Inconsistent Retirement Timing

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Online Appendix

Online Appendix A. Discount Functions

The intention of this online appendix is not to review all properties of different discount functions (see, e.g., Laibson, 1997; Hayashi, 2003; Montiel Olea and Strzalecki, 2014). Instead, we want to highlight a difference in discounting future outcomes that is particularly relevant in the retirement context. As we study the evolution of planned retirement age over time, it is important how future outcomes are treated when they approach in time but do not yet involve the present. We highlight a difference between hyperbolic and quasi-hyperbolic discounting in whether they predict a shift in planned retirement age when people get older.

All considered types of discount functions can be written in the form $DF = \delta^{f(t)}$ with discount factor δ and a function $f(t)$ that describes how time between two periods is perceived (subjective distance between two periods). In case of the exponential discount function time is perceived in a linear way with $f(t) = t$. The same holds true for the quasi-hyperbolic discount function $DF(t) = \beta\delta^t$, which can be rewritten in the above form with $f(t) = t + \frac{\ln(1/\beta)}{\ln(1/\delta)}$ for $t > 0$. The function $f(t)$ is thus shifted upwards by a constant determined by the parameters, which implies that the subjective distance between the present and the future increases.[19] However, the subjective distance between future periods remains linear (see Figure A.1). The quasi-hyperbolic discount function satisfies stationary from period $t = 1$ onward (Montiel Olea and Strzalecki, 2014).

This means if a person at age fifty plans to retire at age 65, she will maintain the same plan at age 55 (all else equal). Present bias will only become relevant, when retiring at the current age becomes an option. This would restrict our ability to make any meaningful observations about time inconsistency for people who are still far from retirement. In contrast, hyperbolic discounting allows for a gradual shift in planned retirement age. The hyperbolic discount function $DF(t) = (1+\alpha t)^{-\frac{\gamma}{\alpha}}$ implies $f(t) = \frac{\gamma}{\alpha}\frac{\ln(1+\alpha t)}{\ln(1/\delta)}$ which is concave in time t. This concavity implies a decreasing perception of time differences. The difference between retiring in 12 years instead of 13 years appears smaller than the difference between retiring in 2 years instead of 3 years.

Figure A.1 shows the exponential discount function, the quasi-hyperbolic discount function, and the general hyperbolic discount function. The parameters are chosen in such a way that all discount functions cross in period 15. Panel A illustrates that both the hyperbolic discount function and the quasi-hyperbolic discount function lead to stronger discounting in earlier periods compared to the exponential function. Panel B presents the corresponding time functions f(t). They are linear for

[19] Note that $f(t) = t + \frac{\ln(1/\beta)}{\ln(1/\delta)}$ collapses to $f(t) = t$ if $\beta = 1$.

