Robo-Advising for Small Investors

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Introduction

Robo-Advising

- Robo-advisors provide financial advice based on automated procedures
- Increasing interest in the industry and in academia (Bianchi Brière 2021)
  - Automation improves financial decisions?
  - Automation promotes financial inclusion?
  - Robo-Human interactions

Why robots may help?

(in increasing order of wishfulness)

- Lower operating costs (minimal capital requirements, management fees), so possibly more inclusive (Bianchi Brière 2021)
- Accountable procedures (Philippon 2017)
- More information, different sources of information
  - Berg et al. (2019) on credit rating, Ant financial
- Real time highly tailored recommendation
  - "debiasing" is notoriously difficult (effects are short lived and even smaller for more vulnerable households, Fernandes et al. 2014)
  - need "local" interventions (occurring at the time of the choice and tailored to the specific situation/household)

Broader question: human-robo interactions

- Financial advice is special, trust is key
  - Money doctors (Gennaioli et al., 2015)
  - Possibly higher algo aversion for financial services (HSBC 2017, Merton 2017, Bianchi Brière 2021)

- Complementarity can be important
  - Is the robo intended to replace own judgment or human advice?
  - Or the robo can promote own judgment and more effective human advice?

This paper

- Robo-advisor introduced by a large French asset manager on Employee Savings Plans
- Take-up (algo aversion vs. need for advice, differences with human advice)
  - Small investors are attracted, large portfolio changes are accepted
- Effects on attention
  - Increased attention after take up (complementarity?)
- Effects on portfolio choices and returns (focus on dynamics)
  - Increased risk taking and risk-adjusted returns, reduced distance from target allocations
- Financial inclusion
  - Effects are larger on investors with smaller portfolios

Related Literature

- Growing literature on the effects of robo advising on portfolio choices (D'Acunto and Rossi 2020, Bianchi and Brière 2021)
  - D'Acunto et al. (2019) robo in an Indian brokerage house has a beneficial impact on less diversified investors but not on diversified investors
  - Rossi and Utkus (2019) robo takers increase investors' exposure to low-cost indexed mutual funds, improve diversification and risk-adjusted performance. Similar findings in Braeuer et al. (2017) and Loos, Previtero, Scheurle and Hackethal (2020), not in Reher and Sun (2016)
  - Reher and Sokolinski (2020) robo improves market participation of middle class investors

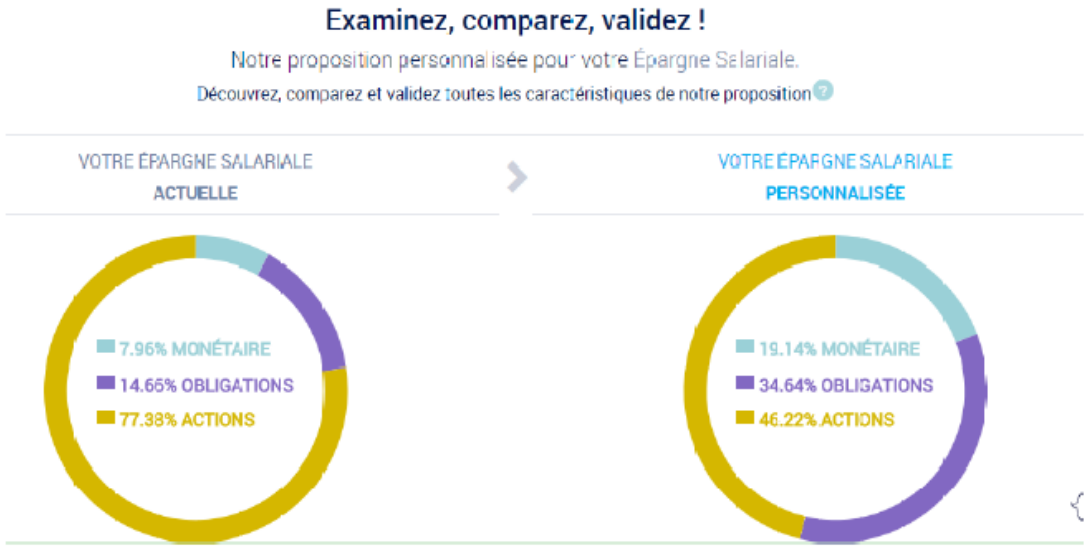
- Key distinctive features:
  - Sample includes investors with small portfolios, little experience and typically no access to financial advising
  - Exploit knowledge of the robo rules
  - Focus on portfolio choices over time

Data

Data

- Employee Savings Plans
  - Each year, employees receive a sum of money that they allocate between a menu of funds proposed by their employer
  - Investment is locked in either for 5 years or until retirement, employees can increase their investment and rebalance their portfolio over time as they wish
- Robo is proposed to employers from Sept 2017
- Robo treatment
  - Elicits information (risk-aversion, financial knowledge, horizon)
  - Proposes an allocation, and if accepted implements it


Quel épargnant êtes-vous ?
Vous avez un profil d'épargnant « Modéré » (résultat du questionnaire auquel vous avez répondu le 16/01/2018).
Continuez avec ce profil ou sélectionnez un profil moins risqué.
Prudent
Modéré
Équilibré
Dynamique
Audacieux
RETOUR
CONTINUER


Examinez, comparez, validez !
Notre proposition personnalisée pour votre Épargne Salariale.
Découvrez, comparez et validez toutes les caractéristiques de notre proposition
VOTRE ÉPARGNE SALARIALE
ACTUELLE
7.96% MONÉTAIRE
14.65% OBLIGATIONS
77.38% ACTIONS
VOTRE ÉPARGNE SALARIALE
PERSONNALISÉE
19.14% MONÉTAIRE
34.64% OBLIGATIONS
46.22% ACTIONS

Data

- Robo treatment
  - Elicits information (risk-aversion, financial knowledge, horizon)
  - Proposes an allocation, and if accepted implements it
  - Sends email alerts if current allocation is too far from proposed allocation
- Monthly data from Sept 2016 to November 2018
- Sample: all takers (14,576 - out of 1.2M exposed) and a random sample of 20,000 non takers, 20,000 non exposed, 20,000 curious
  - Account level data (portfolio choices, returns, risk) + digital footprints (connections) + robo data (profile, proposed allocation)

