Appendix not for publication
"In Search of a Risk-free Asset"
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This appendix is not intended for publication but to supplement the analysis in the main text and provide the reader with a means to replicate the results of the paper or gain more insight into the data construction and technical analysis. Wherever possible, the author has available code and data for replication purposes that he can share upon request.

A Data construction

A.1 RateWatch

The main dataset on deposit rates is a novel proprietary database constructed by RateWatch which contains the yields on the certificates of deposit (CDs) at weekly frequency over the period of 1997-2016 offered over 6,000 FDIC insured commercial banks in over 80,000 local branch offices in over 10,000 cities across the US covering all 366 Metropolitan Statistical Areas (MSA). The survey represents more than 90 percent of deposits in commercial banking. [29] The dataset contains offer rates on the full range of deposit products such as interest checking accounts, savings accounts, money market deposit accounts, and certificates of deposits.

For the purpose of this study I focus on the small denomination CDs as these were consistently covered by the FDIC insurance. The yield information on deposits of denomination less than $\$100,000$ is almost consistently covered by all banks in the sample. I define the geographic boundaries of a deposit market to coincide with the boundaries of an MSA area. As a result the sample of banks is reduced to 3,796 as I exclude a number of small community banks that operate in small towns not included in a MSA area.

One major obstacle to constructing a consistent panel dataset is that RateWatch only maintains the most recent ownership relationships between branches, banks, and their parent holding company. To properly assign a branch to the proper bank that owns the ban, I use the available unique identification number (ID RSSD) and match that number to a database of historical bank-branch ownership maintained by the National Information Center (NIC).[30] Such correction is important as many branches change ownership due to

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[29]http://www.rate-watch.com/
[30]See https://www.ffiec.gov/nicpubweb/nicweb/SearchForm.aspx

mergers and acquisitions and the NIC database allows to pinpoint the exact date of ownership change and the identities (ID RSSDs) of the acquiring banks. I verify the goodness of the match by using the FDIC Summary of Deposit database which only provides annual snapshots of the bank-branch ownership relationships.

A.1.1 Deposit pricing within banking conglomerates

Deposit pricing within multi-branch and multi-market banking organizations is decentralized. Special rate-setting branches determine the rates for all branches in well-defined geographic areas. Table (14) shows the coverage of the rate-setting branches of the ten largest bank holding companies in 2007. Rate-setting branches are a small number relative to the total number of branches. For example, Bank of America designates 33 branches to set the rates for the remaining 5,370 branch locations and, on average, a rate-setting branch sets the rates in 160 branch locations. Most banks designate one rate-setting branch per state. The average deposit-weighted distance between a rate-setting branch and its subordinate locations is relatively short, ranging between 38 km (23 mi) and about 150 km (93 mi). As a result of this decentralized pricing, there is no dispersion in rates among the branches of the same bank within an MSA. For the rest of the analysis, I define a geographic market to correspond to an MSA area.[31]

Table 14: Rate-setting branches in 2007

Institution (BHC)	Rate-setting branches (1)	Coverage of rate-setting branches: Locations (2)	MSA (3)	States (4)	Distance (km) (5)
Bank of America	33	159.1	9	1.1	138.4
JPMorgan	43	58.5	3.8	1.1	69.8
Wachovia	50	46.4	3.5	1	57.6
Wells Fargo	36	86.8	5.7	1.1	127.3
Citigroup	14	37.6	3.4	1.3	73.4
USB	113	18.8	2.3	1.2	52.4
Suntrust	27	67.1	4.9	1.3	70.9
National city	65	36.1	3.4	1.2	38.1
Regions	40	77.0	8.6	2.0	130.8
BB&T	14	99.9	9.1	1.1	149.1

NOTE: Distance is a weighted-average distance with weights equal to the branch location total deposits reported in SOD at the end of June. SOURCE: RateWatch and SOD.

[31] See also Becker [2007] for a discussion on the degree to which deposit markets are geographically segmented and the appropriateness of an MSA as a well-defined geographic deposit market.

