Beliefs About the Stock Market and Investment Choices: Evidence from a Field Experiment

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Motivation

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    Amromin and Sharpe (2013); De Bondt (1993); Dominitz and Manski (2011); Greenwood and Shleifer (2014); Heiss et al. (2019).
- **Little aggregate predictability** of the stock market based on recent returns according to theory and empirical evidence.

Research questions

- What is the role of the **perceived autocorrelation** of stock returns in retail investors' return expectations?
- How do investors' beliefs about the autocorrelation of stock returns **causally** affect their trading decisions?

This paper

- **Survey experiment** with retail investors at a German online brokerage (n≈2,000; Response rate ≈ 16%).
  - Main survey and **four-week follow-up**; re-contact rate ≈ **58%**.
  - Linked to **administrative data** on their investment decisions before and after intervention.

- We measure investors' beliefs about **time-series properties** of aggregate stock returns.

- We **inform** a **random subset** of respondents about the absence of predictive power of recently realized stock returns for future returns.

- We provide **correlational and causal** evidence on the role of the perceived autocorrelation of stock returns in expectation formation and trading decisions.

Related Literature

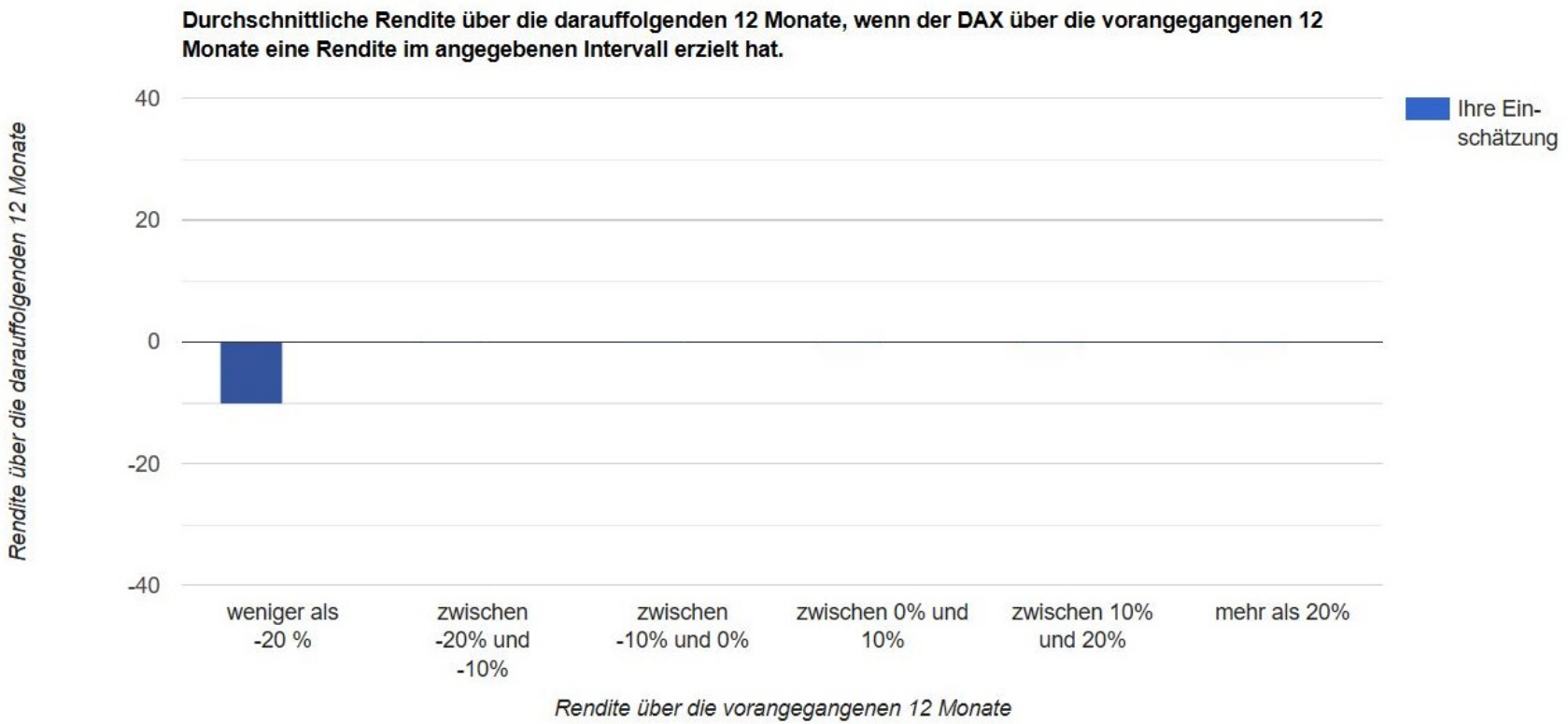
- Literature on formation of **subjective stock market expectations**
  Amromin and Sharpe (2013); Dominitz and Manski (2011); Greenwood and Shleifer (2014); Heiss et al. (2019)

- Literature on association between subjective return **expectations and investment behavior**
  Ameriks et al. (2019); Amromin and Sharpe (2013); Choi and Robertson (2020); Dominitz and Manski (2007); Giglio et al. (2019, 2020); Zimpelmann (2021)

- Literature using **information experiments** to study macroeconomic expectation formation
  Armantier et al. (2016); Armona et al. (2018); Cavallo et al. (2017); Coibion et al. (2020); Fuster et al. (2020); Roth and Wohlfart (2019)

Outline of talk

Elicitation of Prior Beliefs about Autocorrelation



Notes: The figure shows the survey screen for eliciting prior beliefs about dependency of stock market returns (all respondents). Participants were asked to provide their perception of the 12-month ahead stock market return if the return over the previous 12 months falls within the respective bin. Each bin is asked about on a separate screen. The figure collects and displays answers made on previous bins.