Basic Specification

- OLS:

$$y_{i,t} = \alpha_i + \beta T_{i,t} + X'_{i,t}\gamma + \mu_t + \varepsilon_{i,t}, \quad (1)$$

  - α_i and μ_t are individual and time fixed effects
  - $T_{i,t} = 1$ if individual i has taken the robo in period t
  - $X_{i,t}$ portfolio characteristics (past risky share, past returns, account value, ...)
  - standard errors are clustered at the individual level
  - control group are individuals not exposed to the robo (unless specified otherwise)

Take-up

Dep. Variable	Taker	Share	Taker		Equity Change	
Age	-0.000384***	5.85e-07	0.00310***	0.00361***	-0.00139***	-0.00235***
	(0.000145)	(0.000574)	(0.000456)	(0.000409)	(0.000308)	(0.000385)
Female	-0.0347***	-0.0141**	-0.0348***	-0.0342***	0.0117**	-0.0273***
	(0.00413)	(0.00558)	(0.0108)	(0.0108)	(0.00536)	(0.00562)
Account value (ln)	-0.00582*	-0.0358***	-0.0538***	-0.0572***	0.00134	0.0180***
	(0.00303)	(0.00554)	(0.00431)	(0.00441)	(0.00308)	(0.00328)
Long-term contract	-0.0240**	-0.114***	0.132***	0.138***	0.0117	0.0230
	(0.0106)	(0.0263)	(0.0179)	(0.0148)	(0.00963)	(0.0193)
Past risky share	0.000964	0.0874***	0.0198	0.0635	0.390***	-0.354***
	(0.0364)	(0.0272)	(0.0868)	(0.0844)	(0.0370)	(0.0334)
Variable remuneration	-5.43e-08	-3.29e-07	-2.66e-06	-3.65e-06**	2.70e-06**	2.57e-06*
	(8.65e-07)	(1.62e-06)	(1.66e-06)	(1.77e-06)	(1.23e-06)	(1.48e-06)
Past return	0.0576	0.741***	-0.158	-0.273	-0.624***	1.020***
	(0.223)	(0.232)	(0.439)	(0.415)	(0.239)	(0.301)
Connexions	0.0243***	-0.00121	0.00964***	0.0107***	-0.00590***	-0.00134
	(0.00402)	(0.00104)	(0.00210)	(0.00227)	(0.00205)	(0.00133)
Remuneration in t	0.0828***	0.00530	0.0245*	0.0205*	0.0165**	0.0162***
	(0.0152)	(0.0111)	(0.0125)	(0.0124)	(0.00788)	(0.00449)
Remuneration in t-1	0.145***	-0.00798	0.0293*	0.0243	0.0146**	0.0163*
	(0.0409)	(0.00686)	(0.0172)	(0.0153)	(0.00726)	(0.00856)
Robo equity distance			0.121***			
			(0.0247)			
Robo equity change				0.274***		
				(0.0340)		
Sample	Takers+Exp	Takers	Takers+Curious		Takers	Curious
Mean Dep. Var.	0.11	0.76	0.17	0.17	0.08	0.02
Observations	116,661	15,702	31,858	31,858	15,702	16,156
R-squared	0.086	0.077	0.042	0.062	0.136	0.155
Number of Clusters	1,823	745	927	927	745	719

Trust and Take-Up

- Robo attracts investors with smaller portfolio (possibly underserved by traditional advice)
- Investors are willing to accept robo allocations that are far away from their current allocation (differently than when interacting with human advisers)

Activities

Attention

Table: Investors' Attention

	(1)	(2)	(3)	(4)	(5)	(6)
Dep. Variable	Connexions		Minutes		Pages	
Robo treated*after	0.277***	0.278***	4.042***	4.717***	5.082***	5.869***
	(0.0205)	(0.0156)	(0.162)	(0.133)	(0.146)	(0.108)
Robo treated	0.761***		5.634***		5.671***	
	(0.0199)		(0.135)		(0.113)	
Fixed Effects	No	Yes	No	Yes	No	Yes
Observations	879,041	782,234	879,041	782,234	879,041	782,234
R-squared	0.048	0.021	0.046	0.029	0.080	0.059
Number of Clusters	34,441	34,441	34,441	34,441	34,441	34,441

NOTE: This table reports the results of OLS regressions. In columns 1-2, the dependent variable is the number of connections per month; in columns 3-4, the dependent variable is the number of minutes spent on the dedicated website per month; in columns 5-6, the dependent variable is the number of webpages visited per month. In columns 2,4,6 regressions include individual and time fixed effects. Controls include the average risky share and the average returns over the past 12 months, the account value in the previous month, the value of the yearly variable remuneration, a dummy if the variable remuneration was received in the current month and a dummy if the variable remuneration was received in the past month. Standard errors, clustered at the individual level, are in parenthesis. *, ** and *** denotes significance at 10%, 5% and 1% level, respectively.

Activities

Table: Trading Activities

	(1)	(2)	(3)	(4)	(5)	(6)
Dep. Variable	Changes	Robo	Individual	Contributions	Redemptions	Net inflows
Robo treated*after	0.272***	0.273***	0.00376**	0.00658***	-0.00157*	131.6***
	(0.00231)	(0.00137)	(0.00154)	(0.00160)	(0.000921)	(16.07)
Observations	782,234	782,234	782,234	782,234	782,421	782,234
R-squared	0.075	0.166	0.002	0.168	0.011	0.026
Number of Clusters	34,441	34,441	34,441	34,441	34,441	34,441

NOTE: This table reports the results of OLS regressions. In column 1, the dependent variable is the number of allocation changes per month; in columns 2-3, the dependent variable is the number of allocation changes induced by the robo and directly chosen by the individual, respectively; in column 4, the dependent variable is the number of personal contributions; in column 5, the dependent variable is the number of redemptions; in column 6, the dependent variable is the net monthly inflow in euros. All regressions include individual and time fixed effects. Controls include the average risky share and the average returns over the past 12 months, the account value in the previous month, the value of the yearly variable remuneration, a dummy if the variable remuneration was received in the current month and a dummy if the variable remuneration was received in the past month. Standard errors, clustered at the individual level, are in parenthesis. *, ** and *** denotes significance at 10%, 5% and 1% level, respectively.

