

**SECTION II: SAS CODE TO MATCH TRADES TO FISD, TO CREATE
'AGGREGATE MARKET' SAMPLE OF TRADES, AND TO IDENTIFY DEALERS IN
THE TOP 70% SAMPLE AND CONSTANT DEALER SAMPLE**

```
/*Part A: Match Screened CUSIPS to FISD Data, Delete if Missing Offering or  
Maturity Date, Create File of Dates w/ Changes to Amount Outstanding  
Unrelated to Maturity*/;
```

```
/*1A) Start with initial file of screened CUSIPS*/;  
data t;set bond.cleancusip_character_2006_2016;drop cusip_id;run;  
data t;set t;cusip_id=substr(complete_cusip,1,9);run;  
proc sort data=t nodupkey;by cusip_id;run;
```

```
/*2A) Stack two FISD data sets. Revised to extend sample to 2016.  
(fisd_data0190to0416 includes issues between 1990 and April 2016,Fisd_data  
includes 1950 to October 2014)*/  
data temp;set bond.fisd_data0190to0416;new=1;run;  
data FISD;set bond.Fisd_data temp;F=1;run;
```

```
/*3A) Merge screened cusips to FISD data by issue_id*/  
proc sort data=t;by issue_id;run;  
proc sort data=FISD;by issue_id;run;  
data three;merge t (in=a) FISD (in=b);by issue_id;if a;run;  
proc sort data=three;by issue_id descending new;run;  
proc sort data=three nodupkey;by issue_id;run;
```

```
/*4A) Delete if missing offering or maturity date*/  
data four;set three;if offering_date=. then delete;if maturity=. then  
delete;run;  
proc sort data=four out=test nodupkey;by issue_id;run;
```

```
/*5A)Save final sample of cusips for input into aggregate data sas code.*/  
data bond.fincusip121316JF;set four;keep cusip_id issue_id issuer_id  
offering_amt offering_date maturity industry_group r144a;run;  
proc sort data=bond.fincusip121316JF nodupkey;by issue_id;run;
```

```
/*6A) Create a file that identifies dates of changes to amount outstanding  
unrelated to the date the issue matures, use action_type in FISD*/  
data bond.amtOSJF;set four;if (offering_amt ne amount_outstanding) and  
action_type not in ('IM');keep issue_id effective_date  
amount_outstanding;run;  
/*ACTION_TYPE IM = Issue Matured*/
```

```
/*Part B: Create Aggregate Market Sample*/;
```

```
/*1B) Pull in main sample created in Part A*/  
data inv1;set bond.fincusip121316JF;keep cusip_id;run;  
proc sort data=inv1;by cusip_id;run;
```

```
/*2B) Pull in trade files from 2006 to 2010. Note the format changed in 2010.  
Create volume and time variables*/
```

```
data topl1a;set  
bondnew.Trades_w_dealercodes_2006_new bondnew.Trades_w_dealercodes_2007_new  
bondnew.Trades_w_dealercodes_2008_new bondnew.Trades_w_dealercodes_2009_new  
bondnew.Trades_w_dealercodes_2010_new;format TRD_EXCTN_DT MMDYY10.;
```

```

/*Create volume and 9-digit CUSIP*/
volume_dol=(entrd_vol_qt*1000*(entrd_pr/100));cusip_id=substr(cusip_id,1,9);f
ormat cusip_id $9.;length cusip_id $9;
keep TRD_EXCTN_DT EXCTN_TM cusip_id volume_dol buydc selldc entrd_vol_qt
entrd_pr cust buyrsc sellrsc;run;
/*Create time variables based on execution date and time*/
data topl1;set topl1;trdyrmonth = year(TRD_EXCTN_DT)*12 +
month(TRD_EXCTN_DT);
trdsec = EXCTN_TM/1000000;
trdhr = int(trdsec/10000);
trdmin = int(trdsec/100) - trdhr*100;
trdsec = trdsec - trdhr*10000 - trdmin*100;
trdday = day(TRD_EXCTN_DT);
trdmonth = month(TRD_EXCTN_DT);
trdyr = year(TRD_EXCTN_DT);
trdtime = (((trdyr*12 + trdmonth)*30 + trdday)*24 + trdhr)*60 +
trdmin)*60 + trdsec;run;

/*3B) Pull in trades files from 2010 to 2016. Note the format changed in
2010. Create volume and time variables*/
data toplb;set bondnew.Trades_w_dealercodes_2010_11_new
bondnew.Trades_w_dealercodes_2012_g2_new
bondnew.Trades_w_dealercodes_2013_g1_new
bondnew.Trades_w_dealercodes_2014_g1_new
bondnew.Trades_w_dealercodes_2015_g1_new;
format TRD_EXCTN_DT MMDDYY10.;
/*Create volume and 9-digit CUSIP*/
volume_dol=(entrd_vol_qt*(entrd_pr/100));
EXCTN_TM=trd_EXCTN_TM;format EXCTN_TM time.;
