REGULATIONS IN THE US AND BOND MARKET LIQUIDITY

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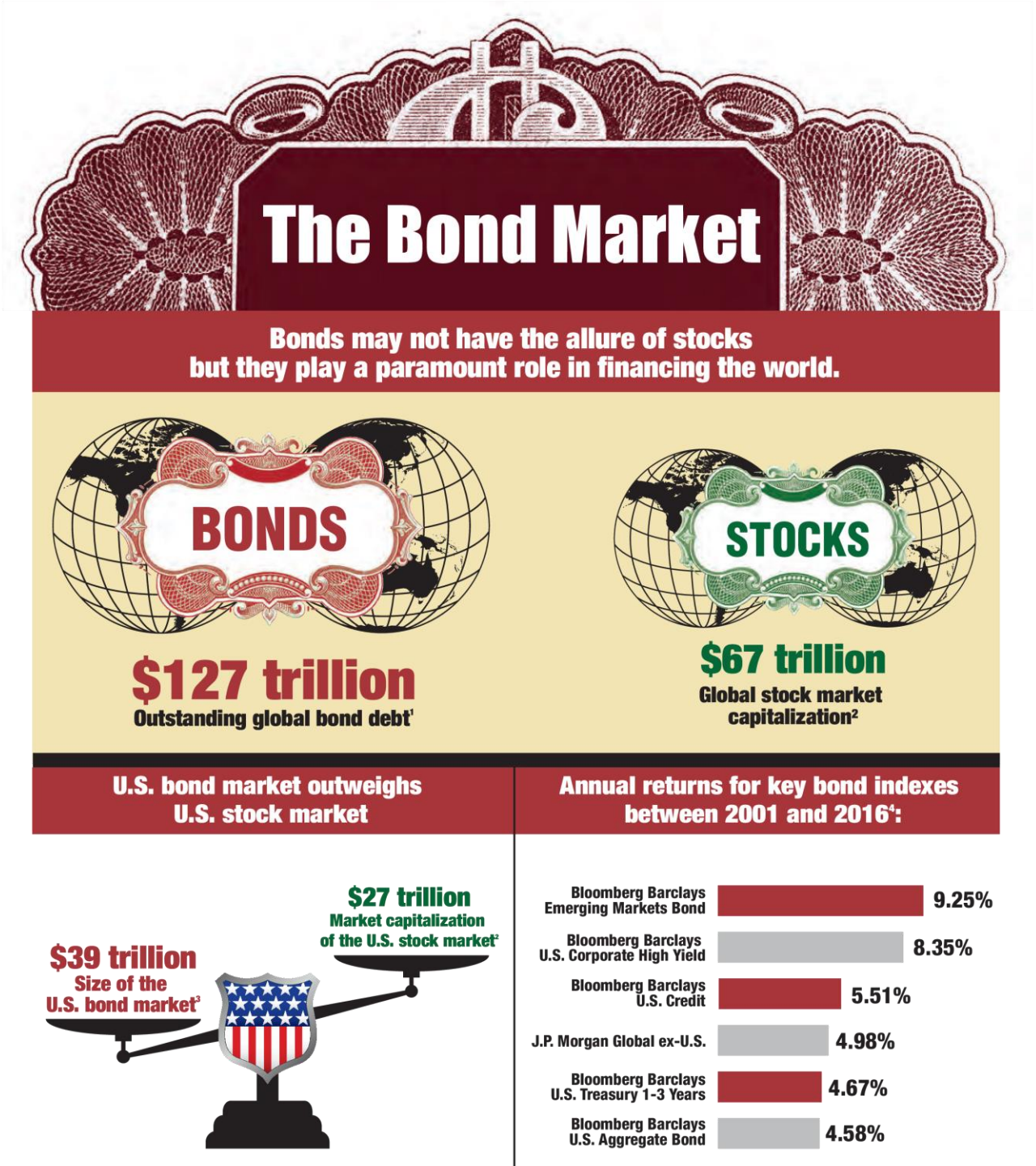
MOTIVATION


The Bond Market
Bonds may not have the allure of stocks
but they play a paramount role in financing the world.
BONDS
$127 trillion
Outstanding global bond debt[1]
STOCKS
$67 trillion
Global stock market capitalization[2]
U.S. bond market outweighs U.S. stock market
$39 trillion
Size of the U.S. bond market[3]
$27 trillion
Market capitalization of the U.S. stock market[2]
Annual returns for key bond indexes between 2001 and 2016[4]:
Bloomberg Barclays Emerging Markets Bond 9.25%
Bloomberg Barclays U.S. Corporate High Yield 8.35%
Bloomberg Barclays U.S. Credit 5.51%
J.P. Morgan Global ex-U.S. 4.98%
Bloomberg Barclays U.S. Treasury 1-3 Years 4.67%
Bloomberg Barclays U.S. Aggregate Bond 4.58%

MOTIVATION

- Financial crisis
- Regulation: Dodd-Frank, Basel III
- Trump administration announcement

RESEARCH QUESTIONS

Do regulations have significant impacts on the bond market liquidity?

Which type of bond is most likely to be affected?

LITERATURE REVIEW

- Mizrach (2015)

Analysis of corporate bond liquidity using trades characteristics

- Bessembinder et la. (2016)

Dealers capital commitment and illiquidity

- Anderson & Stulz (2017)

Post-crisis bond liquidity under stress events

- Trebbi & Xiao (2015)

Examine liquidity using structural breaks

LITERATURE REVIEW

- Dick-Nielsen & Rossi (2016)

The cost of immediacy for corporate bonds

- Choi & Huh(2016)

Provision of liquidity based on transaction costs

- Bao, O'Hara & Zhou (2016)

Price impact under stress events

BACKGROUND

- Dodd-Frank Act:
  - Proposed by the Obama administration on June 15, 2009
  - On July 21, 2010, the Dodd-Frank Act became Public Law
  - Volcker rule: prevent banks from making speculative investments using their own resources
  - Volcker rule's implementation took place on April 1, 2014

- Trump administration's plan to roll back the Dodd-Frank Act and repeal the Volcker Rule through Financial Choice Act

DATA

- FINRA's enhanced TRACE
- FISD bond ratings
- Post-crisis period: 2009 – mid-2017

METHOD

- Market level vs. bond level
- Sub-sample analysis
  - Investment grade
  - Non-investment grade
- Events studies
  - Calculate the expected illiquidity based on the model
  - Compute the cumulated abnormal illiquidity using different windows [-5,5] [-10,10] [-10,-5] [-5,-1] [-10,-1] [1,5] [5,10] [1,10]
- Low-frequency proxies: Amihud (2002), Roll (1987)