Table 15: Deposit funding composition at the largest 20 bank holding companies as of June 30, 2007

Institution (BHC)	Assets	Deposits (total)	Time deposits	Insured deposits			Uninsured deposits		Branches	Markets (MSA)	States
				Share	Accounts	Balance	Accounts	Balance			
	($bln)	($bln)	(% total)	(%)	(1,000)	($1,000)	(1,000)	($1,000)			
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Bank of America	1,536	594	29.9	49.5	47,485	6	771	378	5,370	212	36
JPMorgan Chase	1,458	463	28.7	26.6	17,071	6.3	400	746	3,047	136	31
Wachovia	720	391	33.3	46.5	22,495	5.9	370	414	3,241	170	30
Wells Fargo	540	286	15.2	46	33,833	3.6	313	450.5	2,873	151	32
Citigroup	2,221	238	22.4	45.7	13,142	5.1	114	698.7	990	59	20
Suntrust	180	114	39.4	61.5	5,923	11	134	304.7	1,652	70	12
USB	223	112	23.8	43.9	8,959	5.8	126	522.5	2,208	139	27
Regions	138	88	33.5	58.8	4,535	7.3	77	301.5	1,778	100	16
National City	141	82	34.7	53.4	5,647	7.2	90	394.3	1,377	61	8
BB&T	128	82	42.9	45.7	5,283	6	94	397.4	1,347	85	15
Capital One	146	82	35.1	20.9	3,052	0.9	45	219	675	30	8
PNC	126	73	26	49.5	4,257	6.6	68	420.6	1,106	60	29
Fifth Third	101	66	25.1	47.3	4,445	6.5	72	442.9	1,170	55	12
Keycorp	93	57	31.4	52.9	3,409	8.1	67	370.3	864	69	14
Commerce	48	45	12.6	40.8	2,982	4.2	33	544	438	15	10
Comerica	59	42	31.2	28.4	1,261	9.7	47	654.1	392	29	6
Zions	49	34	22.2	36.7	1,242	7.3	43	367.4	450	43	11
Marshall & Isley	58	32	39.3	42.1	1,115	8.8	28	485	317	32	12
BNY	126	28	69.1	21.9	1,388	6.1	33	925.7	12	5	6
Popular	47	25	43.1	57	4,871	2.7	31	320.7	147	12	7
Other (asset-weighted)	12.8	6.7	42.9	47.5	331	9.3	7	496.5	92	11	5

Note: Columns 2-4 present the total assets and deposits in billions of dollars consolidated at the bank holding company level, as well as the share of time deposits in total deposits, respectively. Columns 5-7 show the percent of total deposit balances in accounts below the deposit insurance limit ($ 100,000), the total number of such accounts in thousands, and the average balance in such accounts in thousands of dollars. Columns 8 and 9 show the number of accounts with balances above the deposit insurance limit. Finally, columns 10-12 present the total number of branches as well as the number of MSA markets and states in which the bank has branches. The last row “All other banks” gives the deposit weighted average for all banks other than the largest 20.

Source: FR Y-9C, Call Reports, Summary of Deposits

A.1.2 Deposit funding of banking conglomerates

At $1.25 trillion outstanding in 2007, the market for small time deposits is large with a significant number of competitors and several close substitutes offered by non-bank financial institutions.[32] As documented in Table (15), time deposits are an important source of funding for banks. For most banks, more than one third of total deposit funding was in the form of time deposits, and close to half of time deposits were small fully insured retail deposits. For example, in 2007, Bank of America, the largest deposit-taking bank at the time, had over 40 million fully insured deposit accounts with an average balance of $6,000. As a comparison, uninsured accounts were 771,000 with an average balance close to four times the deposit insurance limit. More than 20 percent of deposits were time deposits and close to 50 percent of time deposits were insured.

