

Table 1.

401(k) Participant characteristics by investor type.

This table reports summary statistics for the full sample and separately for five types of participants: opted into managed account, defaulted into managed account, 100% allocation to a single TDF and no other fund balances, 100% allocated to a single TDF but additional fund balances, and self-directed participants (who are enrolled in neither a managed account nor allocate 100% to a single TDF). Unless otherwise stated, all variables are measured on December 31, 2019. The full sample is limited to plan participants between the ages of 20 and 75 with a non-negative plan tenure on December 31, 2019 and a deferral rate that is no more than 30%. We lack a gender variable for 20.8% of participants. Because participant allocations across funds need not align with their balances, we report the numbers of funds with positive allocations and positive balances. The "% Equity" variables report equity exposures (reported in Table OA1) weighted by allocations to the fund or the fund's balance scaled by the account balance. In one case, we deflate the balances on March 31, 2020 using the fund (or category) return during 2020Q1, to minimize the impact of 2020Q1 returns on ending balances.

Participant characteristic	Full sample N = 617,376		Opted into MA 3.5% participants 2.2% assets		Defaulted into MA 7.0% participants 4.5% assets		Pure TDF 43.1% participants 16.3% assets		Mixed TDF 6.9% participants 9.0% assets		Self-directed 39.5% participants 68.0% assets	
	Mean	Standard deviation	Mean	Standard deviation	Mean	Standard deviation	Mean	Standard deviation	Mean	Standard deviation	Mean	Standard deviation
	Age	44.3	12.3	42.5	12.0	43.7	12.0	42.0	12.4	45.4	12.2	46.8
Salary (\$000)	97.5	311.2	102.7	126.4	93.7	134.3	73.8	156.2	96.4	143.5	124.1	460.1
Balance (\$000)	113.1	245.2	70.6	162.5	72.9	154.8	43.1	99.7	147.5	260.8	195.5	332.0
Plan tenure	7.1	7.3	4.6	6.3	6.6	6.8	4.9	5.6	9.2	7.3	9.5	8.2
Employee deferral rate	5.4%	5.6%	6.2%	5.5%	3.9%	4.4%	4.5%	4.4%	6.1%	6.2%	6.5%	6.5%
Deferral rate of 0%?	28.8%	45.3%	23.5%	21.909	34.4%	47.5%	26.0%	43.9%	29.9%	45.8%	30.0%	45.8%
Deferral rate match imputed default?	10.2%	30.3%	6.7%	25.0%	13.2%	33.8%	17.4%	37.9%	2.6%	15.9%	3.7%	18.8%
Roth balance?	17.7%	38.2%	29.0%	45.4%	13.8%	34.5%	10.0%	30.0%	15.5%	36.2%	26.2%	44.0%
Rollover into account?	11.4%	31.8%	15.0%	35.7%	8.1%	27.2%	7.4%	26.2%	12.1%	32.6%	16.0%	36.6%
Male?	47.6%	49.9%	42.7%	49.5%	46.1%	49.8%	45.4%	49.8%	55.2%	49.7%	49.4%	50.0%
Female?	31.6%	46.5%	53.0%	49.9%	52.7%	49.9%	31.1%	46.3%	28.9%	45.4%	27.0%	44.4%
Active on 12/31/19?	81.9%	38.5%	88.3%	32.2%	74.3%	43.7%	82.7%	37.8%	82.6%	37.9%	83.0%	37.6%
Active on 12/31/19 but terminated on 03/31/20?	3.3%	17.9%	3.0%	17.1%	2.8%	16.4%	3.5%	18.3%	2.2%	14.6%	2.3%	15.1%
Decrease deferral rate during 2020Q1?	6.7%	25.0%	10.8%	31.0%	6.1%	23.9%	6.1%	24.0%	5.9%	23.6%	7.2%	25.8%
Increase deferral rate during 2020Q1?	11.8%	32.3%	9.5%	29.4%	10.1%	30.2%	11.9%	32.3%	14.3%	35.0%	11.8%	32.2%
Increase deferral rate by 1% during 2020Q1?	8.1%	27.2%	6.0%	23.7%	7.9%	27.0%	8.9%	28.4%	9.8%	29.8%	7.1%	25.7%
Loan balance on 12/31/19?	16.4%	37.0%	11.9%	32.3%	14.4%	35.1%	14.8%	35.5%	20.7%	40.5%	18.2%	38.6%
Loan ratio (when positive on 12/31/19)	17.6%	14.7%	19.8%	16.0%	20.0%	15.4%	20.0%	14.9%	15.4%	13.3%	15.5%	14.2%
New loan during 2020Q1?	0.9%	9.2%	0.9%	9.7%	0.8%	8.9%	1.0%	9.8%	0.8%	8.6%	0.8%	8.6%
Partial withdrawal during 2020Q1?	0.8%	9.0%	1.0%	9.9%	0.8%	9.0%	0.7%	8.3%	0.8%	8.7%	0.9%	9.6%
Full withdrawal during 2020Q1?	1.4%	11.7%	0.0%	0.0%	0.0%	0.0%	0	0	0	0	0	0
Funds with a positive allocation on 12/31/19	4.4	5.1	12.7	3.6	14.2	3.6	1.0	0.0	1.0	0.0	6.2	4.5
Funds with a positive allocation on 03/31/20	4.4	5.0	12.6	3.8	13.9	4.1	1.0	0.4	1.0	0.6	6.2	4.5
Funds with a positive balance on 12/31/19	4.8	5.2	13.0	3.7	14.4	3.8	1.0	0.0	2.9	1.9	6.8	4.5
Funds with a positive balance on 03/31/20	4.8	5.1	12.8	3.8	14.1	4.2	1.0	0.5	3.0	2.0	6.8	4.5
% Equity using allocations on 12/31/19	74.5%	21.4%	76.0%	20.7%	70.4%	19.0%	75.9%	15.2%	72.5%	16.1%	74.0%	27.4%
% Equity using allocations on 03/31/20	73.9%	22.3%	74.7%	21.8%	69.0%	20.4%	75.7%	15.9%	72.0%	17.4%	73.1%	28.4%
% Equity using balances on 12/31/19	75.1%	21.0%	76.2%	20.2%	70.9%	18.5%	75.9%	15.4%	73.6%	18.2%	75.2%	26.5%
% Equity using return-adjusted balances on 03/31/20	74.5%	22.3%	75.9%	21.5%	70.3%	20.2%	75.6%	16.3%	73.5%	19.7%	74.1%	27.9%
% Equity using balances on 03/31/20	73.0%	22.7%	71.7%	22.6%	65.3%	21.3%	75.6%	16.3%	72.9%	20.0%	71.8%	28.3%