METHOD

- Amihud (2002)

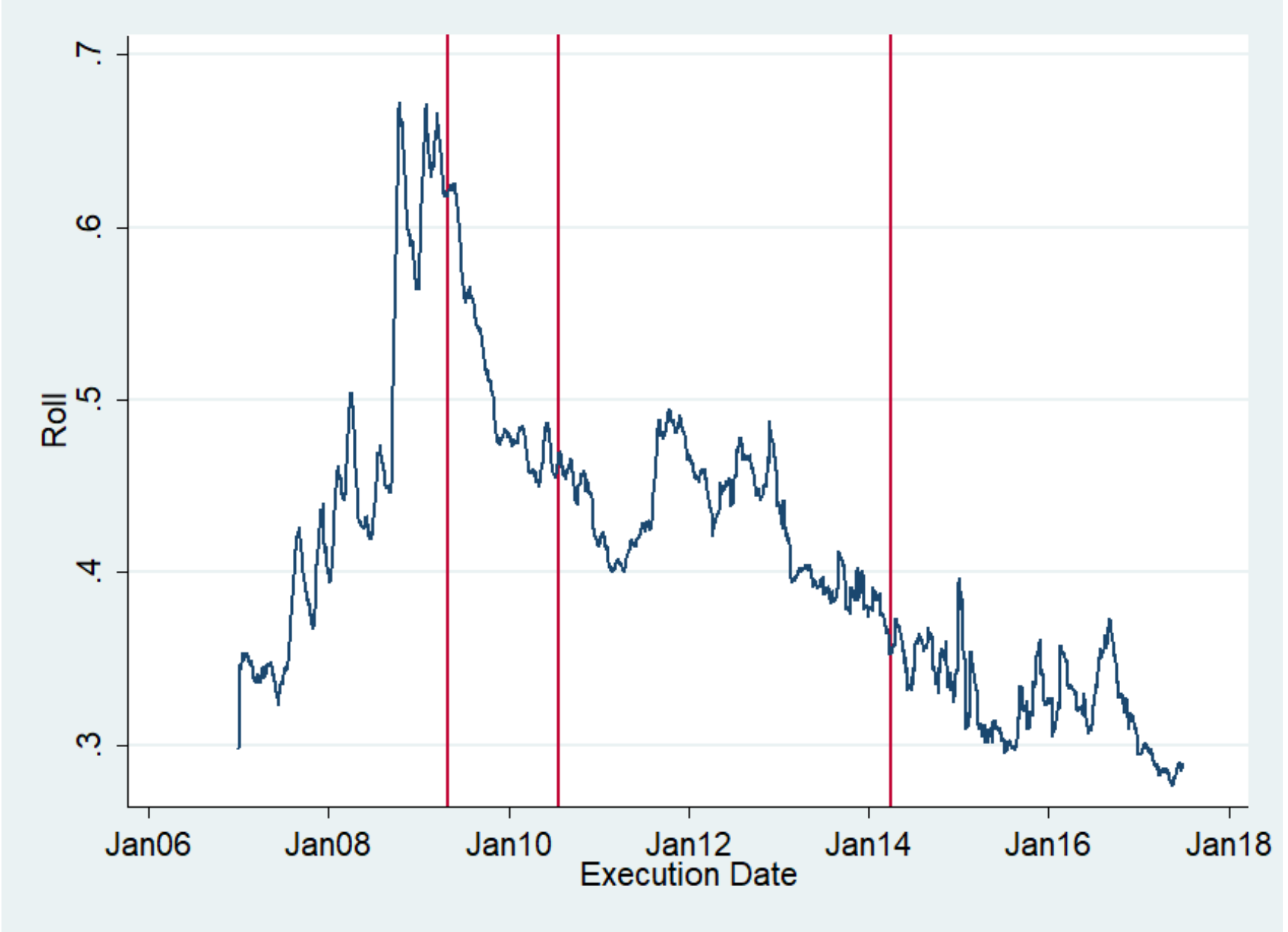
$$Amihud_t = \frac{1}{N_t} \sum_{i=1}^{N_t} \frac{|r_i|}{Q_i}$$

- Roll (1987)

$$Roll_t = \begin{cases} 2\sqrt{-\text{cov}(\Delta P_i, \Delta P_{i-1})}, & \text{if } \text{cov}(\Delta P_i, \Delta P_{i-1})) < 0 \\ 0, & \text{otherwise} \end{cases}$$

Amihud Measure

Roll Measure



REGRESSIONS

$$\begin{aligned} Illiquidity_{i,t} = & \beta_0 + \beta_1 PostCrisis_{i,t} + \beta_2 PostDoddFrank_{i,t} + \beta_3 PostVolcker_{i,t} + \theta_1 Time_{i,t} \\ & + \theta_2 Time_{i,t}^2 + \phi_1 \log(Age_{i,t}) + \phi_2 \log(Maturity_{i,t}) + \phi_3 \log(Volume_{i,t}) \\ & + \delta Illiquidity_{i,t-1} + \gamma FixedEffect_i + \epsilon_{i,t} \end{aligned}$$

- ***PostCrisis***: Dummy variable equal to 1 for May 1, 2009 to July 20, 2010 and 0 otherwise.
- ***PostDoddFrank***: Dummy variable equal to 1 for July 21, 2010 to March 31, 2014 and 0 otherwise.
- ***PostVolcker***: Dummy variable equal to 1 for April 1, 2014 to June 30, 2017 and 0 otherwise.
- The omitted period dummy is the Crisis period (January 1, 2009 to April 30, 2009)
- ***Time***: time trend variable

FINDINGS

Table 3: Full Sample Analysis - Market Level

This table presents how corporate bond market liquidity in the full sample changes during the period between January 1, 2009 and June 30, 2017, especially after the implementation of the Dodd-Frank Act and the Volcker Rule. The *Amihud* measure is used as the dependent variable in column (1) (2) (3) (4) and the *Roll* measure is used as the dependent variable in column (5) (6) (7) (8) (9). The *Amihud* proxies the price impacts whereas the *Roll* represents the transaction costs. The main analysis of the proposed model is under column (4) and (8) for the *Amihud* and the *Rol*, respectively. The primary independent variables of interest are the dummies *PostCrisis*, *PostDoddFrank* and *PostVolcker*. Multiple versions of the full model using different levels of control are tested to investigate which aspects are crucial to the prediction of market liquidity. Column (1) and (5) only control for linear deterministic time trend, whereas column (2) and (6) allow for curvature in time trend. For column (3) and (6), additional controls for bond characteristics are added and the full model with further control for serial correlation is under column (4) and (8). Column (9) report the model used in the event study, where the variables redundant to the prediction of Roll measure are dropped. The coefficients of each regressions are reported with the standard errors shown in the parentheses. The significance of the coefficients are two-tail tested. One-tail test is used for the difference in coefficients between each pair of sub-periods with the hypothesis that the coefficients of the later periods are smaller than the coefficients of the earlier periods. *, **, and *** indicate the significance at 10%, 5%, and 1% levels, respectively.