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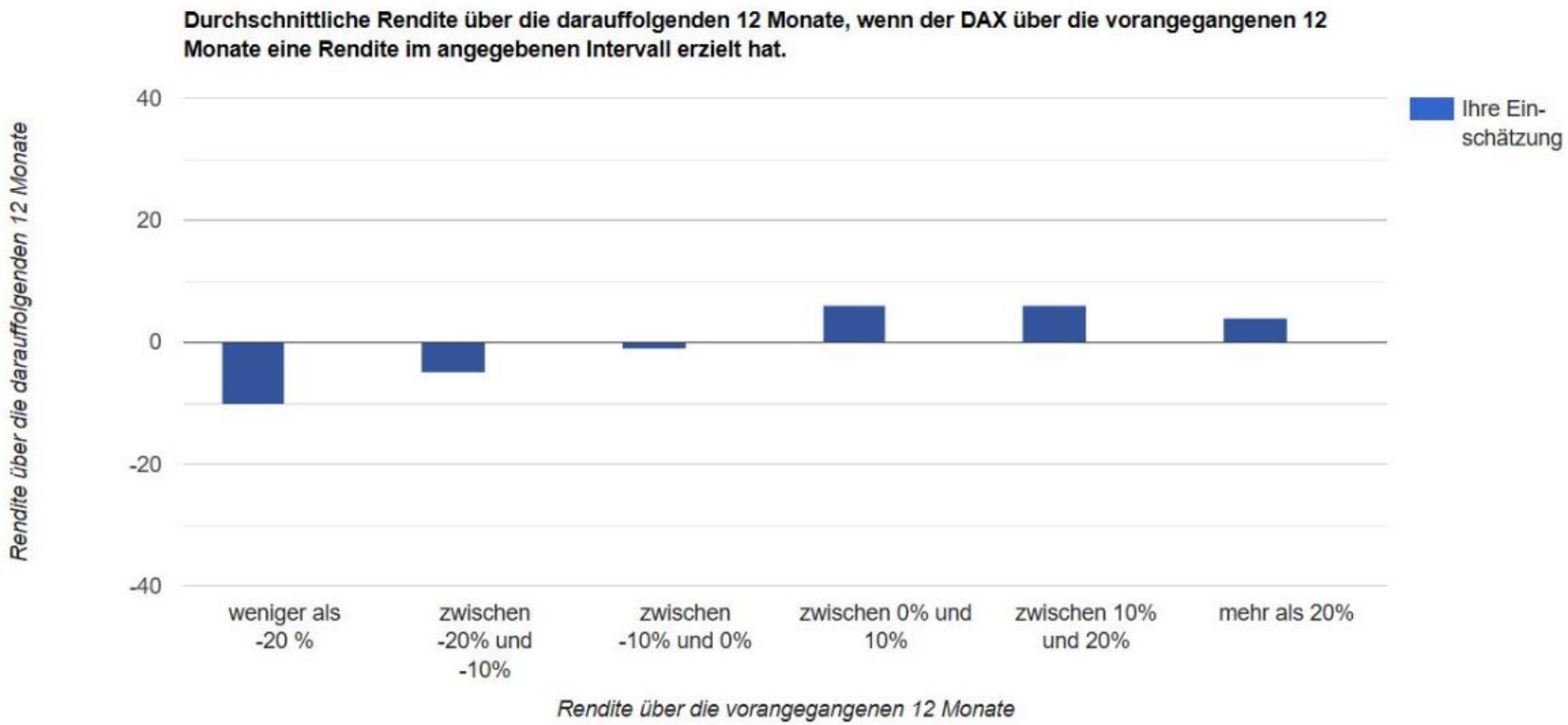