Table 2.

Transitions between participant types.

This table describes participant type transitions between December 31, 2019 and March 31, 2020. In addition, we report the fraction of participants who change type, change type in a manner that increases the level of portfolio delegation (e.g., transitioning from self directed to a managed account), and the fraction that have a positive self-directed brokerage account balance (SDBA) on March 31, 2020.

Participant type on December 31, 2019	Participant type on March 31, 2020						% of participant type who...		
	Defaulted into MA	Opted into MA	Pure TDF	Mixed TDF	SD	All	Change type	Increase delegation	Add SDBA
Defaulted into MA	42,727	0	0	0	555	43,282	1.28%	0.00%	0.05%
Opted into MA	0	21,529	0	10	370	21,909	1.73%	0.00%	0.05%
Pure TDF	0	90	260,921	2,284	2,546	265,841	1.85%	0.03%	0.06%
Mixed TDF	0	22	1,582	40,202	849	42,655	5.75%	3.76%	0.12%
Self-directed	0	623	107	294	242,665	243,689	0.42%	0.42%	0.20%
All	42,727	22,264	262,610	42,790	246,985	617,376	1.51%	0.44%	0.12%

Table 3.

Likelihood of participant-directed portfolio changes.

This table reports the likelihood of participant-directed portfolio changes by participant type. In addition to reporting the fraction of participants for whom we detect participant-directed changes in fund allocations and/or fund balances, we report the fraction of participants for whom the net change in equity exposure due to either changes in allocations or changes in fund balances is at least 5 percentage points, at least 10 percentage points, and at least 20 percentage points.

Participant type	Sample size	Any portfolio change	Decrease equity exposure ≥ 5 pp	Increase equity exposure ≥ 5 pp	Decrease equity exposure ≥ 10 pp	Increase equity exposure ≥ 10 pp	Decrease equity exposure ≥ 20 pp	Increase equity exposure ≥ 20 pp
	(1)	(2)	(4)	(5)	(6)	(7)	(6)	(7)
Defaulted into MA	43,282	1.28%	0.72%	0.34%	0.67%	0.28%	0.63%	0.19%
Opted into MA	21,909	1.73%	0.95%	0.45%	0.88%	0.36%	0.82%	0.23%
Pure TDF	265,841	2.10%	0.86%	0.60%	0.78%	0.41%	0.71%	0.16%
Mixed TDF	42,655	22.72%	3.01%	5.00%	2.46%	2.18%	1.97%	0.89%
Self-directed	243,689	15.51%	5.40%	3.45%	4.50%	2.52%	3.69%	1.50%
Delegated	331,032	1.97%	0.85%	0.56%	0.77%	0.39%	0.70%	0.17%
Mixed TDF and SD	286,344	16.58%	5.05%	3.68%	4.20%	2.47%	3.43%	1.41%
All	617,376	8.74%	2.79%	2.01%	2.36%	1.35%	1.97%	0.74%

Table 4.

Industry-level statistics on separations, withdrawals, deferral rates, and likelihood of portfolio changes.

This table reports selected summary statistics from Table 1 and Table 3 by industry. It focuses on participants who are active on December 31, 2019, but also reports the number of participants who become active by March 31, 2020 scaled by the number of active participants on December 31, 2019. Partial withdrawals, changes in deferral rates, and changes in portfolios are calculated for the subsample of participants without a complete withdrawal.