	Amihud				Roll				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
PostCrisis	-0.0606***	-0.0626***	-0.0566***	-0.0485***	-0.1345***	-0.1326***	-0.1242***	-0.0548***	-0.0569***
	(0.0159)	(0.0161)	(0.0156)	(0.0157)	(0.0052)	(0.0052)	(0.0055)	(0.0051)	(0.0049)
PostDoddFrank	-0.0669***	-0.0760***	-0.0696***	-0.0606***	-0.1680***	-0.1594***	-0.1458***	-0.0624***	-0.0653***
	(0.0166)	(0.0196)	(0.0191)	(0.0192)	(0.0054)	(0.0064)	(0.0067)	(0.0063)	(0.0055)
PostVolcker	-0.0926***	-0.1004***	-0.0943***	-0.0836***	-0.2003***	-0.1934***	-0.1821***	-0.0800***	-0.0827***
	(0.0223)	(0.0240)	(0.0233)	(0.0234)	(0.0075)	(0.0080)	(0.0082)	(0.0076)	(0.0072)
Time	-0.0021	0.0042	-0.0190***	-0.0185**	-0.0233***	-0.0293***	-0.0221***	-0.0071***	-0.0074***
	(0.0026)	(0.0077)	(0.0075)	(0.0075)	(0.0009)	(0.0026)	(0.0027)	(0.0023)	(0.0010)
$Time^2$		-0.0006	0.0013**	0.0013*		0.0006**	0.0003	0.0000	
		(0.0007)	(0.0007)	(0.0007)		(0.0002)	(0.0002)	(0.0002)	
log(*Age*)			-0.0312**	-0.0300***			-0.0173***	-0.0071	
			(0.0064)	(0.0064)			(0.0055)	(0.0046)	
log(*Maturity*)			0.0941***	0.0931***			0.0707***	0.0713***	0.0730***
			(0.0121)	(0.0121)			(0.0126)	(0.0105)	(0.0105)
log(*Volume*)			-0.0364***	-0.0361***			-0.0176***	-0.0148***	-0.0128***
			(0.0030)	(0.0030)			(0.0034)	(0.0028)	(0.0025)
Lag1				0.0634***				0.5446***	0.5467***
				(0.0197)				(0.0178)	(0.0177)
Constant	0.2155***	0.2098***	0.4067***	0.3872***	0.6855***	0.6910***	0.7204***	0.3152***	0.2897***
	(0.0143)	(0.0158)	(0.0379)	(0.0381)	(0.0047)	(0.0051)	(0.0416)	(0.0371)	(0.0332)
N	2401	2401	2401	2399	2157	2157	2157	2156	2156
R^2	0.0331	0.0334	0.0331	0.0981	0.8291	0.8296	0.8339	0.8839	0.8838
PostDoddFrank vs. *PostCrisis*				-0.0121				-0.0076	
PostVolcker vs. *PostCrisis*				-0.0351				-0.0252***	
PostVolcker vs. *PostDoddFrank*				-0.0230				-0.0176**	

SUBSAMPLE

- The implemented regulations leads to lower transaction costs and lower price impacts.
- The effects of regulatory changes are evidently stronger in transaction costs than in price impacts
- The influence of new regulations is more profound for bonds with good ratings.
- Different measures measure different aspects of liquidity and the determinants of each aspect depend largely on the bond rating classes
- Illiquidity we see in the non-investment grade subsample has more to do the bond characteristics and less to do with changes in the regulatory framework.

FINDINGS

Table 6: Bond Level Analysis

This table presents results of robust checks of the analyses on how corporate bond market liquidity evolves after the implementation of the Dodd-Frank Act and the Volcker Rule. Column (1) and (4) show the results for the full sample. Column (2) and (5) shows the results for the investment grade subsample. Column (3) and (6) shows the results for the non-investment grade subsample. The *Amihud* measure is used as the dependent variable in column (1) (2) (3) and the *Roll* measure is used as the dependent variable in column (4) (5) (6). The *Amihud* proxies the price impacts whereas the *Roll* represents the transaction costs. The coefficients of each regressions are reported with the standard errors shown in the parentheses. The significance of the coefficients are two-tail tested. One-tail test is used for the difference in coefficients between each pair of sub-periods with the hypothesis that the coefficients of the later periods are smaller than the coefficients of the earlier periods. *, **, and *** indicate the significance at 10%, 5%, and 1% levels, respectively.

	Amihud			Roll		
	Full Sample	Investment Grade	Non-investment Grade	Full Sample	Investment Grade	Non-investment Grade
	(1)	(2)	(3)	(4)	(5)	(6)
PostCrisis	-0.1154***	-0.0995***	-0.1440***	-0.1846***	-0.1752***	-0.2614***
	(0.0081)	(0.0073)	(0.0309)	(0.0089)	(0.0087)	(0.0371)
PostDoddFrank	-0.1377***	-0.1183***	-0.1649***	-0.2231***	-0.2139***	-0.2845***
	(0.0092)	(0.0083)	(0.0338)	(0.0106)	(0.01042)	(0.0382)
PostVolcker	-0.1432***	-0.1299***	-0.1538***	-0.2341***	-0.2252***	-0.2989***
	(0.0095)	(0.0087)	(0.0336)	(0.0120)	(0.0124)	(0.0398)
Time	-0.0476***	-0.0447***	-0.0253***	-0.0324***	-0.0348***	-0.0122
	(0.0022)	(0.0023)	(0.0041)	(0.0043)	(0.0043142)	(0.0113)
$Time^2$	0.0020***	0.0017***	0.0012***	-0.0005	-0.0004	-0.0010
	(0.0001)	(0.0001)	(0.0003)	(0.0003)	(0.0003)	(0.0009)
log(*Age*)	0.0145***	0.0124***	0.0080***	0.0194***	0.0174***	0.0164***
	(0.0007)	(0.0008)	(0.0015)	(0.0017)	(0.0017)	(0.0051)
log(*Maturity*)	0.0019	-0.0014	0.0098	-0.0411***	-0.0461***	0.0193
	(0.0022)	(0.0023)	(0.0072)	(0.0067)	(0.0071)	(0.0161)
log(*Volume*)	-0.0780***	-0.0778***	-0.0731***	-0.0088***	-0.0150***	0.0017
	(0.0009)	(0.0011)	(0.0018)	(0.0009)	(0.0010)	(0.0018)
*Lag*1	0.0014	0.0753***	0.0693***	0.1002***	0.1076***	0.0556
	(0.0012)	(0.0033)	(0.0076)	(0.0161)	(0.0109)	(0.0374)
Constant	1.3216***	1.2827***	1.1929***	1.0322***	1.0809***	0.8708***
	(0.0207)	(0.0220)	(0.0475)	(0.0279)	(.0245)	(0.0617)
N	2,743,821	2,015,355	591,818	2,725,208	2,015,055	591,695
Number of bonds	28,284	14,466	3,466	23,307	14,456	3,463
F-statistics	857.74***	691.65***	243.67***	169.05***	182.19***	23.12***
PostDoddFrank vs. *PostCrisis*	-0.0223**	-0.0188**	-0.0209	-0.0385***	-0.0387***	-0.0231
PostVolcker vs. *PostCrisis*	-0.0279***	-0.0304***	-0.0098	-0.0495***	-0.0500***	-0.0375
PostVolcker vs. *PostDoddFrank*	-0.0055	-0.0116	0.0111	-0.011	-0.0113	-0.0144