keep TRD_EXCTN_DT EXCTN_TM cusip_id volume_dol buydc selldc entrd_vol_qt
entrd_pr cust buyrsc sellrsc TRDG_MKT_CD;run;
/*Create time variables based on execution date and time*/
data toplb;set toplb;trdyrmonth = year(TRD_EXCTN_DT)*12 +
month(TRD_EXCTN_DT);
trdsec = second(EXCTN_TM);
trdhr = hour(EXCTN_TM);
trdmin = minute(EXCTN_TM);
trdday = day(TRD_EXCTN_DT);
trdmonth = month(TRD_EXCTN_DT);
trdyr = year(TRD_EXCTN_DT);
trdtime = (((trdyr*12 + trdmonth)*30 + trdday)*24 + trdhr)*60 +
trdmin)*60 + trdsec;run;

/*4B) Combine 2006-2010 and 2010-2016 trade samples. Create a unique trade
identifier 'trid'. An interdealer trade will later have the same trid.*/
data AGGtrades0215;set topl1 toplb;trid=_N_;run;

/*5B) Keep only cusips in main sample with trade data*/
proc sort data=AGGtrades0215;by cusip_id;run;
data trades2;merge AGGtrades0215 (in=a) inv1 (in=b);by cusip_id;if a and
b;run;

/*6B) Create a duplicate for each trade. For interdealer trades, we can
construct capital for each dealer. Create 'txn' equal to 1 for dealer buys
and -1 for dealer sells.
Create a dealer code 'dc' for each trade side.*/
data trades2a;set trades2;txn=1;run;

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data trades2b; set trades2a trades2; run;
data trades2b; set trades2b;
    if txn=. then txn=-1;
    if txn=1 then dc=buydc; else dc=selldc;
    if txn=1 then rsc=buyrsc; else rsc=sellrsc;
    drop buydc selldc buyrsc sellrsc; run;

/*7B) Delete customer trades with dc=544 */
data trades2b; set trades2b; if dc=544 then delete; run;

/*8B) Delete bonds with less than 5 trades over entire sample*/
proc sort data=trades2b; by cusip_id; run;
/*Count interdealer trades only once*/
proc sort data=trades2b out=temp nodupkey; by cusip_id trid; run;
proc means data=temp noprint; by cusip_id; output out=counts n=numtrd; run;
data counts; set counts; keep cusip_id _FREQ_; run;
proc sort data=counts; by cusip_id; run;
data trades3; merge trades2b counts; by cusip_id; run;
data trades3; set trades3; if _FREQ_ ge 5; run;
/*How many cusips and unique trades after this screen?*/
proc sort data=trades3 out=temp nodupkey; by cusip_id; run;
proc sort data=trades3 out=temp nodupkey; by trid; run;

/*9B) Now that we have trades, match to issue characteristics by 9-digit
cusip*/
data mat3; set
bond.cleancusip_character_2006_2016; cusip_id=substr(complete_cusip,1,9); run;
proc sort data=mat3 nodupkey; by cusip_id; run;
proc sort data=trades3; by cusip_id; run;
data mat4; merge trades3 (in=a) mat3 (in=b); by cusip_id; if a; run;
/*How many cusips and unique trades after this screen?*/
proc sort data=mat4 out=temp nodupkey; by cusip_id; run;
proc sort data=mat4 out=temp nodupkey; by trid; run;

/*10B) Get daily ratings data and create high yield indicator. Merge by
issue_id and day*/
proc sort data=mat4; by issue_id trd_exctn_dt; run;
data Ratingsbydate12616; set bond.Ratingsbydate; drop spratenumbr
moodyratenumbr; format date mmddyy10.; rename date=trd_exctn_dt; run;
proc sort data=Ratingsbydate12616; by issue_id trd_exctn_dt; run;
data trades4; merge mat4 (in=a) Ratingsbydate12616 (in=b); by issue_id
trd_exctn_dt; if a; run;
/*If missing daily rating retain previous day rating*/
data trades4; set trades4; by issue_id; retain rating2; if rating ne . then
rating2=rating;
else rating2=rating2; run;
/*Set highyield=. for unrated bonds*/
data trades4; set trades4; if rating2 ge 5 then highyield=1; else highyield=0;
if rating2=99 then highyield=.; run;
data trades3; set _null_; run; data trades2; set _null_; run; data trades2b; set
_null_; run; data trades2a; set _null_; run;

/*11B) Get dissemination date. File provided by FINRA*/
proc sort data=trades4; by cusip_id; run;
proc sort data=bond.dess; by cusip_id; run;
data trades6; merge trades4 (in=a) bond.dess (in=b); by cusip_id; if a; run;