Risk Taking

Table: Risk Taking

	(1)	(2)	(3)	(4)	(5)	(6)
Dep. Variable	Equity Sh.	Equity	Balanced	Employer	Bond	Money
Robo treated*after	0.0866***	0.0272***	0.228***	0.00234***	-0.155***	-0.0916***
	(0.00220)	(0.00183)	(0.00318)	(0.000721)	(0.00292)	(0.00250)
Observations	1,450,851	1,450,851	1,450,851	1,450,851	1,450,851	1,450,851
R-squared	0.069	0.010	0.199	0.005	0.118	0.058
N. of Clusters	34,398	34,398	34,398	34,398	34,398	34,398

NOTE: This table reports the results of OLS regressions at the saving account level. In column 1, the dependent variable is the equity share; in column 2, it is the portfolio weight in diversified equity funds; in column 3, it is the weight in balanced funds; in column 4, it is the weight in employer stock funds; in column 5, it is the weight in bond funds; in column 6, it is the weight in money market funds. All regressions include individual and time fixed effects. Controls include the average risky share and the average returns over the past 12 months, the account value in the previous month, the value of the yearly variable remuneration, a dummy if the variable remuneration was received in the current month and a dummy if the variable remuneration was received in the past month. Standard errors, clustered at the individual level, are in parenthesis. *, ** and *** denotes significance at 10%, 5% and 1% level, respectively.

Risk Taking (RDD)

	(1)	(2)	(3)	(4)	(5)
Dep. Variable	Equity Sh.		Average Equity Sh.		Past Equity Sh.
I(score>cutoff)	0.0514***	0.0506***	0.0593*	0.0353	0.00642
	(0.0158)	(0.0145)	(0.0330)	(0.0379)	(0.0197)
Score -cutoff	0.0313	0.0340	-0.0355	0.0739	0.00303
	(0.0417)	(0.0383)	(0.183)	(0.0968)	(0.0521)
Score -cutoff*I(score>cutoff)	-0.128***	-0.136***	-0.159	0.00626	0.00428
	(0.0451)	(0.0414)	(0.191)	(0.104)	(0.0564)
I(score>cutoff)*horizon	0.00546***	0.00587***	0.00554***	-0.00553***	-7.37e-05
	(0.000889)	(0.000817)	(0.00137)	(0.00204)	(0.00111)
Horizon	0.0462***	0.0466***	0.0491***	0.0139**	0.000547
	(0.00248)	(0.00228)	(0.00281)	(0.00590)	(0.00310)
Horizon2	-0.00137***	-0.00138***	-0.00149***	0.000337	0.000390
	(0.000209)	(0.000192)	(0.000223)	(0.000486)	(0.000262)
Horizon3	4.78e-06	5.30e-06	6.53e-06	-1.90e-05*	-1.20e-05*
	(4.91e-06)	(4.51e-06)	(5.23e-06)	(1.13e-05)	(6.15e-06)
Sample		Robo		Non-Robo	Robo
Observations	5,038	5,041	3,944	2,836	5,061
R-squared	0.488	0.540	0.535	0.079	0.398

NOTE: In column 4, the dependent variable is average equity share between time t and time t+1 in contracts held by individual i but not managed by the robo; in column 5, the dependent variable is the equity share at time t-1. In column 1,2,4 and 5 we estimate equation (5) with a bandwidth equal to 1; in column 3 we use a bandwidth equal to 0.5. All regressions include time fixed effects. Controls include the average risky share and the average returns over the past 12 months, the account value in the previous month, the value of the yearly variable remuneration, a dummy if the variable remuneration was received in the current month and a dummy if the variable remuneration was received in the past month.