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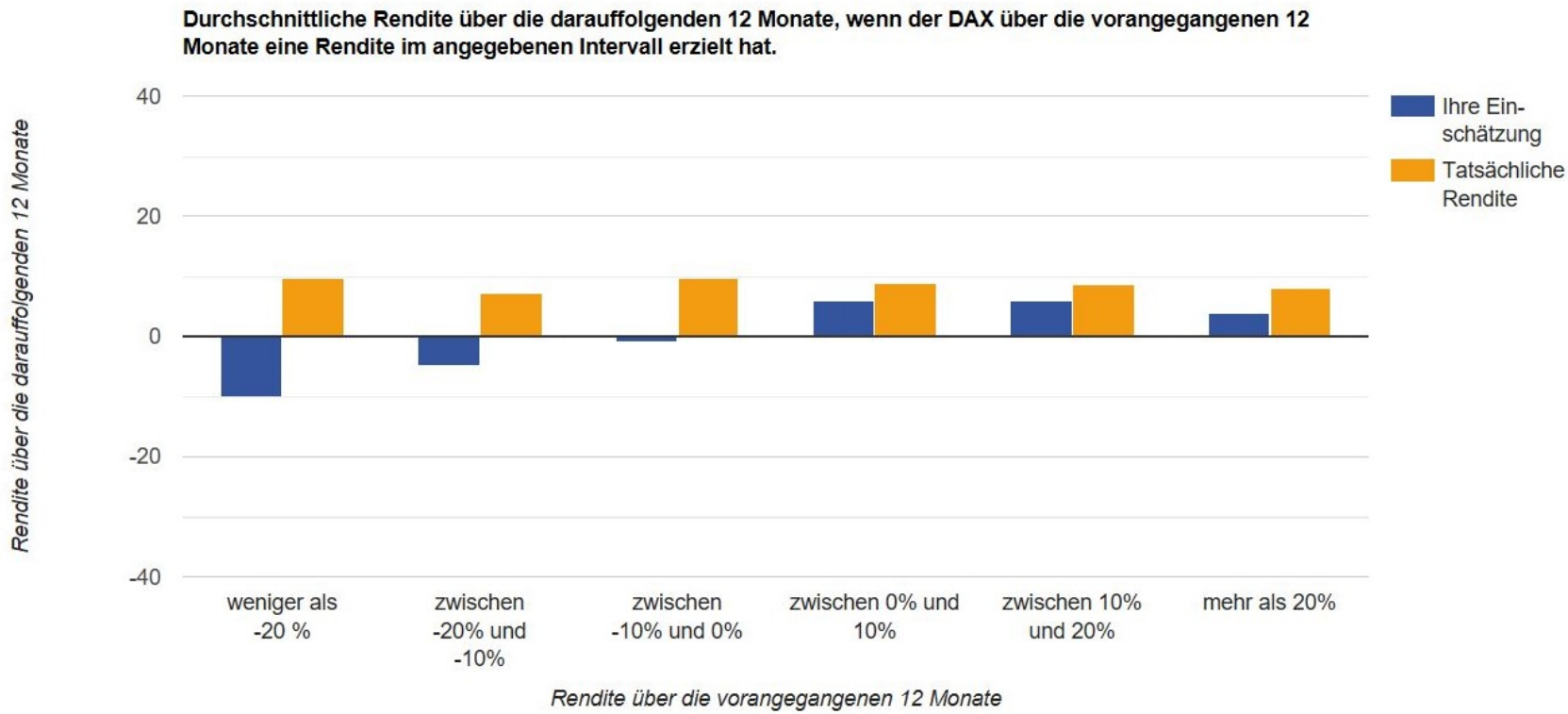
Information treatment

- Provision of actual average returns in the six scenarios to random half of the respondents. treatment text



