditions), we estimate that the liquidity effects of a restrictive implementation of the statute could include:
  - $90-315BN of mark-to-market losses to investors, as lower liquidity erodes the value of assets held by investors
  - $12-43BN in increased annual costs to US corporate issuers, as lower liquidity increases borrowing costs
- Using data on liquidity in the US corporate bond market from 2005-2007, an exceptionally benign environment in which liquidity was abundant and commanded historically low yield premia,[5] we estimate that the liquidity effects of a restrictive implementation would be smaller, but still significant:
  - $10-36BN of mark-to-market losses to investors
  - $2-5BN in increased annual costs to US corporate issuers
- Using full-year 2009 data, we separately estimate $1-4BN of increased annual transaction costs for corporate bond investors, as lower liquidity levels would drive wider bid-offer spreads

[5] See section 3.3 for detail

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Similar threats to liquidity exist in many other asset classes

- The effect on other markets could also be sizeable – banking entities play vital market making and liquidity provision roles in equities, commodities, foreign government debt, securitized assets, and interest rate derivatives

- In some of these markets, our concerns relating to the proposed rule take the same form as those outlined above for US corporate bonds. For example, many foreign government bond markets involve US banks playing major roles as principal-based market makers. As with corporate bonds, a restrictive implementation of the statute would threaten the liquidity levels in these markets and could result in mark-to-market losses for investors, higher borrowing costs for issuers (i.e. governments), and higher transaction costs for investors. While US government bonds are exempt from Volcker restrictions, market making in foreign government bonds is not

- In other markets, our concerns take a slightly different form. In the cash equities market, for example, liquidity in the most common types of trades would be marginally affected by the proposed rule. Non-standard trades, however, rely heavily on principals to minimize market impact and thereby protect investor assets. Simple index rebalances (where listings are added to or subtracted from indices like the S&P 500) could result in incremental costs of $600MM to $1.8BN per annum for investors tracking these indices

We believe that policymakers should refine the proposed rule and implement with care to reduce the risks outlined above

- We believe the proposed rule gets several important things right. It acknowledges that liquidity varies among asset classes and markets, and that the trading patterns and levels of risk-taking that are consistent with permitted market making activities will also vary across trading units. This acknowledgement, however, is not completely reflected in the substance of the proposed regulations.

- As a result, we suggest the following as policymakers look to refine and finalize their approach:

  1. Trading units that are demonstrably organized to serve client trading needs as principal-based market makers should be presumed to comply with permissible market making activity under the rule, unless there is specific evidence to the contrary

  2. While trading units should be required to collect data to enable regulators to monitor and investigate whether prohibited proprietary trading is taking place, the rule should build in more flexibility, so that firms and regulators can discover and judge over time which metrics are in fact useful, and so that one-size-fits-all metrics requirements do not endanger liquidity

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3. The criteria for distinguishing market making from prohibited proprietary trading should not implicitly assume market making functions should show consistent revenue, risk taking, and trading patterns – customer flows are often “lumpy” (e.g. via facilitating large trades) and volatile risk-taking and revenue are natural consequences for market makers

4. Inter-dealer trading should be explicitly acknowledged as a necessary activity of market makers in supporting customer trading, and metrics or principles that would indicate otherwise to dealers and supervisors (such as the Customer-Facing Trade Ratio) should be removed or modified

5. Policymakers should consider a gradual or phased implementation, introducing the Volcker Rule requirements in the asset classes least at risk of liquidity reduction first, and using the experience and lessons learned there to guide further implementation

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Impact on the US corporate bond market

The United States has the deepest and most liquid capital markets in the world today. 21% of global equity capital and 42% of global debt capital was raised in the US in 2010.[6] Nearly $7TN was raised through US bond markets in 2010, with corporate debt accounting for over $1TN alone. This represents 35% of debt issued by non-government or government-affiliated entities.[7]

Below, we examine potential effects of the proposed rule on this critical market. Our analysis will explore (1) the value of the principal market making model for US corporate bonds, (2) the potential effects of the proposed rule on liquidity in this market, and (3) the impact of these liquidity effects on investors and issuers.

3.1. The value of the principal market making model

Corporate bonds are flexible but complex securities. Beyond the interest rate risk associated with any fixed income instrument, investors in the corporate bond market bear meaningful credit or default risk. The market is structured in a way that reflects this risk, with different pricing dynamics for investment grade, high yield, and distressed debt – with the highest credit risk borrowers paying the highest coupons (or interest rates) on their debt.

Corporate bonds also offer issuers and investors significant flexibility in their terms. Corporate bonds may be secured (collateralized) by specific assets, represent senior or subordinated claims on the issuer's cash flows, offer fixed or floating rates, convert to equity under pre-defined circumstances, etc. As a result, a single issuer typically has a number of bond issuances outstanding in the market at any one time, with different maturities, seniority of claims, and coupon rates.

The net effect of this flexibility in credit quality, term structure, and pricing is a highly fragmented market with a large number of securities relative to total debt outstanding. There were roughly 25,000 US corporate bond securities with a total market value of $8TN outstanding at the end of 2010; by contrast, there were only 5,000 US equity listings with a total market value of $17TN.[8]

The fragmentation of the market means that trading activity and overall liquidity at the level of an individual bond is low. Approximately 16,000 individual US corporate bonds were traded in 2009, the most recent year for which comprehensive data are available. For the majority of

[6] Excludes government debt

[7] Dealogic, SIFMA

[8] FINRA TRACE, SIFMA, NYSE, NASDAQ, World Federation of Exchanges

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these bonds, trades occurred on fewer than 50 of the 252 trading days during the year (less than once per week on average). In stark contrast to the equities market, no single bond traded on every day of the year.[9]

TRACE corporate bond data

The Trade Reporting and Compliance Engine (TRACE) was introduced by FINRA (formerly NASD) in 2002 to improve price transparency in the US corporate debt market. The system captures and disseminates transaction-level information for publicly traded investment grade, high yield, and convertible corporate debt securities, representing all over-the-counter market activity in these bonds.

TRACE offers by far the most granular and comprehensive information on US secondary market activity, making corporate bonds the natural market to study the possible effects of the proposed rule. The most comprehensive TRACE data publicly available are the TRACE Enhanced Historical Data, of which 2009 is the most recent year available. Our analyses of trading patterns and liquidity in the corporate bond market are based on the 2009 TRACE Enhanced Historical Data.

[9] All analysis and exhibits in Sections 3.1 and 3.2 are based on TRACE Enhanced Historical Data provided for 2009, which was cleaned to remove retail trades (trades of <$100K), equity-linked notes, agency trades, and all cancelled, removed, or corrected trades.

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Exhibit 1: Distribution of institutional trading activity

Number of US corporate bonds, 2009

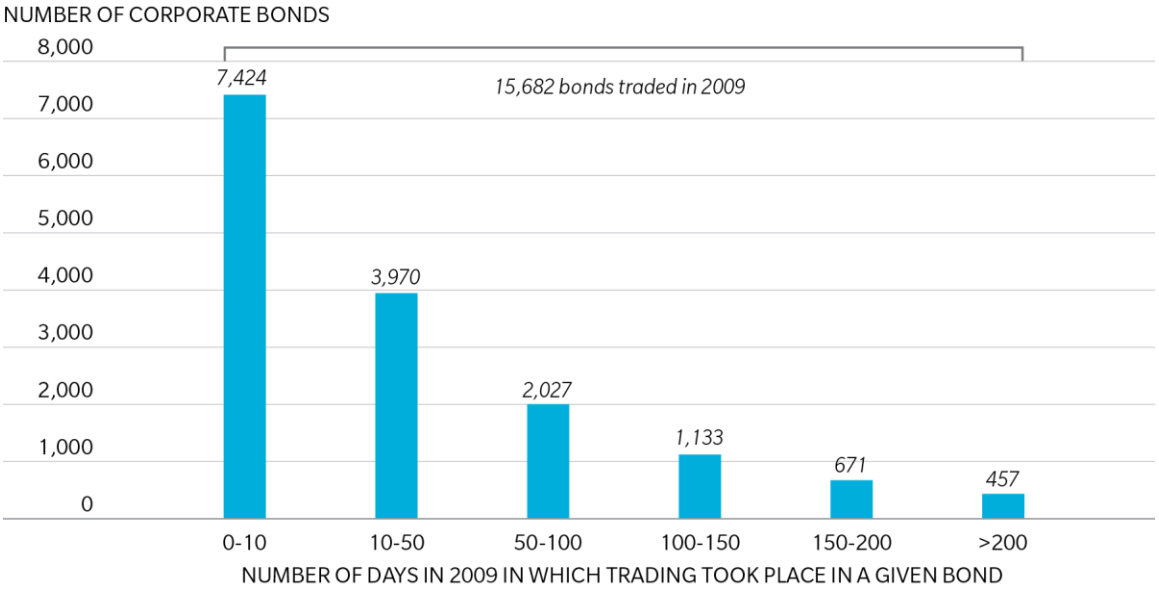

Exhibit 1: Distribution of bonds by the number of days in 2009 in which trading occurred. The majority of securities, regardless of the size of the issuer, traded on fewer than 50 of the 252 trading days during the year. However, a disproportionate number of the low volume bonds belong to small issuers (60% of bonds that traded fewer than 10 days were issued by companies outside the Fortune 500 vs. 30% of bonds that traded more than 200 days) making principal-based intermediation particularly critical for these companies. Source: FINRA TRACE, Oliver Wyman analysis

Because of the inherently limited and unpredictable nature of trading volume in individual corporate bonds, a buyer or seller is highly unlikely to find a natural near-term counterparty (i.e. another investor who wishes to trade the same bond at the same time). By contrast, investors looking to buy or sell equity shares in standard lot sizes can often efficiently trade directly with each other, because there are many active buyers and sellers at a given time for each individual security.[10] Market makers in the US corporate bond market actively bridge this market gap by standing ready to buy or sell (on a principal basis) from investors looking to trade a given security. Such dealers have a business model specifically organized to serve this market intermediation need, which includes:

- A large network of active trading partners, often across multiple asset classes

[10] Such equity trading is handled by brokers, which often act as agents in the transaction, and is generally executed on an organized exchange. Large "block" trades in equities exceed the liquidity typically available in the general market, and are not handled as agency trades. We examine the role of dealers acting as principals for such trades in Section 4.

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- Sizable internal sales forces, that develop and maintain information on the trading interests of many customers, in order to facilitate efficient market making
- Large investments in technology and processes to monitor and manage the risks inherent in principal market making
- Balance sheet capacity to hold inventory and sufficient capital to be a creditworthy counterparty

Absent effective market makers, an investor looking to trade a corporate bond would be forced to (1) hold the asset until a natural counterparty could be identified or (2) transact at prices that are "off market" to attract marginal counterparties to the other side of the trade. These adverse effects are known as "liquidity risk." The business model of the principal market maker is based on absorbing and managing liquidity risk, so that investors need not do so.

A critical aspect of markets that are served by market makers on a principal basis is inter-dealer trading. While the network of trading partners of a major market maker is much larger than that of even the largest investors, it does not cover the entire universe of potential trading partners. By actively trading with other market makers, each individual dealer effectively multiplies the size of its trading network, allowing more efficient market making across the entire market to match supply and demand from customers (and hedge the risk associated with taking on client trades).

Market makers that trade with customers on a principal basis are necessary whenever the inherent liquidity in an asset class (or individual trade) would pose uneconomic levels of liquidity risk to investors.

3.2. Potential effects of the proposed Volcker Rule on liquidity

The dominant market makers in the US corporate bond market are owned by or affiliated with banks: with the conversion of Goldman Sachs and Morgan Stanley to Bank Holding Companies in 2008, 17 of the 21 US primary government securities dealers are now owned by or affiliated with banks.[11] As such, they are subject to Volcker Rule restrictions on proprietary trading. The statute that restricts banks and their affiliates from proprietary trading also explicitly permits those firms to conduct "market making related" trading activities. The proposed rule issued by the regulatory agencies seeks to allow banking entities to continue market making activities while restricting prohibited proprietary trading.

