MEMORANDUM

TO: File

FROM: Division of Trading and Markets and Division of Economic and Risk Analysis[1]

SUBJECT: Inventory risk management by dealers in the single-name credit default swap market.

DATE: October 17, 2014

Introduction

Title VII of the Dodd-Frank Act directs the Commission to, among other things, promulgate rules requiring public dissemination of transaction information in the security-based swap market (for which the single-name CDS market represents the majority of activity.[2])[3] To implement this statutory provision, the Commission proposed Regulation SBSR to provide for both the reporting of security-based swap information to registered security-based swap repositories or the Commission, and the public dissemination of security-based swap transaction, volume, and pricing information.[4]

In its proposal for Regulation of SBSR and in a subsequent re-proposal as part of the Cross-Border Proposing Release,[5] the Commission discussed potential costs to dealers due to real-time public dissemination of transaction information under Regulation SBSR. Dealers who hedge the inventory risk associated with large single-name CDS trades through offsetting transactions in the single-name CDS market or related markets may face higher costs of hedging if real-time public dissemination of information about their activities signals the direction of future order flow to their counterparties. These higher costs could be passed on to other market participants and, in particular, end users who use

[1] This is a memo by the Staffs of the Division of Trading and Markets and the Division of Economic and Risk Analysis of the U.S. Securities and Exchange Commission. The Commission has expressed no view regarding the analysis, findings, or conclusions contained herein.

[2] See Securities Exchange Act Release No. 72472 (June 25, 2014), 75 FR at 47278 (August 12, 2014) ("Cross-Border Adopting Release") note 135.

[3] Section 13(m)(1)(B) of the Exchange Act directs the Commission "to make security-based swap transaction and pricing data available to the public in such form and at such times as the Commission determines appropriate to enhance price discovery." See 15 U.S.C. 78m(m)(1)(B).

[4] See Securities Exchange Act Release No. 63346 (November 19, 2010), 75 FR at 75207 (December 2, 2010) ("Regulation SBSR Proposing Release")

[5] See Securities Exchange Act Release No. 69490 (May 1, 2013), 78 FR at 30967 (May 23, 2013) ("Cross-Border Proposing Release").

single-name CDS to hedge financial or commercial risks.[6] Section 13(m)(1)(E) directs the Commission, among other things:

- to specify the criteria for determining what constitutes a large notional security-based swap transaction (block trade) for particular markets and contracts; and
- to specify the appropriate time delay for reporting large notional security-based swap transactions (block trades) to the public.[7]

In its proposal for Regulation of SBSR, the Commission discussed the above considerations but did not at that time propose any specific criteria for the time delay for reporting block trades to the public.[8]

To better inform the Commission and the public on this topic, the Office of Analytics and Research in the Division of Trading and Markets and Division of Economic and Risk Analysis present in this memo an analysis of recent security-based swap transactions designed to characterize if and how dealers may hedge any large notional exposures that result from executing trades with their customers.[9]

Specifically, the analysis provides information that characterizes dealers' responses to shocks to their inventory that arise as a result of large single-name CDS trades. It is intended to assist the Commission in the development of final rules that implement the public dissemination requirement under Title VII of the Dodd-Frank Act. In part, this analysis should help the Commission evaluate the impact of allowing those market participants who are required to report transaction information (which would be subsequently disseminated to the market by swap data repositories,) to delay their reports to facilitate hedging.[10]

To frame the evaluation of the economic effects of reporting delays and public dissemination requirements for block trades in security-based swaps, we attempt to measure the prevalence of hedging behaviors among ISDA-recognized dealers as well as the speed at which these dealers react to inventory shocks. Our data consist of individual transaction records from the Depository Trust and Clearing Corporation – Trade Information Warehouse (DTCC-TIW).[11]

As described in the detail below, our analysis suggests two notable observations related to dealer hedging of large transactions in single-name CDS:

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6 See Regulation SBSR Proposing Release, 75 FR at 75268. See also Cross-Border Proposing Release 78 FR at 30982.

7 See 15 U.S.C. 13m(m)(1)(E).

8 See Regulation SBSR Proposing Release, 75 FR at 75228.

9 See Chen, Kathryn, M. Fleming, J. Jackson, A. Li and A. Sarkar, "An Analysis of CDS Transactions: Implications for Public Reporting." Federal Reserve Bank of New York Staff Report No. 517 (September 2011), pp 16-18. Available at http://www.newyorkfed.org/research/staff_reports/sr517.pdf.

10 See note 8 *supra*.

11 The information was made available to the Commission under an agreement with the DTCC-TIW and in accordance with guidance provided to DTCC-TIW by the OTC Derivatives Regulatory Forum ("ODRF").

1. After most large transactions between a dealer and customer are executed, dealers do not appear to hedge resulting exposures by executing offsetting transactions (either with other dealers or other customers) in the same single-name CDS;

2. In instances where dealers appear to hedge resulting exposures following a large trade they generally do so within a maximum of 24 hours after executing the original trade.[12]

Background

The credit risk borne by CDS dealers as a result of transaction activity is a function of both the credit quality of the underlying reference entities (underliers) of their CDS contracts and the ability of their counterparties to pay if a credit event occurs (counterparty credit risk). Each transaction in which a dealer engages causes a change in the set of risks borne by that dealer.