Industry	Plans	Participants active on 12/31/19	Delegated?	Active 12/31/19 but terminated by 03/31/20?	Becomes active by 03/31/20?	Withdrawal		Deferral rate			Any portfolio change?
						Partial?	Full?	Decrease?	Increase by 1%?	Increase > 1%?	
Agriculture	3	923	73.3%	3.5%	0.0%	0.7%	0.3%	6.1%	3.5%	3.9%	3.5%
Arts/Entertainment	7	5,083	53.6%	4.0%	0.1%	0.6%	0.6%	7.5%	4.1%	3.7%	5.9%
Business Support	6	9,787	60.2%	3.2%	0.5%	0.8%	0.9%	18.0%	2.9%	2.7%	4.3%
Construction	12	6,614	55.0%	7.1%	0.2%	3.7%	0.6%	8.7%	14.1%	3.2%	2.8%
Education	1	30	0.0%	3.3%	0.0%	0.0%	0.0%	3.3%	3.3%	0.0%	16.7%
Finance and Insurance	63	81,107	49.8%	3.5%	0.1%	0.5%	0.6%	8.5%	9.0%	5.2%	7.8%
Food Services	4	1,361	65.4%	16.5%	0.4%	1.0%	3.2%	16.8%	2.1%	2.9%	3.3%
Health Care	75	52,494	75.7%	4.6%	0.4%	0.6%	0.7%	7.2%	6.9%	2.7%	3.7%
Information	8	6,455	61.9%	8.7%	0.1%	0.5%	1.8%	9.8%	1.9%	3.1%	4.3%
Management	7	5,478	36.5%	3.2%	0.1%	0.4%	0.6%	9.3%	12.9%	4.5%	4.5%
Manufacturing	110	108,460	47.7%	4.3%	0.3%	0.7%	0.8%	7.4%	14.5%	4.9%	10.2%
Mining/Oil/Gas	10	18,577	63.1%	2.3%	0.8%	0.6%	0.4%	5.6%	7.6%	4.2%	5.5%
Other Services	12	19,619	77.0%	4.4%	0.3%	1.4%	0.7%	5.4%	2.4%	1.9%	4.9%
Professional/Scientific	138	91,686	41.3%	4.1%	0.2%	0.8%	1.1%	8.3%	12.7%	4.9%	18.1%
Public Administration	2	3,564	28.4%	2.2%	0.0%	0.3%	0.2%	4.7%	2.9%	1.7%	11.6%
Real Estate	11	3,919	50.6%	3.3%	0.3%	0.4%	0.5%	7.7%	7.2%	5.0%	6.9%
Retail Trade	17	35,076	64.8%	5.3%	0.3%	0.8%	1.0%	7.0%	8.1%	2.9%	3.7%
Transportation/Storage	22	28,854	37.0%	2.5%	0.3%	0.5%	0.5%	10.4%	5.6%	6.0%	11.6%
Utilities	4	3,370	61.0%	2.0%	0.2%	0.4%	0.5%	9.3%	4.6%	6.2%	6.4%
Wholesale Trade	19	30,268	61.7%	3.3%	0.1%	0.5%	0.5%	7.4%	6.8%	3.1%	5.4%
All	531	512,725	53.3%	4.0%	0.3%	0.7%	0.8%	8.0%	9.7%	4.3%	9.1%

Table 5.

Predicting portfolio changes during 2020Q1.

This table reports marginal effects estimated via Probit. The dependent variable in columns (1), (2), and (3) equals one if participant *i* made any changes to her portfolio during 2020Q1, and zero otherwise. The dependent variable in column (4) equals one if participant *i* increased or decreased her exposure to equity by 10 or more percentage points (as indicated in columns (6) and (7) of Table 3), and zero otherwise. The dependent variable in column (5) is defined similarly, using a threshold of 20 percentage points. The "% Changes in industry" variable measures the average value of the dependent variable in all other plans within the same industry. The "% Changes in plan" variable measures the average value of the dependent variable within the plan, excluding participant *i*. Equity exposure fixed effects are based on fund balances on December 31, 2019. Columns (2), (4), and (5) include industry fixed effects. Column (3) replaces industry fixed effects with plan fixed effects. Coefficients and standard errors are multiplied by 100, so that a marginal effect of 1.00 corresponds to an increase of one percentage point. Standard errors are clustered on plan and reported inside parentheses to the right of coefficients.

Dependent variable	Any changes in allocations and/or fund exchanges?						Abs(Change) >= 10 pp		Abs(Change) >= 20 pp	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	
Defaulted into MA?	-1.41 **	(0.68)	-0.33	(0.44)	-2.38 ***	(0.53)	-0.79 ***	(0.17)	-0.39 ***	(0.13)
Opted into MA?	-1.36	(0.89)	-1.50 *	(0.71)	-2.28 ***	(0.58)	-0.59 **	(0.23)	-0.21	(0.20)
Mixed TDF?	28.20 ***	(7.74)	14.43 ***	(3.45)	15.07 ***	(3.71)	1.80 ***	(0.51)	0.91 ***	(0.25)
Self-directed?	13.56 ***	(2.65)	9.43 ***	(0.70)	9.79 ***	(0.72)	3.10 ***	(0.21)	2.10 ***	(0.12)
% Changes in industry	0.13	(0.13)								
% Changes in plan			0.31 ***	(0.01)			0.26 ***	(0.02)	0.21 ***	(0.02)
Active?	1.15 *	(0.56)	2.31 ***	(0.52)	2.14 ***	(0.52)	0.64 ***	(0.09)	0.34 ***	(0.08)
Terminated during 2020Q1?	1.46 **	(0.63)	1.37 **	(0.64)	1.19 **	(0.54)	1.18 ***	(0.52)	1.31 ***	(0.50)
Male?	2.10 *	(1.35)	-0.11	(0.35)	0.32	(0.55)	0.31 ***	(0.10)	0.26 ***	(0.07)
Female?	0.34	(1.15)	-1.16 ***	(0.30)	-0.83 *	(0.49)	-0.43 ***	(0.09)	-0.26 ***	(0.07)
Ln Plan tenure	-1.58 ***	(0.35)	-1.02 ***	(0.21)	-1.03 ***	(0.20)	-0.50 ***	(0.08)	-0.35 ***	(0.04)
Ln Balance	0.56 ***	(0.18)	0.45 ***	(0.12)	0.47 ***	(0.12)	0.43 ***	(0.04)	0.38 ***	(0.03)
Ln Salary	-0.23	(0.35)	0.38 ***	(0.13)	0.39 ***	(0.13)	0.18 ***	(0.05)	0.12 ***	(0.04)
Ln Age	-1.72 **	(0.71)	-0.94 *	(0.49)	-1.08 **	(0.46)	0.78 ***	(0.24)	0.78 ***	(0.14)
Employee deferral rate	0.12 ***	(0.04)	0.10 ***	(0.02)	0.11 ***	(0.02)	0.06 ***	(0.01)	0.04 ***	(0.01)
Deferral rate 0%?	0.08	(0.61)	0.59 **	(0.27)	0.68 ***	(0.23)	0.47 ***	(0.10)	0.36 ***	(0.07)
Default deferral rate?	0.22	(0.69)	0.09	(0.48)	0.18	(0.52)	-0.04	(0.15)	-0.17 *	(0.10)
Roth?	1.12 **	(0.53)	1.43 ***	(0.23)	1.47 ***	(0.21)	0.73 ***	(0.07)	0.45 ***	(0.05)
Rollover into account?	0.57 *	(0.33)	0.33	(0.31)	0.35	(0.28)	0.19 **	(0.08)	0.15 ***	(0.05)
Loan?	0.24	(0.38)	0.32 **	(0.14)	0.41 ***	(0.12)	0.35 ***	(0.09)	0.37 ***	(0.07)
Daily std. dev. during 2020Q1	3.05 *	(1.89)	-0.46	(1.22)	-0.17	(1.07)	0.44 **	(0.21)	0.68 ***	(0.14)
Equity exposure = 10-19%	3.37 ***	(1.54)	5.86 ***	(1.57)	5.60 ***	(1.56)	2.89 ***	(0.63)	0.42 *	(0.26)
Equity exposure = 20-29%	1.19	(1.75)	4.61 ***	(1.66)	4.14 ***	(1.53)	2.30 ***	(0.47)	0.41 *	(0.23)
Equity exposure = 30-39%	-0.84	(2.02)	3.04 *	(1.96)	2.92 **	(1.80)	0.71 **	(0.34)	-0.26	(0.16)
Equity exposure = 40-49%	-2.81	(1.78)	1.31	(1.83)	1.07	(1.65)	-0.32	(0.28)	-0.79 ***	(0.12)
Equity exposure = 50-59%	-3.36	(1.92)	0.97	(2.10)	0.64	(1.83)	-0.70 **	(0.26)	-1.07 ***	(0.11)
Equity exposure = 60-69%	-4.78 **	(1.67)	-0.34	(2.20)	-0.51	(1.89)	-1.27 ***	(0.26)	-1.42 ***	(0.11)
Equity exposure = 70-79%	-5.23 *	(1.90)	0.11	(2.75)	-0.47	(2.24)	-1.40 ***	(0.30)	-1.57 ***	(0.11)
Equity exposure = 80-89%	-7.16 *	(3.80)	0.04	(3.15)	-0.62	(2.69)	-2.23 ***	(0.46)	-2.77 ***	(0.29)