Information treatment

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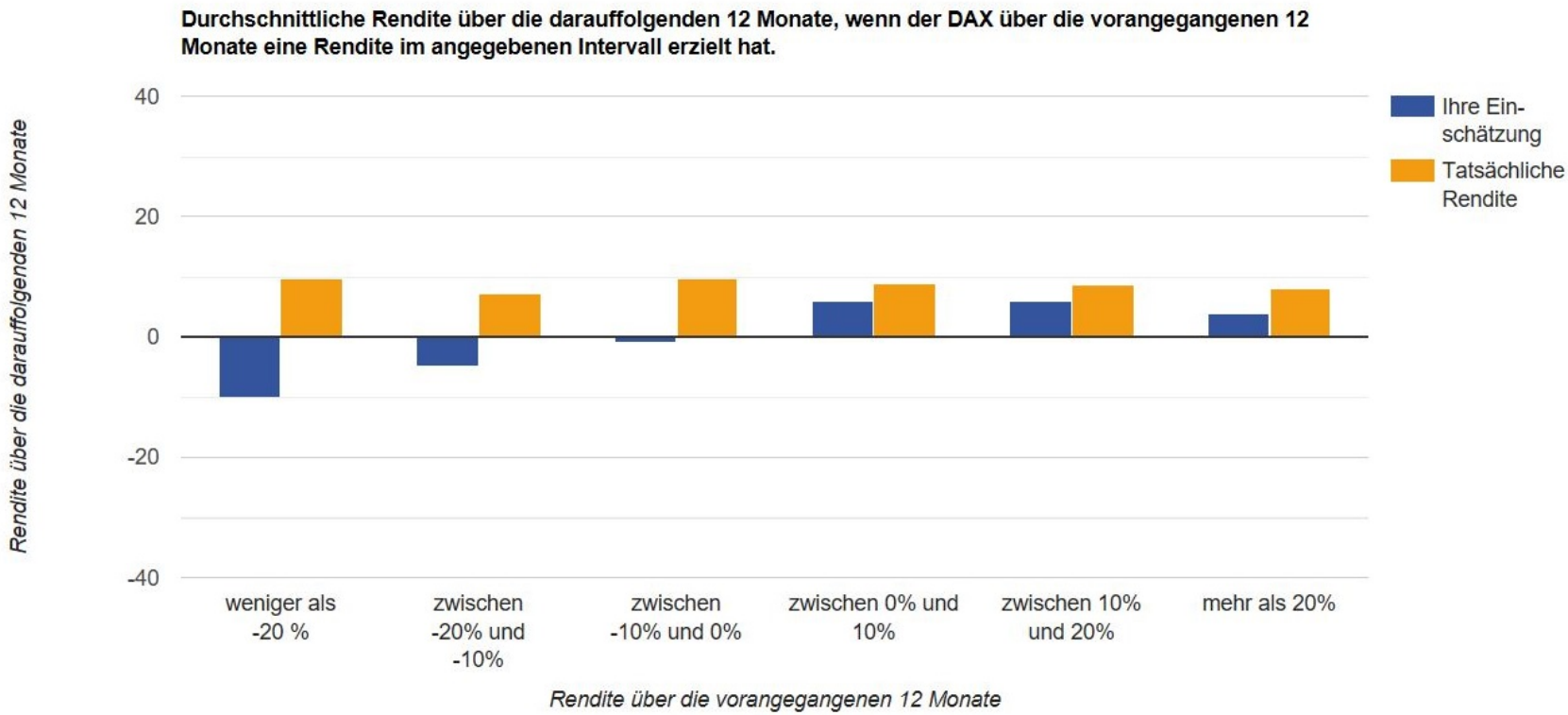
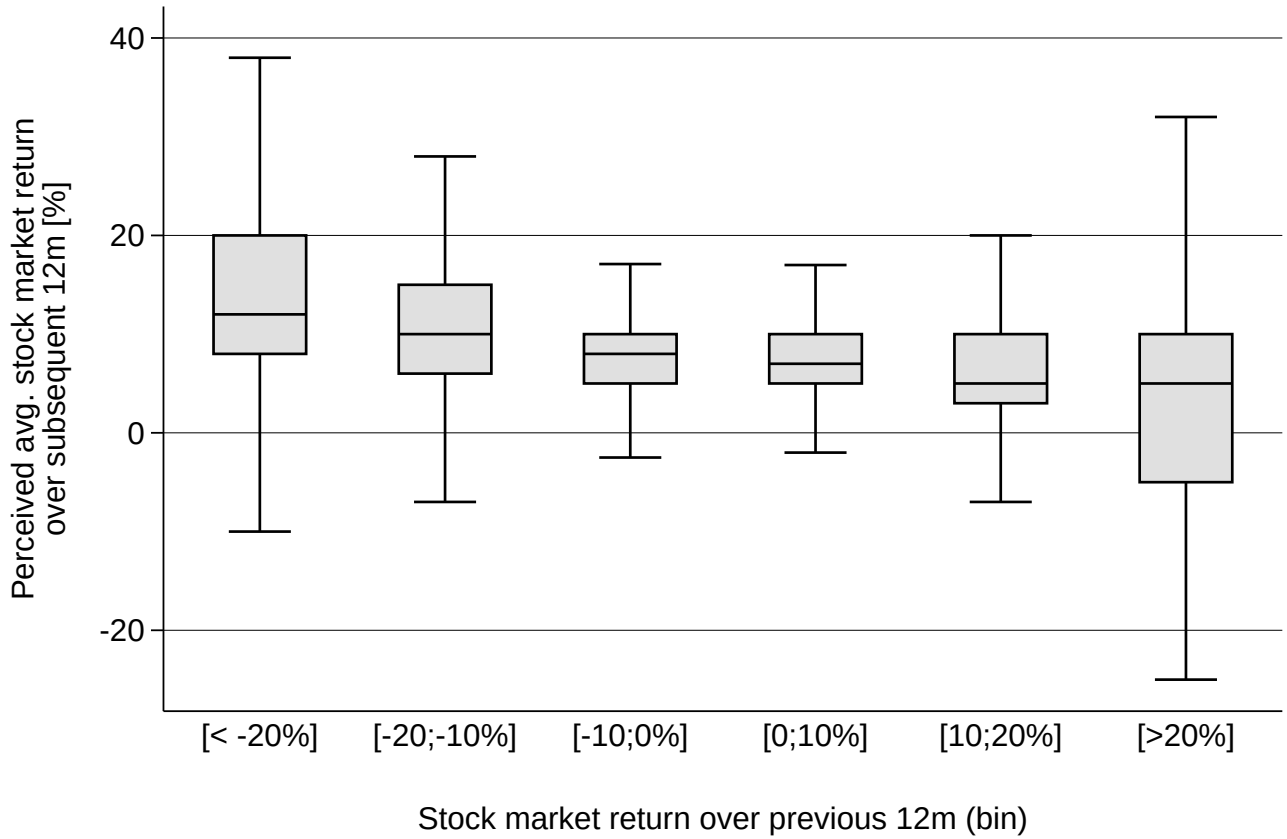


- Provision of overall average historical annual return on DAX to respondents in the control group ▸ control group