A.2 Price and nonprice terms of certificates of deposit

Table 16: Price and non-price characteristics of CDs

		3-month	6-month	1-year	3-year	5-year
Min. deposit amount	median	1000	1000	1000	1000	1000
	mean	1642.35	1444.53	1325.50	1361.67	1795.41
	std	1959.57	1721.50	1490.28	1556.77	2430.28
Early withdrawal penalty (days)	median	90	90	180	180	180
	mean	70.32	96.35	151.62	201.18	246.67
	std	27.91	37.87	58.14	76.75	157.86
Yield	median	2.86	3.75	4.00	3.90	4.07
	mean	2.88	3.59	3.81	3.80	4.06
	std	1.22	1.20	1.07	0.88	0.83
		Spearman rank correlation				
Min.amount - yield	Rank corr.	-0.10	-0.01	0.02	-0.01	0.05
	p-value	0.35	0.93	0.85	0.94	0.63
Penalty (days) - yield	Rank corr.	-0.31	-0.15	-0.10	0.09	0.17
	p-value	0.00	0.15	0.31	0.41	0.11
Min.amount - penalty (days)	Rank corr.	0.03	0.00	-0.19	-0.21	-0.13
	p-value	0.77	0.99	0.07	0.06	0.22

Note: The table gives summary statistics for the minimum deposit to open a CD account, the penalty fees for early withdrawal, and the the yield. The data are based on a survey of CD contracts offered by the 10 largest banks in the 10 largest deposit markets in the U.S. conducted by BankRate Monitor in 2006. The penalty fee is stated in days of accrued interest. The lower panel of the table contains the pair-wise Spearman rank correlations and the corresponding p-values using the Sidak correction.
Source: BankRate Monitor

Time deposits or certificates of deposit (CD) are arguably the most homogeneous interest-

[32] The market for close substitutes within the M2 aggregate, net of M1, totaled $6 trillion, of which $900 billion was invested in retail money market funds. As a comparison, the publicly traded government debt was around $4 billion in 2007.

paying deposit product offered by banks. Similar to a Treasury bond, and unlike an interest checking or savings account, a certificate of deposit is a fixed-income instrument with a pre-determined maturity. The standard maturities that banks offer are 3-months, 6-months, 1-year, 2-year, 3-year and 5-year. Terms rarely exceed 5 years. Certificates of deposits are offered in small denomination with balances below $100,000 and in large (jumbo) denomination with balances above $100,000.[33] CDs differ from government bonds in terms of their taxation, liquidity, and riskiness. Unlike government bonds, certificates of deposits are taxed both at the state and at the Federal level. Without a secondary market and large early withdrawal penalty fees, retail CDs are significantly less liquid than a Treasury bonds.

Table (16) provides summary statistics on the price and nonprice terms for a set of contracts offered by the ten largest banks in the ten largest deposit markets. The data are based on a survey conducted by BankRate Monitor in 2006. While there is some variation in the two nonprice terms, minimum amount to open an account and the penalty for early withdrawal, such nonprice terms are not reflected in the offer rates. In particular, the last three rows show the Spearman correlation coefficient between the yield and the two nonprice terms of CD contracts— the minimum amount to open an account and the penalty fee for early withdrawal. The correlation between the yield and the nonprice terms is very small and statistically insignificant. The correlation between the penalty fee and the yield is statistically significant only for the 3-month CD contract. However, the negative correlation of -0.31 goes against the intuition that high penalty fee contracts should compensate for the reduced liquidity with a higher yield. The early withdrawal penalty fees are usually not explicitly advertised and remain a shrouded attribute of the contract.

A.3 Deposit markets

Despite the considerable consolidation of the banking industry since the 1994 Riegle-Neal Act, the number of commercial and savings banks exceeded 7,000 institutions in 2007. Moreover, as a result of the consolidation the number of multi-state banks competing in the same states or metropolitan statistical area (MSA) increased as many banks expanded their operations. As shown in the last three columns of Table (15), by 2007, the 20 largest bank holding companies had expanded their operations in multiple states and major Metropolitan Statistical Areas (MSA). By measures of concentration, most MSA markets remain with relatively low market concentration. For example, the median MSA market has HHI of about 11 percent in 2007 and the interquartile range varies between 8 and 14.