EVENT STUDY

- Two events are strongly and consistently significant in all three samples:
  - Volcker Rule is scheduled to take effect
  - Full compliance for the Volcker Rule is required.

- Significant impacts of regulation announcements are more profound in longer time windows than in shorter time windows

- The non-investment grade market reacts less to the regulation milestones as the number of significant results in this subsample is less than that of the investment grade sample

FINDINGS

Table 7: Event studies - Full Sample

This table presents results of the event study regarding the announcements effects of 13 regulatory milestones on bond market liquidity, using full sample. The expected illiquidity is computed based on the model specifications in column (9) of Table 3. The abnormal illiquidity is the observed minus the expected illiquidity. Then, the averages of abnormal illiquidity are computed for several windows and reported as *AbnormalLiq*. *AbnormalLiq* is two-tail tested against zero. *, **, and *** indicate the significance at 10%, 5%, and 1% levels, respectively.

No.	Date	Event		[-1,1] (1)	[-5,5] (2)	[-10,10] (3)	[-5,-1] (4)	[-10,-6] (5)	[-10,-1] (6)	[1,5] (7)	[6,10] (8)	[1,10] (9)
1	15/06/2009	Obama's initial proposal	*AbnormalLiq*	-0.0168	-0.0139	-0.0100	0.0030	-0.0177	-0.0085	-0.0136	-0.0118	-0.0127
			t-stat	-1.4561	-1.7480	-1.8008*	0.4091	-1.4039	-1.0417	-1.0557	-0.9300	-1.4890
2	11/12/2009	Dodd-Frank passed the House	*AbnormalLiq*	-0.0024	-0.0128	-0.0072	-0.0054	-0.0150	-0.0102	-0.0116	0.0060	-0.0038
			t-stat	-0.7619	-2.4741**	-1.4642	-0.3704	-1.4485	-1.1928	-1.8922	0.6669	-0.6523
3	21/01/2010	Obama proposed Volcker Rule	*AbnormalLiq*	-0.0173	-0.0113	-0.0142	-0.0146	0.0008	-0.0077	-0.0223	-0.0198	-0.0211
			t-stat	-1.6266	-1.2141	-2.5133**	-1.2100	0.0513	-0.8283	-1.6462	-2.4778*	-2.8352**
4	20/05/2010	Dodd-Frank passed the Senate	*AbnormalLiq*	0.0021	0.0050	0.0019	0.0000	0.0013	0.0006	0.0040	-0.0042	0.0004
			t-stat	0.1282	0.6793	0.3078	-0.0032	0.2494	0.0830	0.2603	-0.2302	0.0363
5	21/07/2010	Dodd-Frank is signed into law	*AbnormalLiq*	-0.0126	-0.0053	-0.0083	-0.0096	-0.0068	-0.0082	-0.0026	-0.0136	-0.0081
			t-stat	-3.6067	-0.5023	-1.3015	-2.0385	-0.3833	-0.9481	-0.1548	-0.9354	-0.7592
6	21/07/2012	Volcker is scheduled to take effect	*AbnormalLiq*	0.0311	0.0227	0.0211	0.0198	0.0182	0.0190	0.0273	0.0191	0.0232
			t-stat	0.8147	2.6109**	3.8312***	1.6025	1.4007	2.2467	2.1417*	2.1455*	3.1119***
7	31/01/2014	Finalized version of Volcker Rule is released	*AbnormalLiq*	-0.0089	-0.0155	-0.0137	-0.0111	-0.0086	-0.0097	-0.0190	-0.0119	-0.0155
			t-stat	-0.5832	-2.5017**	-3.0802***	-1.4018	-0.6787	-1.3058	-4.0973***	-1.0691	-2.6611**
8	01/04/2014	Volcker Rule is officially effective	*AbnormalLiq*	0.0005	-0.0049	-0.0034	-0.0144	-0.0218	-0.0181	0.0100	0.0109	0.0104
			t-stat	0.1432	-0.6910	-0.7213	-2.0267	-2.1530*	-3.0356**	1.5842	1.4432	2.2508*
9	01/07/2014	Banks start filing reports	*AbnormalLiq*	0.0085	0.0018	0.0046	0.0056	-0.0026	0.0015	0.0009	0.0092	0.0056
			t-stat	0.6698	0.1922	0.7779	0.4229	-0.3418	0.2030	0.0433	0.9281	0.5339
10	21/07/2015	Full compliance of Volcker Rule	*AbnormalLiq*	-0.0070	-0.0078	-0.0107	-0.0085	-0.0051	-0.0068	-0.0106	-0.0192	-0.0149
			t-stat	-1.1847	-2.4509**	-4.2601***	-1.5846	-0.9122	-1.8386*	-2.4152*	-3.9542**	-4.3851***
11	09/09/2016	Financial Choice Act is proposed	*AbnormalLiq*	-0.0002	0.0116	0.0096	0.0142	0.0171	0.0157	0.0100	0.0007	0.0054
			t-stat	-0.0308	0.3369	0.5402	1.3744	0.2150	0.4136	1.0672	0.1270	0.9981
12	27/04/2017	Financial Choice Act is introduced to the House	*AbnormalLiq*	-0.0222	-0.0146	-0.0121	-0.0074	-0.0121	-0.0100	-0.0193	-0.0104	-0.0148
			t-stat	-2.4382	-3.2760***	-4.1805***	-1.1632	-1.5145	-1.9952*	-3.2972**	-2.5009*	-4.0238***
13	08/06/2017	Financial Choice Act passed the House	*AbnormalLiq*	-0.0119	-0.0135	-0.0123	-0.0139	-0.0059	-0.0094	-0.0190	-0.0081	-0.0136
			t-stat	-1.4056	-3.6184***	-4.3543***	-1.6091	-1.0238	-1.9449*	-4.7730**	-1.6888	-3.9232***