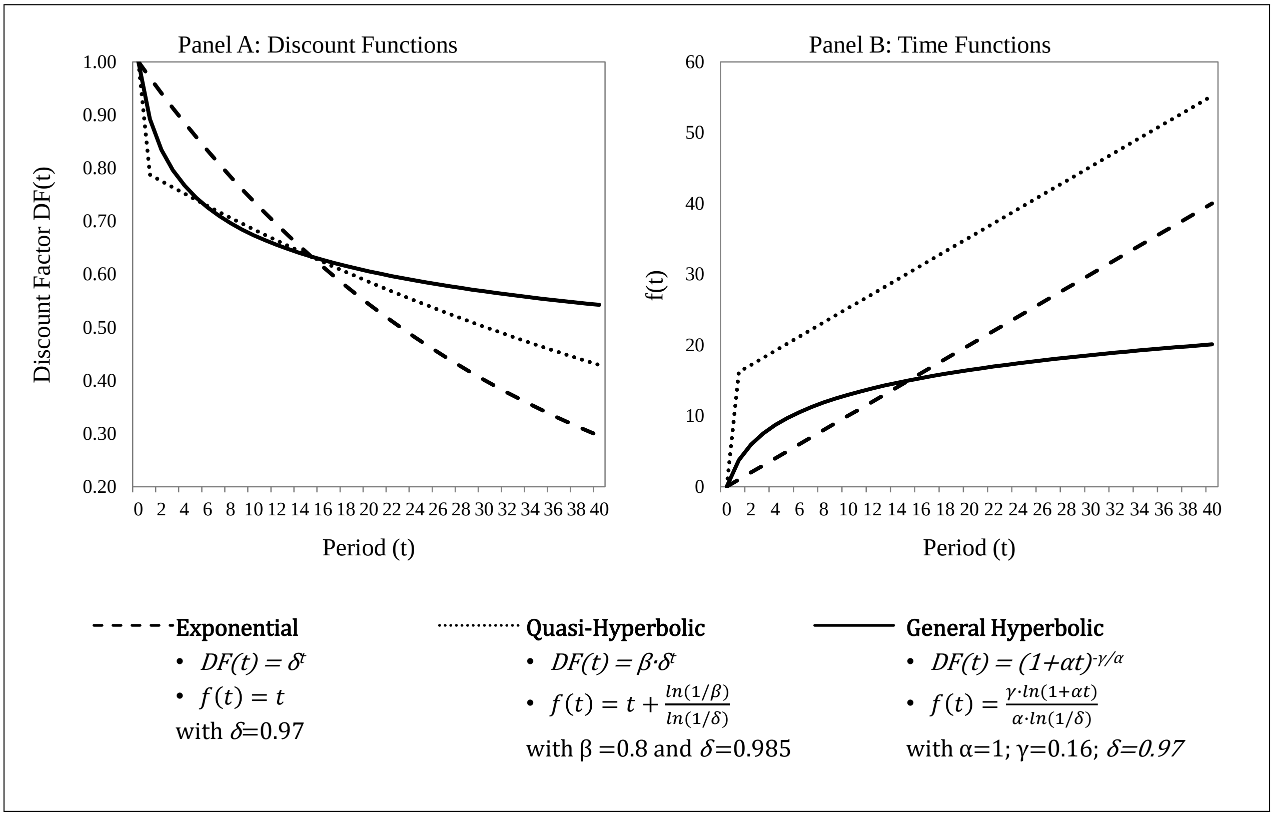

Figure A.1. Discount functions and time functions.
Panel A of the figure shows the exponential discount function, the quasi-hyperbolic discount function, and the general hyperbolic discount function. Panel B the time function f(t) for the three discount functions.

exponential discounting and for quasi-hyperbolic discounting (for $t > 0$). In contrast, the hyperbolic function implies a non-linear perception of time as in this case f(t) is a logarithmic function.

This difference is particularly relevant for hypothesis H3 in the paper. At age fifty, the benefit of retiring with 63 instead of 65 appears smaller than it does five years later at age 55. For the retirement timing decision, it is particularly noteworthy that any gain in leisure occurs at the front end, while the negative consequence of receiving lower retirement benefits is spread out over the whole retirement period. The trade-off between the two might thus change in the hyperbolic model, when retirement is approaching.

Online Appendix B. Financial Impact of Inconsistent Retirement Timing

Evaluating the main results within the institutional settings of the German social security system allows us to assess the financial consequences of inconsistent retirement decisions. Social security benefits in Germany are determined according to the formula presented in Equation (1).[20]

$$\textit{Monthly retirement benefits} = EP \cdot EC \cdot CPV \tag{1}$$

The retirement system is based on earnings points (EP), which employees earn relative to their yearly gross income. For each year t, they accumulate $EP_t = \frac{\text{Gross Income}_t}{\text{Average Gross Income in Germany}_t}$. When claiming social security benefits, the sum of all accumulated earning points EP enters Equation (1). The second factor is the entry coefficient (EC). It equals one for someone, who claims retirement benefits at full retirement age and decreases by 0.3% for each month of claiming early. Delayed claiming, however, increases the entry coefficient by 0.5% per month. The last factor, the current pension value (CPV), is adjusted each year by the government. In 2012, the year of the survey, it amounted to EUR 28.07 (EUR 24.92 for East Germany).