Equity exposure = 90-100%	-7.54 **	(3.11)	-0.31	(3.52)	-1.10	(2.89)	-2.46 ***	(0.41)	-2.50 ***	(0.25)
Industry fixed effects?	--		Yes		--		Yes		Yes	
Plan fixed effects?	--		--		Yes		--		--	
Observed probability	8.62		8.62		8.63		3.62		2.67	
Predicted probability	5.46		4.46		4.12		2.12		1.51	
Sample size	616,412		616,501		615,874		616,501		616,501	
Pseudo-R2	0.1476		0.2841		0.2979		0.1321		0.1222	

Table 6.

Predicting plan withdrawals and increased loan activity during 2020Q1.

This table relates participant type to other portfolio choices during 2020Q1. We report marginal effects estimated via Probit. The dependent variable in column (1) equals one if participant *i* increased her loan balance or initiated a new loan during 2020Q1, and zero otherwise. The sample is limited to participants who are active at the beginning and end of 2020Q1, and to plans in which at least one participant had a positive loan balance on December 31, 2020. The dependent variable in column (2) equals one if participant *i* reduced her deferral rate by at least one percentage point during 2020Q1. The sample is limited to participants who are active at the beginning and end of 2020Q1, and who have a positive deferral rate on December 31, 2020. The dependent variable in columns (3) equals one if participant *i* made an (imputed) partial withdrawal from her account during 2020Q1, and zero otherwise. The dependent variable in column (4) equals one if participant *i* withdraws all plan assets during 2020Q1, and zero otherwise. The limited set of independent variables reflects the limited data that we possess on participants who have an account balance of \$0 at the end of 2020Q1. In particular, we can control for neither participant type nor equity exposure categories. Equity exposure fixed effects in the other columns are based on fund balances on December 31, 2019. All specifications include industry fixed effects. Coefficients and standard errors are multiplied by 100, so that a marginal effect of 1.00 corresponds to an increase of one percentage point. Standard errors are clustered on plan and reported inside parentheses to the right of coefficients.

Dependent variable	Increase loan balance or new loan?		Decrease deferral rate?		Partial withdrawal?		Full withdrawal?	
	(1)	(1)	(2)	(2)	(3)	(3)	(4)	(4)
Defaulted into MA?	0.08	(0.09)	0.35	(0.27)	0.04	(0.09)		
Opted into MA?	0.11	(0.10)	2.21 ***	(0.28)	0.27 ***	(0.13)		
Mixed TDF?	-0.06	(0.10)	0.79 ***	(0.30)	0.08	(0.09)		
Self-directed?	-0.11 **	(0.05)	1.47 ***	(0.14)	0.14 ***	(0.03)		
% Outcome within plan Active?	0.39 ***	(0.02)	0.58 ***	(0.04)	0.10 ***	(0.01)	0.02 ***	(0.01)
Terminated during 2020Q1?					-0.71 ***	(0.13)	-2.80 ***	(0.19)
Male?					5.09 ***	(0.95)	19.50 ***	(1.04)
Female?	-0.01	(0.07)	-0.10	(0.24)	0.02	(0.04)		
Ln Plan tenure	-0.10	(0.08)	0.32	(0.25)	-0.05	(0.04)		
Ln Balance	-0.11 ***	(0.04)	-0.54 ***	(0.12)	0.12 ***	(0.02)	-0.05 ***	(0.02)
Ln Salary	0.01	(0.03)	-0.37 ***	(0.08)	-0.14 ***	(0.02)	-0.04 ***	(0.01)
Ln Age	-0.26 ***	(0.05)	1.13 ***	(0.18)	0.01	(0.02)	0.01 *	(0.00)
Employee deferral rate	0.11	(0.14)	-2.88 ***	(0.22)	0.85 ***	(0.07)	0.16 ***	(0.05)
Deferral rate 0%?	-0.06 ***	(0.01)	0.37 ***	(0.03)	0.01 ***	(0.00)	0.00	(0.00)
Default deferral rate?	-0.75 ***	(0.05)			0.04	(0.05)	0.09 ***	(0.03)
Roth?	-0.73 ***	(0.13)	-1.94 ***	(0.15)	-0.22 ***	(0.03)	-0.13 ***	(0.04)
Rollover into account?	0.31 ***	(0.06)	4.71 ***	(0.20)	0.07 **	(0.03)		
Loan?	-0.08	(0.07)	0.53 ***	(0.14)	0.09 **	(0.04)		
	3.74 ***	(0.30)	3.87 ***	(0.17)	0.75 ***	(0.09)		