FINDINGS

Table 8: Event studies - Investment Grade

This table presents results of the event study regarding the announcements effects of 13 regulatory milestones on bond market liquidity, using investment grade subsample. The expected illiquidity is computed based on the model specifications in column (9) of Table 3. The abnormal illiquidity is the observed minus the expected illiquidity. Then, the averages of abnormal illiquidity are computed for several windows and reported as *AbnormalLiq*. *AbnormalLiq* is two-tail tested against zero. *, **, and *** indicate the significance at 10%, 5%, and 1% levels, respectively.

No.	Date	Event		[-1,1] (1)	[-5,5] (2)	[-10,10] (3)	[-5,-1] (4)	[-10,-6] (5)	[-10,-1] (6)	[1,5] (7)	[6,10] (8)	[1,10] (9)
1	15/06/2009	Obama's initial proposal	*AbnormalLiq*	0.0153	0.0297	0.0303	0.0434	0.0160	0.0297	0.0407	0.0185	0.0296
			t-stat	0.4355	3.0820**	4.4813***	3.2614*	0.8727	2.5584**	4.3273**	1.3280	3.3839***
2	11/12/2009	Dodd-Frank passed the House	*AbnormalLiq*	-0.0023	-0.0158	-0.0111	-0.0053	-0.0185	-0.0119	-0.0133	-0.0055	-0.0098
			t-stat	-0.3443	-2.7276**	-2.1240**	-0.3901	-1.8602	-1.4497	-1.4668	-0.3779	-1.2710
3	21/01/2010	Obama proposed Volcker Rule	*AbnormalLiq*	-0.0142	-0.0165	-0.0188	-0.0160	-0.0034	-0.0104	-0.0309	-0.0263	-0.0286
			t-stat	-1.0626	-1.7845	-3.4467***	-1.5736	-0.2702	-1.3426	-2.2643*	-3.4179**	-3.8495***
4	20/05/2010	Dodd-Frank passed the Senate	*AbnormalLiq*	0.0025	0.0024	-0.0007	-0.0037	-0.0024	-0.0030	-0.0006	-0.0052	-0.0027
			t-stat	0.1149	0.2530	-0.0960	-0.2821	-0.2389	-0.3911	-0.0356	-0.2839	-0.2220
5	21/07/2010	Dodd-Frank is signed into law	*AbnormalLiq*	-0.0175	-0.0117	-0.0134	-0.0117	-0.0095	-0.0106	-0.0119	-0.0188	-0.0154
			t-stat	-6.2883**	-1.2752	-2.1872**	-1.2502	-0.6952	-1.3560	-0.7300	-1.2456	-1.4565
6	21/07/2012	Volcker is scheduled to take effect	*AbnormalLiq*	0.0379	0.0238	0.0236	0.0260	0.0244	0.0252	0.0233	0.0205	0.0219
			t-stat	1.4695	2.6652**	4.4631***	2.3519*	1.9666	3.2155**	1.6226	3.1208**	2.9386**
7	31/01/2014	Finalized version of Volcker Rule is released	*AbnormalLiq*	0.0021	-0.0073	-0.0039	0.0035	0.0036	0.0035	-0.0139	-0.0023	-0.0081
			t-stat	0.1258	-1.0101	-0.7125	0.3520	0.2598	0.4258	-2.4134	-0.1630	-1.0812
8	01/04/2014	Volcker Rule is officially effective	*AbnormalLiq*	0.0052	-0.0020	0.0028	0.0009	-0.0168	-0.0079	0.0102	0.0151	0.0126
			t-stat	1.5916	-0.2599	0.4790	0.0925	-1.5284	-1.0326	1.0069	1.0032	1.4717
9	01/07/2014	Banks start filing reports	*AbnormalLiq*	0.0071	-0.0019	0.0044	0.0066	-0.0056	0.0005	0.0003	0.0146	0.0082
			t-stat	0.8854	-0.1526	0.5731	0.4234	-0.7579	0.0612	0.0087	1.3251	0.5640
10	21/07/2015	Full compliance of Volcker Rule	*AbnormalLiq*	-0.0110	-0.0100	-0.0146	-0.0136	-0.0088	-0.0112	-0.0105	-0.0256	-0.0181
			t-stat	-1.8907	-2.8308**	-5.3197***	-2.5921*	-1.9844	-3.3553***	-1.5176	-5.8297***	-3.9150***
11	09/09/2016	Financial Choice Act is proposed	*AbnormalLiq*	0.0038	0.0104	0.0092	0.0125	0.0136	0.0130	0.0093	0.0034	0.0064
			t-stat	0.3897	1.6315	2.4254**	1.7985	0.9433	1.8705*	1.2962	0.6334	1.4646
12	27/04/2017	Financial Choice Act is introduced to the House	*AbnormalLiq*	-0.0103	-0.0058	-0.0031	0.0040	-0.0054	-0.0012	-0.0091	-0.0029	-0.0060
			t-stat	-1.0387	-1.3808	-1.0699	0.6202	-0.7885	-0.2622	-1.4723	-0.5557	-1.5159
13	08/06/2017	Financial Choice Act passed the House	*AbnormalLiq*	-0.0040	-0.0053	-0.0038	-0.0049	0.0022	-0.0009	-0.0123	0.0004	-0.0060
			t-stat	-1.1993	-2.0831*	-1.2901	-0.4443	1.3280	-0.1939	-4.8809***	0.0499	-1.4240

FINDINGS

Table 9: Event studies - Non-investment Grade

This table presents results of the event study regarding the announcements effects of 13 regulatory milestones on bond market liquidity, using non-investment grade subsample. The expected illiquidity is computed based on the model specifications in column (9) of Table 3. The abnormal illiquidity is the observed minus the expected illiquidity. Then, the averages of abnormal illiquidity are computed for several windows and reported as *AbnormalLiq*. *AbnormalLiq* is two-tail tested against zero. *, **, and *** indicate the significance at 10%, 5%, and 1% levels, respectively.