The decision to retire early affects the accumulated earnings points (EP), as well as the entry coefficient (EC). We can thus calculate the reduction in monthly benefits due to early retirement for the experimental data. Time inconsistent participants retire on average 1.75 years (= 21 months) earlier than time consistent participants. This results in a reduction of the entry coefficient by 6.3% ($0.003 \cdot 21$). To estimate the reduction in earning points, we have to make two assumptions. First, a person is assumed to have contributed for 40 years when entering retirement. Second, the forgone income is assumed to be equal to the average income of that person. Since the income usually increases with years of employment, the second assumption results in a conservative estimate of the forgone contributions. The reduction in earning points can then be calculated as $\frac{\text{Number of Years Retired Earlier}}{40+\text{Number of Years Retired Earlier}}$. In the example, this leads to a reduction of $\frac{1.75}{41.75} = 4.2\%$.

In sum, monthly social security benefits are reduced by about 10.5% (6.3% + 4.2%). Time-inconsistent participants confront a considerable loss in monthly pension benefits due to early retirement. For a naïve hyperbolic discounter, this loss comes unanticipated. The result indicates that having less time-consistent preferences strongly influences financial well-being in retirement. As we use the multivariate estimate, this is after controlling for differences in demographics and personal characteristics, such as risk and loss aversion, financial literacy, and subjective life expectancy.

[20] The pension formula is explained in detail in the following legal text: §64, Sozial Gesetzbuch (SGB) VI.

Online Appendix C. The Time Preference Measure

In this appendix, we show how an agent with quasi-hyperbolic preferences would respond to the tax refund choices illustrated in Figure 1. The quasi-hyperbolic discount factor is $DF(t) = \beta\delta^t$ and $DF(0) = 1$, with δ and β between 0 and 1. Figure C.1 shows the number of inconsistent choices depending on the parameters of the discount function.

	Delta																														
Beta	1.00	0.99	0.98	0.97	0.96	0.95	0.94	0.93	0.92	0.91	0.90	0.89	0.88	0.87	0.86	0.85	0.84	0.83	0.82	0.81	0.80	0.79	0.78	0.77	0.76	0.75	0.74	0.73	0.72	0.71	0.70
1.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.99	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
0.98	0	1	1	1	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0
0.97	1	1	1	1	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0
0.96	1	1	1	1	0	0	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0
0.95	1	1	1	1	0	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	1	1	1	1	0	0	0	0	0	0	0
0.94	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0	0
0.93	1	1	2	2	1	1	1	1	1	1	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0
0.92	1	2	2	2	1	1	1	1	1	1	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0
0.91	2	2	2	2	1	1	1	1	1	1	0	0	0	0	0	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0
0.90	2	2	2	2	1	1	1	1	1	1	0	0	0	0	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0
0.89	2	2	2	2	1	1	1	1	1	1	0	0	0	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0
0.88	2	2	2	2	1	1	1	1	1	1	0	0	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0
0.87	2	2	2	2	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0
0.86	2	2	2	2	1	1	1	1	1	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0
0.85	2	2	2	2	1	1	1	1	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0
0.84	2	2	2	2	1	1	1	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0
0.83	2	2	2	2	1	2	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0
0.82	2	2	2	2	2	2	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0
0.81	2	2	3	3	2	2	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0
0.80	2	3	3	3	2	2	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0
0.79	3	3	3	3	2	2	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0
0.78	3	3	3	3	2	2	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0
0.77	3	3	3	3	2	2	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0
0.76	3	3	3	3	2	2	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0
0.75	3	3	3	3	2	2	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0
0.74	3	3	3	3	2	2	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0
0.73	3	3	3	3	2	2	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0
0.72	3	3	3	3	2	2	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0
0.71	3	3	3	3	2	2	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0
0.70	3	3	3	3	2	2	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0

Figure C.1. Number of inconsistent choices.
The figure shows the number of inconsistent choices by a quasi-hyperbolic agent depending on the parameters $\delta =$ and β.