[11] Primary dealers are official trading counterparties of the Federal Reserve Bank of New York in its implementation of monetary policy. The role includes obligations to: (1) participate consistently as counterparty to the New York Fed in its execution of open market operations, (2) provide the New York Fed's trading desk with market information and analysis helpful in the formulation and implementation of monetary policy, and (3) participate in all auctions of U.S. government debt. While these dealers have no formal role in the US corporate debt market, in practice these 21 dealers (given their scale and creditworthiness) are the primary 'market making' counterparties for all US debt markets.

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The proposed rule defines seven prescriptive criteria that all must be met for activity to fall within the definition of permissible market making. For example, the statute permits market making-related "activities…to the extent that [they] are designed not to exceed the reasonably expected near term demands of clients, customers, or counterparties." The proposed rule goes beyond the activity-based *design* test of the statute, to create a test based on whether inventory has exceeded reasonably expected near term demands of only customers *in any particular instance*: "Absent explanatory facts and circumstances, particular trading activity will be considered to be prohibited proprietary trading, and not permitted market making-related activity, if the trading unit… retains principal positions and risks in excess of reasonably expected near term customer demands."[12] What will constitute sufficient explanatory facts and circumstances is not clear.

The proposed rule also mandates the collection of a range of metrics in order to aid regulators with ongoing judgments about which activities are permissible and which are not. For example, several metrics aim to measure whether inventory or risk positions exceed reasonably expected near-term customer demand – specifically inventory turnover, inventory aging, and customer-facing trade ratio. Furthermore, the proposed rule is clear that lower inventory turnover, longer inventory holding periods, and higher levels of inter-dealer trading (relative to customer trading) will be indicative of prohibited proprietary trading:

> *"The fourth set of quantitative measurements relates to customer-facing activity measurements, and includes Inventory Risk Turnover, Inventory Aging, and Customer-facing Trade Ratio. These measurements are intended to provide banking entities and Agencies with meaningful information regarding the extent to which trading activities are directed at servicing the demands of customers. Quantitative measurements such as Inventory Risk Turnover and Inventory Aging assess the extent to which size and volume of trading activity is aimed at servicing customer needs, while the Customer-facing Trade Ratio provides directionally useful information regarding the extent to which trading transactions are conducted with customers."* [13]

The proposed rule appropriately does not include specific limits for these metrics. It remains possible, however, that supervisors could establish such limits explicitly or implicitly (via supervisory expectations) during or after the conformance period.

Even if supervisors do not establish such limits, banking entities may end up changing their own behavior in conducting market making activities. One of the ways the proposed rule could induce unintended behavioral changes is its requirement that a range of pre-defined metrics must all be collected for every trading unit on a daily basis. Metrics that are collected and assessed by supervisors tend to induce behavioral changes at regulated institutions, even if there are not formal standards for the metrics. Given the interpretive lens through which the mandated quantitative measurements will viewed by the regulators (as articulated in the proposed rule), banking entities may look to avoid legitimate and beneficial market making

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[12] "Prohibitions and Restrictions on Proprietary Trading and Certain Interests in, and Relationships with, Hedge Funds and Private Equity Funds" 76 FR 68962 (November 7 2011)

[13] "Prohibitions and Restrictions on Proprietary Trading and Certain Interests in, and Relationships with, Hedge Funds and Private Equity Funds" 76 FR 68888 (November 7 2011)

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activities that would produce "worse" metric results. Given the prescriptive criteria for permitted market making in the proposed rule, such institutions would look to change their current customer-facing activities, in order to be certain that the criteria are met on a continuous basis. Such behavioral changes could easily result in effective limits on activities that are directly measured by the mandated metrics, such as holding inventory or inter-dealer trading.

Whether limits on holding inventory or inter-dealer trading are explicit or the effective result of behavioral changes, the result would be an overly restrictive implementation of the statute. Despite the proposed rule containing no specific limits, we view the emergence of effective versions of such limits as a plausible outcome of the proposed rule.

What would be the effects of such effective limits on inventory turnover, inventory holding periods, and inter-dealer trading? To help answer this question, we simulate the effect of possible constraints on the holding period and size of inventory for securities in the US corporate bond market using 2009 trade-level data from TRACE.

Limits on inventory holding period

To estimate the effect of constraints on the length of time market makers can hold a position in inventory, we place a one month (21 trading day) limit on the holding period permitted for any security. For each security, we re-play all 2009 customer-to-dealer trades and estimate how long it would take for each trade to find a "natural match." For each customer buy transaction, we track how long it takes for subsequent offsetting customer sell transactions to take place (and vice versa). We match all buy and sell volume sequentially from the start of the year and track the time between the offsetting trades. We then calculate what dollar volume of customer trades could be served if market makers could only hold onto positions for one month. (This analysis looks only at the first-order impact on customer volume that can be served, and so does not consider the possibility of non-banks entering the market to provide liquidity; we discuss this possibility more broadly at the end of Section 3.2.)

This analysis assumes a perfect inter-dealer market exists, so that any two customer orders can be offset against one another. This implies, for example, that a customer buy order received by one dealer can be immediately offset against a customer sell order received by another dealer. Our calculation, therefore, is conservative.

We find that limiting inventory holding periods to one month would prevent 27% of customer trading volume from being served. This is the average observation across all bonds, and while it is significant, more telling is the potential impact on individual securities. For example, roughly 60% of trading volume in the most frequently traded Gillette bond[14] could not be served by market makers subject to a one-month holding period limit; and 15% of customer volume would still be cut off if limits were relaxed to three months (see Exhibit 2a). The results vary considerably across bonds, ranging from 24% of volume not served for the most heavily traded securities (top 25% of bonds) to 73% of volume not served for the least heavily traded securities

[14] FINRA Bond Symbol G.GV, with 65 customer transactions in 2009

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(bottom 25% of bonds) under a one-month limit (see Exhibit 2b).[15] Dealers constrained by holding period limits would actively reduce exposure to the least liquid securities, which are precisely the securities in greatest need of dealer intermediation to serve customers.

Exhibit 2a: Executable customer volume under inventory holding period limits
Sample bonds, 2009

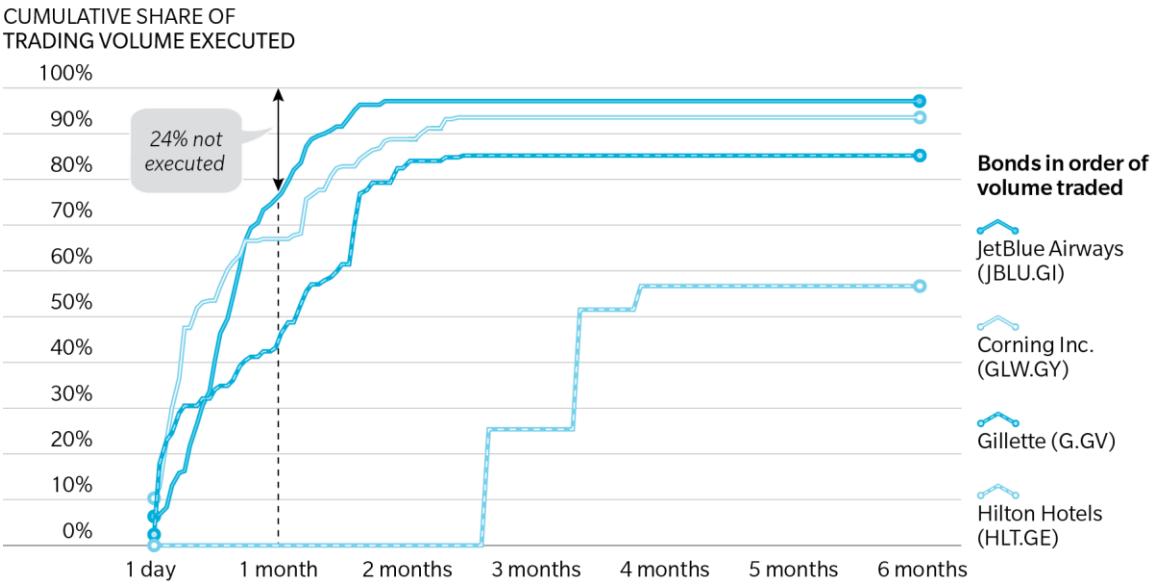

Exhibit 2a: Executable customer volume under inventory holding period limits for a sample of issuers. Each bond shown above is the bond most frequently traded in 2009 for each issuer. For each security, we re-play all 2009 customer-to-dealer trades and estimate how long it would take for each trade to find a "natural match." In other words, for each customer buy transaction, we track how long it takes for subsequent offsetting customer sell transactions to take place (and vice versa). We match all buy and sell volume sequentially from the start of the year and track the time between the offsetting trades. We then calculate what dollar volume of customer trades could be served if market makers could only hold onto positions for certain maximum periods (e.g. 1 day, 1 month, 2 months, etc.). Note that many bonds trade only a handful of times all year (such as the Hilton Hotels bond shown above, which traded only seven times in 2009). If, for example, the first trade of the year is a buy order in January and an offsetting sell order does not occur until April, then executable volume will only rise above zero percent after three months. These less liquid bonds will naturally produce "kinked" curves similar to that of the Hilton Hotels bond shown above. Source: FINRA TRACE, Oliver Wyman analysis

[15] Summary results (across volume quartiles or the market as a whole) reflect the average executable volume for all securities in the sample, weighted by total number of trades in 2009 in each security. By way of illustration, if security A traded 95 times in 2009 and showed 100% of volume executed within one month and security B traded 5 times in 2009 and showed 50% of volume executed within one month, then the average executable volume at one month across these two securities would be 97.5%: (100%*95 + 50%*5) / (95 + 5) = 97.5%. Volume quartiles are constructed based on total 2009 dollar volume traded.