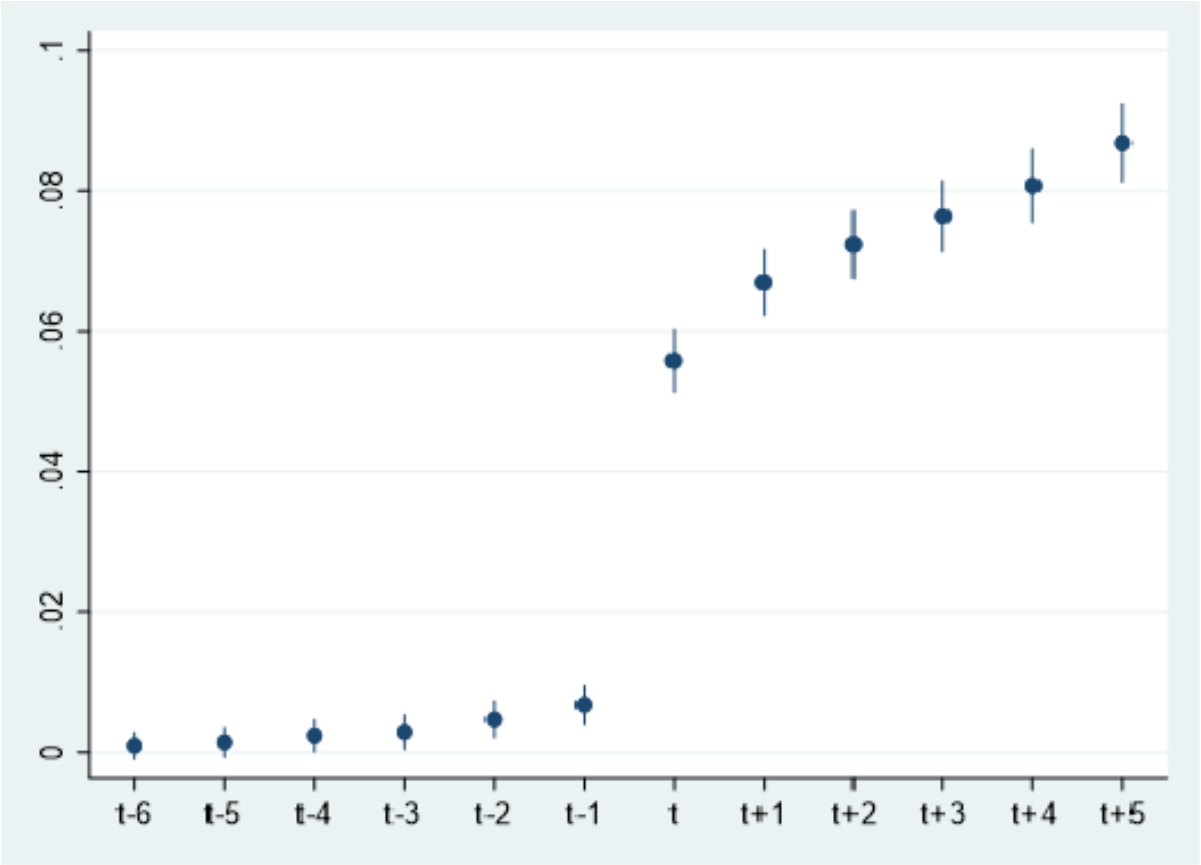
Attention, Activities and Risk Taking

- Robo is associated to an increased level of attention (investors do not take the robo as a substitute for their own attention)
  - 0.28 extra connections per month (average is 0.5)
  - True even beyond the time of its subscription and the time of reception of the variable remuneration
  - Increased attention at the reception of subsequent variable remunerations

- Robo is associated to more trading activities and to an increase in the investment in the plan
  - Net inflow increase by 102 euros (average is -39 euros)

- Robo induces higher risk taking (exposure to equity)
  - DiD: 8.6% increase in the equity share (relative to an average of 15.7%)
  - RDD: 5% in the equity share

Figure: Equity Exposure: Dynamics



NOTE: This figure displays how the changes in equity exposure differ between robo takers and non-takers, before and after the robo subscription. T-5/T-1 correspond to months before the treatment, T/T+5 correspond to months after the treatment. The points correspond to the estimated beta coefficients of equation (3), the bars correspond to 95% confidence intervals.

Alerts

JJ/MM/20AA

Alerte sur votre épargne personnalisée

Bonjour [champ Prénom] [champ Nom],

Dans le cadre du service « personnaliser mon épargne », nous vérifions tous les jours l'adéquation entre notre recommandation personnalisée, et la répartition de votre épargne [Nom dispositif].

Nous constatons aujourd'hui un décalage suite, par exemple à une opération (versement, remboursement, arbitrage), ou à une modification de l'environnement économique et financier.

Rendez-vous dans **votre espace personnel du site [nom du site]** pour mettre à jour votre épargne personnalisée.

Nous vous remercions pour la confiance que vous accordez à [redacted]

[redacted]

Votre correspondant
Service Clients

Rebalancing

- Robo service sends alerts to investors when current allocation is far from the target (defined at the time of subscription or latest profiling).
- How do investors respond to those alerts?
  - Are alerts effective to get investors stay closer to the target? (typical problem for less sophisticated investors, Bianchi 2018)
  - Indirect evidence on whether trust in the robo persists after having experienced the service, and after relatively large shocks
- Analysis
  - DiD on robo takers vs. robo curious (for whom we can construct counterfactual alerts)
  - RDD on robo takers exploiting the alert discontinuity around the x threshold

Rebalancing

	(1)	(2)	(3)	(4)	(5)	(6)
Dep. Variable	Change in Distance Actual - Target Equity Share					Distance
Robo treated*after*alert	-0.0489***	-0.0693***	-0.0492***			
	(0.00300)	(0.00544)	(0.00430)			
Robo treated*after	0.0203***	0.0176*	0.0249***			
	(0.00368)	(0.0103)	(0.00482)			
Alert	0.00989***	0.0326***	0.0147***	-0.0346***		
	(0.00239)	(0.00421)	(0.00375)	(0.00182)		
Alert MIF					-0.00731*	
					(0.00408)	
I(distance>cutoff)						-0.0127**
						(0.00527)
Distance (SRRI)						0.474***
						(0.0487)
Distance*I(dist>cutoff)						-0.407***
						(0.0862)
Sample		Robo takers+curious			Robo takers	
		Actual>Target	Actual<Target			
Observations	139,598	59,097	64,204	82,330	70,610	4,326
R-squared	0.031	0.063	0.026	0.039	0.017	0.332
Number of Clusters	25,337	14,386	17,736	15,262	14,979	

NOTE: In columns 1-5, t is first the month at which the distance between those allocations exceeds the alert. In column 6, the sample is restricted to observations in which the distance based on SRRI does not exceed 0.1.

Rebalancing

- Alert induces robo takers to decrease their distance by 4.8% more than robo curious
  - Conditionally on being alerted, the average distance is 11.6% and the average change in the distance is -2.3%.
  - Investors are more likely to follow the robo when this prescribes a reduction than when it prescribes an increase in the exposure to equity
  - Effect of the MIF alert is very small (placebo)

- Ending up just above the alert threshold induces a 1.27% decreases the distance