For $\delta < 0.77$, an agent would always prefer the sooner option independent of the initial delay. However, such low values of delta imply very strong time discounting. For higher values of δ, the number of inconsistent choices depends on β and increases with lower beta (higher present bias). The most inconsistent choices occur when β is very low, but δ is close to one. Such time preferences discriminate strongly between the present and the future, but not so much between two dates in the future. This is why a choice involving an immediate payout will be viewed differently from a choice involving two payouts in the future. Importantly, we observe at least one time-inconsistent choice for most parameter combinations. To capture all forms of time-inconsistent preferences, a higher number of questions would be needed (e.g., using an interest rate between the chosen values).

We further show how the time preference measures are related to other observable participant characteristics. Table C.1 shows regressions of the time preference measures on the other variables used in the main regressions. The overall explanatory power of the control variables for time preferences is low. We find a positive association of both time-inconsistency variables and age, which suggests that older participants are more inconsistent. However, the economic magnitude of the effect is rather small, with 0.01 more inconsistent answers for each year of age. We also find a negative relation of education and financial literacy to time inconsistency, which suggests that more sophisticated individuals make more time-consistent choices.

Table C.1. Effect of demographic and control variables on time preferences.
The table shows linear regressions of time preference measures (number of inconsistent answers, inconsistency indicator, and impatience) on demographic variables and controls. The included variables are as defined in Table 2. Robust standard errors are displayed in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10%-level, respectively.

	# Incon. Answers	Incon. Indicator	Impatience Scale
Age	0.010	0.004	–0.003
	(0.00)***	(0.00)***	(0.00)
Gender [male=1]	–0.076	–0.056	–0.396
	(0.06)	(0.03)*	(0.11)***
Married	–0.052	–0.024	0.022
	(0.05)	(0.03)	(0.09)
Number of Children	0.012	0.003	0.002
	(0.02)	(0.01)	(0.03)
Education [0-2]	–0.066	–0.032	0.031
	(0.04)*	(0.02)*	(0.06)
Income / Benefits [log]	–0.014	–0.011	0.097
	(0.03)	(0.01)	(0.04)**
Risk Aversion	–0.012	–0.002	–0.053
	(0.02)	(0.01)	(0.03)*
Loss Aversion	0.008	–0.000	0.074
	(0.02)	(0.01)	(0.03)**
Financial Literacy	–0.079	–0.043	–0.011
	(0.02)***	(0.01)***	(0.03)
Life Expectancy	–0.004	–0.002	–0.010
	(0.00)*	(0.00)	(0.00)**
Private Pension Insurance	–0.060	–0.037	–0.063
	(0.04)	(0.02)*	(0.07)
Constant	1.244	0.773	4.311
	(0.30)***	(0.16)***	(0.56)***
R^2	0.030	0.024	0.010
Observations	2215	2215	2299

Online Appendix D. Financial Literacy Questions

The financial literacy questions of the FAZ survey and the SAVE survey are presented in this appendix. Correct answers to the financial literacy questions are in bold.

A. FAZ Survey

1. Suppose you had EUR 100 in a savings account and the interest rate was 4% per year. After 10 years, how much do you think you would have in the account if you left the money to grow?
   (i) More than EUR 140; (ii) Exactly EUR 140; (iii) Less than EUR 140; (iv) Do not know/Refusal.
2. Normally, which asset described below display the highest fluctuations over time:
   (i) Savings accounts; (ii) Bonds; **(iii) Stocks**; (iv) Do not know/Refusal.
3. Which of the following statements is correct?
   (i) Once one invests in a mutual fund, one cannot withdraw the money in the first year; **(ii) Mutual funds can invest in several assets, for example invest in both stocks and bonds**; (iii) Mutual funds pay a guaranteed rate of return which depends on their past performance; (iv) None of the above; (v) Do not know/Refusal.
4. Consider a call-option with a stock as underlying. Please judge the following statement: "The price of the call-option should increase if the volatility of the underlying stock increases"
   (i) True; (ii) False; (iii) The statement cannot be judge with the information given; (iv) Do not know/Refusal.
5. If the interest rate falls, what should happen to bond prices:
   (i) Rise; (ii) Fall; (iii) Stay the same; (iv) None of the above; (v) Do not know/Refusal.
6. What is measured by a stocks "beta"?
   (i) The stocks book to market value; (ii) The stocks volatility; **(iii) The sensitivity of the stock price to price changes of a benchmark index**; (iv) None of the above; (v) Do not know/Refusal.