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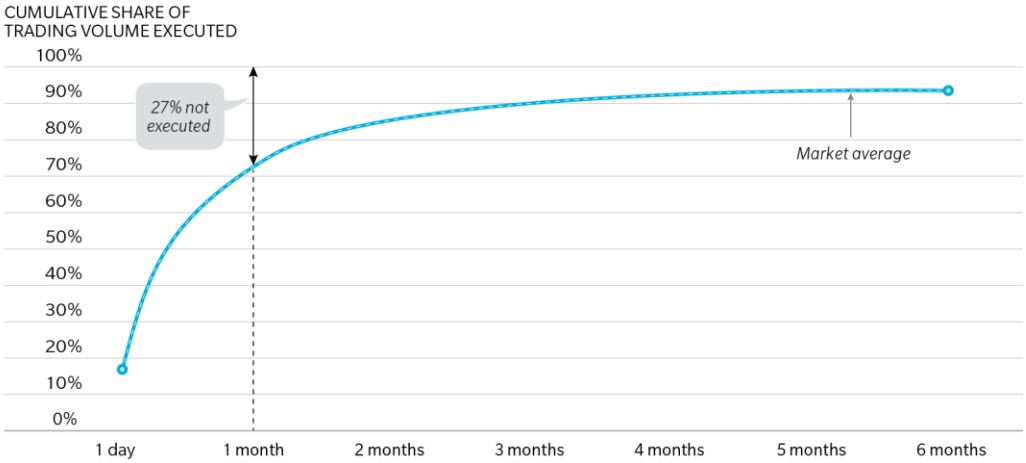
Exhibit 2b: Executable customer volume under inventory holding period limits
Market summary, 2009



	1 day	1 month	2 months	3 months	4 months	5 months	6 months
MARKET AVERAGE	16%	73%	86%	90%	92%	93%	93%
25% most heavily traded bonds	14%	76%	89%	93%	94%	95%	95%
25%-50% most heavily traded bonds	23%	65%	78%	83%	87%	88%	89%
50%-75% most heavily traded bonds	19%	42%	50%	56%	60%	63%	65%
25% least heavily traded bonds	12%	27%	30%	33%	35%	37%	38%

Exhibit 2b: Market executable customer volume under inventory holding period limits. Summary results (across volume quartiles or the market as a whole) reflect the average executable volume for all securities in the sample, weighted by total number of trades in 2009 in each security. By way of illustration, if security A traded 95 times in 2009 and showed 100% of volume executed within one month and security B traded 5 times in 2009 and showed 50% of volume executed within one month, then the average executable volume at one month across these two securities would be 97.5%: (100%*95 + 50%*5) / (95 + 5) = 97.5%. In general, less volume can be served for less heavily traded bonds within a given time limit. However, because less heavily traded bonds often trade only around significant events (e.g. a credit downgrade), these bonds actually see relatively more trades "matched" within a day than many more regularly traded bonds. Across all bonds, but especially for the least frequently traded bonds, even the full year is generally not long enough for market makers to locate an offsetting trade for all customer trades. Volume quartiles each contain ~4,000 bonds and are constructed based on total 2009 dollar volume traded. Source: FINRA TRACE, Oliver Wyman analysis

Limits on inventory size

We use a similar re-play of actual customer trades to assess the impact of constraints on the size of market maker inventories. We assume a limit of the average daily volume for the market as a whole (1x ADV) for 2009 and randomly assign trades to five dealers.[16] We measure a

[16] While there are more than five large dealers for US corporate bonds, there is also a degree of specialization in market making at the level of individual issuers and bonds (often related to which dealers originally underwrote the

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given dealer's total inventory as the sum of its net long and net short positions in each bond[17] and count trades that would cause inventories to exceed the 1x ADV limit as not permitted.

As before, we start by assuming a perfect inter-dealer market, where one dealer can trade with another to execute order flow, find available inventory capacity, and manage risk. Under this assumption, a trade can be split among multiple dealers and is only not permitted if all five dealers collectively lack the necessary capacity to fill the order. We find that a limit on inventory size for each dealer of 1x ADV for the year would cut off 38% of customer trading volume in the market.

Limits on inter-dealer trading

We then relax the assumption of a perfect inter-dealer market and re-run the inventory limit simulation. For this scenario, any trade that would put a given dealer over its limit is not permitted – i.e. no inter-dealer trading takes place. Here, we find that a limit on inventory size for each dealer of 1x ADV for the year would cut off 69% of customer trading volume in the market (see Exhibit 3b).

The natural level of inter-dealer volume in the US corporate bond market is significant – inter-dealer trading made up 16% of total trading volume in 2010.[18] Restricting this activity would reduce dealers' capacity to orders that could be executed within their own individual limits. Restricting inter-dealer trading (in a hypothetical five dealer market) would reduce executable customer volumes from 62% to 31% under an inventory limit of 1x ADV – effectively halving the amount of customer trading that could be accommodated.

See appendix B.1.1 for further details on methodology.

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bond when it was issued, as shown in the equity market by Ellis, Michaely, and O'Hara (2000)). We believe five dealers is a reasonable approximation for the number of dealers active at the level of individual bonds.

[17] This is consistent with the data that will be collected under the proposed rule for the Inventory Aging metric, which will track a "trading unit's aggregate assets and liabilities" (see Appendix A). A trading unit's long positions are accounted for as assets, while a trading unit's short positions are accounted for as liabilities.

[18] 2010 TRACE Fact Book

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Exhibit 3a: Simulated Home Depot bond inventory

1x ADV limit and no inter-dealer market, 2009

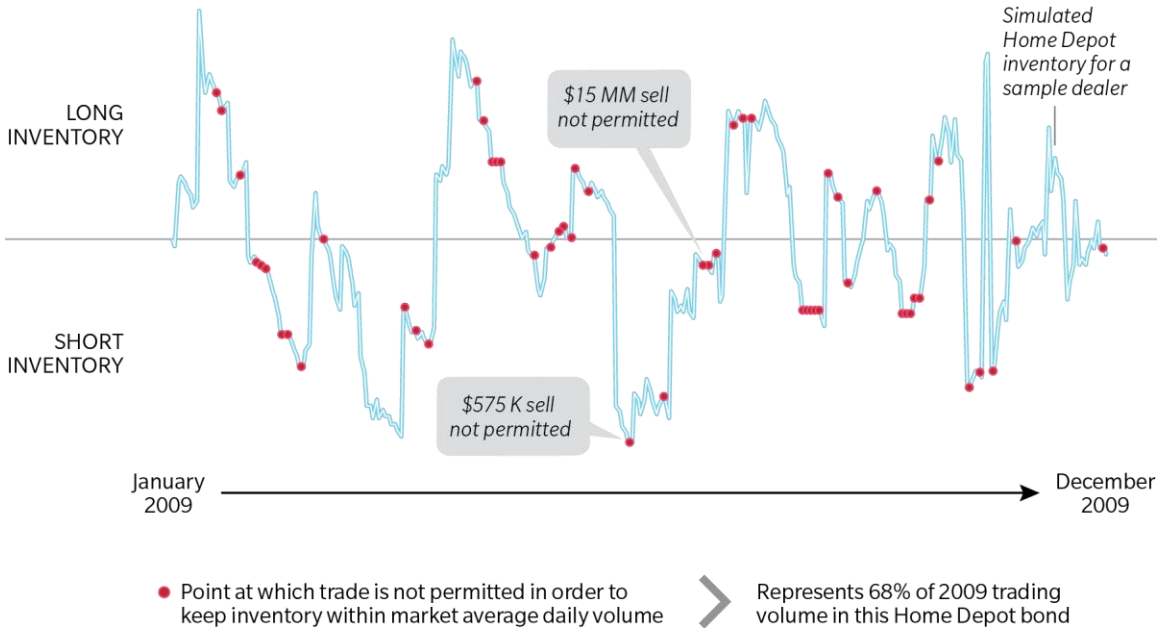

Exhibit 3a: Simulated 2009 inventory for a Home Depot bond (FINRA bond symbol HD.GH) for one of five dealers with an inventory limit of the 2009 market average daily volume (ADV) and no inter-dealer market. All observed 2009 trades in this bond are randomly assigned to five dealers. The blue curve represents one dealer's inventory over the course of the year, with inventory rising as the dealer buys bonds from customers and falling when it sells bonds to customers. Where the inventory line crosses the axis, the dealer is holding no inventory. This is one bond from a total of 15,682 total corporate bonds across the market whose inventories are being tracked and totaled. If a trade is observed that would put the market-wide inventory above the 1x ADV limit, then it is not executed ("not permitted") in order to keep inventory within the limit. The red circles show each instance of a trade in this one bond being not permitted. The analysis demonstrates that under effective limits on inventory size, even when a dealer's inventory in close to zero, large customer orders could be prevented from being filled. Further, when a dealer's inventory is large, even small customer orders could be prevented from being filled. Source: FINRA TRACE, Oliver Wyman analysis

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Exhibit 3b: Permitted share of customer volume under inventory limits

Percent permitted under market-level limits, 2009

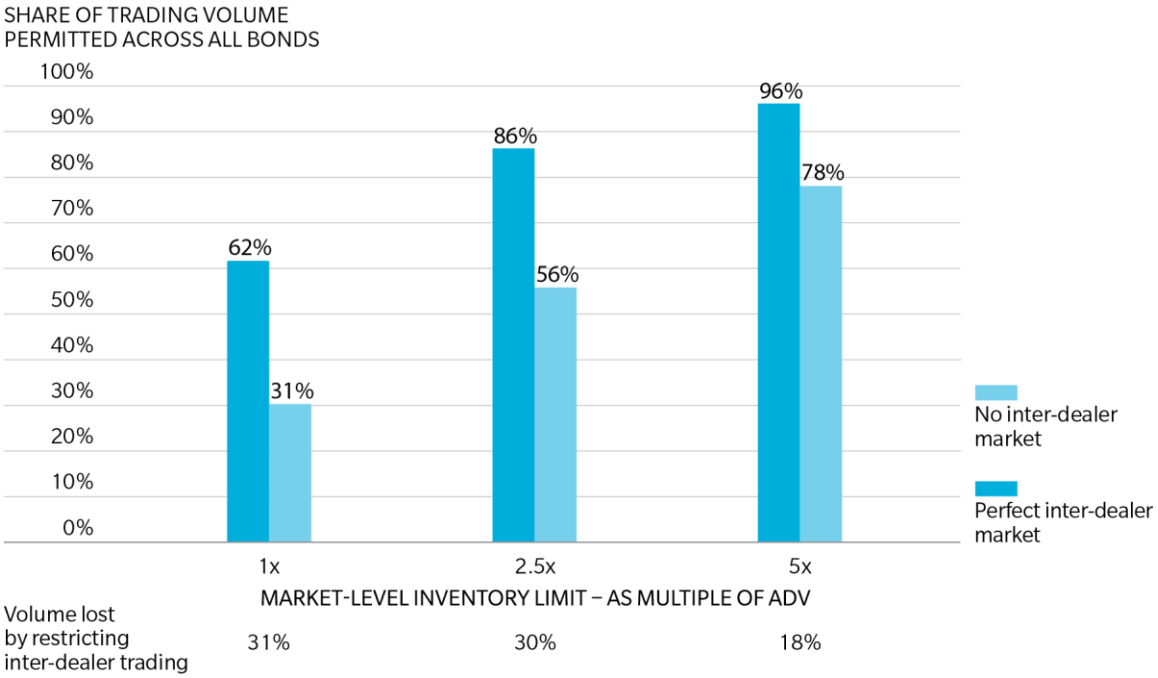

Exhibit 3b: Permitted share of customer volume under market-level inventory limits. Results of analysis that simulates effect of inventory limits by randomly assigning observed 2009 trades to 5 dealers and tracking when trades would put dealer inventories above given limits – multiples of the average daily volume (ADV) traded across a single asset class, in this case all corporate bonds. The perfect inter-dealer scenario allows all trades for which the market as a whole has capacity whereas the no inter-dealer market scenario only allows trades for which a given dealer has capacity. Difference between the perfect inter-dealer market scenario and the no inter-dealer market scenario is the incremental volume served as a result of inter-dealer trading. Source: FINRA TRACE, Oliver Wyman analysis

As this analysis illustrates, the proposed rule could cause market makers to curtail their market making activities, via implicit limits on inventory holding periods, inventory size, and inter-dealer trading. Any such pullback by affected market makers would have significant effects on the liquidity available to investors seeking to buy or sell US corporate bonds, with knock-on effects for corporate issuers.

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The potential for non-banks to fill the liquidity gap

Because the proposed rule only applies to banking entities, the natural question arises of whether new or existing firms not subject to Volcker would take the place of today's bank-affiliated market makers. The answer is a complex and qualified *eventually*.

Existing non-bank broker dealers (such as Jefferies and Cantor Fitzgerald) are a fraction of the size of the major, bank-affiliated dealers, and could not take over those institutions' market making functions anytime soon. The largest dealers have developed over decades large capital bases, balance sheets, technology platforms, global operations, relationships with clients, sales forces, risk infrastructure, and management processes that would take smaller or new dealers years and billions of dollars to replicate.

Could a large number of much smaller, simpler firms take the place of today's leading dealers? We think this is doubtful, given the economies of scale and scope inherent in the business. For many products, the "table stakes" of being a credible dealer are so large that small franchises are not economical. For example, operating a market maker in such core products as interest rate swaps and equity derivatives requires an enormous infrastructure merely in order to properly track counterparty credit risk. Many other internal risk management and regulatory requirements similarly incentivize firms to spread such fixed costs over larger businesses. Critically, having a global presence and a large network of trading partners allows the major dealers to match supply and demand efficiently and to better diversify risks.