Equity exposure = 10-19%	-0.17	(0.24)	0.34	(0.51)	0.25	(0.21)
Equity exposure = 20-29%	0.16	(0.26)	0.49	(0.49)	0.04	(0.09)
Equity exposure = 30-39%	-0.42 **	(0.18)	0.55	(0.39)	0.00	(0.07)
Equity exposure = 40-49%	-0.65 ***	(0.11)	0.26	(0.32)	0.08	(0.06)
Equity exposure = 50-59%	-0.32 **	(0.13)	0.78 ***	(0.32)	-0.04	(0.05)
Equity exposure = 60-69%	-0.04	(0.14)	0.78 ***	(0.30)	-0.20 ***	(0.04)
Equity exposure = 70-79%	0.07	(0.13)	0.87 ***	(0.28)	-0.14 ***	(0.04)
Equity exposure = 80-89%	0.13	(0.13)	1.27 ***	(0.29)	-0.10 **	(0.05)
Equity exposure = 90-100%	-0.22	(0.13)	1.06 ***	(0.29)	-0.03	(0.05)
Industry fixed effects?	Yes		Yes		Yes	Yes
Observed probability	2.32		6.02		0.81	1.38
Predicted probability	1.70		4.46		0.40	0.13
Sample size	474,844		422,406		616,513	625,959
Pseudo-R2	0.0838		0.1585		0.1624	0.3735

Table 7.

Are portfolio changes associated with lower realized quarterly returns?

This table relates estimated participant quarterly returns during 2020Q1 to measures of portfolio change, job loss, and equity exposure (based on fund balances on December 31, 2019). The measures of portfolio changes are a dummy variable that equals one when the participant makes "any change" (column (3) in Table 3); a dummy variable that equals one when the exposure to equity decreases by 10 percentage points or more (based on either allocations or return-adjusted changes in account balances); a dummy variable that equals one when the exposure to equity increases by 10 percentage points or more (based on either allocations or return-adjusted changes in account balances); and a dummy variable that equals one when the participant transitions from Mixed TDF or SD to Pure TDF or MA. Our measure of job loss is whether a participant is classified as terminated during 2020Q1. We estimate separate specifications for three subsamples of participants (as classified on December 31, 2020): those invested through managed accounts; Pure TDF; and Mixed TDF plus Self-directed. Quarterly returns are inferred from changes in balances between December 31, 2019 and March 31, 2020. We control for the level of predicted retirement contributions during the quarter using annual salary and deferral rate data from December 31, 2019, scaled by the balance on December 31, 2019. We include one measure for participants who are still active on March 31, 2020 and another measure for participants who are terminated before March 31, 2020, to capture average differences in the level of participant contributions. We include plan fixed effects interacted with whether the participant is active on December 19, 2019 to control for variation in the level of employer contributions across active and inactive participants (which we do not directly observe). We include equity exposure category fixed effects based on fund balances on December 31, 2019. We exclude participants with full or (imputed) partial withdrawals (i.e., those with imputed returns below -50.0%). We also excluded participants for whom the estimated quarterly returns were likely to be particularly noisy due to the timing and level of retirement contributions. Namely, we exclude participants with estimated quarterly returns in excess of 100.0%, participants for whom predicted portfolio contributions were likely to increase the estimated quarterly return by 25% or more, and participants with December 31, 2019 balances of \$1,000 or less. Coefficients and standard errors are multiplied by 100, so that a marginal effect of 1.00 corresponds to an increase of one percentage point. Standard errors are clustered on plan and reported inside parentheses to the right of coefficients.