B. SAVE Survey

1. Suppose you had EUR 100 in a savings account and the interest rate was 2% per year. After 5 years, how much do you think you would have in the account if you left the money to grow?

   (i) More than EUR 102; (ii) Exactly EUR 102; (iii) Less than EUR 102; (iv) Do not know/Refusal.

2. Suppose you had EUR 100 in a savings account and the interest rate was 20% per year. After 5 years, how much do you think you would have in the account if you left the money to grow?

   (i) More than EUR 200; (ii) Exactly EUR 200; (iii) Less than EUR 200; (iv) Do not know/Refusal.

3. Imagine that the interest rate on your savings account was 1% per year and inflation was 2% per year. After 1 year, how much would you be able to buy with the money in this account?

   (i) More than today; (ii) Exactly the same; **(iii) Less than today**; (iv) Do not know/Refusal.

4. Suppose that in the year 2012, your income has doubled and prices of all goods have doubled too. In 2012, how much will you be able to buy with your income?

   (i) More than today; **(ii) The same**; (iii) Less than today; (iv) Do not know/Refusal.

5. Normally, which asset described below displays the highest fluctuations over time:

   (i) Savings accounts; (ii) Bonds; **(iii) Stocks**; (iv) Do not know/Refusal.

6. Which of the following statements describes the main function of the stock market?

   (i) The stock market helps to predict stock earnings; (ii) The stock market results in an increase in the price of stocks; **(iii)The stock market brings people who want to buy stocks together with those who want to sell stocks**; (iv) None of the above; (v) Do not know/Refusal.

7. Buying a company stock usually provides a safer return than a stock mutual fund?

   (i) True; **(ii) False**; (iii) Do not know/Refusal.

8. Which of the following statements is correct?

   (i) Once one invests in a mutual fund, one cannot withdraw the money in the first year; **(ii) Mutual funds can invest in several assets, for example invest in both stocks and bonds**; (iii) Mutual funds pay a guaranteed rate of return which depends on their past performance; (iv) None of the above; (v) Do not know/Refusal.

9. If the interest rate falls, what should happen to bond prices:

   (i) Rise; (ii) Fall; (iii) Stay the same; (iv) None of the above; (v) Do not know/Refusal.

Online Appendix E. Analysis of Subsamples

In this appendix, we analyze different subsamples of the full data to shed light on the retirement behavior of specific groups. We first show differences between the FAZ and SAVE data focusing on income and education in Table E.1. The averages net income and level of education in the SAVE panel is close to data provided by the German Federal Statistical Office. For the FAZ sample, average income and education are much higher.

Table E.1. Comparison FAZ Experiment with SAVE Panel and Federal Statistical Office. The table shows average annual and monthly net income in the analyzed datasets, as well as obtained educational levels. For comparison, data from the federal statistical office (Statistisches Bundesamt) are displayed.

Income

	Net Income p.a.	**Net Income p.m.**	**Year**
FAZ	40,940.76	3,411.73	2012
SAVE 2010	18,175.56	1,514.63	2010
Fed. Stat. Office	20,730.00	1,727.50	2012

Education

	High School	**University**	**Year**
FAZ	91.6%	66.7%	2012
SAVE 2010	29.8%	18.1%	2010
Fed. Stat. Office	29.6%	19.4%	2012

Table E.2 shows the results of the main regressions for the FAZ survey when the sample is restricted to participants with lower income (Panel B) and participants with lower education (Panel C). From each table in the paper, the regression with full controls is selected. Panel A shows the results in the full sample for comparison. For the actual retirement timing analyzed in Tables 3 and 4, the effect size increases when restricting the sample. This shows that inconsistent time preferences might have even more detrimental effects for this subgroup (earlier retirement and retirement regret). For planned retirement, results in the restricted sample are in line with the original results with the exception of the interaction effect, which is weaker. Statistical significance decreases due to lower power.