No.	Date	Event		[-1,1] (1)	[-5,5] (2)	[-10,10] (3)	[-5,-1] (4)	[-10,-6] (5)	[-10,-1] (6)	[1,5] (7)	[6,10] (8)	[1,10] (9)
1	15/06/2009	Obama's initial proposal	*AbnormalLiq*	0.0064	0.0284	0.0237	-0.0207	0.0192	-0.0008	0.0272	0.0576	0.0424
			t-stat	0.1624	1.2058	1.0068	-0.2936	0.5368	-0.0205	0.6747	1.0937	1.3387
2	11/12/2009	Dodd-Frank passed the House	*AbnormalLiq*	-0.0490	-0.0368	-0.0272	-0.0560	-0.0403	-0.0481	-0.0475	0.0350	-0.0109
			t-stat	-1.1715	-2.2088*	-1.6756	-2.0944	-1.8039	-2.8947**	-1.7493	0.6493	-0.3617
3	21/01/2010	Obama proposed Volcker Rule	*AbnormalLiq*	-0.0612	-0.0249	-0.0371	-0.0706	-0.0194	-0.0478	-0.0076	-0.0280	-0.0178
			t-stat	-1.6732	-1.5757	-2.9192***	-2.2901*	-0.9346	-2.3434**	-0.5456	-1.1254	-1.2837
4	20/05/2010	Dodd-Frank passed the Senate	*AbnormalLiq*	0.0128	0.0212	0.0138	-0.0064	0.0468	0.0202	0.0092	0.0187	0.0134
			t-stat	0.2417	1.1641	1.0502	-0.2982	1.3690	0.9600	0.6359	0.4983	0.7816
5	21/07/2010	Dodd-Frank is signed into law	*AbnormalLiq*	-0.0792	-0.0333	-0.0237	0.0027	-0.0354	-0.0164	-0.0295	-0.0289	-0.0292
			t-stat	-3.4097*	-1.8337*	-1.8397*	0.0883	-1.0597	-0.7347	-1.1237	-1.2900	-1.7946
6	21/07/2012	Volcker is cheduled to take effect	*AbnormalLiq*	0.0356	0.0256	0.0345	0.0411	0.0124	0.0267	0.0388	0.0457	0.0422
			t-stat	0.6925	2.1098*	4.3991***	2.6094*	1.2351	2.6686**	1.7823	3.4434**	3.4986***
7	31/01/2014	Finalized version of Volcker Rule released	*AbnormalLiq*	0.0006	-0.0097	-0.0109	-0.0215	-0.0151	-0.0180	-0.0188	-0.0051	-0.0120
			t-stat	0.0173	-1.0043	-1.1738	-1.2516	-1.5377	-2.0421*	-1.6507	-0.1687	-0.7734
8	01/04/2014	Volcker Rule is officially effective	*AbnormalLiq*	-0.0069	-0.0037	-0.0127	-0.0255	-0.0098	-0.0177	-0.0005	-0.0200	-0.0102
			t-stat	-0.4333	-0.3519	-1.6930	-3.8619*	-0.5001	-1.7439	-0.0339	-0.9381	-0.8296
9	01/07/2014	Banks start filing reports	*AbnormalLiq*	0.0119	0.0189	0.0080	0.0098	0.0304	0.0201	-0.0019	-0.0156	-0.0095
			t-stat	0.6786	1.6423	0.9974	0.6175	1.4641	1.5715	-0.4351	-1.1660	-1.2423
10	21/07/2015	Full compliance of Volcker Rule	*AbnormalLiq*	-0.0027	-0.0164	-0.0191	-0.0287	-0.0104	-0.0195	-0.0256	-0.0155	-0.0206
			t-stat	-0.2658	-2.8776**	-4.0067***	-2.5538*	-0.9657	-2.4607**	-5.6439***	-1.2970	-3.2858***
11	09/09/2016	Financial Choice Act is proposed	*AbnormalLiq*	-0.0188	0.0382	0.0360	0.0584	0.0897	0.0740	0.0105	0.0090	0.0097
			t-stat	-0.5847	0.7787	1.4089	5.3477***	0.8436	1.4616	0.5576	0.9162	0.9752
12	27/04/2017	Financial Choice Act is introduced to the House	*AbnormalLiq*	-0.0206	-0.0042	-0.0082	-0.0153	0.0135	0.0007	-0.0195	-0.0112	-0.0153
			t-stat	-8.9535**	-0.5510	-1.3682	-1.0066	1.5504	0.0761	-1.9078	-0.8001	-1.8535*
13	08/06/2017	Financial Choice Act passed the House	*AbnormalLiq*	-0.0256	-0.0124	-0.0118	-0.0042	-0.0151	-0.0102	-0.0049	-0.0165	-0.0107
			t-stat	-3.5235*	-1.5108	-1.6367	-0.1674	-1.3422	-0.8592	-0.3453	-1.1003	-1.0806

CONCLUSION

- The implementation of the regulations does not decrease the liquidity of the market as a whole. The analyzed regulation are improving the liquidity.

- The impacts of regulations are different for bonds in different grades. For investment grade bonds, the regulations have favorable impacts and improve the liquidity level. For non-investment bonds, the regulations do not improve their liquidity but also do not worsen the situation

- Our event study confirms that there are anticipation effects of changes in the regulatory framework.

THANK YOU!

FINDINGS

Table 4: Investment Grade Subsample Analysis - Market level

This table presents how corporate bond market liquidity in the investment grade subsample changes during the period between January 1, 2009 and June 30, 2017, especially after the implementation of the Dodd-Frank Act and the Volcker Rule. The *Amihud* measure is used as the dependent variable in column (1) (2) (3) (4) and the *Roll* measure is used as the dependent variable in column (5) (6) (7) (8) (9). The *Amihud* proxies the price impacts whereas the *Roll* represents the transaction costs. The main analysis of the proposed model is under column (4) and (8) for the *Amihud* and the *Rol*, respectively. The primary independent variables of interest are the dummies *PostCrisis*, *PostDoddFrank* and *PostVolcker*. Multiple versions of the full model using different levels of control are tested to investigate which aspects are crucial to the prediction of market liquidity. Column (1) and (5) only control for linear deterministic time trend, whereas column (2) and (6) allow for curvature in time trend. For column (3) and (6), additional controls for bond characteristics are added and the full model with further control for serial correlation is under column (4) and (8). Column (9) report the model used in the event study, where the variables redundant to the prediction of Roll measure are dropped. The coefficients of each regressions are reported with the standard errors shown in the parentheses. The significance of the coefficients are two-tail tested. One-tail test is used for the difference in coefficients between each pair of sub-periods with the hypothesis that the coefficients of the later periods are smaller than the coefficients of the earlier periods. *, **, and *** indicate the significance at 10%, 5%, and 1% levels, respectively.