	Imputed quarterly return									
	MA		Pure TDF				Mixed TDF and SD			
	(1)		(2)		(3)		(4)		(5)	
Any portfolio change?	-0.84	(0.53)	2.18 ***	(0.75)			1.51 ***	(0.21)		
Decrease exposure to equity by 10 pp?					1.16 **	(0.58)			2.71 ***	(0.61)
Increase exposure to equity by 10 pp?					2.30 ***	(0.69)			0.02	(1.00)
Increase delegation?							0.48	(1.67)		
Mixed TDF?							-0.20	(0.51)	-0.13	(0.60)
Terminated 2020Q1?	-1.03	(0.77)	-1.49 ***	(0.29)	-1.49 ***	(0.28)	-0.95 ***	(0.28)	-0.98 ***	(0.28)
Predicted contributions * Active 2020Q1?	1.33 ***	(0.09)	1.49 ***	(0.06)	1.49 ***	(0.06)	1.43 ***	(0.07)	1.44 ***	(0.07)
Predicted contributions * Terminated 2020Q1?	0.72 ***	(0.14)	0.80 ***	(0.07)	0.80 ***	(0.07)	0.77 ***	(0.06)	0.78 ***	(0.06)
Equity allocation = 10-19%	0.80 **	(0.39)					-3.79 ***	(0.29)	-3.79 ***	(0.33)
Equity allocation = 20-29%	-4.31 ***	(0.46)					-5.72 ***	(0.24)	-5.79 ***	(0.28)
Equity allocation = 30-39%	-6.02 ***	(0.68)	-10.68 ***	(3.49)	-10.93 ***	(3.44)	-8.21 ***	(0.25)	-8.31 ***	(0.27)
Equity allocation = 40-49%	-8.78 ***	(0.56)	-12.76 ***	(3.44)	-13.00 ***	(3.38)	-10.23 ***	(0.43)	-10.35 ***	(0.43)
Equity allocation = 50-59%	-11.00 ***	(0.64)	-14.73 ***	(3.46)	-14.97 ***	(3.41)	-12.91 ***	(0.43)	-13.02 ***	(0.43)
Equity allocation = 60-69%	-13.41 ***	(0.66)	-16.57 ***	(3.44)	-16.82 ***	(3.38)	-14.20 ***	(0.38)	-14.31 ***	(0.37)
Equity allocation = 70-79%	-15.17 ***	(0.65)	-17.75 ***	(3.43)	-18.00 ***	(3.37)	-16.51 ***	(0.24)	-16.63 ***	(0.22)
Equity allocation = 80-89%	-16.35 ***	(0.60)	-20.37 ***	(3.40)	-20.61 ***	(3.35)	-18.15 ***	(0.31)	-18.24 ***	(0.29)
Equity allocation = 90-100%	-18.59 ***	(0.83)	-19.25 ***	(3.44)	-19.49 ***	(3.38)	-19.02 ***	(0.52)	-19.16 ***	(0.57)
Constant	1.67 **	(0.77)	4.10	(3.41)	4.36	(3.36)	2.49 ***	(0.28)	2.70 ***	(0.32)

Plan fixed effects * Active?	Yes	Yes	Yes	Yes	Yes
Sample size	54,627	213,382	213,382	267,277	267,277
R2	0.398	0.516	0.516	0.535	0.535

Table OA1.

Investment option summary statistics by narrow Morningstar category.

This table reports summary statistics for each of the 83 narrow Morningstar categories reflected in the menus of the 532 401(k) plans that we study, including our assumed allocation to equity (based on historical allocations rounded to the nearest 5 percentage points), AUM on December 31, 2019 and March 31, 2020, the number of options for which we observe fund-level returns, and the number of options for which we observe narrow category level returns. Only 1.661 of the 2.391 unique investment options are mutual funds. The assumed % equity for All options is the equal-weighted average across the 2.391 options.