Our analysis is concerned with how dealers manage large changes in exposure to reference entities (inventory risk). Large CDS transactions on a particular reference entity create large inventory positions that shock dealers' exposure to the credit risk of reference assets. Dealers may respond to these shocks in a number of ways. For example, dealers may pass through costs of holding inventory risk to their customers by widening their quotes ex-ante.[13] Additionally, dealers may actively manage inventory risks that they do not want to bear by entering into offsetting contracts that diversify or hedge new risk exposures.[14] Doing so requires finding market participants, typically in the interdealer market, who are willing to act as counterparties to these offsetting contracts.

In light of the small number of participants in the interdealer market, public dissemination of CDS transaction information is potentially costly for a dealer who actively hedges CDS inventory because knowledge of a large trade and the need to hedge inventory risk could cause potential counterparties to update their beliefs and anticipate future liquidity demand. These counterparties could respond by strategically widening spreads in an effort to extract rents above those associated with competitive liquidity supply. By examining the time that elapses between large trades and subsequent activity in the security-based swap market consistent with hedging inventory risk, this memo attempts to measure the likelihood with which these scenarios may arise.

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[12] As will be described below, this 24 hour estimate is presently an upper bound. Hedging (when it occurs) may be accomplished on even shorter time scale, but at present the data does not allow us to robustly estimate these shorter times.

[13] See Ho, Thomas and Hans R. Stoll. "Optimal dealer pricing under transactions and return uncertainty." Journal of Financial Economics 9, no. 1 (1981): 47-73.

[14] See Hansch, Oliver, Narayan Y. Naik, and S. Viswanathan. "Do inventories matter in dealership markets? Evidence from the London Stock Exchange." The Journal of Finance 53, no. 5 (1998): 1623-1656.

Data

Our analysis is based on transaction data collected by DTCC-TIW from participants in the credit default swap market. While other financial instruments fall within the definition of security-based swap, we estimate that the market for single-name CDS makes up about 80% of the security-based swap market as a whole.[15]

In addition to the transaction data from DTCC-TIW, we incorporate monthly foreign exchange rates into our analysis. As noted elsewhere, the CDS market is global in nature,[16] and contracts are often denominated in different currencies. In order to enhance comparability between trades with notional amounts reported in different currencies, we use monthly exchange rates to translate all amounts to U.S. dollars.[17]

The Commission has used data collected by DTCC-TIW in the economic analyses of rules it has proposed and adopted. In each of these cases it has noted particular limitations associated with the data that may affect any conclusions drawn from analysis.[18] Similarly, here, these limitations will impact the potential interpretation of the results of our data analyses.

First, we observe only those transactions in single-name CDS where a U.S.-domiciled entity is the reference entity underlying the contract, or where at least one counterparty is domiciled within the U.S. With respect to the examination of hedging in the CDS market, this limitation of the data may have implications for the conclusions we draw. Our ability to observe the inventory process for non-U.S. counterparties for single-name CDS on underlying non-U.S. reference entities will be limited to their inventory positions with other U.S. counterparties. As a result, our analysis of the hedging practices of non-U.S. dealers will be limited to their activity in single-name CDS on U.S. underliers. By contrast, our data allows us to build a fairly complete picture of the inventory positions of U.S. counterparties for single-name CDS on both U.S. and non-U.S. underliers.

Second, we generally do not observe transaction activity between affiliates. A dealer may engage in risk management across multiple accounts, using one account to engage in large trades with non-dealers and a separate account to hedge the resulting inventory risk. The dealer may eventually consolidate these single-name CDS positions into a third account. While our data does not allow us to precisely measure central hedging activity, Figure 5 depicts dealers' hedging activity at the firm level by aggregating changes in inventory across all of a dealer's accounts subsequent to a large trade in any one of the dealer's accounts.

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15 See note 2 *supra.*

16 See Cross-Border Adopting Release, Section III.

17 We use monthly rates from the Federal Reserve Bank of Saint Louis (available at http://research.stlouisfed.org/fred2/categories/95) computed by averaging daily noon New York buying rates.

18 See Cross-Border Adopting Release, note 152.

An additional limitation of the data is that although each CDS transaction record includes both the date and time at which DTCC received and recorded the transaction, only the date of the execution is reported to DTCC, and not the actual time of the execution. We understand that many CDS transactions are reported to DTCC contemporaneously with the execution. We also recognize, however, that transaction reporting may be delayed or even “batched” to the end of trade date or even to a subsequent date. In the present analyses we therefore cannot be certain that the time stamp recorded for any given transaction is the actual time of execution. The impact of this uncertainty on our analysis is more fully described in the results section below.

One final limitation of the present analysis is that we cover only transactions in single-name CDS. The totality of inventory risk faced by dealers is a result of positions held across asset classes, including in the underlying security. For example, a trade that would appear to greatly extend a dealer’s inventory risk when viewed solely in the context of exposure to single-name CDS, may have a more muted effect on inventory risk after accounting for diversification across the breadth of the dealer’s positions in all asset markets. Additionally, a dealer may choose to hedge the inventory risk it assumes outside of the market for single-name CDS.

In addition to the data limitations discussed earlier, we recognize that our results come from an environment with evolving regulation and no requirement for post trade reporting. In addition to requiring regulatory reporting and public dissemination of transaction data, Title VII directs the Commission to implement a broader regulatory regime for security-based swaps, including single-name CDS, and the features of this new regulatory regime may have consequences for inventory risk management by dealers. Our analysis describes behavior given the current market structure for single-name CDS and will not capture the market’s response to regulation.