[33] Until October 3, 2008 the FDIC insurance limit per depositor per bank was $100,000. Since then it was set to $250,000.

Table 17: Summary statistics of MSA markets, 2007

	min	p25	p50	p75	max
Population	55, 288	144, 712	252, 442	560, 032	18, 572, 325
Share population age 65 plus	5.69	10.87	12.59	14.16	31.77
Income per capita	18.82	30.95	34.00	38.07	80.14
Deposits per capita	6.56	15.60	19.80	28.00	244.80
Number of banks	5	20	27	42	252
Number of branches	15	88	123	228	4, 190
HHI index	3.21	7.95	10.91	14.24	68.19

NOTE: Summary statistics are constructed for 2007. The first three rows are variables constructed from the Census Bureau data. The last four rows are variables constructed from the Summary of Deposit Database. The Herfindahl-Hirschman Index (HHI) index is constructed as the sum of squared deposit market shares and takes values from 0 (the least concentrated) to 1 (the most concentrated). SOURCE: Census Bureau and the Summary of Deposits, 2007

A.4 Survey of Consumer Finances

A.4.1 Deposit allocations

To conduct the analysis in Section (2.7), I use the publicly available version of the Survey of Consumer Finances (SCF). Apart from the raw data, the Federal Reserve provides the so called "Summary Extract Public Data" which contain a set of derived items from the raw data. Example of derived items are total assets, total debt, net worth, total financial assets, and their breakdowns by asset class. Those items are used to construct Table (8). To construct deposit allocations across different bank accounts, I use the reported allocations of deposits across different deposit account types—interest checking, savings, and certificates of deposit, and across different institutions and institution types reported in the raw data. For example, to construct the distribution of investments in CDs across contracts and bank accounts in Figure (3), I use the following items from the raw data

1. X3720: Altogether, how many such CDs do you (and your family living here) have?
2. X3721: What is the total dollar value of (this CD/these CDs)?
3. X3726: How many different institutions do you use for all these CDs?
4. (X3722 X3723 X3724 X3725 X7618 X6654 X6655): Please look at the list of institutions you wrote down. (Is this/Are these) CD(s) with any of the institutions on the list, or from someplace else?
5. (X9134 X9135 X9136 X9137 X9214 X9217 X9218): Type of institution,

where in items 4 and 5 respondents record which institution they hold the CD from a master list of institutions and the type of institution (i.e. commercial bank, credit union, mutual fund etc). To identify whether a CD contract is held with a main checking-account bank, I check if the institution matches the bank where the household holds the largest checking account balance.

A.4.2 Financial sophistication index

To construct the financial sophistication index, I use a set of categorical and quantitative characteristics of households related to their financial wealth management. The set of quantitative characteristics are

- Share of interest and dividend income in total income
- Share of risky assets in total financial assets, where risky assets are defined as direct holdings of equity, corporate bonds, and shares in equity and bond mutual funds.
- Diversity of financial asset holdings measured as the Herfindahl index of different asset category holdings.

The set of categorical (qualitative) characteristics take a true or false value

- Use of professional advise (lawyer, accountant, banker, broker, or financial planner) on decisions related to borrowing and saving
- Direct holdings of equity
- Excellent understanding of the SCF questionnaire
- Ownership of a brokerage, MMF, or other mutual fund accounts
- Willingness to take above average financial risks
- Time period for planning or budgeting of saving and spending that exceeds 5 years.

The financial sophistication index is then computed as the first principal component of those two sets of variables.[34] The table below presents summary statistics of the index.

Table 18: Summary statistics for the financial sophistication index

Min.	1st Qu.	Median	Mean	3rd Qu.	Max.
−2.34	−1.66	−0.66	0.00	1.60	6.17

[34] I use the R package PCAmixdata.

Table (19) reports the R-squares and factor loadings of the financial sophistication score on its underlying variables. It is interesting to note that most of the variation in the financial sophistication score is related to the share of risky assets and its different components. The second principal component, not shown, has high correlation with variables related to the use of professional advice.