Returns

Returns

Table: Returns

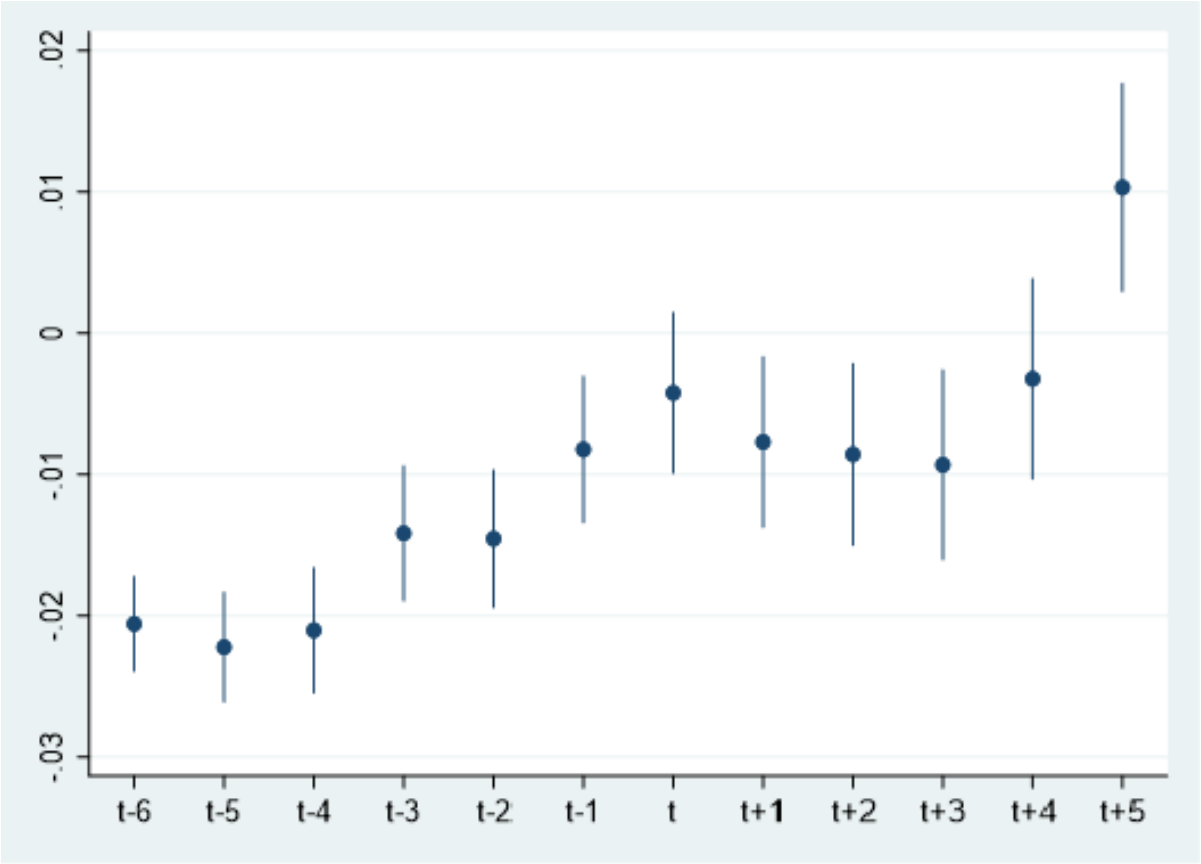
	(1)	(2)	(3)	(4)	(5)	(6)
Dep. Variable		Annual return			Return Diff (t)	Return Diff (t-1)
Robo treated*after	0.0539***	0.0471***	0.0306***	0.0423***	-0.000406	0.0101***
	(0.00160)	(0.00168)	(0.00117)	(0.00150)	(0.000603)	(0.00103)
Average equity share (t-12 - t-1)		0.102***				
		0.00610				
Volatility			1.171***		0.182***	0.660***
			(0.0249)		(0.0316)	(0.0552)
Beta				0.0299***		
				(0.00268)		
Observations	1,362,797	1,362,797	1,362,797	776,564	1,362,797	1,362,797
R-squared	0.104	0.105	0.479	0.190	0.056	0.309
Number of Clusters	34,241	34,241	34,241	32,485	34,241	34,241

NOTE: This table reports the results of OLS regressions. In columns 1-4, the dependent variable is the annual returns at the saving vehicle level. In column 5, the dependent variable is the difference between the returns experienced by the investor and the counterfactual returns she would have earned had she kept the same portfolio as the one at the subscription of the robo (for robo takers) or at the first reception of the variable remuneration (for non-takers). In column 6, the dependent variable is the difference between the returns experienced by the investor and the counterfactual returns she would have earned had she kept the same portfolio as the one just before the subscription of the robo (for robo takers) or just before the first reception of the variable remuneration (for non-takers). All regressions include individual and time fixed effects. Controls include the account value in the previous month, the value of the yearly variable remuneration, a dummy if the variable remuneration was received in the current month and a dummy if the variable remuneration was received in the past month. Standard errors, clustered at the individual level, are in parenthesis. *, ** and *** denotes significance at 10%, 5% and 1% level, respectively.

Returns

- Robo is associated to an increase in returns by 5.4% per year (average return is 6.7%).
  - Controlling for risk, increase between 3% and 4%
  - Robo fees are about 0.04%
- Controlling for volatility, static effect of robo taking accounts for a 1% increase, remaining 2% is due to different rebalancing

Figure: Risk-Adjusted Returns: Dynamics



NOTE: This figure displays how the changes in returns adjusted for volatility differ between robo takers and non-takers, before and after the robo subscription. T-5/T-1 correspond to months before the treatment, T/T+5 correspond to months after the treatment. The points correspond to the estimated beta coefficients of equation (3), the bars correspond to 95% confidence intervals.

Inclusion

Financial Inclusion

	(1)	(2)	(3)	(4)	(5)	(6)
Dep. Variable		Equity Exposure			Annual return	
Robotreat*after*D<q25	0.133***	0.0557***	0.195***	0.0472***	0.0384***	0.0578***
	(0.00348)	(0.00751)	(0.00301)	(0.00153)	(0.00261)	(0.00148)
Robotreat*after*D(q25,q50)	0.0789***	0.127***	0.137***	0.0226***	0.0457***	0.0535***
	(0.00407)	(0.00316)	(0.00440)	(0.00185)	(0.00147)	(0.00132)
Robotreat*after*D(q50,q75)	0.0557***	0.0620***	0.0996***	0.0252***	0.0153***	0.0168***
	(0.00492)	(0.00439)	(0.00341)	(0.00215)	(0.00204)	(0.00197)
Robotreat*after*D>=q75	0.0270***	0.0480***	-0.0560***	0.0144***	0.0141***	-0.0512***
	(0.00600)	(0.00485)	(0.00502)	(0.00270)	(0.00225)	(0.00372)
Volatility				1.172***	1.171***	1.171***
				(0.0248)	(0.0249)	(0.0249)
D Variable	Assets	Remun	Risk	Assets	Remun	Return
Observations	1,450,851	1,450,851	1,450,851	1,365,421	1,365,421	1,365,421
R-squared	0.082	0.080	0.144	0.479	0.479	0.481
Number of Clusters	34,398	34,398	34,398	34,241	34,241	34,241

NOTE: This table reports the results of OLS regressions. In columns 1-3, the dependent variable is the equity share; in columns 4-6, the dependents variable is the annual return. The estimated coefficients refer to the interaction between the robo treatment and investor's quartile based on portfolio size, value of the variable remuneration, equity share, and returns. Quartiles are determined based on the average values observed before the first robo introduction (August 2017). All regressions include individual and time fixed effects. Controls include the account value in the previous month, the value of the yearly variable remuneration, a dummy if the variable remuneration was received in the current month and a dummy if the variable remuneration was received in the past month. Standard errors, clustered at the individual level, are in parenthesis. *, ** and *** denotes significance at 10%, 5% and 1% level, respectively.