	Amihud				Roll				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
PostCrisis	-0.0481***	-0.0424***	-0.0359***	-0.0200***	-0.1452***	-0.1424***	-0.1373***	-0.0593***	-0.0590***
	(0.0026)	(0.0025)	(0.0026)	(0.0024)	(0.0053)	(0.0053)	(0.0055)	(0.0051)	(0.0051)
PostDoddFrank	-0.0814***	-0.0564***	-0.0461***	-0.0249***	-0.1850***	-0.1726***	-0.1644***	-0.0705***	-0.0675***
	(0.0028)	(0.0031)	(0.0034)	(0.0033)	(0.0056)	(0.0065)	(0.0069)	(0.0063)	(0.0060)
PostVolcker	-0.0868***	-0.0665***	-0.0531***	-0.0282***	-0.2135***	-0.2035***	-0.2030***	-0.0915***	-0.0891***
	(0.0038	(0.0039)	(0.0039)	(0.0037)	(0.0077)	(0.0082)	(0.0084)	(0.0076)	(0.0074)
Time	-0.0058***	-0.0237***	-0.0162***	-0.0083***	-0.0259***	-0.0347***	-0.0196***	-0.0009	-0.0040***
	(0.0004)	(0.0013)	(0.0013)	(0.0012)	(0.0009)	(0.0026)	(0.0029)	(0.0024)	(0.0010)
$Time^2$		0.0017***	0.0009***	0.0004***		0.0009***	0.0002	-0.0003	
		(0.0001)	(0.0001)	(0.0001)		(0.0002)	(0.0002)	(0.0002)	
log(*Age*)			-0.0188***	-0.0165***			0.0079	0.0129***	0.0133***
			(0.0047)	(0.0042)			(0.0061)	(0.0050)	(0.0050)
log(*Maturity*)			-0.0190***	-0.0111**			0.1616***	0.1566***	0.1543***
			(0.0062)	(0.0056)			(0.0138)	(0.0113)	(0.0112)
log(*Volume*)			-0.0595***	-0.0492***			-0.0171***	-0.0168***	-0.0158***
			(0.0022)	(0.0020)			(0.0038)	(0.0031)	(0.0030)
*Lag*1				0.3790***				0.5583***	0.5566***
				(0.0172)				(0.0170)	(0.0170)
Constant	0.1673	0.1834	0.8180***	0.6281***	0.7011***	0.7090***	0.5311***	0.1431***	0.1415***
	(0.0024)	(0.0025)	(0.0249)	(0.0241)	(0.0048)	(0.0053)	(0.0478)	(0.0408)	(0.0408)
N	2143	2143	2143	2142	2149	2149	2149	2148	2148
R^2	0.6872	0.7173	0.7916	0.8292	0.8441	0.8450	0.8554	0.9035	0.9034
PostDoddFrank vs. *PostCrisis*				-0.0049				-0.0112*	
PostVolcker vs. *PostCrisis*				-0.0082**				-0.0322***	
PostVolcker vs. *PostDoddFrank*				-0.0033				-0.021**	

FINDINGS

Table 5: Non-investment Grade Subsample Analysis - Market level

This table presents how corporate bond market liquidity in the non-investment grade subsample changes during the period between January 1, 2009 and June 30, 2017, especially after the implementation of the Dodd-Frank Act and the Volcker Rule. The *Amihud* measure is used as the dependent variable in column (1) (2) (3) (4) and the *Roll* measure is used as the dependent variable in column (5) (6) (7) (8) (9). The *Amihud* proxies the price impacts whereas the *Roll* represents the transaction costs. The main analysis of the proposed model is under column (4) and (8) for the *Amihud* and the *Rol*, respectively. The primary independent variables of interest are the dummies *PostCrisis*, *PostDoddFrank* and *PostVolcker*. Multiple versions of the full model using different levels of control are tested to investigate which aspects are crucial to the prediction of market liquidity. Column (1) and (5) only control for linear deterministic time trend, whereas column (2) and (6) allow for curvature in time trend. For column (3) and (6), additional controls for bond characteristics are added and the full model with further control for serial correlation is under column (4) and (8). Column (9) report the model used in the event study, where the variables redundant to the prediction of Roll measure are dropped. The coefficients of each regressions are reported with the standard errors shown in the parentheses. The significance of the coefficients are two-tail tested. One-tail test is used for the difference in coefficients between each pair of sub-periods with the hypothesis that the coefficients of the later periods are smaller than the coefficients of the earlier periods. *, **, and *** indicate the significance at 10%, 5%, and 1% levels, respectively.

	Amihud				Roll				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
PostCrisis	0.0218***	0.0230***	-0.0579***	-0.0443***	-0.1130***	-0.1157***	-0.1144***	-0.0866***	-0.0880***
	(0.0034)	(0.0035)	(0.0034)	(0.0031)	(0.0090)	(0.0091)	(0.0117)	(0.0118)	(0.0096)
PostDoddFrank	0.0302***	0.0353***	-0.0651***	-0.0517***	-0.1054***	-0.1175***	-0.1051***	-0.0759***	-0.0741***
	(0.0036)	(0.0043)	(0.0042)	(0.0037)	(0.0095)	(0.0112)	(0.0143)	(0.0143)	(0.0096)
PostVolcker	0.0214***	0.0256***	-0.0667***	-0.0509***	-0.1551***	-0.1648***	-0.1515***	-0.1101***	-0.1096***
	(0.0050)	(0.0053)	(0.0047)	(0.0042)	(0.0131)	(0.0140)	(0.0163)	(0.0163)	(0.0133)
Time	0.0004	-0.0032*	-0.0066***	-0.0046***	-0.0162***	-0.0076*	-0.0078	-0.0067	-0.0152***
	(0.0006)	(0.0017)	(0.0014)	(0.0012)	(0.0016)	(0.0045)	(0.0048)	(0.0046)	(0.0021)
$Time^2$		0.0004**	0.0004***	0.0003**		-0.0008**	-0.0012**	-0.0010**	
		(0.0002)	(0.0001)	(0.0001)		(0.0004)	(0.0005)	(0.0005)	
log(*Age*)			0.0113**	0.0041			0.0470***	0.0503***	0.0375***
			(0.0047)	(0.0041)			(0.0144)	(0.0140)	(0.0128)
log(*Maturity*)			-0.0317***	-0.0305***			0.0422*	0.0509**	0.06737***
			(0.0081)	(0.0071)			(0.0253)	(0.0245)	(0.0232)
log(*Volume*)			-0.0351***	-0.0263***			0.0045	0.0043	
			(0.0009)	(0.0009)			(0.0032)	(0.0032)	
*Lag*1				0.3896***				0.2491***	0.2506***
				(0.0157)				(0.0209)	(0.0209)
Constant	0.0157***	0.0190***	0.5496***	0.4212***	0.6563***	0.6485***	0.4917***	0.3169***	0.3555***
	(0.0031)	(0.0034)	(0.0203)	(0.0186)	(0.0082)	(0.0090)	(0.0643)	(0.0645)	(0.0482)
N	2143	2143	2143	2142	2145	2145	2145	2144	2144
R^2	0.0526	0.0548	0.4579	0.5750	0.4734	0.4744	0.4775	0.5104	0.5099
PostDoddFrank vs. *PostCrisis*				-0.0074*				-0.0107	
PostVolcker vs. *PostCrisis*				-0.0066				-0.0235	
PostVolcker vs. *PostDoddFrank*				0.0008				-0.0342*	