Sample

Our core analysis of hedging behavior relies on transactions in single-name CDS during a 12-month period from April 2013 to March 2014. Each transaction in the sample is associated with a particular transaction type, specifying, among other things, whether the observation is associated with a new position or is a modification to an existing position. We present the frequency of different transaction types in our sample in Table 1 and discuss our use and interpretation of these transaction types in a following section.

As noted earlier, our core analysis covers transactions in single-name CDS contracts and Table 2 presents the proportion of transaction activity, by number of trades and notional value of contracts, associated with different types of reference entities. We have further broken down the set of transactions involving corporate underliers according to their ISDA documentation. Within our sample, we estimate that 63% of corporate transaction volume is based on U.S. underliers. Due to the data limitations noted above, we believe that the results of our analysis across all dealers are more robust for this subsample.

As the Commission has previously noted, security-based swaps are used by market participants to share financial and commercial risks and a small group of dealers intermediate trades between these participants.[19] Table 3 divides the set of accounts in our sample into those associated with the dealing activity of ISDA-recognized dealers and the remainder that we identify as "non-dealers".[20] Consistent with our characterization of security-based swap activity as being concentrated among a core group of dealers, we find that the bulk of transaction activity, measured in transactions or in transaction notional, takes place between dealing accounts, though these accounts represent only 0.63% of all accounts in the sample.

As mentioned above, the transaction records we have obtained from DTCC-TIW allow us to identify trade execution dates but not trade execution times. Based on our understanding of the data, we have determined that, in certain circumstances, the time stamp associated with the initial creation of a transaction record in DTCC-TIW may serve as an upper bound on the time of a trade. In certain circumstances, the data suggest that the time stamp recorded for a particular transaction cannot be the actual time of the execution. For example, if the date of execution for a given transaction provided by the dealer to DTCC does not match the date at which DTCC recorded receipt of the record, then the time at which DTCC received the transaction is likely not the execution time. In these cases, we assign the transaction to the end of the day to ensure it is included in the analysis, even if it cannot be accurately sequenced within a given day. Figure 1 plots the frequency of time stamps in our sample.

Methods

The first step in our analysis of dealers' management of inventory risk that results from entering into a large trade with a customer is to identify an initial set of large trades, or "seed transactions". For the purposes of our analysis, we separately compute and track the change in exposure, or change in inventory, of each dealer by underlier. In other words, we track changes in inventory at the dealer-reference entity level. A seed transaction is:

1) A new trade, an assignment representing entry into an existing contract, or a voluntary termination of an existing contract ahead of its scheduled termination date;[21]
2) Between a dealer and a non-dealer;
3) Involving a large notional value; and
4) Free of other, confounding, large trades.

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19 See Cross-Border Adopting Release at note 44.

20 The DTCC-TIW includes "firm ids" which group together accounts which share a transacting agent. We identified the set of firm ids associated with the "G15" group of dealers from ISDA's 2013 Operations Benchmarking Survey (available here: http://www2.isda.org/functional-areas/research/surveys/operations-benchmarking-surveys/,) and defined account numbers associated with this set of firm ids with notional activity above $3 billion within the sample period as "dealing accounts".

21 In an effort to exclude terminations that result from portfolio compression or central clearing of CDS contracts, we include only those terminations for which we can identify cash flows between counterparties.

First, by restricting analysis to new trades, voluntary terminations, and instances where a party enters an existing trade though an assignment we are attempting to capture those events that are more likely to indicate provision of liquidity to CDS market participants. Notably, this definition excludes exits. Exits in our sample represent instances where a CDS contract ends as a result of a default event, and are unlikely to represent a choice on the part of either counterparty to the contract.

Second, we restrict our definition of seed transaction to activities that involve a dealer interacting with a non-dealer. We are interested in how dealers respond to inventory shocks that arise as a result of liquidity demand. In a transaction involving both a non-dealer and a dealer, it is more likely that the dealer is responsible for supplying liquidity to the non-dealer. However, identifying the liquidity supplier in an interdealer setting is difficult, and we therefore eliminate these trades. Conditioning the data in this manner allows us to distinguish trades in which the network of dealers provides liquidity to users of CDS contracts from those that redistribute risks among dealers.[22]

Further, interdealer transactions differ in their informational characteristics. On one hand, a dealer who trades with another dealer in an opaque market may be unsure whether the counterparty to the trade is hedging or taking advantage of private information.[23] On the other hand, interdealer markets are often characterized as repeated games in which reputational concerns and long-term relationships among counterparties lessen incentives for gathering economic rents in the short-run.[24]

Third, we focus our attention on seed transactions that involve large notional values. Transactions that represent larger perturbations to dealer inventory are more likely to require a hedge. Table 5 presents critical values of the trade size distribution and Table 6 presents statistics for a subsample of trades exceeding $30 million in notional value, including the number of underlying reference entities that trade in size as well as the proportion of dealers and non-dealers that participate in these large trades.

Finally, we construct our set of seed transaction to exclude confounding shocks to inventory. We exclude from the set of seed transactions any transaction that has another qualifying transaction that precedes it by fewer than five trading days.[25] We take this step to ensure that our measurement of a dealer's attempt to hedge the inventory shock created by a large trade is not biased by earlier shocks the dealer may still be in the process of hedging. Additionally, removing such transactions reduces the likelihood that we introduce dependency between the seed transactions in our sample and bias our probability estimates.

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22 See e.g. Lyons, Richard K. 2001. The microstructure approach to exchange rates. Cambridge, Mass: MIT Press, pp.94-95, for examples of interdealer risk sharing in the foreign exchange market.