In some asset classes, hedge funds and other active traders can and do provide incidental liquidity as they pursue trading strategies. However, such firms do not have a business model based on making markets, and are at best opportunistic sources of liquidity looking to maximize revenue on each transaction. Market makers often face facilitation costs on client trades, as clients on average usually want to sell when markets are dropping – hedge fund liquidity is not positioned for this market role. Many funds withdraw from the markets in times of trading stress.[19]

Some major hedge funds could look to start or expand affiliated broker-dealers. However, the limited success that some large hedge funds have had in recent years in trying to enter the market making business point towards the considerable hurdles such a shift would involve. For example, today's largest dealers have headcounts an order of magnitude larger than the biggest hedge fund groups. And as the experience of MF Global shows, non-bank broker-dealers remain vulnerable to "runs" as they depend on market funding and confidence.

If liquidity were significantly damaged by the proposed rule, we believe that non-bank firms that look very much like today's major dealers could eventually take their place. The transition period would likely involve significant cost and disruption to many markets. Moreover, such firms would present all of the same supervisory challenges and systemic risk concerns that today's largest dealers do. The non-bank dealers would either exist outside the bank supervisory framework and therefore outside the most stringent supervision and rigorous monitoring in the financial system, or would alternatively be designated as systemically important and therefore require a tailored and untested supervisory regime (potentially even including Volcker Rule restrictions). Pushing the critical and complex activity of market making outside of the most carefully regulated financial institutions is both inconsistent with the statute and a poor policy outcome.

[19] Examples include hedge funds Appaloosa Management and Atticus Capital withdrawing $2.5BN (80%) and $7.6BN

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3.3. Impact on investors, issuers, and the broader economy

We believe that a meaningful reduction in liquidity available to market participants is a real risk posed by the proposed rule as it is finalized and implemented. The analysis of hypothetical limits on market makers described above indicates that simple (and plausible, given the proposed rule) constraints on dealer activities could result in a meaningful shift of liquidity risk to investors. Customers that could not be served by market makers under Volcker restrictions would have to absorb unwanted price risk as they could not trade immediately, and would face greater overall costs of trading, as larger price concessions would be needed to attract willing counterparties.

We have estimated the potential size of the clear first-order effects of a general reduction in liquidity on participants in the US corporate bond market. To understand the range of potential effects of a liquidity shift and their magnitude, we model three scenarios of a market-wide reduction in liquidity. Each scenario is defined as an overall shift in the distribution of a statistical measure of liquidity, which directly measures the overall costs of trading a given bond, as well as how volatile that cost is over time.[20] We size these liquidity shifts by reference to how much liquidity is observed to vary across different bonds over a period covering 2005-2009.

Specifically, the scenarios correspond to how much the liquidity statistic changes between the median liquidity bond and a bond (1) 5 percentile points less liquid, (2) 10 percentile points less liquid, and (3) 15 percentile points less liquid (see Exhibit 4).

(95%) of their capital, respectively, from the market amidst stock market turmoil in 2008. "Tepper, Barakett Abandon Stocks as Funds Cut Holdings (Update2)", Bloomberg (November 17, 2008)

[20] Liquidity here is defined as the composite measure λ developed in DFL, calculated as an equally weighted sum of Amihud's measure of price impact, a measure of roundtrip cost of trading, and the standard deviations of both, all normalized.

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Exhibit 4: Liquidity shift scenarios

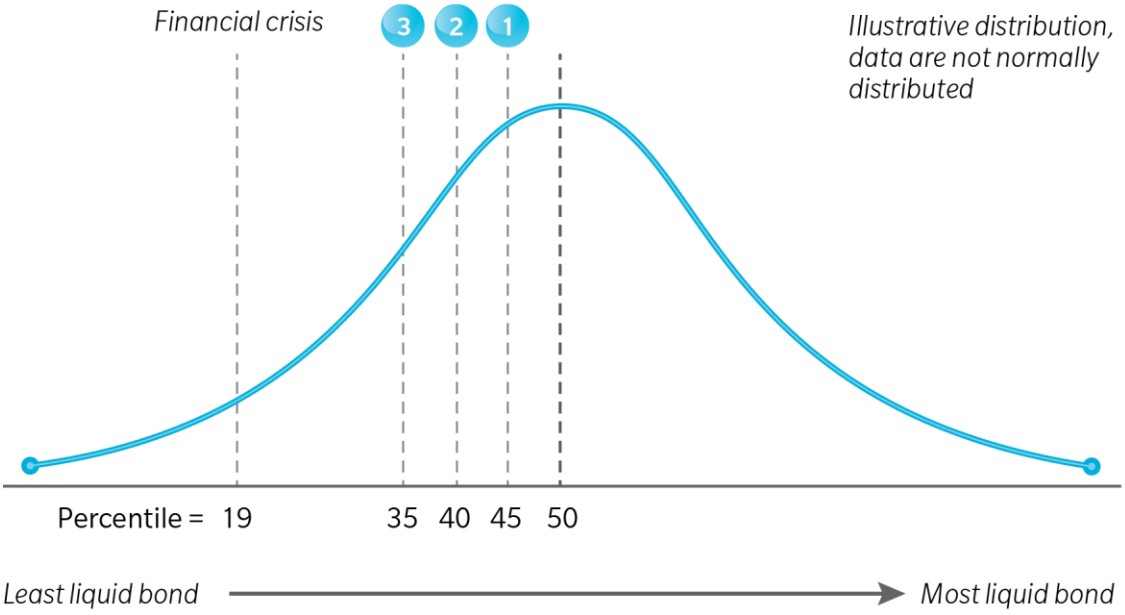

Exhibit 4: Liquidity shift scenarios. Each scenario postulates a reduction in liquidity for the median liquidity bond (50th percentile) within the most recently observed distribution of observed liquidity. Source: Dick-Nielsen, Feldhütter, Lando. "Corporate bond liquidity before and after the onset of the subprime crisis" (May 2011) ("DFL"), Oliver Wyman analysis

This way of constructing our liquidity reduction scenarios is necessarily arbitrary, but we judge the overall shifts in liquidity modeled to be realistic potential outcomes of the proposed rule. One reference point is provided by the reduction in liquidity that the US corporate bond market experienced during the recent financial crisis, which in equivalent terms would be comparable to a 31 percentile point liquidity shift (vs. a 15 percentile point shift in our large scenario).[21]

Our analyses of the effects on customer trading of hypothetical limits also suggest that our scenarios are likely to be conservative – an inability to serve ~30% customer volume under a hypothetical inventory restriction does not translate precisely to a 30 percentile shift of a statistical liquidity measure, but would logically drive a significant increase in liquidity risk for investors.

[21] Using a standardized measure of the liquidity premium, DFL observes a six-fold increase in the liquidity premium – from 32 bps to 200 bps – following the crisis. An equivalent shift would translate to ~$800BN in mark-to-market losses on holdings of corporate bonds today. This equates to a 31 percentile shift for the 'median liquidity bond' in the most recently available sample of corporate bonds – the starting point for our scenario analysis.

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Regarding the Dick-Nielsen, Feldhütter, and Lando paper (DFL)

The effects of liquidity on asset values are well studied in academic finance, both theoretically and empirically. The advent of the FINRA TRACE database, which provides a rich and essentially complete record of historical trades of US corporate bonds, has made that market one of the best studied in finance.

The most recent and robust analysis is "Corporate bond liquidity before and after the onset of the subprime crisis" by Jens Dick-Nielsen, Peter Feldhütter, and David Lando (DFL). DFL uses the same core method used by many investigations into liquidity effects on corporate bonds: a disaggregation of credit risk and liquidity risk contributions to observed yields.[22] For our investigations of the potential effects of a liquidity reduction, we rely on the core liquidity impact analysis by DFL – estimates for yield differences among bonds of different liquidities (i.e. yield liquidity premia). We have also undertaken complementary analytical work in order to extend the baseline DFL analysis, to be able to better estimate the effects of specific changes in liquidity.

Note that DFL is fundamentally concerned with liquidity changes between the pre- and post-crisis period. While we do use the DFL analysis as a building block, we do not assume that our potential liquidity reductions are related (in magnitude or structure) to the liquidity effect of the crisis, and our liquidity scenarios are not defined in terms of that difference.

Using scenarios ranging from a 5-15 percentile shift in liquidity, we find that any reduction in liquidity of this magnitude would have significant effects. The magnitude of the estimated effects is a function not only of the assumed reduction in liquidity, but also of market conditions, which can dramatically affect how valuable liquidity is for market participants. The DFL study provides estimates of liquidity yield premia from two panels: 2005Q1-2007Q1 and 2007Q2-2009Q2. The pre-crisis 2005-2007 panel covers a period of exceptionally ample liquidity in global markets. One of the underlying statistical measures of market illiquidity used in DFL (the Amihud measure of price impact) was at 25-year lows in equity markets during 2005-2007.[23] The most recent DFL panel (2007-2009) includes both more typical market conditions and the stress conditions of the financial crisis.

Using both panels, we find significant potential effects from plausible decreases in market liquidity resulting from a restrictive implementation of the statute. Using the 2007-2009 panel, we estimate:

[22] "Liquidity Risk of Corporate Bond Returns" (Acharya, Amihud, Bharath 2009); "Corporate Yield Spreads and Bond Liquidity" (Chen, Lesmond, Wei 2007); "Liquidity or Credit Risk? The Determinant of Very Short-Term Corporate Yield Spreads" (Covitz, Downing 2007)

[23] "An Analysis of the Amihud Illiquidity Premium" (Michael Brennan, Sahn-Wook Huh, Avanidhar Subrahmanyam 2011)

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- $90-315BN of mark-to-market losses to investors, as lower liquidity would erode asset values, other things equal

- $12-43BN in increased annual costs to US corporate issuers, as lower liquidity would raise borrowing costs, other things equal

Using data from the exceptionally benign market of 2005-2007, we estimate much smaller but still significant results:

- $10-36BN of mark-to-market losses to investors
- $2-5BN in increased annual costs to US corporate issuers

Separately, we estimate $1-4BN of increased annual transaction costs for corporate bond investors based on full-year 2009 data, as lower liquidity levels would drive wider bid-offer spreads.

Exhibit 5: Summary of impacts under liquidity stress scenarios[24]

	Liquidity shift scenario				
Additional cost	**Small**	**Medium**	**Large**	**One-time cost**	**Recurring annual cost**
Asset valuations: asset holders will suffer a one-time market value depreciation as a result of higher illiquidity premiums	*2007-2009 panel*			✓	
	$90BN	$200BN	$315BN		
	2005-2007 panel				
	$10BN	$22BN	$36BN		
Borrowing costs: issuers will have to pay higher yields on new debt raised to compensate investors for holding less liquid assets	*2007-2009 panel*				✓
	$12BN	$26BN	$43BN		
	2005-2007 panel				
	$1.6BN	$3.4BN	$5.5BN		
Transaction costs: investors will have to pay more to trade bonds that are now systematically less liquid	$1.3BN	$2.4BN	$3.9BN		✓

Below we discuss these potential effects in more detail.