Financial Inclusion

- Increase in equity exposure associated to the robo is larger for investors with smaller portfolio and smaller variable remuneration and lower baseline risk exposure
- Increase in returns associated to the robo is larger for smaller investors (portfolio and remuneration value) and lower baseline returns
- Robo induces larger changes on smaller investors, those less likely to receive traditional advice and to participate to the stock market
  - Robo service can be an important instrument towards financial inclusion

Discussion

Discussion

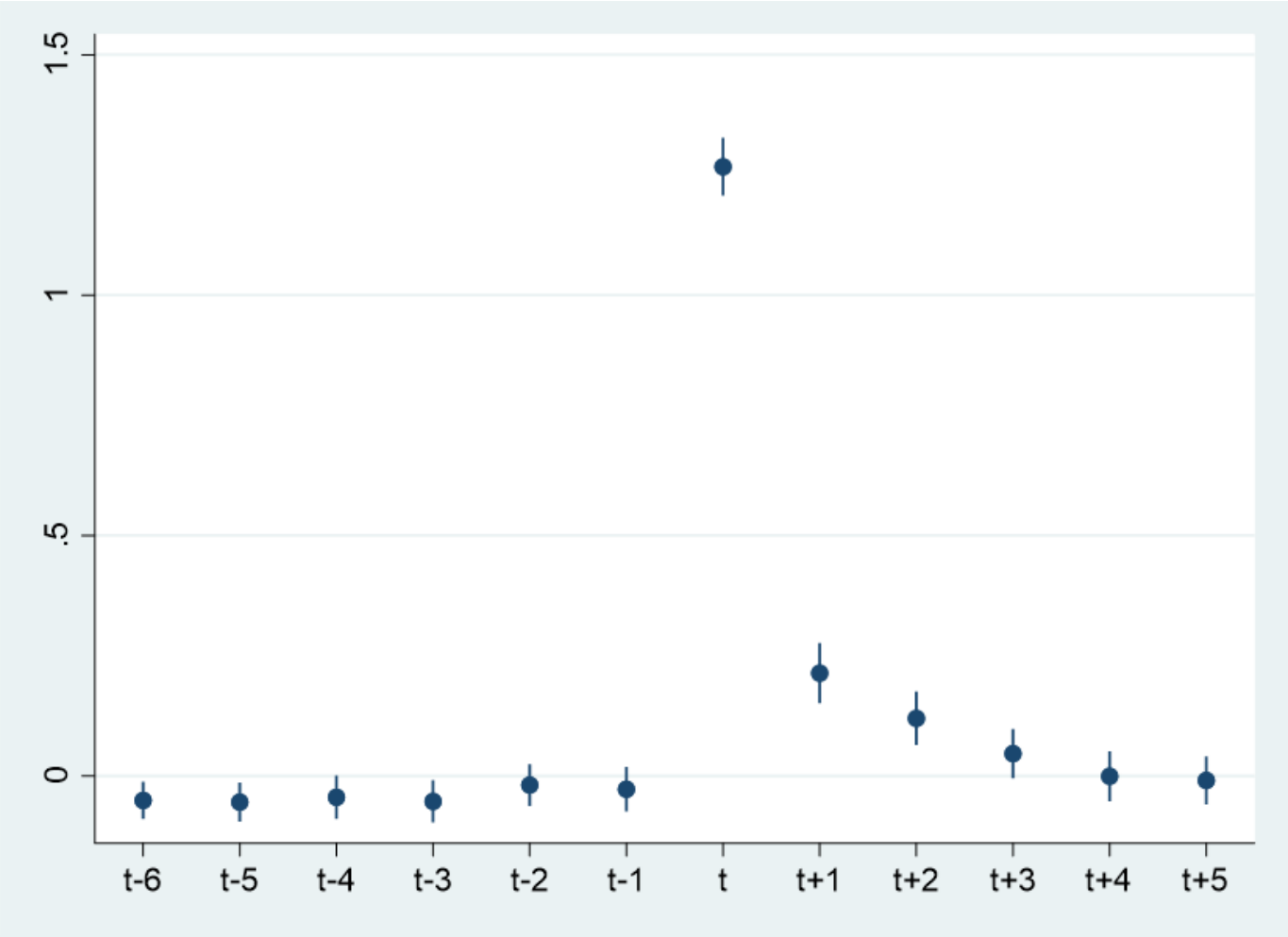
- Robo is able to reach investors with smaller portfolios and induce significant allocation changes
- Increased attention, risk taking, and risk-adjusted returns
- Importance of portfolio dynamics

- Open questions
  - Mechanisms of increased trust? Human/robo vs. human/human interactions? (Bianchi Brière 2021)
  - Long term effects? Effects in bad times? (Bianchi Brière ...)

Thank you.