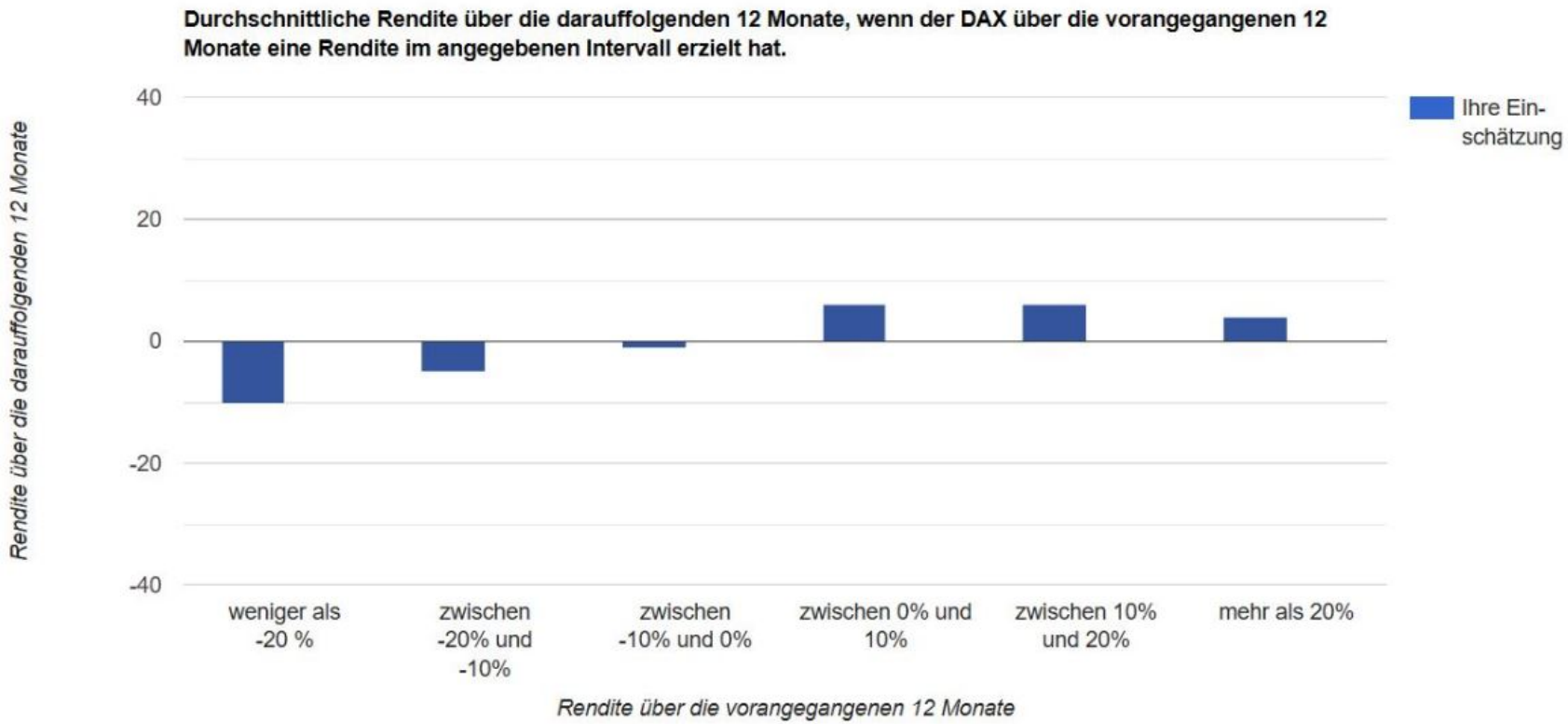
Outline of talk

Priors beliefs about autocorrelation of stock returns



Notes: The figure shows box plots of the perceived 12-month ahead stock market return if the return over the previous 12 months falls within the respective bin.

Definition of belief types



Define types based on prior perceived autocorrelation:
(robust to alternative definitions)

- **Extrapolator**: Perceived difference gain-loss ≥ 4
- **Neutral**: -4 $\leq$ diff. < 4
- **Mean-reverter**: Perceived difference gain-loss $<$ -4

Correlates of beliefs

	Extra-polator (diff. $\geq$ 4)	Neutral (-4 $\leq$ diff. $<$ 4)	Mean-reverter (diff. $<$ -4)
	(1)	(2)	(3)
Log(Fin. wealth with bank)	-0.008	-0.011	0.018***
	(0.005)	(0.007)	(0.007)
Invest. experience $\geq$ Median	-0.038*	-0.056**	0.094***
	(0.021)	(0.027)	(0.028)
Full financial literacy score	-0.022	-0.052**	0.074***
	(0.019)	(0.025)	(0.028)
Follow DAX $\geq$ Median	-0.004	-0.067***	0.070***
	(0.017)	(0.022)	(0.024)
Observations	1,961	1,961	1,961
R-squared	0.03	0.02	0.04

Notes: Robust standard errors are in parentheses. * denotes significance at 10 pct., ** at 5 pct., and *** at 1 pct. level.

Summary

Result 1:
A majority of investors believe in mean reversion (more prevalent among attentive, sophisticated, experienced and wealthy investors).

Perceived autocorrelation and trading

Do beliefs affect the timing of investors' trading decisions?

	Purchases			Sales			Net purchases
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Prob (buy)	# of purchases	Log buying volume	Prob (sell)	# of sales	Log selling volume	Net log buying
DAX down ×	-0.062***	-0.149**	-0.411***	-0.013	-0.025	-0.086	-0.325***
Extrapolator (diff. $\geq$ 4)	(0.014)	(0.056)	(0.098)	(0.011)	(0.018)	(0.087)	(0.114)
DAX down ×	-0.014	-0.040	-0.131	-0.001	-0.003	0.007	-0.138*
Neutral (-4 $\leq$ diff. $<$ 4)	(0.012)	(0.039)	(0.082)	(0.009)	(0.014)	(0.065)	(0.077)
R-squared	.463	.61	.319	.113	.12	.125	.241
Observations	51595	51595	51595	51595	51595	51595	51595
Investor FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: Robust standard errors are in parentheses. * denotes significance at 10 pct., ** at 5 pct., and *** at 1 pct. level.

Summary

Result 1:
A majority of investors believe in mean reversion (more prevalent among attentive, sophisticated, experienced and wealthy investors).

Result 2:
Mean reverters are more likely to buy equity in response to negative stock market returns compared to extrapolators

Manipulation checks

Did the treatment change respondents' beliefs about the autocorrelation of stock returns?

Agreement to the statements (after the intervention):

- *When the stock market has recently increased it makes no sense to buy stocks.*
- *When the stock market has recently increased it is more likely that stock returns will be positive over the following time than when the stock market has recently decreased.*

Manipulation checks

Did the treatment change respondents' beliefs about the autocorrelation of stock returns?