[24] (1) Asset depreciation is a mark-to-market loss calculated as the percent reduction in price of outstanding bonds from face value as a result of yield premium increase (where price is calculated for each rating classification using average coupon and average maturity from Dealogic data) multiplied by the total debt outstanding. (2) Borrowing costs reflect the "steady state" cost, which implies that all outstanding debt has been refinanced at higher rates. (3) Transaction costs proxied using 50% of average purchase and sale price range. Source: Dealogic, TRACE, "Corporate bond liquidity before and after the onset of the subprime crisis" (Dick-Nielsen, Feldhütter, Lando 2011), Oliver Wyman analysis

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Systematically reduced asset values

Investors hold approximately $7.7TN in US corporate bonds with maturities of greater than one year worldwide today; US household investors hold nearly $3TN of this total.[25] Liquidity is a key factor in the value of these outstanding securities. The price investors are willing to pay for an asset is partly a function of the ability to resell this asset to other investors in the future. An asset that is relatively costly or difficult to liquidate in the future will be worth less. In the debt markets, this manifests as lower market values for individual bonds and higher market yields (interest payments relative to the amount paid for the security).

Based on the liquidity profile of US corporate bonds in the most recent sample of 2007-2009, we estimate an average increase in liquidity premium (higher yield paid to compensate investors for reduced liquidity) of 16-55 bps, depending on the severity of the liquidity shift. These represent the average liquidity premia across all securities; the magnitude of the liquidity premium varies considerably across the credit spectrum, with A-rated debt bearing a premium of 27 bps and high-yield debt 72 bps (both under a 10-percentile liquidity shift).

A liquidity premium increase of 16-55 bps would equate to a mark-to-market decline in the value of existing securities of $90-315BN across the three scenarios. While large on an absolute basis, the loss in the large scenario amounts to less than a 5% reduction in the value of outstanding US corporate debt.

Using liquidity data from the exceptionally benign (high-liquidity) environment of 2005-2007, the estimated increase in liquidity premia would be 2-7 bps. A liquidity premium increase of 2-7 bps would equate to a mark-to-market decline in the value of existing securities ranging from $10-36BN across the three scenarios.

Higher borrowing costs for issuers

US corporate issuers raise approximately $1TN in debt through the capital markets each year – $950BN on average from 2007-2010. Borrowing costs are modest, with an average interest rate of 5.7% across securities issued since 2005 (excluding floating rate coupons). As liquidity declines for all securities under our three scenarios, the average interest rate of new offerings will increase to compensate investors.

A single year of issuance incorporating higher liquidity premia would result in incremental costs for US corporate issuers of $2-6BN using the 2007-2009 liquidity panel. Once existing debt has been fully replaced with debt incorporating the higher coupon payments, the steady-state annual incremental cost to issuers would be $12-43BN. These costs will fall disproportionately on smaller issuers with lower ratings, given higher liquidity premia for the bonds of lower rated (generally smaller) issuers. We estimate a steady-state earnings drag (increased borrowing costs as a percentage of net income in 2010) of 1-3% for A-rated issuers like Walt Disney and Caterpillar and up to 20% for high yield issuers like Delta Airlines and Sears.

[25] Source: SIFMA, Federal Reserve Flow of Funds (Q2 2011), Oliver Wyman analysis

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Using the earlier panel of data from DFL, we estimate steady-state incremental costs to corporate issuers of $1.6-5.5BN under a highly benign environment.

Higher transaction costs for investors

Transaction costs are a direct reflection of market liquidity, and any decrease in liquidity would result in higher costs paid by investors to trade. For US corporate bonds (as with most other asset classes), there is no readily available public or proprietary source of information on transaction costs (i.e. bid-offer spread). We therefore estimate imputed transaction costs by matching dealer-to-customer buy orders and sell orders conducted on the same day, for each individual bond.

Our analysis indicates that institutional investors pay an average of 20.5 bps (on a one-way trade) to transact in US corporate bonds, based on the most recent full sample of trade-level data (2009). Given annual customer-to-dealer transaction volumes of $3.3TN, total transaction costs paid by investors are approximately $6.7BN today. However, there is significant variation in transaction costs across securities of different liquidity – rising as high as 48 bps on average for the least liquid securities.

A percentile shift roughly equivalent to the liquidity stress scenarios we model above would add between $1.3 and 3.9BN in additional costs for investors: $1.3BN for a 5 percentile increase in transaction costs (small scenario), $2.4BN for a 10 percentile increase in transaction costs (medium scenario), and $3.9BN for a 15 percentile increase in transaction costs (large scenario).

See appendix B.1.2 for further details on methodology.

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Exhibit 6: Imputed transaction costs by liquidity bucket

Transaction costs in bps, liquidity buckets in $MM of trading volume for each security and day

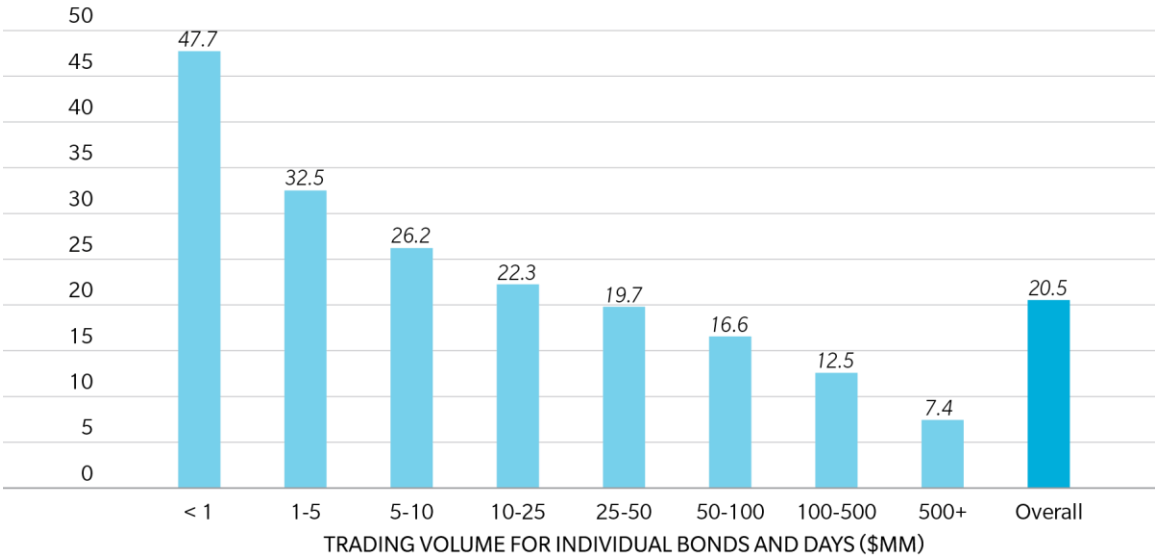

Exhibit 6: Imputed transaction costs by liquidity bucket. We calculate transaction costs in each bond as half the difference between the average customer buy prices and average customer sell prices in a given day taken as a share of the bond price. This represents the effective cost paid by investors for a given transaction. Buckets reflect average transaction costs where a bond's volume for the day falls within the bucket range. By way of example, 7.4 bps is the average transaction cost across all transactions where a bond traded more than $500MM in a day in 2009. Source: FINRA TRACE, Oliver Wyman analysis

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Considerations for other asset classes

The analysis above provides a comprehensive illustration of the possible liquidity effects of the proposed rule and the downstream impact of reduced liquidity on investors, issuers, and other stakeholders in a single asset class – US corporate bonds. However, the impact of the proposed rule will clearly reach beyond any single asset class. We have therefore extended our analysis to several other markets where a restrictive implementation could have significant effects (or would have had significant effects if trading in these asset classes had not been expressly excluded from the scope of the rule or designated as permitted activities).

Below, we provide a high level summary of the potential liquidity effects and economic impact of a restrictive implementation of the statute for several asset classes, with representative illustrations of these effects for (1) cash equities and (2) foreign sovereign bond markets.

4.1. Liquidity effects and economic impact across markets

Markets that require a high level of principal intermediation today will face the greatest liquidity effects under the Volcker Rule, unless the Volcker Rule is implemented to allow banking entities to take positions, hold inventory, and trade in the inter-dealer markets at existing levels. The majority of fixed income markets fall into this category (including corporate bonds, asset-backed securities, and foreign government bonds), as do the majority of derivatives traded over-the-counter. These markets rely on principals to execute even small trades in the most liquid instruments because there is no central exchange or natural counterparty to absorb trade flow. In brief, all the attributes that apply to the corporate bond market apply to the majority of fixed income and derivatives asset classes:

- No central exchange (with meaningful liquidity) exists to trade the securities[26]
- Liquidity is fragmented across a potentially infinite number of instruments
- The majority of instruments trade only a few times each year

However, even model “agency” markets like cash equities will be affected – dealers may be reluctant to execute (or effectively prohibited from executing) large, principal transactions due to the transparent impact on inventory metrics in these asset classes.

[26] In the corporate bond market, this is not because central exchanges have not been attempted. NYSE, TradeWeb, eSpeed, MarketAxess, as well as dealer groups have each created electronic platforms for corporate bond trading. But each has struggled to attract significant trade volume, as the fragmented nature of the market generally results in limited activity in a given security at a given time. The MarketAxess corporate bond trading platform has been most successful, but only for relatively small trade sizes.

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Exhibit 7 below summarizes at a high level the relative impact of the proposed rule on liquidity in several major asset classes and the downstream impact of reduced liquidity on investors, issuers, and other stakeholders. We estimate liquidity effects based on the structure of the market today and the specific treatment of the asset class under the proposed rule. The economic impact is a function of the magnitude of the liquidity effect and the nature of the downstream impact of reduced liquidity: (1) increased transaction costs alone or (2) increased transaction costs, reduced asset valuations, and higher issuer costs.

Exhibit 7: Liquidity effects and economic impact across markets

Market	Market structure	Liquidity effects	Economic impact
Corporate bonds	• OTC market intermediated by bank dealers	●	●
Private label ABS	• OTC market intermediated by bank dealers	●	●
OTC derivatives (Rates, FX, credit, equity derivatives)	• OTC market (with limited transition to electronic trading facilities) • Balance sheet critical for intermediation	◔	◑
Foreign government bonds (Includes agency and municipal debt)	• OTC market intermediated by primary dealers	◑	◑
Commodities	• Parallel exchange and OTC markets	◑	◑
FX spot and forwards	• OTC markets (via electronic trading platforms) • Limited principal intermediation	◔	◑
Cash equities	• Parallel exchange and OTC markets • Principal intermediation critical for large trades	◔	◔
Repo and securities lending	• OTC market intermediated by bank dealers • Balance sheet critical for intermediation	No restrictions	
US government bonds (Includes agency and municipal debt)	• OTC market intermediated by primary dealers	No restrictions[27]	

● **Larger liquidity effects or economic impact in the relevant market**

○ **Smaller liquidity effects or economic impact in the relevant market**

[27] Trading in certain types of municipal debt is not included as a permitted activity under the proposed rule.

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We see a spectrum of liquidity effects and economic impacts across asset classes, with the most significant impact in the fixed income markets and negligible effects in asset classes excluded from the rule or designated as permitted activities:

- **Corporate debt and Private label ABS –** The secondary markets for US corporate bonds and private label asset-backed securities (ABS) rely more on principal intermediation than other asset classes. Market makers acting as principals were involved in more than 90% of trades executed across these markets in the last quarter of trading activity.[28] Restricting banking entities' ability to hold inventory or trade through the inter-dealer market would have meaningful effects on overall liquidity in the market, and significant downstream economic costs for investors and issuers.

- **OTC derivatives –** The OTC derivatives markets (for rates, foreign exchange, credit, and equity derivatives) would experience similar liquidity effects to the corporate debt markets. Transactions in these markets tend to be highly customized, resulting in limited liquidity and trading volume in economically equivalent instruments. Dealers typically hold these risk positions in inventory and hedge the risk because there is no natural offsetting trade. Ongoing efforts to standardize OTC derivative contracts (and transition to exchange trading and central clearing) may mitigate some of the potential impact on liquidity in the OTC derivatives markets, but most contracts would still be affected.