```

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/*12B) If any single transaction has volume that exceeds issue size by 1x,
then delete all trades from that cusip*/;
data OK2;set trades6;if volume_dol gt (offering_amt*1000) then X=1;run;
proc sort data=OK2;by cusip_id descending X;run;
proc sort data=OK2 nodupkey out=ok2 (keep=cusip_id X);by cusip_id;run;
proc sort data=trades6;by cusip_id;run;
data oneb;merge trades6 (in=a) ok2 (in=b);by cusip_id;if a;run;
data trades7;set oneb;if X ne 1;run;
/*How many cusips and unique trades after this screen?*/
proc sort data=trades7 nodupkey out=test;by cusip_id;run;
proc sort data=trades7 nodupkey out=test;by trid;run;
data trades6;set _null_;run;

/*13B) Delete primary market trades*/
data trades8;set trades7;if TRDG_MKT_CD eq 'P1' then delete;run;
/*How many cusips and unique trades after this screen?*/
proc sort data=trades8 out=temp nodupkey;by cusip_id;run;
proc sort data=trades8 out=temp nodupkey;by trid;run;

/*14B) Determine changes to amount outstanding*/

proc sort data=trades8;by issue_id;run;
/*Create unique identifier for each trade observation'tempid'*/
data trades8;set trades8;tempid=_N_;run;
data trades9;set trades8;keep tempid issue_id TRD_EXCTN_DT;run;
/*Merge trade data with 'amtOSJF' file by issue_id. Keep only issues with
change to amount outstanding*/
proc sort data=bond.amtOSJF;by issue_id;run;
data trades10;merge trades9 (in=a) bond.amtOSJF (in=b);by issue_id;if a and
b;run;

/*effective_date is 'The date on which the change to the issue's amount
outstanding became effective' in FISD.*/
data trades10;set trades10;if TRD_EXCTN_DT lt effective_date then delete;run;
proc sort data=trades10;by tempid issue_id TRD_EXCTN_DT descending
effective_date;run;
proc sort data=trades10 nodupkey;by tempid issue_id TRD_EXCTN_DT;run;
proc sort data=trades8;by tempid;run;
data trades11;merge trades8 (in=a) trades10 (in=b);by tempid;if a;run;
/*If change to 'amount_outstanding' then the final amount outstanding finOS
is set to amount_outstanding*/
/*If no change to 'amount_outstanding' then the final amount outstanding
finOS is set to the offering amount*/
/*Create 'enddt' variable. If change to 'amount_outstanding' that results in
0 outstanding, enddt is the effective_date, otherwise enddt is the maturity
date.*/
data trades11;set trades11;if amount_outstanding ne . then
finOS=amount_outstanding;else finOS=offering_amt;
if finOS=0 then enddt=effective_date;else enddt=maturity;format enddt
YYMMDDN8.;run;