	No sense to buy after high return		Positive return more likely after high return	
	(1)	(2)	(3)	(4)
Treatment	-0.054		-0.147***	
	(0.044)		(0.045)	
Treatment × Extrapolator (diff. $\geq$ 4) (a)		0.021		-0.375***
		(0.114)		(0.115)
Treatment × Neutral (-4 $\leq$ diff. $<$ 4)		0.075		-0.084
		(0.080)		(0.081)
Treatment × Mean-reverter (diff. $<$ -4) (b)		-0.155***		-0.114*
		(0.060)		(0.062)
Extrapolator (diff. $\geq$ 4)	-0.018	0.008	0.143**	0.288***
	(0.071)	(0.098)	(0.072)	(0.102)
Mean-reverter (diff. $<$ -4)	0.046	0.160**	-0.127**	-0.113
	(0.051)	(0.070)	(0.053)	(0.072)
p-value (a=b)		0.174		0.047
Observations	1,961	1,961	1,961	1,961
R-squared	0.08	0.08	0.04	0.04

Notes: All outcome measures are z-scored using the mean and the standard deviation in the sample. Robust standard errors are in parentheses. * denotes significance at 10 pct., ** at 5 pct., and *** at 1 pct. level.

Updating of expectations in response to treatment

Do respondents in the treatment group **update future return expectations** towards the treatment information?

Updating of expectations in response to treatment

Updating by size of the **perception gap**:

- Respondent's perceived return over the 12 months before the survey.
- Respondent's prior beliefs about autocorrelation of stock returns.
- Perception gap = Difference between information and prior for relevant return interval.

$$\Delta \text{exp}_i = \alpha_0 + \alpha_1 \text{percgap}_i \times \text{T}_1 + \alpha_2 \text{percgap}_i + \alpha_3 \text{T}_1 + \mathbf{\Pi}^T \mathbf{X}_i + \varepsilon_i$$

where $\text{percgap}_i = \text{hist}(int(\text{percpast}_i)) - \text{prior}_i(int(\text{percpast}_i))$

and $int(\text{percpast}_i)$: interval containing respondent i's perception of the return over the 12 months before the survey.

Updating of expectations in response to treatment

	Updating (point belief) main survey		Updating (mean distr.) main survey	
	(1) OLS	(2) IV	(3) OLS	(4) IV
Treatment × Perception gap main	0.086**	0.138***	0.115***	0.142**
	(0.038)	(0.051)	(0.044)	(0.060)
Perception gap main	-0.004	-0.019	0.022	0.044
	(0.025)	(0.033)	(0.028)	(0.038)
Treatment	1.077***	1.007***	0.047	0.019
	(0.212)	(0.219)	(0.263)	(0.266)
First stage F-stat		1020.48		1020.48
Observations	1,961	1,961	1,961	1,961
R-squared	0.05	0.04	0.04	0.04

Notes: Robust standard errors are in parentheses. * denotes significance at 10 pct., ** at 5 pct., and *** at 1 pct. level.

Updating of beliefs and persistence

- Changes in perceived autocorrelation and in expected returns **persist** in a four-week follow-up survey (at almost the same magnitude).
- **Experimenter demand effects** less likely to be driving our results (de Quidt et al., 2018) .
- Results unlikely due to unconscious **numerical anchoring** (Cavallo et al., 2017; Haaland et al., 2020) .

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Result 2:
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Result 3:
Respondents adjust their future return expectations in response to the information. This provides causal evidence that investors form expectations based on beliefs about the historical autocorrelation of aggregate returns.

Changes in trading behavior

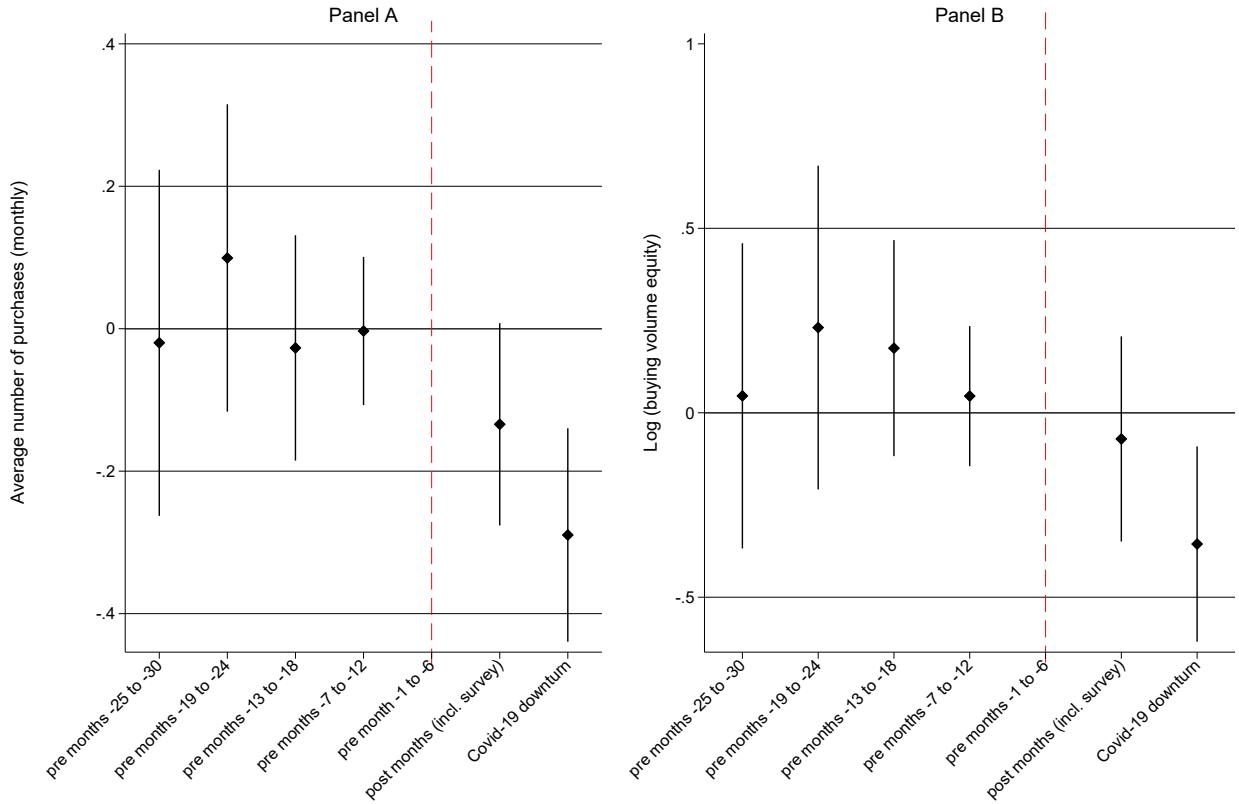
Do changes in beliefs in response to our treatment affect future trading behavior?