Table 19: Factor loadings on financial sophistication score

Variable	R-sq	Loading	Std.error
Share interest and dividend income	0.154	0.019	0.0003
Share risky assets	0.490	0.093	0.001
Financial assets HHI	0.047	-0.063	0.002
Use of professional advice (borrowing)	0.073	0.092	0.002
Use of professional advice (investment)	0.047	0.074	0.002
Own equity	0.623	0.234	0.001
Own brokerage account	0.468	0.169	0.001
Own MMF	0.190	0.066	0.001
Own Mutual fund	0.480	0.153	0.001
Excellent understanding of SCF	0.057	0.084	0.002
Above average risk-taking	0.119	0.097	0.002
Long planning horizon (greater than 5 years)	0.121	0.118	0.002

NOTE: SOURCE: Survey of Consumer Finances, 2007

B Maximum likelihood construction and estimation

B.1 Construction

The structural estimation of the model applies the logic of Moraga-González and Wildenbeest [2008] to construct a maximum likelihood estimator of the unobserved search cost distribution. To start, let us define the profit per captured depositor.

$$\psi(R) = (\tilde{R} - R)(1 - h^d(R))$$

The indifference condition implied by the symmetric mixed strategies equilibrium allows us to construct a likelihood function of observing a particular offer rate. To do so, we equate profit function at the lowest bound of the support with any rate in the support must be the same $\pi(R) = \pi(R_{min})$ for all $R \in S$. Using this equilibrium condition, we can construct a function which relates an offer rate with the observed percentiles of the equilibrium distribution $F = F(R)$.

$$G(R, F) = \psi(R)\Big[\sum_{k=1}^{N} kq_k F^{k-1}\Big] - (\tilde{R} - R_{min})(1 - h^d(R_{min}))q_1 = 0$$

Applying the implicit function theorem to the equation above gives us an expression for the likelihood function

$$f_R(R|\sigma, \{q_k\}_{k=1}^N) = \frac{-\psi'(R)}{\psi(R)} \times \frac{\sum_{k=1}^N kq_k F_R(R)^{k-1}}{\sum_{k=1}^N k(k-1)q_k F_R(R)^{k-2}}. \tag{27}$$

To guarantee that the likelihood function is a proper probability density function (i.e. $f_R(\cdot) \geq 0$), the derivative of the profit function needs to be negative $\psi'(R) < 0$. The derivative of the profit function is

$$\psi'(R) = -(1 - h^d(R))\Big(1 + (1 - \sigma)\frac{\tilde{R} - R}{R} h^d(R)\Big). \tag{28}$$

The derivative is always negative for $\sigma < 1$. For $\sigma > 1$, one has to check the following condition $1 + (1 - \sigma)\frac{\tilde{R}-R}{R} h^d(R) > 0$ which imposes an upper bound on σ

$$\sigma < 1 + \frac{R_{min}}{\tilde{R} - R_{min}} \frac{1}{h(R_{min})}. \tag{29}$$

For all plausible values of $(\tilde{R}, R_{min})$, the right-hand side of the expression exceeds 2.

The log-likelihood optimization problem can be written as

$$L(R|\theta) = \frac{1}{N} \sum_{j=1}^{N} \log(f_R(R_j|\theta)) \longrightarrow max_\theta \tag{30}$$

where θ is the parameter vector to be estimated $\theta = \{\sigma, \{q_k\}_{k=1}^N\}$. The equilibrium offer distribution $F_R(R)$ is implicitly defined from the equilibrium condition

$$\psi(R) \sum_{k=1}^{N} kq_k F_R(R)^{k-1} = \psi(R_{min})q_1. \tag{31}$$

To derive the score of the likelihood function requires straightforward but tedious algebra. Let us express analytically the following derivatives with respect to the underlying parameters

$$h_\sigma(R) \equiv \frac{\partial h(R)}{\partial \sigma} = -h(R)(1-h(R)) \times \ln(\beta^\tau R) \tag{32}$$