Narrow Morningstar category	Broad category	Assumed % equity	AUM 12/31/19 (\$ million)	AUM 3/31/20 (\$ million)	AUM 12/31/19 (%)	AUM 3/31/20 (%)	Percentage change in AUM	Options with fund return	Average fund return	Standard deviation of fund return	Options with category return	Average category return
Target date 2000-2010	TDF	35	204.3	185.8	0.27%	0.28%	-9.07%	16	-8.52%	2.29%	38	-7.94%
Target date 2015	TDF	40	356.4	322.7	0.48%	0.49%	-9.48%	13	-9.29%	1.84%	33	-9.48%
Target date 2020	TDF	45	2131.4	1888.4	2.84%	2.89%	-11.40%	22	-10.66%	1.73%	48	-10.04%
Target date 2025	TDF	50	2635.2	2296.8	3.51%	3.52%	-12.84%	26	-12.33%	2.15%	57	-12.19%
Target date 2030	TDF	60	4309.2	3697.5	5.75%	5.66%	-14.19%	25	-14.81%	1.58%	57	-14.26%
Target date 2035	TDF	70	2779.4	2359.0	3.71%	3.61%	-15.13%	26	-16.66%	1.77%	58	-16.56%
Target date 2040	TDF	80	3654.0	3040.3	4.87%	4.65%	-16.80%	26	-18.66%	1.70%	58	-18.27%
Target date 2045	TDF	85	1793.0	1498.2	2.39%	2.29%	-16.44%	25	-19.57%	1.82%	57	-19.60%
Target date 2050	TDF	85	2150.8	1798.3	2.87%	2.75%	-16.39%	26	-20.14%	1.60%	57	-20.04%
Target date 2055	TDF	90	676.3	586.8	0.90%	0.90%	-13.23%	24	-20.04%	1.45%	56	-20.37%
Target date 2060+	TDF	90	216.4	201.0	0.29%	0.31%	-7.11%	24	-20.03%	1.40%	56	-20.71%
Target date retirement	TDF	30	439.0	412.3	0.59%	0.63%	-6.09%	16	-8.26%	2.43%	44	-7.27%
Allocation 15% to 30% equity	Allocation	15	55.2	51.4	0.07%	0.08%	-7.00%	5	-8.52%	5.61%	9	-8.58%
Allocation 30% to 50% equity	Allocation	35	117.2	114.6	0.16%	0.18%	-2.23%	16	-9.05%	1.98%	59	-12.21%
Allocation 50% to 70% equity	Allocation	60	1297.7	1105.8	1.73%	1.69%	-14.79%	38	-14.37%	3.31%	76	-14.74%
Allocation 70% to 85% equity	Allocation	75	320.4	255.9	0.43%	0.39%	-20.11%	11	-17.45%	1.08%	32	-19.68%
Allocation 85%+ equity	Allocation	95	13.2	10.6	0.02%	0.02%	-19.75%	3	-19.55%	3.32%	34	-22.79%
Tactical allocation	Allocation	50	33.0	28.4	0.04%	0.04%	-13.73%	1	-16.05%		3	-13.87%
World allocation	Allocation	50	89.6	74.9	0.12%	0.11%	-16.33%	14	-17.03%	5.13%	16	-17.47%
Large blend	US equity	100	10896.3	8809.0	14.53%	13.48%	-19.16%	71	-21.28%	4.56%	90	-20.92%
Large growth	US equity	100	5608.6	4730.1	7.48%	7.24%	-15.66%	97	-14.50%	5.41%	110	-15.48%
Large value	US equity	100	4223.5	3083.4	5.63%	4.72%	-26.99%	88	-26.57%	4.33%	103	-26.77%
Mid-cap blend	US equity	100	2106.1	1508.9	2.81%	2.31%	-28.36%	36	-27.85%	3.36%	43	-28.28%
Mid-cap growth	US equity	100	1428.6	1113.3	1.91%	1.70%	-22.07%	83	-19.92%	4.08%	92	-20.64%
Mid-cap value	US equity	100	960.1	666.1	1.28%	1.02%	-30.62%	56	-31.98%	4.63%	58	-32.53%
Small blend	US equity	100	3505.4	3363.9	4.67%	5.15%	-4.04%	65	-32.13%	3.18%	78	-32.37%
Small growth	US equity	100	1500.5	1150.8	2.00%	1.76%	-23.31%	92	-23.81%	4.03%	95	-24.59%
Small value	US equity	100	1063.4	659.2	1.42%	1.01%	-38.01%	59	-36.83%	4.39%	62	-36.89%
Diversified emerging markets	Intl equity	100	728.3	537.5	0.97%	0.82%	-26.20%	52	-24.83%	2.83%	53	-25.26%
Diversified Pacific/Asia	Intl equity	100	6.9	5.8	0.01%	0.01%	-16.42%	2	-19.99%	1.25%	2	-20.77%
Europe stock	Intl equity	100	0.1	0.0	0.00%	0.00%	-28.94%	1	-25.69%		1	-24.77%
Foreign large blend	Intl equity	100	2580.2	1957.5	3.44%	3.00%	-24.13%	52	-23.97%	3.94%	63	-23.39%
Foreign large growth	Intl equity	100	2039.9	1578.1	2.72%	2.42%	-22.64%	40	-18.87%	3.06%	44	-19.08%
Foreign large value	Intl equity	100	325.6	226.0	0.43%	0.35%	-30.60%	21	-28.72%	2.70%	22	-27.33%
Foreign small/mid blend	Intl equity	100	121.5	86.8	0.16%	0.13%	-28.56%	13	-30.19%	3.72%	13	-28.31%
Foreign small/mid growth	Intl equity	100	132.0	98.3	0.18%	0.15%	-25.52%	18	-24.14%	3.00%	19	-24.39%
Foreign small/mid value	Intl equity	100	21.2	14.0	0.03%	0.02%	-33.98%	3	-33.38%	1.32%	3	-30.40%
World large stock	Intl equity	100	454.8	352.9	0.61%	0.54%	-22.39%	30	-21.63%	5.11%	32	-21.05%
World small/mid stock	Intl equity	100	22.1	15.4	0.03%	0.02%	-30.46%	5	-23.00%	1.53%	5	-26.22%