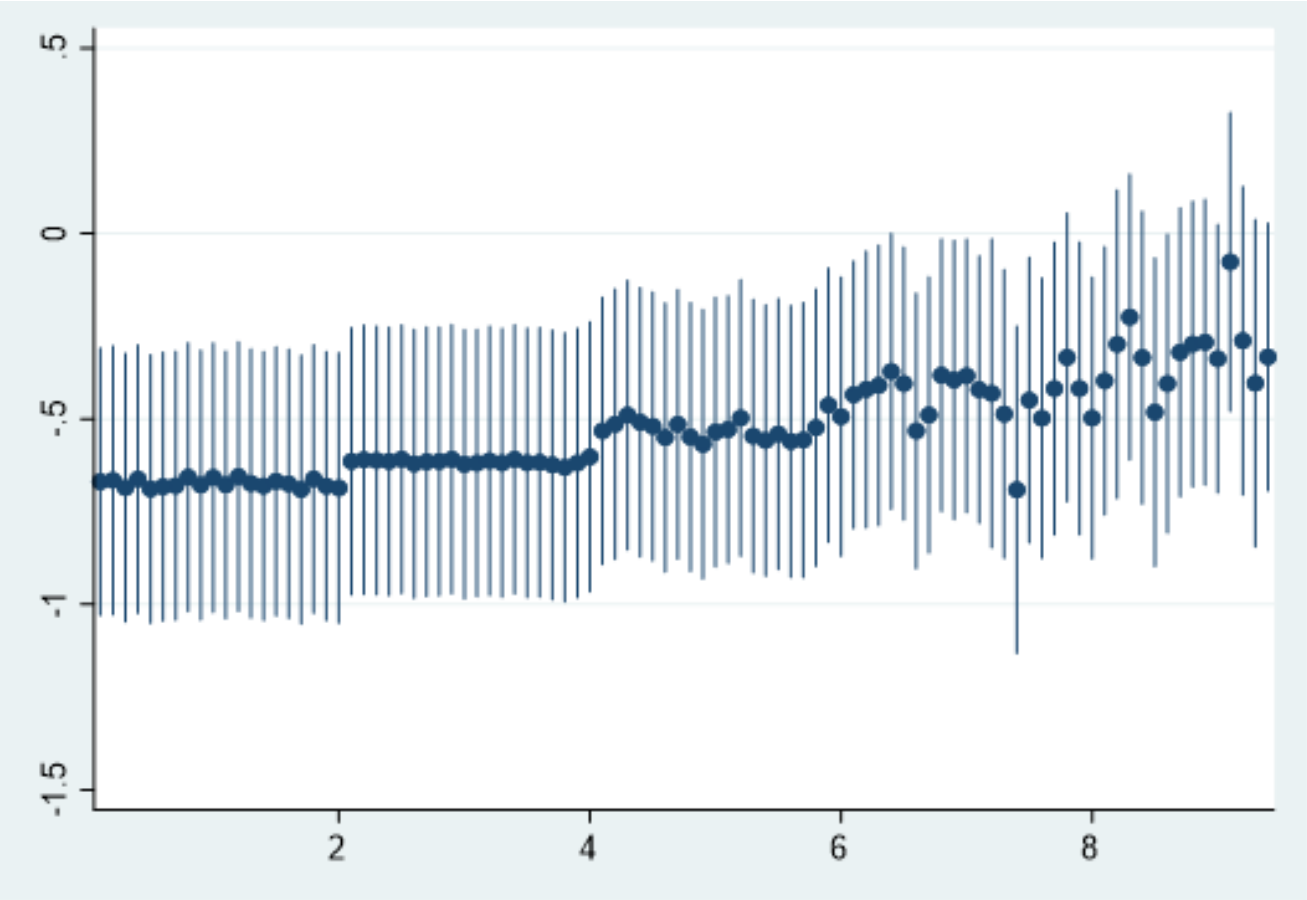
Appendix

Figure: Investors' Attention: Dynamics



NOTE: This figure displays how the changes in the number of connections to the platform differ between robo takers and non-takers, before and after the robo subscription. T-5/T-1 correspond to months before the treatment, T/T+5 correspond to months after the treatment. The points correspond to the estimated beta coefficients of equation (3), the bars correspond to 95% confidence intervals.

Figure: Investor Score and Equity Share



NOTE: This figure plots investors' equity share as a function of the risk score assigned by the robo, controlling for investors' horizon. The points correspond to the estimated beta coefficients of equation (6), the bars correspond to 95% confidence intervals.

Descriptive Statistics

Variable	p5	mean	p95	sd	N
Panel A: Individual characteristics					
Age	29	48.4828	67	11.7225	2,263,612
Female	0	0.3053	1	0.4606	2,255,803
Saving plan value	0	7,654	36,569	27,065	2,263,612
Total account value	48.73	36,140	148,381	74,763	2,263,612
Nb of saving vehicles	1	4.4334	11	3.4352	2,263,612
Nb of LT saving vehicles	0	1.3051	4	1.4359	2,263,612
Nb of ST saving vehicles	1	3.1282	8	2.5580	2,263,612
Panel B: Attention					
Number of connexions per month	0	0.4926	2	2.4692	2,263,612
Number of web pages viewed per month	0	4.0528	24	17.3932	2,263,612
Number of min spent on website per month	0	3.8180	22.3833	21.2251	2,263,612
Panel C: Asset allocation					
Risky share	0	0.7052	1	0.3334	2,173,345
Risky share wo employer stock	0	0.5491	1	0.3651	1,926,082
Equity exposure	0	0.1568	0.5708	0.2020	2,173,345
Weight in diversified equity funds	0	0.0922	0.4584	0.1703	2,173,345
Weight in balanced funds	0	0.2029	0.8612	0.2838	2,173,345
Weight in employer stock funds	0	0.3439	1	0.3901	2,173,345
Weight in guarantee funds	0	0.0483	0.3727	0.1554	2,173,345
Weight in other funds	0	0.0179	0.0852	0.0902	2,173,345
Weight in bond funds	0	0.1616	0.9185	0.2701	2,173,345
Weight in money market funds	0	0.1120	0.7404	0.2373	2,173,345
Weight in blocked cash funds	0	0.0212	0.1196	0.0977	2,173,345

Descriptive Statistics

Variable	p5	mean	p95	sd	N
Panel D: Transactions					
Monthly contribution (Euros)	0	266.2853	1103.95	1334.23	2,263,612
Monthly personal contribution (Euros)	0	68.2276	200	631.05	2,263,612
Monthly redemption (Euros)	0	305.5624	4.99	4856.52	2,263,612
Net monthly inflow (Euros)	0	-39.2772	1038.89	5008.97	2,263,612
Net monthly voluntary inflow (Euros)	0	-237.3349	192.17	4887.17	2,263,612
Personal contributions	0	0.1822	1	0.4668	2,263,612
Asset allocation changes	0	0.1939	1	0.5455	2,263,612
Asset allocation changes (robo)	0	0.0278	0	0.1939	2,263,612
Asset allocation changes (life-cycle funds)	0	0.1328	1	0.3627	2,263,612
Asset allocation changes (individual)	0	0.0329	0	0.3441	2,263,612
Number of redemptions	0	0.0322	0	0.2070	2,263,612
Panel E: Performances					
Ann. return	-0.0969	0.0662	0.3177	0.1768	2,040,570
Volatility	0.0005	0.0968	0.2579	0.1311	2,040,570
Ann. return (wo employer stock)	-0.0195	0.0315	0.1226	0.2045	1,580,493
Volatility (wo employer stock)	0	0.0406	0.1290	0.1721	1,580,493
Panel F: Robo interest					
Nb of saving vehicles with robo	0	0.5471	2	0.6971	2,263,612
Nb of LT saving vehicles with robo	0	0.1998	1	0.4004	2,263,612
Nb of ST saving vehicles with robo	0	0.3473	1	0.4767	2,263,612
Robo treated (in a given saving vehicle)	0	0.1811	1	0.3851	2,263,612