23 See Glosten, Lawrence R., and Paul R. Milgrom. "Bid, ask and transaction prices in a specialist market with heterogeneously informed traders." Journal of financial economics 14, no. 1 (1985): 71-100.

24 See e.g. Desgranges, Gabriel, and Thierry Foucault. "Reputation-based pricing and price improvements." Journal of Economics and Business 57, no. 6 (2005): 493-527 (showing that long-term incentives can persuade dealers to offer price improvements to clients.)

25 If a trade's time stamp indicates it occurred overnight, between 7:00pm and 7:00am, we delay our day count until 7:00am.

Using the procedure outlined above and restricting our sample to only transactions that either (i) involve a U.S. domiciled dealer, regardless of the domicile of the underlier; or (ii) involve non-U.S. dealers where the underlier has a U.S. domicile, results in 2101 seed transactions involving 21 dealing accounts trading with 370 nondealing accounts on 400 reference entities. Table 7 presents summary statistics for the seed transactions we use for analysis.

Results

Once we have identified the set of seed transactions in our sample, we estimate the degree to which dealers hedge the inventory positions they acquire as a result of these seed transactions. As discussed in our description of the DTCC-TIW data, the time stamps associated with individual CDS transaction records likely represent execution time, but with error. In cases where we believe these time stamps are reliable, we have used them to sequence intraday transactions by a particular dealer on the day of a seed transaction. We assume that those transactions for which we cannot establish a reliable time stamp occur at the end of the trading day. Since the proportion of such trades is small (8% of trades, representing $1.36 billion in notional value,) we do not expect this assumption to affect our conclusions in any significant way.

On the day of a seed transaction by a particular dealer in a particular reference entity, we assume all transaction activity by the same dealer in the same reference entity with a later time stamp occurred subsequent to the seed transaction. In other words, we assume that activities with later time stamps represent a continuation of the same inventory process after the shock generated by the seed transaction. We recognize that the period between the time stamps of two trades may not reflect the actual time that a dealer takes to make the decision to engage in a large trade or to hedge inventory exposures caused by large trades. Since we cannot determine how tightly our time stamps bound the time that counterparties choose to trade, we acknowledge that we may underestimate or overestimate the amount of time that elapses between an inventory shock and subsequent hedging activity.[26]

Figure 2 summarizes dealer activity following seed transactions. At the end of each of the first five days following a seed transaction, we compute the number of dealer-reference entity pairs that showed either (i) no change in inventory after the seed transaction, (ii) a net increase in inventory in the same direction as the seed transaction, or (iii) a net reduction in inventory in the same direction as the seed transaction.

Figure 3 contains the results of a test for frequency of hedging activity by dealers. After identifying a seed transaction in a particular reference entity that might prompt hedging by the dealer involved, we examine that dealer's subsequent trading activity over the following five days. For the purposes of this

[26] In particular, we would tend to underestimate (overestimate) the length of time it takes to hedge an inventory shock if the time that elapses between a large trade and its time stamp is longer (shorter) than the time that elapses between the subsequent hedging transactions and their time stamps.

chart, if the dealer engages in trading activity in the same reference entity sufficient to reverse 80% of the notional exposure of the seed transaction then we classify the seed transaction as hedged.[27]

Figure 3 shows that approximately 16% of seed transactions were hedged within one day and that by end of day five, approximately 20% of these seed transactions were hedged. Viewed another way, an additional 4% of seed transactions are hedged by at least 80% between the end of day one and the end of day five. Figure 4 shows the sensitivity of our result to alternative definitions of seed transactions. In each panel of the figure, we display hedging characteristics for seed transactions defined using alternative size thresholds. These results suggest that even looking across different trade sizes, hedging activity is not common and most hedging activity happens within a day of the initial inventory shock. Finally, Figure 5 shows hedging behavior across accounts at a given firm. To produce this chart, we aggregated dealing accounts affiliated with the same firm and estimated hedging activity at the firm level.

Figure 6 presents a broader view of hedging activity at the level of individual seed transactions. As in Figure 3, for each seed transaction, we aggregate the subsequent transaction activity of the same dealer on the same reference entity and estimate the level of hedging. Here, however, we plot the mean and median levels of hedging activity we observe at the end of each day across the dealer-reference entity pairs.

Table 8 follows individual seed transactions and depicts the evolution of hedging over time. We first group the set of seed transactions on the basis of how much the resulting position was hedged by the end of day five ("T+5"). Then, across all of the seed transactions in each bucket, we compute the average level of hedging at the end of each day from one to five. For example, if we consider only the seed transactions that are eventually hedged by between 50% and 75% at the end of day five, on average this group is 33% hedged at the end of day one and more than 50% hedged at the end of day four.

[27] The 80% threshold we selected for Figure 3 is one possible threshold for classifying positions as hedged. Table 8 suggests that the patterns of hedging behavior we observe are robust to this choice of threshold.