- **Foreign government debt –** Another class of assets that could face significant liquidity effects from the proposed rule is foreign government debt. These securities rely heavily on a special class of market maker, the primary dealer, to provide liquidity in the primary and secondary markets. Foreign dealers trading exclusively with foreign counterparties are not directly covered by the rule, but US dealers and US investors play a key role in every major sovereign debt market. Restricting dealers' ability to hold inventory or trade through the inter-dealer market would effectively divide the global liquidity pool for these securities, with significant adverse effects for US investors, foreign investors, and ultimately foreign governments. *We discuss the potential effects on the foreign government debt market in greater detail in section 4.3.*

- **Commodities –** Physical and financial commodities markets could be significantly affected by the proposed rule. All trading in physical spot commodities was excluded in the proposed rule, while physical forwards and all financial contracts are covered by the restrictions on proprietary trading. Commodities markets are extremely diverse, ranging from highly liquid, exchange-traded instruments to highly illiquid, bespoke contracts purpose-built for a specific transaction (e.g. power plant off-take agreements to finance construction). The broad scope of the proposed rule represents a clear threat to liquidity provided by banking entities. A number of non-bank participants are also active in the commodities markets and may step in to fill this liquidity gap, but the extent to which these participants will support highly illiquid transactions or provide liquidity during periods of market stress remains highly uncertain.

[28] TRACE Fact Book (Q3 2011)

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- **FX spot and forwards –** The proposed rule creates a parallel regime for foreign exchange trading. Trading in spot FX is excluded, but forwards and currency swaps are covered by the rule. This arbitrary division of the rule effectively ensures that all spot and forward transactions will be covered under the rule, as these distinctions merely represent two sides of the same business. The spot and short-dated forward markets are highly liquid (executing nearly $2TN in trades per day)[29] with well-established electronic trading platforms to intermediate and clear much of this volume. However, trading in longer-dated forwards, non-deliverable forwards, and currency swaps widely used for foreign currency funding or hedging (especially in emerging markets) would face significant liquidity risk and downstream effects associated with revenue or earnings volatility, forgone investments in new markets, etc. As in other fixed income markets, dealers play a critical role in providing liquidity to customers in these less liquid transactions.

- **Cash equities –** The equities market is often thought of as an exemplary agency market, with extremely liquid trading executed largely on major global exchanges around the world. However, liquidity varies considerably across different securities and for particular types of trades. Lower liquidity trades (e.g. large block orders) rely heavily on principals to "work orders" in a manner that minimizes market impact, a key component of transaction costs for institutional investors. Dealers may be reluctant to execute (or effectively prohibited from executing) large, principal transactions due to the transparent impact on inventory metrics in these asset classes under the proposed rule. *We illustrate the potential effects on the cash equities market in greater detail in section 4.2.*

- **US government debt and repurchase agreements –** All trading in the US government debt market (commonly known as the Treasuries market) was classified as a permitted activity and all trading in repurchase agreements or securities lending transactions was classified as excluded activity.

4.2. Cash Equities

The equities or common stock market is the most widely known and broadly discussed US financial market, familiar to many Americans in ways that other capital markets are not. This is due in large part to the unique characteristics which set this market apart from most other asset classes – highly standardized security terms and structures, exceptional liquidity, and active trading by a broad spectrum of different investors.

These unique characteristics of cash equities allow for a relatively high level of trading on an agency basis, where a broker-dealer matches buyer and seller without taking any principal risk to make markets. However, even in this more liquid market, a significant number of trades depend on the willingness and ability of dealers to assume principal risk by taking the other side of less liquid (generally large) trades. The analysis below will focus on two key dealer activities that provide direct liquidity: index rebalances and block trades.

[29] Bank for International Settlements

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- **Index rebalances –** Nearly $6TN of investor assets are held in mutual funds and ETFs that track major equity indices today.[30] The composition of these indices changes over time, as the value of listed shares within the index rise or fall, new listings are added or removed from the index, etc. These changes are announced periodically and require all funds tracking the indices to rebalance their portfolios. In the most liquid indices, market liquidity is sufficient to support rebalance trades with minimal impact on share prices. In less liquid indices that rebalance less frequently, however, rebalance trades executed on the open market would have substantial effects on share prices. The portfolio trading desks of major broker-dealers step in to provide this liquidity to fund managers and the individual investors they serve, primarily by building inventory in anticipation of the trade.

- **Block trades –** A block trade is the purchase or sale of a significant position in the secondary market for any security. While the theoretical threshold for a block trade is any transaction of sufficient size to impact market prices, most exchanges set practical definitions that apply to all securities traded regardless of the liquidity of the individual position.[31] A block relies heavily on market makers to minimize price impact. Principal risk taking (or capital commitment) is a critical part of this function – some form of price or volume guarantee may be needed to provide investors with a degree of certainty in their immediate execution at prevailing market prices. This can vary substantially in execution from immediate price or size commitment for the full trade to a standing commitment to work the order through the market (typically intraday) with a minimum price and/or size negotiated ex ante.

  In addition to capital commitment, dealers offer the expertise and efficiency gained from participating in large numbers of trades in a variety of securities on a daily basis. This translates into the ability to work down inventories quickly and to find natural pockets of offsetting demand among institutional investors when client needs dictate block trading activity.

Dealers may be reluctant to execute (or effectively prohibited from executing) large, principal transactions due to the transparent impact on inventory metrics in these asset classes under the proposed rule. Exhibit 8 summarizes the estimated potential impact of constraining these two illustrative forms of direct liquidity provision.

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[30] Kevin Olsen, “Indexed Assets Surge 25%”, *Pensions & Investments* (September 19, 2011)

[31] For example, the New York Stock Exchange (NYSE) defines a block trade as any transaction equal to or greater than 10,000 shares traded or $200,000 in value. The London Stock Exchange (LSE) uses an alternative approach based on Normal Market Size (NMS) for a given security. NMS is the minimum number of securities for which a market maker is obliged to quote firm bid and offer prices. NMS for each security is calculated quarterly and is based on 2.5% of the security’s average daily turnover in the preceding year. Block trades are defined as a multiple of the NMS (75x for a security with an NMS of 2,000 shares or above 50x for a security with an NMS of 1,000 shares)

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Exhibit 8: Potential impacts for equities investors

Additional cost	Range of outcomes with no direct liquidity provision			Recurring annual cost to investors
	Small	Medium	Large	
Index rebalances: investors face higher market impact costs when major index rebalances take place	$0.6BN	$1.2BN	$1.8BN	✓
Block trades: investors face higher market impact costs to trade out large block positions over aggressive timescales	$1.7BN	$3.0BN	$4.3BN	✓

Index rebalances

Based on the major index rebalances that took place in 2011, we estimate that periodic changes to major indices drive "rebalancing trades" of approximately $60BN for institutional investors tracking benchmarks that rebalance infrequently.[32] Dealers stabilize rebalances for these investors, primarily by building inventory in anticipation of the rebalance trade, to reduce their client's exposure to sharp shifts in the value of the assets tracking the index.

The average daily volatility across the major indices reviewed here was approximately 2% in 2011, ranging from 1.6% to 2.4% across the sample. We assume that the incremental cost for investors executing a rebalance trade (with no direct liquidity provision from a market maker) would be approximately the same as typical one-day price movements – this equates to $1.2BN based on 2011 volumes and volatility. There is considerable variation in daily volatility, so we set a range from 0.5x to 1.5x around the baseline volatility to reach our range estimate of $600MM to $1.8BN in aggregate impact.

See appendix B.2.1 for further details on methodology.

Block trades

We estimate the cost of reduced liquidity provision for block trades based on the incremental market impact of executing large orders over a shorter time frame than dealers typically would provide. Placing real or effective limits on the size or holding period of trading inventory would clearly impact dealers' ability or willingness to execute these orders at current pricing. Total block trading volume reported for NYSE and NASDAQ was $3.5TN in 2010. However, this includes all trades of 10,000 shares or greater, a size that would typically not produce a

[32] The Russell and MSCI indices are re-weighted only once or twice each year, creating a wave of major "rebalance trades" over a relatively short period of time. We base our analysis on estimated "rebalance trades" required for funds tracking these indices only.

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meaningful market impact. We use a more conservative estimate of true block trades of $850BN, an effective 75% haircut of the NYSE and NASDAQ figure.

Based on market interviews and analysis of standard market impact models provided by dealers, we estimate the market impact of executing large block orders (with no direct liquidity provision from market makers) as the difference between the market impact costs of executing a block trade over a 5-day period vs. a 1-day period – approximately 20-50 bps depending on the size of the trade. Assuming this is the baseline impact on investors executing block trades, we estimate the range of incremental transaction costs to be $1.7 to $3.4BN per annum.

See appendix B.2.1 for further details on methodology.

Indirect effects

The case studies above provide two illustrations of the effect of removing dealer-provided liquidity from specific transactions. However, the restrictions associated with the proposed rule would also have a broader, indirect impact on market liquidity, as major dealers reduce clearly prohibited trading activity and more borderline activities that may be interpreted as violating the proposed rule.

Again, based on market interviews and analysis of standard market impact models provided by dealers, we estimate that institutional investors incur pure market impact costs of 11 bps on average; this translates to approximately $32BN in annual transaction costs (given trading volume of $29TN in 2010).[33] A 5-15% reduction in baseline liquidity would drive an increase of 0.3-0.9 bps, adding between $800MM and $2.7BN in transaction costs across all investors.

4.3. Foreign Government Debt

Sovereign debt is generally considered the safest financial investment in a given market, backed by the taxing authority and other resources of the government. Even during the European sovereign debt crisis, many European government bonds were still considered a safe investment. These assets represent a benchmark holding for investors of every kind, including individuals, fund managers, financial institutions, and foreign governments. Beyond its status as a “risk free” investment, sovereign debt plays a critical role in the financial markets across a number of dimensions:

- **Risk management –** Sovereign debt is widely used as a hedging tool in G10 markets.[34] Holding long or short positions in G10 sovereign debt can effectively allow an investor to create a pure interest rate position.

[33] SIFMA

[34] The G10 markets include Belgium, Canada, France, Germany, Italy, Japan, Netherlands, Sweden, Switzerland, the United Kingdom, and the United States (11 in total).

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- **Collateral –** Sovereign debt is the most basic and commonly accepted form of market collateral. Many transactions involve the posting or exchange of collateral to mitigate the risk of future failure to perform on obligations (i.e. counterparty risk). Both exchange-traded and over-the-counter derivatives transactions, for example, generally require collateral. Sovereign debt plays a critical role as the most liquid, secure, and marketable form of collateral for such transactions.

- **Pricing –** Sovereign debt yields are a benchmark for trading and pricing debt instruments, derivatives, and a wide range of other common and esoteric assets.

Many sovereign debt markets rely heavily on a special class of market maker, the primary dealer, to provide liquidity in both the primary and secondary markets. Primary dealers in the most G10 debt markets play an essential role in the issuance of new securities through a formal auction process –primary dealers are generally required to participate actively in each auction.

After securities are issued, trading occurs in the OTC market in which market participants trade with each other on a bilateral basis rather than on an exchange. Trading can occur between primary dealers, other dealers, and other investors. Dealers make markets in sovereign debt securities by standing ready to buy securities from or sell securities to customers. As a result, market makers need to hold temporary positions in the securities (as inventory) sufficient to meet the demands of investors.