$$\psi_\sigma(R) \equiv \frac{\partial \psi(R)}{\partial \sigma} = -(\tilde{R}-R) \times h_\sigma(R) + \tilde{R}_\sigma(1-h(R)) \tag{33}$$

$$\psi'_\sigma(R) \equiv \frac{\partial \psi'(R)}{\partial \sigma} = \Big(1+(1-\sigma)\frac{\tilde{R}-R}{R}h^d(R)\Big)h_\sigma(R) + \tag{34}$$

$$(1-h(R))\Big(\frac{\tilde{R}-R}{R}h(R)-(1-\sigma)\frac{\tilde{R}-R}{R}h_\sigma(R)+(1-\sigma)\frac{\tilde{R}_\sigma}{R}h(R)\Big) \tag{35}$$

where $\tilde{R}_\sigma$ is the derivative of the expression for the marginal cost of funds (23) with respect to IES. To simplify notation further, let us define the following sums

$$s_1 = \sum_{k=1}^{N} k q_k F_R(R)^{k-1} \tag{36}$$

$$s_2 = \sum_{k=2}^{N} k(k-1) q_k F_R(R)^{k-2} \tag{37}$$

$$s_3 = \sum_{k=3}^{N} k(k-1)(k-2) q_k F_R(R)^{k-3}. \tag{38}$$

Applying the implicit function theorem to (31), we can analytically express the derivative of the equilibrium offer distribution with respect to the coefficient of intertemporal substitution

$$F_\sigma(R) = -\frac{1}{s_2\psi(R)}\Big(s_1\psi_\sigma(R) - \psi_\sigma(R_{min})q_1\Big). \tag{39}$$

Similarly, we can calculate the derivatives with respect to the market segments

$$F_{q_1}(R) = -\frac{1}{s_2\psi(R)}\Big(\psi(R)+\psi_{\tilde{R}}(R)\tilde{R}_{q_1}s_1 - \psi(R_{min}) - \psi_{\tilde{R}}(R_{min})\tilde{R}_{q_1}q_1\Big) \tag{40}$$

$$\text{for k = 2,..,N} \tag{41}$$

$$F_{q_k} = -\frac{1}{s_2\psi(R)}\Big(\psi(R)kF^{k-1} + \psi_{\tilde{R}}(R)\tilde{R}_{q_1}s_1 - \psi_{\tilde{R}}(R_{min})\tilde{R}_{q_k}q_1\Big). \tag{42}$$

Using the notation introduced above, the derivative of the likelihood function with respect to σ can be expressed as

$$f_\sigma = -\frac{\psi'_\sigma(R)\psi(R) - \psi_\sigma(R)\psi'(R)}{\psi(R)^2}\frac{s_1}{s_2} - \frac{\psi'(R)}{\psi(R)}\Big(1 - \frac{s_1 s_3}{s_2^2}\Big)F_\sigma. \tag{43}$$

The derivatives of the likelihood function with respect to $\{q_k\}_{k=1}^N$ are

$$f_{q_k} = -\frac{\psi'_{\tilde{R}}(R)\psi(R) - \psi_{\tilde{R}}(R)\psi'(R)}{\psi(R)^2}\frac{s_1}{s_2}\tilde{R}_{q_k} - \tag{44}$$
$$-\frac{\psi'(R)}{\psi(R)}\Big(\frac{1}{s_2}kF^{k-1} - \frac{s_1}{s_2^2}k(k-1)F^{k-2} + (1 - \frac{s_1 s_3}{s_2^2})F_{q_1}\Big)$$

The gradient of the log-likelihood function is

$$S(\theta) = \sum_{j=1}^{N} S_j(\theta) \tag{45}$$

where

$$S_j(\theta) = \frac{\partial L(R_j|\theta)}{\partial \theta} = \frac{1}{f_R(R_j|\theta)} \times \begin{pmatrix} f_\sigma(R_j|\theta) \\ f_{q_1}(R_j|\theta) \\ \vdots \\ f_{q_k}(R_j|\theta) \\ \vdots \\ f_{q_N}(R_j|\theta) \end{pmatrix}', \text{ for } j = 1, .., N.$$

The variance-covariance matrix of the parameter estimates is estimated with the inverse of the outer product of the gradients $COV(\widehat{\theta}) = (S(\widehat{\theta})^T S(\widehat{\theta}))^{-1}$.