Table E.2. Robustness test FAZ: Lower income and lower education subsample.
This table shows results for a low income (income smaller than average income, Panel A) and low education (education 0 or 1, Panel B) subsample of the FAZ dataset. The analyses presented in Tables 3 to 7 are repeated for both subsamples using the main specification that includes demographic and control variables. Robust standard errors are displayed in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10%-level, respectively.

Table Specification Variable of Interest	**Table 3** (5) # Incon. Answers	**Table 4** (5) # Incon. Answers	**Table 5** (6) Age x # Incon. Answers	**Table 6** (4) # Incon. Answers	**Table 7** (5) # Incon. Answers
Panel A: Full Sample					
Coefficient	–0.978	0.079	–0.032	–0.446	–0.025
	(0.41)**	(0.04)**	(0.01)**	(0.14)***	(0.01)**
N	160	158	2046	897	2046
Panel B: Lower Income Sample					
Effect	–1.282	0.131	–0.021	–0.448	–0.024
	(0.48)***	(0.06)**	(0.01)	(0.20)**	(0.15)*
N	90	89	1359	473	1359
Panel C: Lower Education Sample					
Effect	–1.645	0.174	–0.015	–0.407	–0.039
	(0.90)*	(0.10)*	(0.02)	(0.25)*	(0.02)*
N	60	60	646	267	646

We next examine the role of employment as a civil servant, as this group draws a state pension which is more generous than social security. The assumption is that potential constraints due to undersaving should be less binding for this group. As we only have detailed employment information for the SAVE panel, we concentrate on the SAVE data for this subsample analysis. We add a state pension indicator to the cross-sectional regressions of Table 9. We further interact this indicator with both time inconsistency proxies (smoking behavior and overdraft usage). The results displayed in Table E.3 show that there is indeed a negative effect of getting a state pension on retirement age (column 1). The difference of 2.6 years is not much different from official statistics.[21] However, not all of the effect should be attributed to time preferences, as civil servants include occupations that traditionally retire early (e.g., police officers or teachers), not to mention other between-group differences.

[21] In 2018, the average pension age was 62.2 (`www.demografie-portal.de/DE/Fakten/pensionsalter.html`), and the average retirement age of social security claimants was 64.0 (`www.demografie-portal.de/DE/Fakten/renteneintrittsalter.html`.

Table E.3. Robustness test SAVE: Actual retirement age of civil servants.
The table shows results of cross-sectional regressions with Actual Retirement Age as the dependent variable. State pension is an indicator if a participant receives state pension. This indicator is interacted with the time preference proxies. ***, **, and * indicate statistical significance at the 1%, 5%, and 10%-level, respectively.

	Actual Retirement Age					
	(1)	(2)	(3)	(4)	(5)	(6)
State Pension	–2.610	–2.403	–2.509	0.372	0.514	0.545
	(0.75)***	(0.79)***	(0.77)***	(1.27)	(1.28)	(1.27)
Smoker [0/1]		–3.470	–2.460			–2.285
		(0.87)***	(0.85)***			(0.84)***
Smoker x State Pension		–0.082	–0.462			–0.001
		(2.09)	(2.11)			(1.86)
Overdraft [1-4]				–1.388	–1.085	–1.093
				(0.30)***	(0.27)***	(0.27)***
Overdraft x State Pension				–1.718	–1.822	–1.761
				(0.62)***	(0.63)***	(0.61)***
Health Status			1.357		1.374	1.453
			(0.47)***		(0.46)***	(0.46)***
Satisfaction Health			0.034		0.031	-0.011
			(0.14)		(0.14)	(0.15)
Prologned Illness			0.676		0.582	0.426
			(0.54)		(0.53)	(0.53)
Gender			1.563		1.334	1.289
			(0.48)***		(0.47)***	(0.46)***
Married			–0.693		–1.098	–1.314
			(0.5)		(0.5)**	(0.49)***
Number of Children			0.12		0.209	0.219
			(0.17)		(0.15)	(0.15)
Education			0.939		0.748	0.736
			(0.25)***		(0.26)***	(0.26)***
Income [log]			-0.229		–0.196	–0.186
			(0.06)***		(0.07)***	(0.06)***
Financial Literacy			–0.09		–0.117	–0.113
			(0.2)		(0.2)	(0.2)
Life Expectancy			0.157		0.154	0.139
			(0.03)***		(0.04)***	(0.04)***
PPI			–4.433		–4.483	–4.205
			(1.05)***		(1.00)***	(0.99)***
Constant	59.217	59.688	42.241	61.726	44.454	46.129
	(0.24)***	(0.24)***	(3)***	(0.47)***	(3.26)***	(3.33)***
R^2	0.015	0.044	0.164	0.093	0.220	0.232
Observations	907	907	905	753	752	752