The headline liquidity of the sovereign debt markets would suggest that very little inventory is required to meet this demand – dealers could easily source securities from other investors given the high volume of trading on a daily basis. However, liquidity varies substantially across the market. The most recently issued security of a given maturity is exceptionally liquid and actively traded – this highly liquid segment of the market is known as “on-the-run”. Older issuances of a given maturity become known as “off-the-run” and are generally traded much less actively. Off-the-run securities are less liquid and as a result, trade at a discount in price to otherwise similar on-the-run securities and require market makers to hold inventory for a longer period of time.[35]

In these respects, the role of the dealers in supporting the market for sovereign debt is very similar to the role they play in other debt markets, such as that for corporate debt:

- Primary dealers (generally large banking entities) are critical providers of liquidity in the primary and secondary markets for these securities

- All government bond markets require principal activity to function efficiently – the large number and diverse structure of individual securities fragment liquidity, so many client orders (particularly in off the run securities) cannot be matched naturally

Congress classified all trading in US government securities as permitted activities under the statute. We therefore focus our analysis of liquidity effects in the sovereign debt market on a number of non-US sovereign debt markets – Canada, Japan, UK, Germany, France, and Spain.

[35] As discussed in “Measuring Treasury Market Liquidity” (Fleming 2003), for example

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Liquidity effects

The Volcker Rule restrictions on proprietary trading will not directly apply to foreign dealers trading with foreign counterparties.[36] However, the major US-based dealers are significant participants in the major sovereign debt markets worldwide and they will clearly be covered by the rule (as shown in Exhibit 9 below):

Exhibit 9: Number of primary dealers in government securities by country[37]

	France	Japan	UK	Germany	Spain	Canada
US primary dealers	5	5	6	6	3	1
Bank of America	✓	✓	✓	✓		✓
Citi	✓	✓	✓	✓	✓	
Goldman Sachs	✓	✓	✓	✓	✓	
J.P. Morgan	✓	✓	✓	✓	✓	
Jefferies[38]			✓	✓		
Morgan Stanley	✓	✓	✓	✓		
Non-US primary dealers	15	19	23	27	18	14
Total primary dealers	20	24	29	33	21	15
US share of total primary dealers	25%	21%	21%	18%	14%	7%

In addition, major global banks domiciled outside the US would face the same constraints on trading activity for desks that face US clients or counterparties. Placing meaningful constraints on US (and foreign) banking entities' ability to take positions, hold inventory, and trade in the inter-dealer markets would have two clear effects on liquidity:

- **Sovereign debt markets will be fragmented into separate liquidity pools** – a core market for foreign counterparties serviced by foreign banks (with no special constraints) and a separate liquidity pool for US counterparties serviced by US and foreign banking entities in compliance with permitted activities in the Volcker Rule

- **Overall liquidity will be reduced across foreign sovereign debt markets** due to (1) the fragmentation of liquidity across global markets and (2) the loss of liquidity provided by US investors and dealers in the core market[39]

[36] To qualify for the exemption, no party to the trade may be a US resident, no personnel directly involved in the trade may be physically located in the US, and the trade must be wholly executed outside US borders (risk management and booking outside the US is insufficient)

[37] Source: European Primary Dealers Handbook, Bloomberg, World Bank

[38] Jefferies is not a covered banking entity under the proposed rule

[39] Concerns over the likely reduction to liquidity in sovereign bond markets due to the proposed rule have been publicly voiced by UK, Japanese and Canadian financial regulators: Letter from George Osborne (Chancellor of the

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Reduced liquidity in the foreign sovereign debt markets will naturally have similar knock-on effects to those described for the US corporate bond market – all else equal, the markets would see increased transaction costs for investors and other counterparties, one-off mark-to-market losses as liquidity is reduced, and likely future increased borrowing costs for issuers (in this case, governments). These knock-on effects are very difficult to predict, especially in the current economic climate. A number of factors distinct from liquidity have an equal or greater influence on yields and asset pricing.

Exhibit 10: Foreign government debt turnover and value outstanding
2010 turnover multiple and value outstanding ($TN)

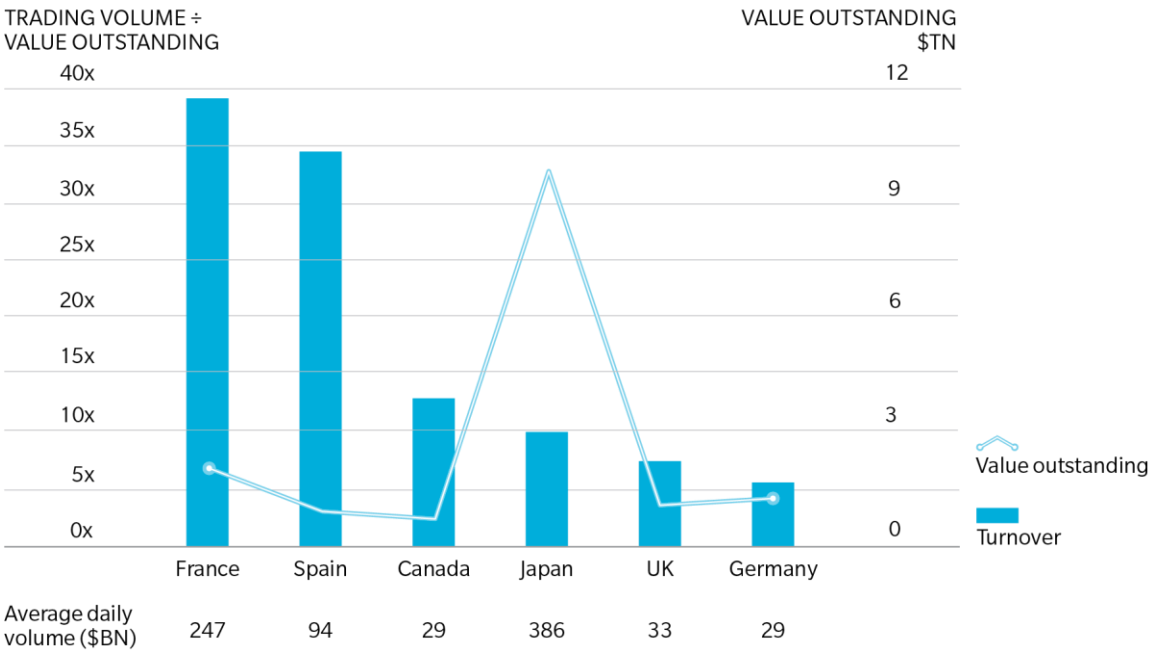

Exhibit 10: 2010 turnover and value outstanding for foreign government debt. Source: Ministry of Finance Japan, Japan Securities Dealer Association, Agence France Trésor, Tesoro Publico Espana, Bank of Canada, Deutsche Finanzagentur, UK Debt Management Office

Exchequer) to Ben Bernanke (January 23, 2012); Letter from Financial Services Agency Government of Japan, and Bank of Japan to the OCC, Board, FDIC and SEC (December 28, 2011); Letter from the Office of the Superintendent of Financial Institutions Canada to the OCC, Board, FDIC and SEC (December 28, 2011)

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Recommendations for policymakers in implementing the Volcker Rule

This study has argued that the proposed rule issued by regulators risks reducing liquidity in a wide range of markets supported by principal market makers, and thereby imposing increased costs and risks for all market participants.

Some of this risk is inherent in the statute itself, in particular in the difficult challenge it poses to regulators and affected firms, who are asked to distinguish permitted market making from prohibited proprietary trading. As many have noted, these two activities can give rise to essentially the same individual trades and risk-taking levels, distinguished only by the unknowable intent of individual traders. Any regime that aims to make such nebulous but legally mandated distinctions risks curtailing some of the "permitted" activity. However, the proposed rule also includes some specific features that unnecessarily increase the chances of broad and significant harm to market liquidity.

We believe the proposed rule gets many important things right. It acknowledges that liquidity varies among asset classes and markets, and that the trading patterns and levels of risk-taking that are consistent with permitted market making activities will also vary among trading units. This acknowledgement, however, is not completely reflected in the substance of the rule. Both the prescriptive criteria for market making and the mandated metrics increase the risk that banking entities and supervisors will over time act in a way that curtails core market making activities such as holding inventory and inter-dealer trading. Our analysis indicates that such effective restrictions could have significant effects on dealers' ability to meet customer trading needs and on overall market liquidity.

We recommend that the proposed rule be refined to reduce the risk of significantly harming market liquidity. Specifically, we suggest the following changes are made:

1. Trading units that are demonstrably organized to serve client trading needs as principal-based market makers should be presumed to comply with permissible market making activity under the rule, unless there is specific evidence to the contrary

2. While trading units should be required to collect data to enable regulators to monitor and investigate whether prohibited proprietary trading is taking place, the rule should build in more flexibility, so that firms and regulators can discover and judge over time which metrics are in fact useful, and so that one-size-fits-all metrics requirements do not endanger liquidity

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3. The criteria for distinguishing market making from prohibited proprietary trading should not implicitly assume market making functions should show consistent revenue, risk taking, and trading patterns – customer flows are often “lumpy” (e.g. via facilitating large trades) and volatile risk-taking and revenue are natural consequences for market makers

4. Inter-dealer trading should be explicitly acknowledged as a necessary activity of market makers in supporting customer trading, and metrics or principles that would indicate otherwise to dealers and supervisors (such as the Customer-Facing Trade Ratio) should be removed or modified

5. Policymakers should consider a gradual or phased implementation, introducing the Volcker Rule requirements in the asset classes least at risk of liquidity reduction first, and using the experience and lessons learned there to guide further implementation

The risk of harming market liquidity by curtailing beneficial market making is real. Both regulators and the firms they oversee have a difficult task ahead that will be shaped by judgment as well as by trial and error. Given the stakes involved, regulation that is flexible and cognizant of current market structures has both the best chance of success and the least chance of inadvertent harm.

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APPENDIX A

Definitions of proposed Customer-Facing Activity Measurements[40]

A.1. Inventory Risk Turnover

- Description: For purposes of this appendix, Inventory Risk Turnover is a ratio that measures the amount of risk associated with a trading unit's inventory, as measured by Risk Factor Sensitivities, that is turned over by the trading unit over a specific period of time. For each Risk Factor Sensitivity, the numerator of the Inventory Risk Turnover ratio generally should be the absolute value of the Risk Factor Sensitivity associated with each transaction over the calculation period. The denominator of the Inventory Risk Turnover ratio generally should be the value of each Risk Factor Sensitivity for all of the trading unit's holdings at the beginning of the calculation period.

- General Calculation Guidance: As a general matter, a trading unit should measure and report the Inventory Risk Turnover ratio for each of the Risk Factor Sensitivities calculated and furnished for that trading unit.

- Calculation Period: 30 days, 60 days, and 90 days.

A.2. Inventory Aging

- Description: For purposes of this appendix, Inventory Aging generally describes the trading unit's aggregate assets and liabilities and the amount of time that those assets and liabilities have been held for the following periods: (i) 0-30 days; (ii) 30-60 days; (iii) 60-90 days; (iv) 90-180 days; (v) 180-360 days; and (vi) greater than 360 days. Inventory Aging should measure the age profile of the trading unit's assets and liabilities.

- General Calculation Guidance: In general, Inventory Aging should be computed using a trading unit's trading activity data and should identify the trading unit's aggregate assets and liabilities. In addition, Inventory Aging should include two schedules, an asset-aging schedule and a liability-aging schedule. The asset-aging schedule should record the value of the trading unit's assets that have been held for: (i) 0-30 days; (ii) 30-60 days; (iii) 60-90 days; (iv) 90-180 days; (v) 180-360 days; and (vi) greater than 360 days. The liability-aging schedule should record the value of the trading unit's liabilities that have been held for: (i) 0-30 days; (ii) 30-60 days; (iii) 60-90 days; (iv) 90-180 days; (v) 180-360 days; and (vi) more than 360 days.

[40] "Prohibitions and Restrictions on Proprietary Trading and Certain Interests in, and Relationships with, Hedge Funds and Private Equity Funds" 76 FR 68959-68960 (November 7 2011)

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- Calculation Period: 30 days, 60 days, and 90 days.