/*15B) Delete trades after end date*/
data trades11;set trades11;if TRD_EXCTN_DT gt enddt then delete;run;
/*How many cusips and unique trades after this screen?*/
proc sort data=trades11 out=temp nodupkey;by cusip_id;run;
proc sort data=trades11 out=temp nodupkey;by trid;run;

```

```

/*16B) Update ratings downgrades/upgrades for a few months beyond FISD
availability*/
data trades11;set trades11;cus6=substr(cusip_id,1,6);
if cus6='00507V' and TRD_EXCTN_DT ge '17MAY2016'd then highyield=0;
if cus6='017363' and TRD_EXCTN_DT ge '29JUL2016'd then highyield=1;
if cus6='05463D' and TRD_EXCTN_DT ge '02SEP2016'd then highyield=0;
if cus6='086516' and TRD_EXCTN_DT ge '26JUL2016'd then highyield=0;
if cus6='109641' and TRD_EXCTN_DT ge '13SEP2016'd then highyield=1;
if cus6='117043' and TRD_EXCTN_DT ge '22AUG2016'd then highyield=0;
if cus6='23331A' and TRD_EXCTN_DT ge '26JUN2016'd then highyield=0;
if cus6='364760' and TRD_EXCTN_DT ge '20MAY2016'd then highyield=1;
if cus6='462613' and TRD_EXCTN_DT ge '14APR2016'd then highyield=0;
if cus6='481165' and TRD_EXCTN_DT ge '21APR2016'd then highyield=1;
if cus6='529043' and TRD_EXCTN_DT ge '03JUN2016'd then highyield=0;
if cus6='67066G' and TRD_EXCTN_DT ge '07SEP2016'd then highyield=0;
if cus6='761655' and TRD_EXCTN_DT ge '05JUL2016'd then highyield=1;
if cus6='776249' and TRD_EXCTN_DT ge '20JUL2016'd then highyield=0;
if cus6='84860W' and TRD_EXCTN_DT ge '22APR2016'd then highyield=0;
if cus6='868157' and TRD_EXCTN_DT ge '28JUN2016'd then highyield=1;
if cus6='87161C' and TRD_EXCTN_DT ge '17JUN2016'd then highyield=0;
if cus6='929160' and TRD_EXCTN_DT ge '09MAR2016'd then highyield=0;run;

/*17B) All bonds are disseminated after June 2014. Delete if missing
dissemination date before*/
data trades11;set trades11;if (dsssdate=. or dsssdate=' ') and
year(TRD_EXCTN_DT) ge 2015 then dsssdate=offering_date;
if (dsssdate=. or dsssdate=' ') and year(TRD_EXCTN_DT) eq 2014 and
month(TRD_EXCTN_DT) gt 6 then dsssdate=offering_date;run;
data trades12;set trades11;if dsssdate=' ' then delete;if dsssdate=. then
delete;run;
/*How many cusips and unique trades after this screen?*/
proc sort data=trades12 nodupkey out=test;by cusip_id;run;
proc sort data=trades12 nodupkey out=test;by trid;run;

/*18B) Update with 144A flag and industry group variables from FISD in file
'small_2006_2016'*/
proc sort data=trades12;by cusip_id;run;
proc sort data=bond.small_2006_2016;by cusip_id;run;
data trades13;merge trades12 (in=a) bond.small_2006_2016 (in=b);if a;by
cusip_id;run;

/*19B) Delete trades executed prior to sample start at January 2006*/
data trades13;set trades13;if year(trd_exctn_dt) lt 2006 then delete;run;
/*How many cusips and unique trades after this screen?*/
proc sort data=trades13 nodupkey out=test;by cusip_id;run;
proc sort data=trades13 nodupkey out=test;by trid;run;

/*20B) Save final Aggregate Market data sample*/
data bond.aggtradedata121516JF;set trades13;run;

/*21B) Create alternate Aggregate Market data sample that excludes one
relatively large dealer that, during 2014, began to report an immediately
offsetting transaction for the large majority of its principal trades.
Conversations with FINRA indicated that these transactions actually
represented transfers of inventory to an off-shore subsidiary. */
/*Since November 2015 FINRA has required dealers to specifically flag such
offshore affiliate transactions. See