- Transaction data until March 2020
- Very unique set up (stock market crash)

Figure: Development of the DAX from August 2019 to March 2020

Changes in trading behavior

Treatment effect on trading activity for the group of Mean Reverter



Notes: This figure displays coefficient estimates on the interaction terms of the treatment indicator with the different pre- and post-periods based on investor-month level estimations.

- Moderate effect on trading decisions in the **short-term**.

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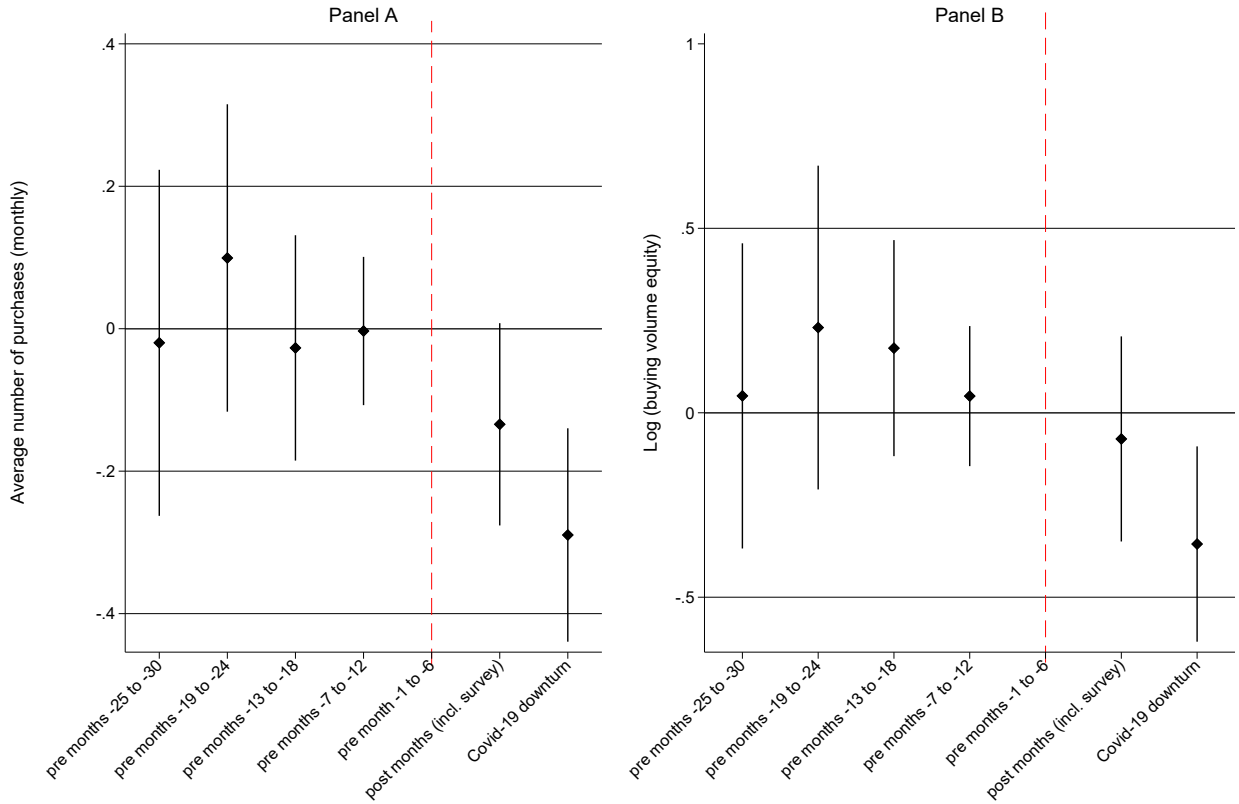

Notes: This figure displays coefficient estimates on the interaction terms of the treatment indicator with the different pre- and post-periods based on investor-month level estimations.

- Moderate effect on trading decisions in the **short-term**.
- Treated (mean reverters) purchase **significantly less** during COVID-19 crash.

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Result 4:
Changes in beliefs about the autocorrelation of aggregate returns induced by the experimental intervention reduce equity purchases during the COVID-19 crash among those who believe in mean reversion of aggregate returns before the intervention.

Outline of talk

Conclusion

- Field experiment with $\approx$ 2,000 clients at a German online broker.
- Opposed to previous findings, the majority of investors believe in **mean reversion** of aggregate stock returns, potentially due to
  - eliciting beliefs about autocorrelation directly
  - eliciting beliefs in a sample of active retail investors
- Beliefs about the stock market **causally** affect trading decisions.
- Even **experienced retail investors** make trading decisions based on **erroneous beliefs** about the aggregated precitability of the stock market.
- Short information interventions can change decisions months later.

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Outline of talk

Prior Perceptions of 12-month Stock Market Returns

- Prior perceptions of stock market returns over past 12 months

Betrachten wir die vergangenen 12 Monate:

Was glauben Sie, welche Rendite (in Prozent) hat der DAX über die vergangenen 12 Monate erzielt?