B.2 Maximum likelihood estimation

The optimization of the log-likelihood function is computationally demanding. To find the global optimum, I use the global optimization toolbox of Matlab and parallelize computations in a cluster of 32 CPU cores. I use a trust region reflective algorithm and the analytical scores and the Hessian derived in (45). This set-up significantly speeds up the computation of the optimum. For almost all estimates, the optimization algorithm arrives at a global optimum that satisfies the optimality conditions for the specified tolerance levels.

B.2.1 Goodness-of-fit

I use the two-sample Kolmogorov-Smirnov (KS) test to evaluate the goodness-of-fit of the model. The KS test is based on the maximal difference between the empirical distribution and the model generated evaluated at the MLE estimates. The KS test statistic is computed for each MSA market and each period. According to p-values from this test, the model generated distribution is statistically close to the empirical distribution for most of the MSA markets throughout the sample period. One fails to reject the null hypothesis of equality at the 5 percent significance level for the majority of markets, and the deposit-weighted average p-value exceeds 25 percent in all years of the sample. I focus the analysis on markets with p-values exceeding 5 percent, which excludes at most 8 mostly small markets.

Table 20: Kolmogorov-Smirnov two-sample statistic p-value (percent)

year	5th	25th	Median	75th	95th	Weighted mean	p-value $< 5\%$ Markets	p-value $< 5\%$ Share	Markets number
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1997	0	7.1	35.9	63.7	90.8	26.3	7	8	101
1998	0	11.3	39.9	69.6	94.5	29.2	3	6	118
1999	0	11.6	43.8	74.5	94.4	26.1	4	7	124
2000	0.1	26.8	63.1	86.6	98.2	44.1	5	7	137
2001	1.5	38.4	71.7	90.1	98.9	49.6	0	0	138
2002	2.1	36.7	63.3	84.8	98.1	45.1	1	5	147
2003	0.8	29.4	61.2	83	97.4	37.9	1	4	149
2004	0.5	21	50.1	79.2	96.4	35.3	0	0	159
2005	0.5	21.7	54.9	83.8	97.9	32.5	2	3	173
2006	2.8	20.8	59.7	86.3	98	35.4	4	4	179
2007	4.6	33.1	69.3	90.7	99.1	45.1	3	2	192
2008	4.5	41.5	72.9	90.8	99.1	51.4	2	5	212
2009	5.5	35.2	65.1	86.3	98.3	43.1	1	4	217
2010	5.2	36.9	66.8	87.2	98	37.8	1	4	222
2011	3.2	36.4	61.9	82.3	96.6	34.3	2	14	215
2012	2	30.8	56.4	77.4	94.7	43	2	5	214
2013	4.4	24.1	51	74.9	92.9	41.4	5	2	201
2014	3	22.3	47.6	73.2	94	45.7	5	2	193
2015	1.6	18.4	44.7	70.8	93.6	44.3	8	7	191
2016	2.1	20.5	46.6	74.3	95.5	42.8	7	8	174

NOTE: The Kolmogorov-Smirnov test statistic is calculated using the empirical and the model generated CDF of offer rates on the 12-month CD under null hypothesis that the two distributions are the same. P-values are calculated for each MSA market and for each period. The weighted-mean is weighed by the total MSA-level deposits reported in the FDIC's SOD for that year.

Table (20) shows the p-values of the goodness-of-fit measure based on the Kolmogorov-Smirnov two-sample statistic. Columns two through five show select percentiles of the distribution of the p-values across different markets. Column 7 gives the deposit-weighted average of the p-values to summarize the statistic for the largest markets. Columns 8 and 9 show the number of markets for which the p-value is below 5 percent. Overall, the test statistic fails to reject the null hypothesis that the the model generated and the empirical distribution of rates are the same.