A.3. Customer-Facing Trade Ratio

- Description: For purposes of this appendix, the Customer-Facing Trade Ratio is a ratio comparing (i) the number of transactions involving a counterparty that is a customer of the trading unit to (ii) the number of transactions involving a counterparty that is not a customer of the trading unit. For purposes of calculating the Customer-Facing Trade Ratio, a counterparty is considered to be a customer of the trading unit if the counterparty is neither (i) a counterparty to a transaction executed on a designated contract market registered under the Commodity Exchange Act or national securities exchange registered under the Exchange Act, nor (ii) a broker-dealer, swap dealer, security-based swap dealer, any other entity engaged in market making-related activities, or any affiliate thereof. A broker-dealer, swap dealer, or security based swap dealer, any other entity engaged in market making-related activities, or any affiliate thereof may be considered a customer of the trading unit for these purposes if the covered banking entity treats that entity as a customer and has documented how and why the entity is treated as such.

- Calculation Period: 30 days, 60 days, and 90 days.

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APPENDIX B

Detailed methodology

B.1. Impact on the US corporate bond market

B.1.1. Potential effects of the Volcker Rule on liquidity

We analyze historical data to determine the possible effects of the Volcker Rule if it were to limit principal risk taking via limits on holding periods or limits on inventory size. The data used for the impact analysis on the US corporate bond market are the FINRA TRACE Enhanced Historic Data for 2009, the most recent full year of comprehensive US corporate bond data. The dataset is cleaned and then used to simulate the effects of potential inventory holding period limits and inventory size limits under a restrictive application of the proposed Volcker Rule.

Cleaning the TRACE dataset

We clean the TRACE dataset to retain the most relevant and correct historical data. First, transactions that are labeled as “corrected”, “canceled”, or “removed” are corrected for or removed as appropriate. Then, equity linked notes and agency transactions are removed because we are interested in corporate bond transactions where the dealer acts as principal. Finally, we remove trades with volume of less than $100,000 because we do not want to include retail trades in our analysis, which is focused on institutional trading. This cleaning process reduces the initial dataset of 27,489 unique bonds to 15,682 cleaned bonds that we use in our inventory limit simulations.

Inventory holding period limit simulation

We simulate the effective holding period for all observed 2009 trades (using the cleaned TRACE data described above) and calculate the percentage of volume that would have been executed within holding period limits. The time to execute corporate bond orders is calculated by simulating an order book environment for all 2009 US corporate bond customer trades and estimating how long it would take for each trade to find a “natural match.” For each bond, all buy and sell volumes are matched sequentially and the time between the offsetting trades is tracked. Orders are matched in pieces as offsetting orders come in (e.g. one $10 MM buy order followed by ten $1 MM sell orders is matched in ten pieces and timed for each sell order rather than matched together on the day of the last sell order). When volumes are matched, we consider that volume executed.

Only customer trades are analyzed, and the market is treated as a single entity, assuming a “perfect” inter-dealer market. In the perfect inter-dealer market, dealers can trade instantly amongst themselves such that volumes are executed regardless of which dealer initiated each side of the trade. This assumption results in a conservative simulation of time to execute.

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Some volume is unable to be executed even by the end of the year (6% across the market), as a result of (1) moderate disparities between observed customer buy and sell volumes and (2) bonds where all observed trading takes place entirely in one direction (and for which there is therefore no executable volume).

Bonds are divided into quartiles by total annual trade volume. Time to execute across corporate bonds is calculated in each quartile and across the market as a whole using an average of results for each bond weighted by total number of 2009 trades per bond.

Inventory size limit simulation

We simulate the effect of inventory limits by randomly assigning each transaction observed in 2009 (using the cleaned TRACE data described above) to one of five dealers[41] under several inventory limits and determine the percentage of volume that would have been permitted under these limits. We set limits based on the average daily volume (ADV) across all corporate bonds in 2009 – limits of 1x ADV, 2.5x ADV and 5x ADV.

We define a dealer's total inventory to be the sum of the long and short positions of the bonds he holds. For example, if a dealer has a $100,000 long position in Bond A and a -$50,000 short position in Bond B, we say his total inventory is $150,000. This is consistent with the data that will be collected under the proposed Volcker Rule for the Inventory Aging metric, which will track a "trading unit's aggregate assets and liabilities" (see Appendix A). A trading unit's long positions are accounted for as assets, while a trading unit's short positions are accounted for as liabilities.

For the "no inter-dealer market" scenario, whenever any trade causes a dealer's total inventory to breach the ADV bound, that trade is counted as "not permitted" and is not added to inventory (Exhibit 3a shows simulated dealer inventory for a sample bond under this scenario).

For the "perfect inter-dealer market" scenario, when a trade puts a dealer's total inventory over the ADV bound, it is split among multiple dealers, and each dealer executes a portion of the trade up to the ADV bound. When a trade would collectively put all five dealers' total inventories over their limits, it is counted as "not permitted" and is not added to inventory.

Aggregating the trades gives the percent permitted and not permitted for the market.

[41] While there are more than five large dealers for US corporate bonds, there is also a degree of specialization in market making at the level of individual issuers and bonds (often related to which dealers originally underwrote the bond when it was issued). We believe five dealers is a reasonable approximation for the number of dealers active at the level of individual bonds

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B.1.2. Impact on investors, issuers, and the broader economy

DFL methodology

We use as a reference the 2011 paper “Corporate bond liquidity before and after the onset of the subprime crisis" by Dick-Nielsen, Feldhütter, and Lando (DFL). They clean raw data, test different liquidity factors, and analyze liquidity effects across periods before and after the subprime crisis. First, they cross-reference Q1 2005 through Q2 2009 data from TRACE, Bloomberg, Datastream, and IBES and remove retail-sized and erroneous trades, arriving at 5,376 bonds with 8.2 MM trades. They also obtain treasury yields and LIBOR rates from the British Bankers’ Association. Then, using yield spread to swap rate as the dependent variable, they test eight commonly used liquidity measures to determine which correlated most highly with yield spread. The credit risk contribution to the yield spread is controlled with the addition of twelve additional factors: bond age, amount issued, coupon size, time-to-maturity, equity volatility, ratio of operating income to salaries, leverage ratio, ratio of long-term debt to assets, interest rate coverage, 10-year swap rate, 10-year minus 1-year swap rate, and earnings forecast dispersion. DFL develops a composite liquidity measure using a normalized average of the Amihud liquidity measure, the imputed roundtrip cost, and the standard deviation of each. Running the regression using this composite liquidity measure determines the liquidity component of bond yields.

Mark-to-market valuation loss

We calculate the mark-to-market valuation loss by finding the increase in the liquidity component of yield spread and scaling by the current outstanding corporate debt. DFL provides certain percentile values of their composite liquidity measure and its coefficients in regressions on the yield spread for each rating bucket (AAA, AA, A, BBB, HY). We perform an exponential regression on the percentile values of the liquidity measure to interpolate values at other percentiles, and use the coefficients from the most recently available period (2007-2009) for our analysis of the present. We find the difference in liquidity premia between a median liquidity bond and a bond with lower liquidity as per each scenario by multiplying the difference in the liquidity measure at the appropriate percentiles by the corresponding regression coefficient for each rating bucket.

From Dealogic data, we calculate the yield of 2010 outstanding debt using average maturity and average coupon for each rating bucket. Then, we can calculate the percent mark-to-market loss of value as a result of increasing the current yield by the change in the liquidity component. The 2010 corporate debt outstanding for each rating bucket is inferred from the total amount by assuming the same proportions as across 2005 through H1 2011 Dealogic data. We then find the mark-to-market loss of value in absolute terms by multiplying percent loss of value by 2010 outstanding corporate debt in each rating bucket.

Issuance cost

The additional issuance cost is calculated similarly. We assume annual issuance to be the same as that for recent years based on Dealogic data. For each scenario, we multiply the

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change in liquidity premium by the estimated annual issuance to obtain the additional issuance cost. We then project annual issuance cost by assuming that each year some bonds mature and are replaced with more costly bonds as dictated by the maturity rate, so that annual cost increases at the rate of the additional annual cost each year for the amount of time of average maturity, at which point it plateaus to steady state.

Transaction cost to investors

We use TRACE data to impute transaction costs from realized buy and sell prices reported and calculate the effect of different shift scenarios. Using the cleaned TRACE dataset, we aggregate the transactions by bond and by day, calculating the average buy and sell prices weighted by trading volume for each security and day. The transaction cost in absolute terms is calculated as half of the difference between the average sell and buy prices, multiplied by the total trading volume for each security and day. This translates into transaction costs per traded dollar for each security and day by dividing absolute transaction cost by the total price. We calculate the increase in transaction costs under different scenarios of shift in transaction cost percentiles and translate into dollar costs by multiplying by the relevant amount of customer trading volume.

B.2. Considerations for other asset classes

B.2.1. Cash equities

Index rebalances

We estimate total savings to investors in index tracking funds (with access to direct liquidity provision from market markers) of $600MM to $1.8BN in 2011. Results were quantified by identifying savings in just the five major rebalances in 2011 with approximately $60 BN in imbalance volume – Russell (June), MSCI DM (May, November) and MSCI EM (May, November). While rebalancing can be analyzed across funds that track other indices including the S&P and FTSE, these involve more liquid underlying assets and the rebalances happen more frequently so they do not result in the same liquidity demands.

For each rebalance, the predicted price impact was computed by calculating the impact that would exist if liquidity providers were not present and converting the impact into an expected magnitude of price move (one unit of daily volatility plus the predicted price impact caused by this imbalance event). The normal day volatility was compared with realized daily volatility on these event days to show evidence that the current market is effective at covering these extreme imbalances.

The average daily volatility across the major indices reviewed here was approximately 2% in 2011, ranging from 1.6% to 2.4% across the sample. We assume that the base case cost for investors executing a rebalance trade (with no direct liquidity provision from a market maker) would be equivalent to the price movement on the average day – this equates to $1.2BN based on 2011 volumes and volatility. There is obviously considerable variation in daily volatility, so

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we set a range from 0.5x to 1.5x around the baseline volatility to reach our range estimate of $600MM to $1.8BN in aggregate impact.

Block trades

Total block trading volume reported for NYSE and NASDAQ was $3.5TN in 2010. However, this includes all trades of 10,000 shares or greater, a size that would typically not produce a meaningful market impact. We use a more conservative estimate of true block trades of $850BN, an effective 75% haircut of the NYSE and NASDAQ figure.

We then estimate cost to customers of trading out of large block positions by considering the cost impact of accelerating trades out of large block positions from 5 days to just 1, assuming no direct liquidity provision from dealers. The estimated cost reduction under three scenarios (20-50 bps of cost impact) was analyzed to impute the total impact on annual transaction costs for block trades across the US market of $1.7BN to 4.3BN.

Indirect effects

To calculate indirect effects (i.e. reduced baseline liquidity in the US equities market) we use an industry standard MIE model described by Grinhold and Kahn.[42] The MIE model is a general purpose impact cost model that is widely used in the industry and provides reasonable estimates for liquidity demands up to approximately 20% of daily volume.

Using a common 1.5% average daily value order size, investors pay an estimated 11 bps to transact in US equities. The model shows that a 5-15% decrease in liquidity leads to 0.3-0.9 bps of additional transaction costs. For institutional investors who trade in larger sizes (5% ADV per order), the cost impact ranges from 0.5-1.7 bps.

Given average daily trading volume in the US equities markets of $114BN in 2010, annual average trading volume is estimated to be $29 TN, which translates to annual transaction costs of $32 BN in 2010. A 5% to 15% decrease in liquidity would add between $0.8 and 2.7 BN in additional costs for investors.

[42] Richard Grinhold and Ronald Kahn, “Active Portfolio Management: A Quantitative Approach for Producing Superior Returns and Controlling Risk,” Chapter 13, McGraw-Hill (1999)

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