Mit Rendite ist die prozentuale Wertänderung einer Anlage in den Deutschen Aktienindex (DAX) über die vergangenen 12 Monate gemeint. Eine positive Zahl bedeutet, dass der Wert des DAX gestiegen ist, eine negative Zahl bedeutet, dass der Wert gefallen ist.

Prozent

Nach Ihrer Einschätzung würde ein Anleger, der vor 12 Monaten 100 EUR in den DAX investiert hat, heute EUR erhalten.

Note: Percentages are automatically translated into EUR terms below the entry field.

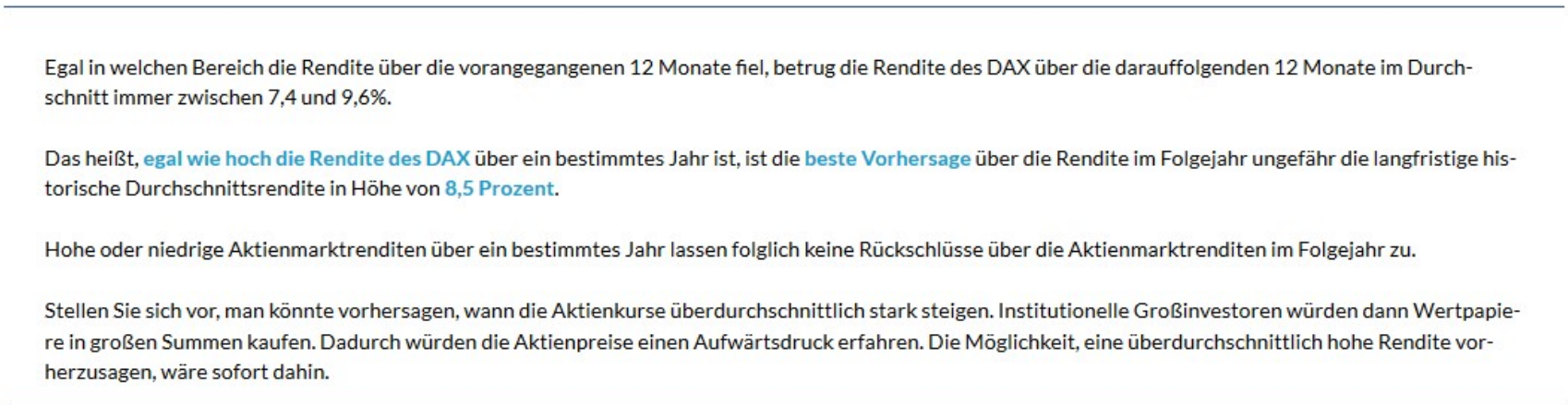
- Confidence

Wie sicher sind Sie sich mit Ihrer Antwort?

Überhaupt nicht sicher						Sehr sicher
1	2	3	4	5	6	7
○	○	○	○	○	○	○

Back

Information treatment: Treatment text



Egal in welchen Bereich die Rendite über die vorangegangenen 12 Monate fiel, betrug die Rendite des DAX über die darauffolgenden 12 Monate im Durchschnitt immer zwischen 7,4 und 9,6%.

Das heißt, **egal wie hoch die Rendite des DAX** über ein bestimmtes Jahr ist, ist die **beste Vorhersage** über die Rendite im Folgejahr ungefähr die langfristige historische Durchschnittsrendite in Höhe von **8,5 Prozent**.

Hohe oder niedrige Aktienmarktrenditen über ein bestimmtes Jahr lassen folglich keine Rückschlüsse über die Aktienmarktrenditen im Folgejahr zu.

Stellen Sie sich vor, man könnte vorhersagen, wann die Aktienkurse überdurchschnittlich stark steigen. Institutionelle Großinvestoren würden dann Wertpapiere in großen Summen kaufen. Dadurch würden die Aktienpreise einen Aufwärtsdruck erfahren. Die Möglichkeit, eine überdurchschnittlich hohe Rendite vorherzusagen, wäre sofort dahin.

Figure: Treatment text provided to participants in the treatment group in support of graphical treatment.

Back

Information treatment: Control group

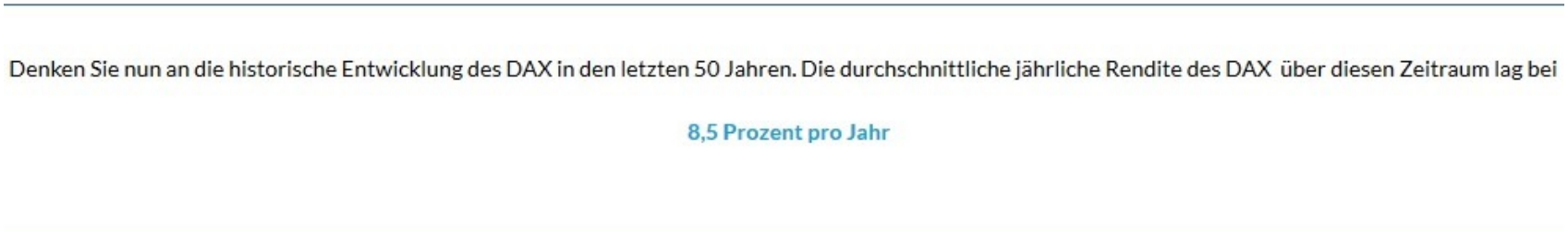


Figure: Information on avg. hist. annual return of the DAX provided to participants in the control group.

Back