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<http://www.finra.org/industry/notices/15-14>. Since the affiliate flag was not available for the majority of our sample period we could not reliably identify which trades involved genuine capital commitment by this bank. See Section II.b of the paper and Footnote 15. */

/*Create new aggregate data that excludes the affiliate code 3763 (which is first reported in November 2015*/

/*and that excludes dealer 3458 April 2014 to October 2015.*/

```
data bond.aggtradedata121516ADJF;set bond.aggtradedata121516JF;
```

```
if dc=3763 then delete;
```

```
if dc=3458 and trdyr=2014 and trdmonth ge 4 then delete;
```

```
if dc=3458 and trdyr in (2015,2016) then delete;run;
```

/**/**/**/**/**/**/**/**/**/**/**/**/**/**/**Part C: Determine Dealers in the Top 70 and Constant Dealer samples**/**/**/**/**/**/**/**/**/**/**/**/**/**/**/;

/*1C) Find customer volume for each dealer-year relative to total customer volume each year*/

/*Exclude dealer 3458 with affiliate trades*/

```
data top2;set bond.aggtradedata121516JF;keep dc TRD_EXCTN_DT volume_dol;if cust=1;if dc=3458 then delete;run;
```

```
data top2;set top2;year=year(TRD_EXCTN_DT);run;
```

```
proc sort data=top2;by year dc;run;
```

```
proc means data=top2;by year dc;var volume_dol;output out=year sum=dcvol;run;
```

```
proc sort data=top2;by year;run;
```

```
proc means data=top2;by year;var volume_dol;output out=year2 sum=totvol;run;
```

```
data dcthreshold121516;merge year year2;by year;run;
```

```
proc sort data=dcthreshold121516;by year descending dcvol;run;
```

```
data dcthreshold121516;set dcthreshold121516;retain pct;by
```

```
year;p=dcvol/totvol;if first.year then pct=p;else pct=pct+p;run;
```

/*how many potential dealers?*/

```
proc sort data=dcthreshold121516 nodupkey out=test;by dc;run;
```

/*2C) Dealers in Top 70% Sample*/

```
proc sort data=dcthreshold121516;by year descending dcvol;run;
```

```
data bond.dealerthresh051917JF;set dcthreshold121516;if lag(pct) gt .70 and lag(year)=year then delete;run;
```

```
proc sort data=bond.dealerthresh051917JF nodupkey out=test;by dc;run;
```

/*25 dealers*/

/*3C) Dealers in Constant Dealer Sample*/

```
data top2;set bond.aggtradedata121516JF;keep dc TRD_EXCTN_DT volume_dol;if cust=1;run;
```

```
data top2;set top2;year=year(TRD_EXCTN_DT);run;
```

```
proc sort data=top2;by year dc;run;
```

```
proc means data=top2;by year dc;var volume_dol;output out=dcconstant121516 sum=dcvol;run;
```

```
proc sort data=dcconstant121516;by year descending dcvol;run;
```

```
data two;set dcconstant121516;retain rank;by year;if first.year then rank=1;else rank=rank+1;run;
```

/*Keep if in Top 30 by volume in any given year*/

```
data two;set two;if rank le 30;run;
```

```
proc sort data=two nodupkey;by dc;run;
```

/*58 unique dealers in top 30 in any year*/

```
data two;set two;ind=1;keep dc ind;run;
```

```
proc sort data= dcconstant121516;by dc;run;
```

```
proc sort data= two; by dc;run;
data three;merge dcconstant121516 two;by dc;run;
data three;set three;if ind=1;run;
proc transpose data=three out=four;by dc;id year;var dcvol;run;
data four;set four;if _2006=. or _2007=. or _2008=. or _2009=. or _2010=. or
_2011=. or _2012=. or _2013=. or _2014=. or _2015=. or _2016=. then
delete;run;
/*Keep if traded in all sample years */
/*36 left*/
data four;set four;tot=_2006+ _2007+ _2008+ _2009+ _2010+ _2011+ _2012+
_2013+ _2014+ _2015 + _2016;run;
proc sort data=four;by descending tot;run;
/*Exclude dealer 3458 with affiliate trades*/
data bond.dealerconstant051917JF;set four;if dc=3458 then delete;run;
```