Table 1: Transaction Counts by Transaction Type in the Single-Name Credit Default Swap Market

Transaction Type	Transaction Count
Trade	373,259
Assignment	143,399
Termination	364,854
Other	10,489
Total	892,001

Table 2: Transaction Counts and Traded Notional Amounts by Reference Entity Type in the Single-Name Credit Default Swap Market

Type of Reference Entity	Transaction Count	Notional Amounts ($B)
Corporate	748,352	3,526.92
Sovereign	127,529	1,370.15
Other	16,120	99.36
Total	892,001	4,996.43

Table 3: Dealer Participation in the Credit Default Swap Market

	Accounts		Transaction Count	Notional Amounts ($B)
Dealer	31	Interdealer	571,360	3,513.01
Non-Dealer	4912	Dealer to Non-Dealer	320,641	1,483.42

Table 4: Summary Statistics for Samples with Differing Time Stamps

	Estimate Time Stamp Available	Estimate Time Stamp Unavailable
Transaction Count	948,232	83,243
Total Notional ($B)	7,011.05	372.37
Average Notional ($M)	7.39	4.47
% Notional Amount with Non-Dealers	52.10%	30.40%
% Transactions with Non-Dealers	42.84%	25.97%

Table 5: Summary Statistics for Trade Sizes in Sample (N=892001)

Trade Size Statistic	Value (Dollar Values in Millions)
Mean	$5.60
Standard Deviation	$9.77
Mode	$5.00
1st Percentile	$0.05
25th Percentile	$1.00
Median	$3.00
75th Percentile	$6.54
99th Percentile	$40.47
Transactions with Non-Dealer Counterparty	35.95%

Table 6: Summary Statistics for Trade Sizes in Sample restricted to trades larger than $30 Million (N=17270)

Trade Size Statistic	Value (Dollar Values in Millions)
Mean	$51.84
Standard Deviation	$37.18
Mode	$50.00
1st Percentile	$30.00
25th Percentile	$34.00
Median	$41.24
75th Percentile	$53.00
99th Percentile	$200.00
Transactions with Non-Dealer Counterparty	27.57%

Table 7: Characteristics of Seed Transactions

Panel A. Seed Transactions by Reference Entity Type

Corporate	1098
- U.S. Reference Entities	*596*
- Non-U.S. Reference Entities	*502*
Sovereign	976
Other/Unclassified	27
Total	2101

Panel B. Seed Transactions by Dealer Domicile

U.S. Domicile Dealers	1758
Non-U.S. Domicile Dealers	343
Total	2101

Panel C. Seed Transactions by Transaction Type

New Trades	1360
Assignments	352
Voluntary Terminations	389
Total	2101

Table 8: Timing of hedging activity at different levels of hedging

	Average Level of Hedging at:					
Hedge Level At T+5	T+1	T+2	T+3	T+4	T+5	Fraction of Seed Transactions
Less than 0%[28]	(66%)	(79%)	(99%)	(113%)	(123%)	60.40%
(0%, 25%)	11%	11%	12%	14%	12%	5.90%
(25%, 50%)	20%	29%	33%	35%	37%	4.71%
(50%, 75%)	33%	39%	48%	56%	64%	5.47%
(75%, 100%)	74%	81%	85%	88%	92%	8.04%
Greater than 100%[29]	137%	199%	252%	313%	338%	15.47%
Total						100%

28 Positions classified as "Less than 0%" hedged are those in which dealers continued to extend positions in the same reference entity in the same direction as the initial seed transaction. Negative numbers indicate that inventory levels increase above the benchmark inventory set before the seed transaction.

29 Positions classified as "Greater than 100%" hedged are those in which dealer positions in the same reference entity five days after the seed transaction were lower in absolute value than their positions immediately prior to the seed transactions. For example at the end of day one, the average inventory level for aggressive hedgers was 37% of the size of the initial seed transaction, but in the opposite direction.

Figure 1: Assigned time stamps for DTCC-TIW transaction activity from April 2013 to March 2014