More interesting is the interaction of pension status with time preferences, as financially unconstrained people are freer to follow their (inconsistent) preferences. We indeed find a negative coefficient on both interaction terms, but only the interaction with overdraft usage is economically and statistically significant. When both interaction terms are included (column 6), the interaction with overdraft usage dominates. While the results are in line with economic intuition, they need to be interpreted with caution as less than 10% of retirees and non-retirees are civil servants. For planned retirement age, we repeat the analysis of Table 10 for the subsample of civil servants. Smoking civil servants reduce their retirement age more drastically in each wave than other employees (see Table E.4). However, we must remark that the sample gets very thin and lowly powered when restricting by age group.

Table E.4. Robustness test SAVE: Planned retirement age in subsample of civil servants. The table shows panel results for the subsample of civil servants. The SAVE data is multiply imputed with five different imputations. All five imputations are used. Coefficients and standard errors are calculated according to Rubin (1987). ***, **, and * indicate statistical significance at the 1%, 5%, and 10%-level, respectively.

Panel A	**Full Panel**	**Smoker**			**Non-Smoker**		
		All	Age>40	Age>50	All	Age>40	Age>50
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Wave	–0.071	–0.091	–0.822	–1.329	–0.083	–0.125	–0.154
	(0.15)	(0.54)	(0.53)	(1.00)	(0.15)	(0.18)	(0.18)
Health Status	–0.026	–0.095	0.002	–0.223	–0.011	–0.077	0.067
	(0.07)	(0.19)	(0.16)	(0.64)	(0.07)	(0.09)	(0.13)
Satisf. Health	–0.168	0.204	0.807	1.277	–0.287	–0.443	–0.035
	(0.45)	(0.50)	(0.52)	(1.55)	(0.65)	(0.75)	(0.63)
Prolonged Illness	0.038	–0.191	–1.351	–2.405	0.080	0.439	0.007
	(0.31)	(1.43)	(1.63)	(3.08)	(0.28)	(0.31)	(0.32)
Constant	64.51	64.46	72.771	80.126	64.826	64.169	64.812
	(1.42)***	(7.61)***	(8.47)***	(15.1)***	(1.07)***	(1.20)***	(1.33)***
R^2	0.004	0.010	0.149	0.245	0.008	0.029	0.045
Obs	280	72	55	24	208	154	78

Panel B	**Full Panel**	**Overdraft=1**			**Overdraft=0**		
		All	Age>40	Age>50	All	Age>40	Age>50
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Wave	–0.071	-0.422	-0.829	-0.555	0.081	-0.011	-0.141
	(0.15)	(0.31)	(0.35)**	(0.45)	(0.16)	(0.19)	(0.18)
Health Status	–0.026	0.143	0.313	0.73	-0.064	-0.097	-0.012
	(0.07)	(0.23)	(0.25)	(0.53)	(0.08)	(0.09)	(0.13)
Satisfaction Health	–0.168	0.019	0.876	1.246	-0.232	-0.512	-0.38
	(0.45)	(0.65)	(0.91)	(1.45)	(0.63)	(0.76)	(0.54)
Prolonged Illness	0.038	-0.454	-0.975	-1.984	0.166	0.418	0.268
	(0.31)	(0.7)	(1.04)	(1.68)	(0.36)	(0.42)	(0.61)
Constant	64.51	67.799	70.704	69.652	63.154	63.202	64.207
	(1.42)***	(3.28)***	(4.32)***	(5.57)***	(1.33)***	(1.44)***	(2.04)***
R^2	0.004	0.051	0.233	0.203	0.009	0.023	0.038
Obs	280	86	59	32	193	149	70

Online Appendix F. Robustness Tests

In this appendix, we include several robustness tests for some of the main results in the paper.