Communications	Sector	100	0.1	0.0	0.00%	0.00%	-34.35%	1	-18.62%		1	-17.59%
Consumer cyclical	Sector	100	0.2	0.1	0.00%	0.00%	-32.59%	1	-23.07%		1	-26.33%
Consumer defensive	Sector	100	0.3	0.0	0.00%	0.00%	-90.53%	1	-14.11%		1	-17.30%
Energy limited partnership	Sector	100	1.1	0.7	0.00%	0.00%	-38.24%	1	-49.32%		1	-50.29%
Equity energy	Sector	100	2.2	1.3	0.00%	0.00%	-41.87%	5	-45.00%	9.07%	5	-53.36%
Equity precious metals	Sector	100	0.9	0.6	0.00%	0.00%	-37.25%	2	-14.80%	6.04%	2	-25.96%
Financial	Sector	100	82.1	84.6	0.11%	0.13%	3.08%	1	-34.99%		2	-34.67%
Global real estate	Sector	100	129.9	88.5	0.17%	0.14%	-31.89%	18	-27.12%	2.98%	18	-26.19%
Health	Sector	100	39.8	34.2	0.05%	0.05%	-13.94%	5	-12.01%	1.18%	5	-13.94%
Industrials	Sector	100	0.6	0.4	0.00%	0.00%	-30.45%	2	-28.26%	0.54%	2	-28.47%
Infrastructure	Sector	100	0.0	0.0	0.00%	0.00%	-18.00%	1	-22.77%		1	-21.41%
Natural resources	Sector	100	0.8	0.3	0.00%	0.00%	-58.57%	4	-35.79%	6.31%	4	-33.28%
Real estate	Sector	100	423.6	322.1	0.56%	0.49%	-23.97%	29	-24.12%	1.75%	32	-26.35%
Technology	Sector	100	92.8	82.3	0.12%	0.13%	-11.27%	13	-12.45%	4.17%	13	-14.39%
Utilities	Sector	100	1.8	1.4	0.00%	0.00%	-22.04%	3	-15.52%	1.93%	3	-15.51%
Long-short equity	Alternative	60	12.5	9.7	0.02%	0.01%	-21.78%	6	-17.87%	3.88%	6	-12.40%
Managed futures	Alternative	50	1.3	1.6	0.00%	0.00%	20.36%	3	-1.31%	9.18%	3	0.03%
Market neutral	Alternative	50	0.7	0.7	0.00%	0.00%	-1.00%	1	-2.39%		1	-4.07%
Multialternative	Alternative	50	3.5	3.3	0.00%	0.00%	-7.26%	5	-5.43%	5.15%	5	-9.71%
Options-based	Alternative	90	12.3	10.3	0.02%	0.02%	-16.26%	2	-7.46%	3.61%	2	-12.93%
Commodities broad basket	Commodities	20	47.9	34.0	0.06%	0.05%	-29.01%	9	-28.05%	6.20%	10	-24.72%
Commodities precious metals	Commodities	0	7.4	8.3	0.01%	0.01%	11.65%	3	-3.93%	16.45%	3	-3.93%
Bank loan	Taxable bond	0	17.5	14.5	0.02%	0.02%	-17.35%	4	-13.51%	2.02%	4	-12.45%
Corporate bond	Taxable bond	0	25.0	22.6	0.03%	0.03%	-9.82%	2	-3.26%	3.92%	2	-4.74%
Emerging markets bond	Taxable bond	0	13.4	10.7	0.02%	0.02%	-20.39%	9	-14.70%	2.40%	9	-14.59%
Emerging markets local-currency bond	Taxable bond	0	8.8	6.2	0.01%	0.01%	-30.35%	2	-17.39%	3.59%	2	-13.98%
High yield bond	Taxable bond	0	185.0	157.7	0.25%	0.24%	-14.77%	41	-13.62%	2.43%	41	-12.70%
Inflation-protected bond	Taxable bond	0	536.0	563.6	0.71%	0.86%	5.15%	24	0.55%	1.69%	28	-0.16%
Intermediate core bond	Taxable bond	0	2987.5	3252.6	3.98%	4.98%	8.88%	29	2.36%	1.46%	44	1.57%
Intermediate core-plus bond	Taxable bond	0	2406.5	2521.4	3.21%	3.86%	4.77%	49	-0.12%	2.26%	53	-1.10%
Intermediate government	Taxable bond	0	172.0	182.3	0.23%	0.28%	5.98%	28	5.41%	2.12%	28	4.23%
Long government	Taxable bond	0	1.0	2.7	0.00%	0.00%	171.43%	2	21.54%	0.99%	2	20.48%
Long-term bond	Taxable bond	0	7.1	8.4	0.01%	0.01%	17.67%	2	4.19%	3.01%	2	-0.63%
Multisector bond	Taxable bond	0	166.5	153.3	0.22%	0.23%	-7.93%	17	-9.74%	2.99%	17	-8.95%
Nontraditional bond	Taxable bond	0	46.5	41.6	0.06%	0.06%	-10.54%	14	-5.94%	1.84%	14	-7.55%
Preferred stock	Taxable bond	0	2.7	2.4	0.00%	0.00%	-10.63%	1	-13.51%		1	-17.90%
Short government	Taxable bond	0	159.0	176.9	0.21%	0.27%	11.22%	10	2.63%	1.10%	10	2.15%
Short-term bond	Taxable bond	0	366.3	406.4	0.49%	0.62%	10.96%	34	-2.10%	2.62%	34	-2.14%
Stable value	Taxable bond	0	3792.6	4580.9	5.06%	7.01%	20.78%	0			87	0.56%
Ultrashort bond	Taxable bond	0	11.9	11.6	0.02%	0.02%	-1.99%	3	-0.72%	1.25%	3	-1.76%
World bond	Taxable bond	0	60.9	62.0	0.08%	0.09%	1.83%	12	-7.75%	5.37%	13	-5.02%
World bond-USD hedged	Taxable bond	0	87.4	86.4	0.12%	0.13%	-1.22%	10	-1.89%	2.85%	10	-1.86%
Money market - taxable	Money market	0	845.4	1134.0	1.13%	1.74%	34.13%	7	0.31%	0.03%	25	0.25%
Prime money market	Money market	0	161.0	208.0	0.21%	0.32%	29.14%	4	0.37%	0.03%	5	0.28%
Company stock		100	3.0	2.4	0.00%	0.00%						
Loan fund		0	1063.7	1074.7	1.42%	1.64%						
Personal choice retirement account		0	0.0	84.4	0.00%	0.13%						
All Options		68.2	74,985.1	65,337.3	100.00%	100.00%		1,661	-18.47%	10.82%	2,391	-17.30%

Table OA2.

Likelihood of participant-directed portfolio changes.

This table reports the likelihood of participant-directed portfolio changes by participant type. Column (3) reports the likelihood of any change. For participants investing through a managed account, column (3) reports the fraction who stop using the managed account product during 2020Q1. For all other participants, column (3) reports the sum of the likelihoods in columns (4) through (7). Column (4) contains the fraction of participants who changed fund allocations and also added or removed funds. Column (5) contains the fraction of participants who changed fund allocations without adding or removing any funds. Column (6) contains the fraction of participants who added or removed funds without changing fund allocations. Column (7) contains the fraction of participants that neither added nor removed funds nor made any changes to their fund allocations, but for whom we infer a fund exchange.

Participant type	Sample size (1)	No change (2)	Any portfolio change (3)	Change in allocations and fund add/drop (4)	Change in allocations without fund add/drop (5)	Fund add/drop without changes in allocations (6)	Other imputed fund exchanges (7)
Defaulted into MA	43,282	98.72%	1.28%				
Opted into MA	21,909	98.27%	1.73%				
Pure TDF	265,841	97.90%	2.10%	1.01%	0.08%	1.00%	0.00%
Mixed TDF	42,655	77.28%	22.72%	1.87%	0.33%	13.41%	7.12%
Self-directed	243,689	84.49%	15.51%	5.11%	2.96%	5.00%	2.44%
Delegated	331,032	98.03%	1.97%	1.09%	0.07%	0.80%	0.00%
Mixed TDF and SD	286,344	83.42%	16.58%	4.63%	2.57%	6.25%	3.13%
All	617,376	91.26%	8.74%	2.73%	1.23%	3.33%	1.46%