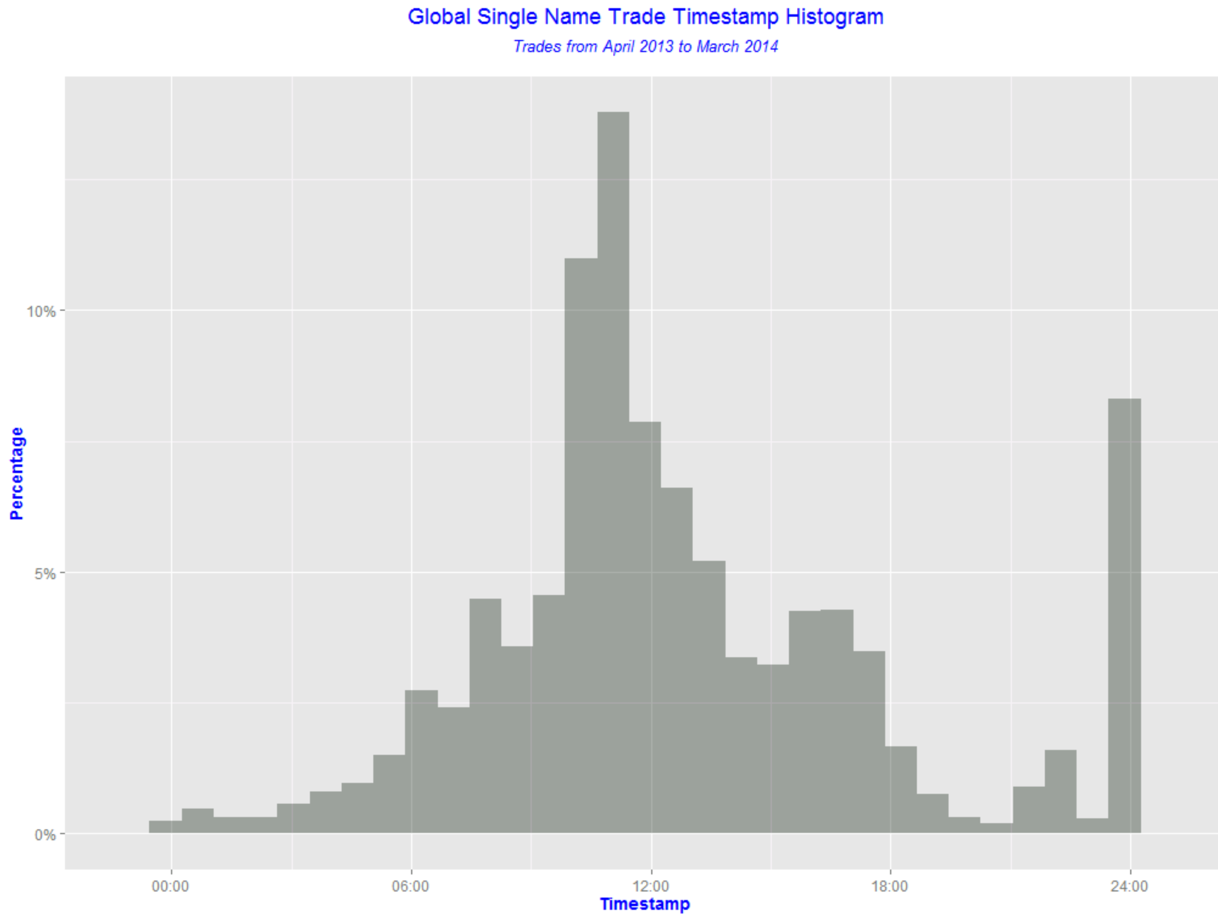

Figure 2: Changes to inventory positions following seed transactions

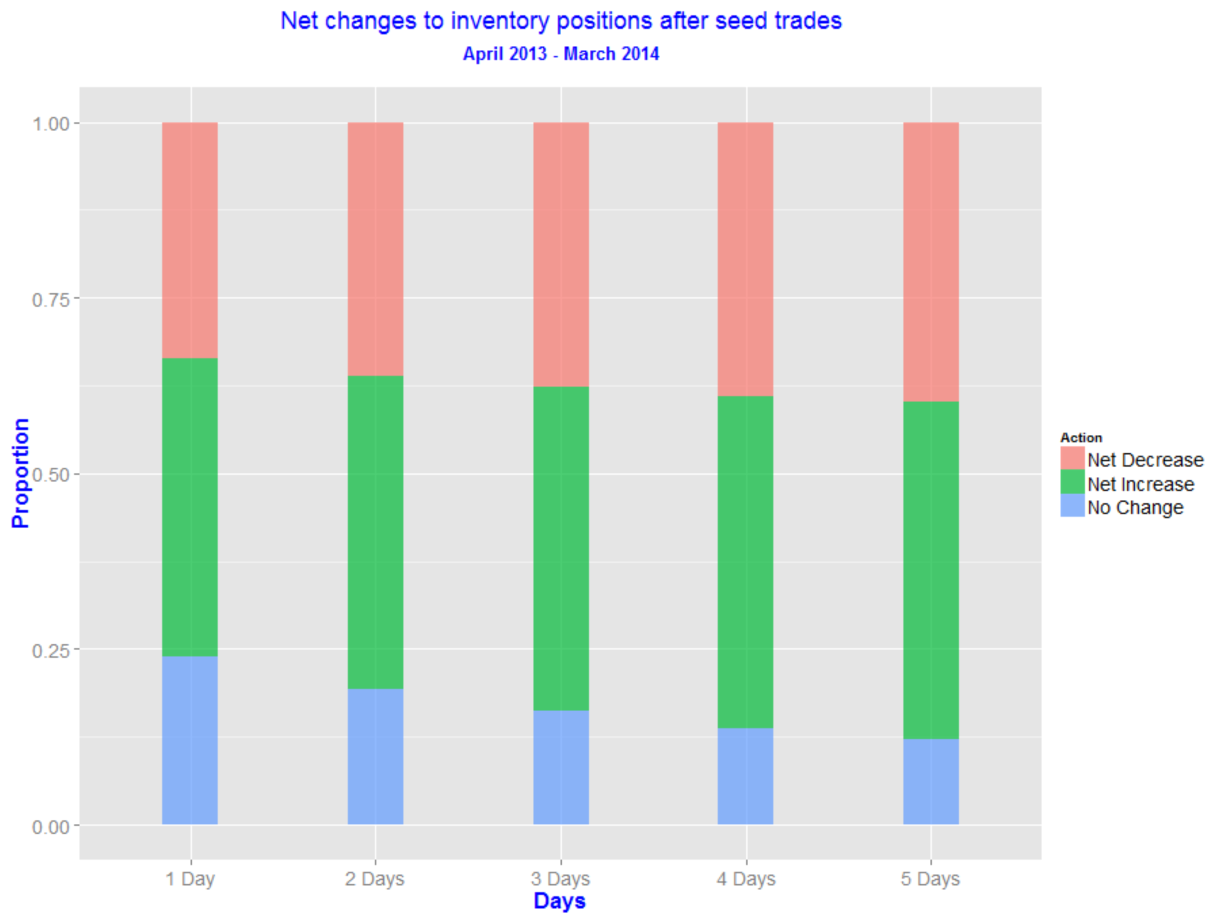

Figure 3: Proportion of Seed Transactions hedged at the end of days one through five