Table: Investors' Attention: Robustness

	(1)	(2)	(3)	(4)	(5)	(6)
Dep. Variable	Minutes	Pages		Connexions		
Robo treated*after	3.250***	4.041***	0.205***			0.0842***
	(0.127)	(0.102)	(0.0148)			(0.0154)
Remuneration months t-3 to t-1				0.187***	0.0583***	
				(0.0477)	(0.00625)	
Remuneration month t				0.757***	0.299***	
				(0.0568)	(0.0115)	
Remuneration months t+1 to t+3				0.0313	0.00514	
				(0.0263)	(0.00717)	
Observations	637,029	637,029	637,029	71,285	682,680	627,071
R-squared	0.010	0.023	0.008	0.031	0.012	0.006
Number of Clusters	33,019	33,019	33,019	13,098	34,409	33,018

NOTE: This table reports the results of OLS regressions. In column 1, the dependent variable is the number of minutes spent on the dedicated website per month; in column 2; the dependent variable is the number of webpages visited per month; in columns 3-6, the dependent variable is the number of connections per month. In column 1-3, we exclude the month before and the month at which the individual has received the variable remuneration. In columns 4-5, time t corresponds to the reception of the remuneration, conditional on the fact that this occurs at least two months after the subscription of the robo. In column 4, the sample is restricted to robo treated; in column 5, the sample is restricted to non- treated investors. In column 6, the sample excludes the two months around the robo subscription and the month of the reception of the remuneration. All regressions include individual and time fixed effects. Controls include the average risky share and the average returns over the past 12 months, the account value in the previous month, the value of the yearly variable remuneration. Standard errors, clustered at the individual level, are in parenthesis. *, ** and *** denotes significance at 10%, 5% and 1% level, respectively.

Table: Risk Taking (individual level)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Dep. Variable	Risky Sh.	Equity	Balanced	Employer	Bond	Money	Equity Sh.
Robo treated*after	0.191***	0.0199***	0.181***	-0.00453***	-0.134***	-0.0505***	0.0729***
	(0.00297)	(0.00142)	(0.00273)	(0.00105)	(0.00267)	(0.00194)	(0.00179)
Observations	777,832	777,832	777,832	777,832	777,832	777,832	777,832
R-squared	0.185	0.013	0.182	0.013	0.117	0.036	0.080
N. of Clusters	34,408	34,408	34,408	34,408	34,408	34,408	34,408

NOTE: This table reports the results of OLS regressions at the individual level. In column 1, the dependent variable is the risky share; in column 2, it is the portfolio weight in diversified equity funds; in column 3, it is the weight in balanced funds; in column 4, it is the weight in employer stock funds; in column 5, it is the weight in bond funds; in column 6, it is the weight in money market funds; in column 7, it is the equity weight. All regressions include individual and time fixed effects. Controls include the average risky share and the average returns over the past 12 months, the account value in the previous month, the value of the yearly variable remuneration, a dummy if the variable remuneration was received in the current month and a dummy if the variable remuneration was received in the past month. Standard errors, clustered at the individual level, are in parenthesis. *, ** and *** denotes significance at 10%, 5% and 1% level, respectively.

Attention and Market

	(1)	(2)	(3)	(4)	(5)	(6)
Dep. Variable	Number of connexions per month					
Market return	0.0871***	-0.0343***				
	(0.00801)	(0.00239)				
Robo treated*after*market return		0.0810**				
		(0.0319)				
Robo treated*market return		0.399***				
		(0.0204)				
Return			0.0252***	-0.0183***		
			(0.00289)	(0.00146)		
Robo treated*after*return				0.0615***		
				(0.0166)		
Robo treated*return				0.102***		
				(0.00916)		
Market volatility					-0.0322	1.005***
					(0.288)	(0.105)
Robo treated*after*market volatility						-25.86***
						(1.408)
Robo treated*market volatility						-8.076***
						(0.909)
Robo treated*after		0.271***		0.294***		2.011***
		(0.0156)		(0.0157)		(0.0905)
Observations	782,234	782,234	782,234	782,234	650,300	650,300
R-squared	0.016	0.019	0.019	0.022	0.017	0.024
Number of Clusters	34,441	34,441	34,441	34,441	34,104	34,104

Returns

Table: Returns

	(1)	(2)	(3)	(4)	(5)	(6)
Dep. Variable		Annual return			Return Diff (t)	Return Diff (t-1)
Robo treated*after	0.0539***	0.0471***	0.0306***	0.0423***	0.00320***	0.0232***
	(0.00160)	(0.00168)	(0.00117)	(0.00150)	(0.000485)	(0.000952)
Average equity share (t-12 - t-1)		0.102***				
		0.00610				
Volatility			1.171***			
			(0.0249)			
Beta				0.0299***		
				(0.00268)		
Observations	1,362,797	1,362,797	1,362,797	776,564	1,362,797	1,362,797
R-squared	0.104	0.105	0.479	0.190	0.005	0.019
Number of Clusters	34,241	34,241	34,241	32,485	34,241	34,241

NOTE: This table reports the results of OLS regressions. In columns 1-4, the dependent variable is the annual returns at the saving vehicle level. In column 5, the dependent variable is the difference between the returns experienced by the investor and the counterfactual returns she would have earned had she kept the same portfolio as the one at the subscription of the robo (for robo takers) or at the first reception of the variable remuneration (for non-takers). In column 6, the dependent variable is the difference between the returns experienced by the investor and the counterfactual returns she would have earned had she kept the same portfolio as the one just before the subscription of the robo (for robo takers) or just before the first reception of the variable remuneration (for non-takers). All regressions include individual and time fixed effects. Controls include the account value in the previous month, the value of the yearly variable remuneration, a dummy if the variable remuneration was received in the current month and a dummy if the variable remuneration was received in the past month. Standard errors, clustered at the individual level, are in parenthesis. *, ** and *** denotes significance at 10%, 5% and 1% level, respectively.