FINDINGS

Table 1: Summary Statistics - Full Sample

This table presents the summary statistics for the variables used in the regression analysis for the full sample. Panel A reports the descriptive statistics for the set of market-level variables related to the time-series-regression on the Amihud measure. This panel includes the Amihud measure of illiquidity, the log of Age measured in years, the log of Maturity measured in years and the log of the uncapped Volume in dollars at bond level. Panel B reports the descriptive statistics for the set of bond-level variables related to the time-series regression on the Roll measure. This panel includes the Roll measure of illiquidity, the log of Age measured in years, the log of Maturity measured in years and the log of the uncapped Volume in dollars at bond level. Panel C reports the descriptive statistics for the set of bond-level variables related to the panel-data-regression on the Amihud measure. This panel includes the Amihud measure of illiquidity, the log of Age measured in years, the log of Maturity measured in years and the log of the uncapped Volume in dollars at bond level. Panel D reports the descriptive statistics for the set of bond-level variables related to the panel-data-regression on the Roll measure. This panel includes the Roll measure of illiquidity, the log of Age measured in years, the log of Maturity measured in years and the log of the uncapped Volume in dollars at bond level.

	N	Mean	Std.	Median
Panel A - Market Level - Amihud				
Amihud	2,401	0.0569	0.0313	0.0482
log(Age)	2,401	0.6939	0.3122	0.7314
log(Maturity)	2,401	1.7807	0.1369	1.7609
log(Volume)	2,401	10.3526	0.3039	10.3890
Panel B - Market Level - Roll				
Roll	2,157	0.4051	0.0999	0.3937
log(Age)	2,157	0.6944	0.3121	0.7316
log(Maturity)	2,157	1.7807	0.1362	1.7610
log(Volume)	2,157	10.3531	0.3048	10.3090
Panel C - Bond Level - Amihud				
Amihud	2,856,552	0.1602	0.3644	0.0441
log(Age)	2,856,552	0.4776	1.2436	0.7685
log(Maturity)	2,856,552	1.6651	0.9516	1.7293
log(Volume)	2,856,552	10.8111	1.6009	10.3090
Panel D - Bond Level - Roll				
Roll	2,754,922	0.5064	0.7571	0.3677
log(Age)	2,754,922	0.4788	1.2411	0.7695
log(Maturity)	2,754,922	1.6656	0.9509	1.7296
log(Volume)	2,754,922	10.8116	1.6008	10.3090

FINDINGS

Table 2: Summary Statistics - Subsamples

This table presents the summary statistics for the variables used in the regression analysis for the subsamples. Panel A reports the descriptive statistics for the set of market-level variables related to the time-series-regression on the Amihud measure. This panel includes the Amihud measure of illiquidity, the log of Age measured in years, the log of Maturity measured in years and the log of the uncapped Volume in dollars at bond level. Panel B reports the descriptive statistics for the set of bond-level variables related to the time-series regression on the Roll measure. This panel includes the Roll measure of illiquidity, the log of Age measured in years, the log of Maturity measured in years and the log of the uncapped Volume in dollars at bond level. Panel C reports the descriptive statistics for the set of bond-level variables related to the panel-data-regression on the Amihud measure. This panel includes the Amihud measure of illiquidity, the log of Age measured in years, the log of Maturity measured in years and the log of the uncapped Volume in dollars at bond level. Panel D reports the descriptive statistics for the set of bond-level variables related to the panel-data-regression on the Roll measure. This panel includes the Roll measure of illiquidity, the log of Age measured in years, the log of Maturity measured in years and the log of the uncapped Volume in dollars at bond level. Column (1), (2), (3), (4), present the statistics for investment grade subsample and column (5), (6), (7), (8) present the statistics for non-investment grade subsample.

	Investment Grade				Non-investment Grade			
	N	Mean	Std.	Median	N	Mean	Std.	Median
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A - Market Level - Amihud								
Amihud	2,143	0.0639	0.0378	0.0516	2,143	0.0421	0.0284	0.0372
log(Age)	2,143	0.7120	0.2907	0.7673	2,143	0.7776	0.2664	0.7246
log(Maturity)	2,143	1.7981	0.1508	1.7616	2,143	1.7475	0.0849	1.7640
log(Volume)	2,143	10.2739	0.1885	10.2751	2,143	10.7734	0.7730	10.5966
Panel B - Market Level - Roll								
Roll	2,149	0.3944	0.1074	0.3834	2,145	0.4575	0.0997	0.4449
log(Age)	2,149	0.7073	0.3234	0.7671	2,145	0.7769	0.2687	0.7246
log(Maturity)	2,149	1.7988	0.1526	1.7620	2,145	1.7468	0.0877	1.7640
log(Volume)	2,149	10.2828	0.2716	10.2751	2,145	10.7733	0.7729	10.5966
Panel C - Bond Level - Amihud								
Amihud	2,031,731	0.1628	0.3593	0.0476	595,545	0.1542	0.3661	0.0379
log(Age)	2,031,731	0.4713	1.2668	0.7665	595,545	0.6579	1.0286	0.8831
log(Maturity)	2,031,731	1.6822	0.9887	1.7419	595,545	1.6708	0.6914	1.7297
log(Volume)	2,031,731	10.6912	1.4994	10.2751	595,545	11.1102	1.7911	10.5966
Panel D - Bond Level - Roll								
Roll	2,031,421	0.4836	0.7026	0.3572	595,422	0.5643	0.8229	0.4193
log(Age)	2,031,421	0.4714	1.2665	0.7665	595,422	0.6579	1.0285	0.8831
log(Maturity)	2,031,421	1.6822	0.9886	1.7419	595,422	1.6708	0.6913	1.7298
log(Volume)	2,031,421	10.6914	1.4993	10.2751	595,422	11.1106	1.7910	10.5966