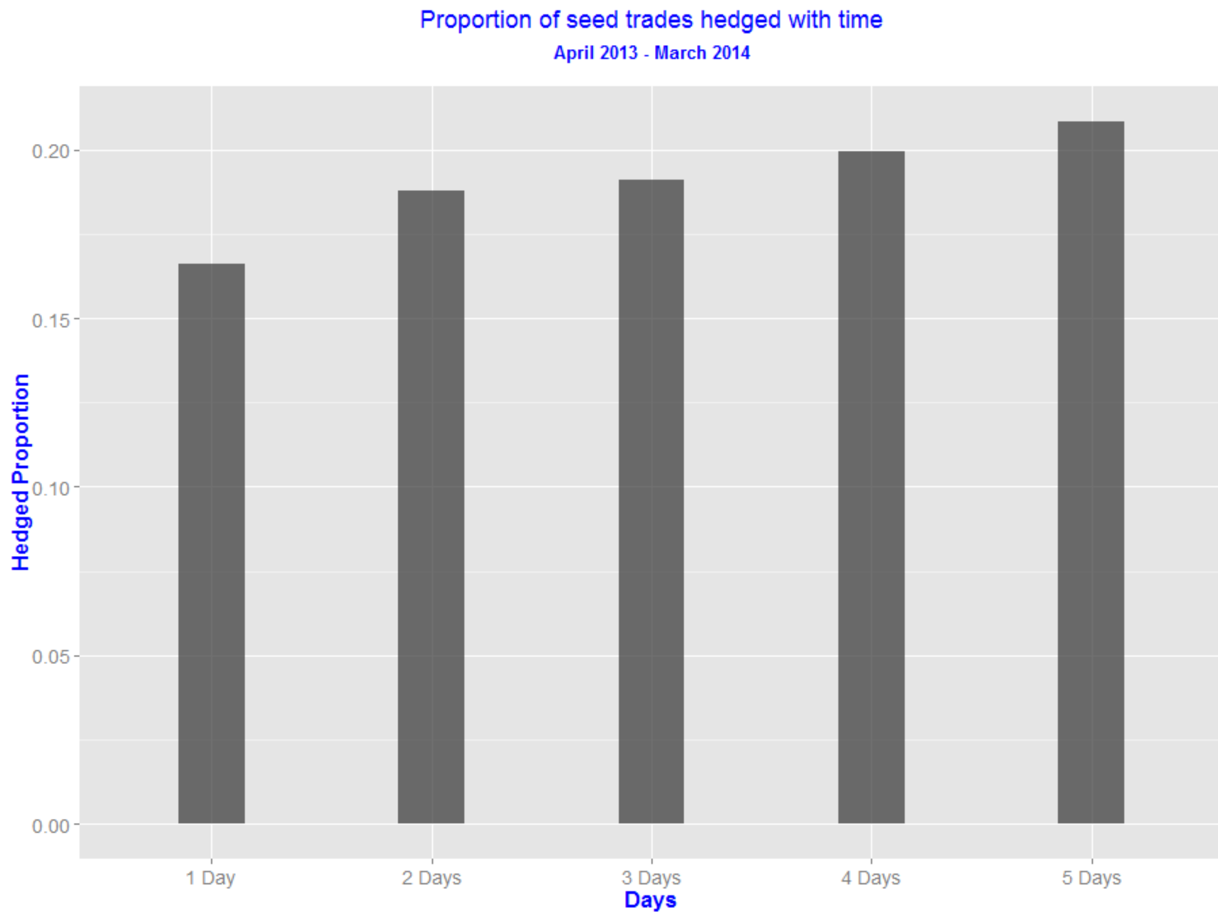

Figure 4: Proportion of hedging at the end of days one through five, using alternative thresholds for defining seed transactions

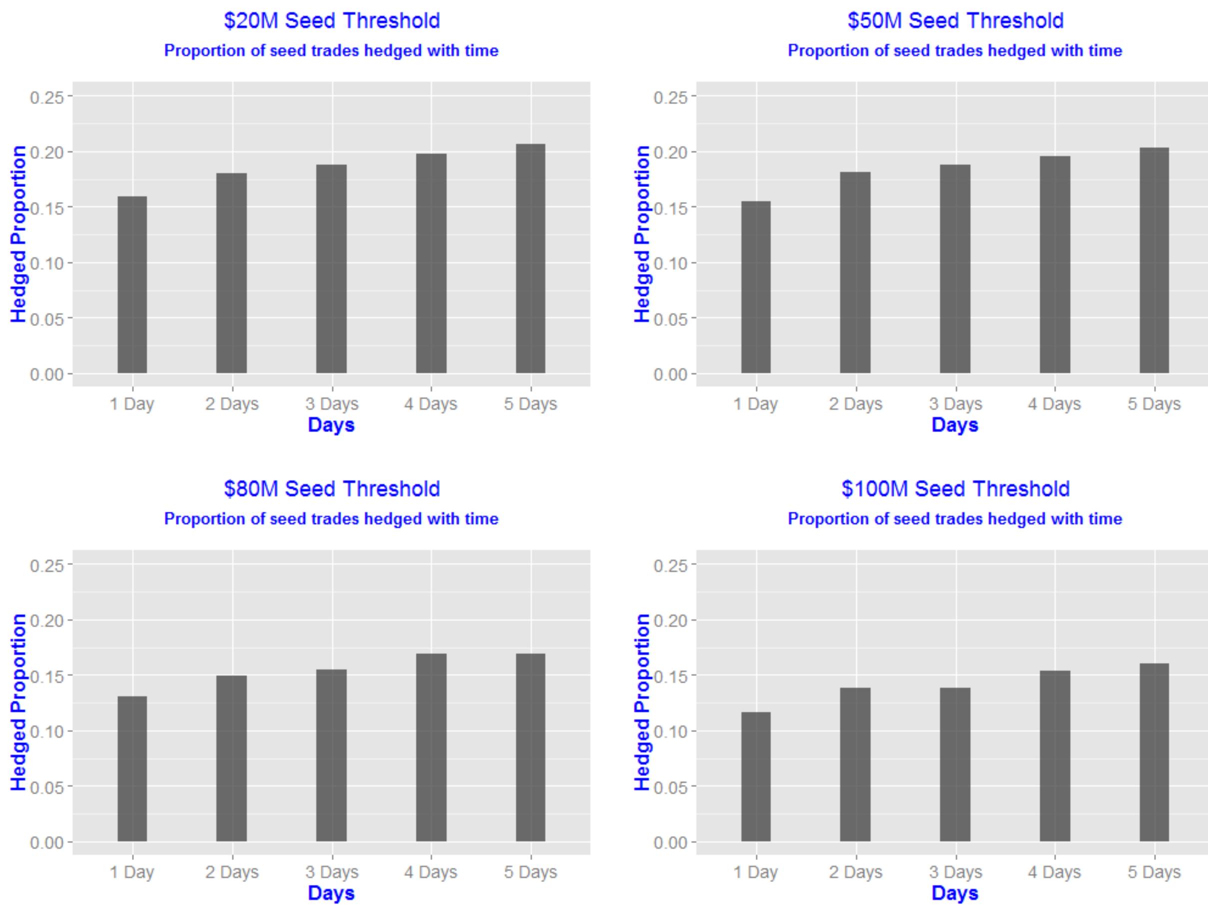

Figure 5: Proportion of Seed Transactions hedged at the end of days one through five aggregated to the level of DTCC-TIW firms (transacting agents)

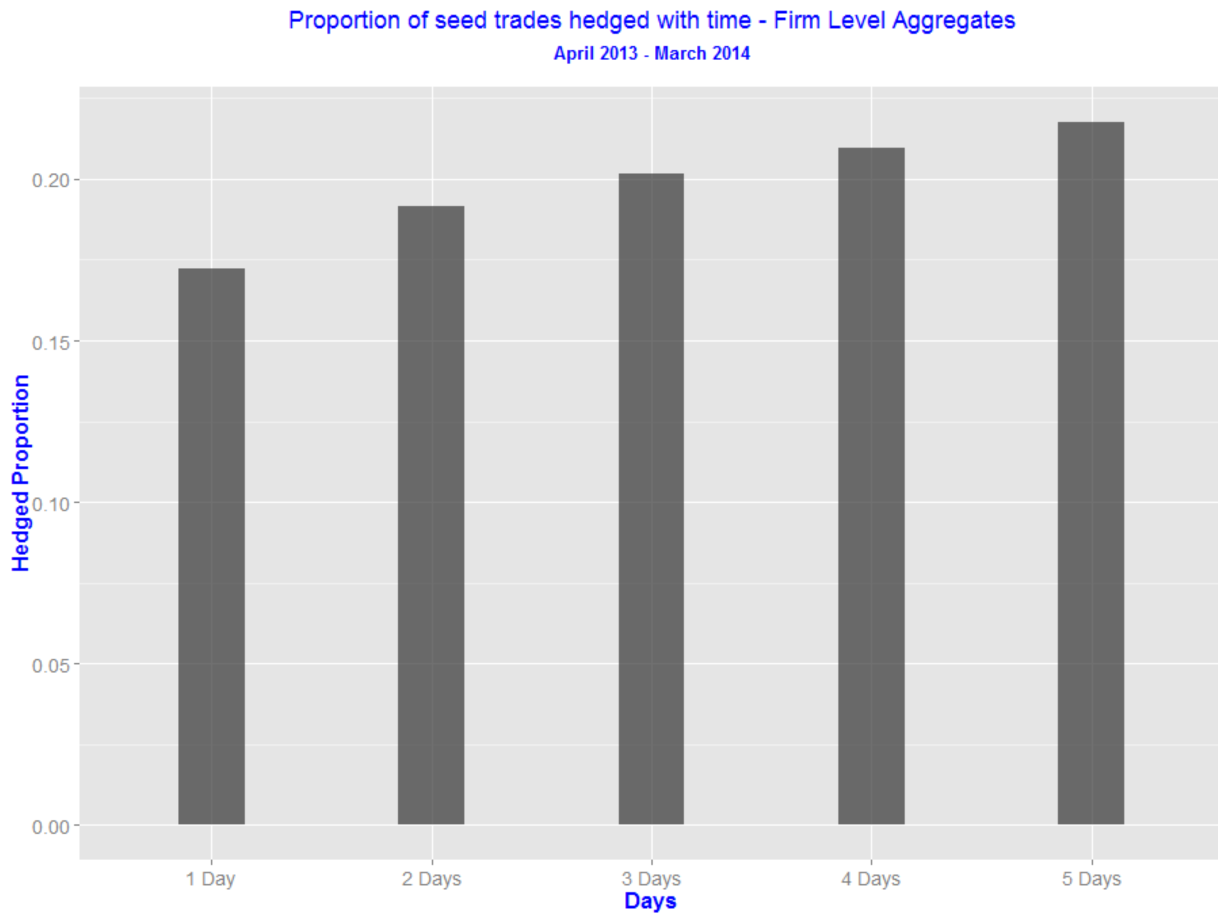

Figure 6: Response to inventory shocks for mean and median dealer-reference entity pairs