First, the regressions with binary dependent variables of Tables 4 and 7 are re-estimated using a logistic model. Table F.1 shows coefficients of logistic regressions with retirement regret (*Retired Too Early*) as the dependent variable. The results confirm those of the linear probability model. The number of inconsistent answers is a strong predictor of regret. Earlier retirement per se, however, appears not to be a reason for regret. Table F.2 shows coefficients of logistic regressions with ownership of private pension insurance (*Private Pension Insurance*) as the dependent variable. The results again confirm those of the linear regression. Participants with time inconsistent preferences are less likely to own insurance.

For the SAVE panel, we report regressions with all controls to establish robustness of the results displayed in Figure 5. Table F.3 shows linear probability models (OLS) with an indicator of whether a participant retired earlier than planned as the dependent variable. The analysis relies on participants who retire during the used panel waves (2008-2011). It compares participants' age in the year of retirement (t) to the planned retirement age in t-1. If planned retirement age is larger than actual retirement age, the indicator equals one and zero otherwise. Even though the analysis uses panel information, the regressions are cross-sectional as every participant occurs only once. We use all static control variables (such as gender, age, etc.) from year t. For income, we use information from t-1. It is important to control for health, as a health shock might explain sudden retirement. A negative health shock is best observed by using the change in health from t-1 to t.

The results in Table F.3 confirm that smoking behavior and overdraft usage are positively related to earlier than planned retirement. Effect sizes are very large as both proxies increase the probability of inconsistent retirement timing by about 30%-points. The effects survive when both proxies are included simultaneously (columns 5 and 6). Of the control variables, higher age reduces the probability to retire earlier than planned. This is intuitive, as older participants are presumably closer to their planned retirement age. Higher income before retirement increases the probability of retiring earlier than planned as it relaxes financial constraints. Changes in health do not have a significant effect on inconsistent retirement timing. However, health status, which had the strongest effect in previous regressions, shows the expected sign as a negative delta (health decline) results in a higher probability to retire early.

We next replicate the results for private pension insurance for the SAVE panel. Table F.4 confirms that time-inconsistent people (proxied by smoking or overdraft usage) are not more likely to purchase private pension insurance. The coefficients are close to zero and often negative. We also test whether selective mortality causes high panel attrition of smokers in the SAVE panel (see Table F.5). The drop-out rates suggest an only slightly higher attrition in the subsample of retirees and no higher attrition for non-retirees. It seems that the four-year span is too short for mortality effects to have a large impact. We thus do not see it as a major concern for the panel results.

Based on the finding by Grignon (2009) that time-inconsistent smokers find it harder to quit smoking, we predict that former smokers as a group are less time inconsistent than smokers. It seems reasonable to expect coefficients closer to zero for this group in regressions explaining retirement timing. We identify former smokers in the SAVE data using all waves from 2001 to 2010. A former smoker is defined as someone who smoked at any point during 2001-2009, but does no longer smoke in 2010. This definition omits people who quit smoking earlier than 2001, and it omits people who were smokers, but did not participate in earlier waves of the survey. We nevertheless identify 66 people as former smokers. This is about half the number of current smokers, and taking the two groups together, we arrive at 22% of the sample. Adding former smokers partly closes the gap to the sample of non-retirees (31% smokers) and confirms that quitting contributes to the lower rates of smokers in the retiree sample (in addition to mortality).

We then re-run the analysis of Table 9 including indicators for smokers and former smokers (baseline are never-smokers). We find that the coefficient for former smokers is close to the one for smokers in all regression specifications (see Table F.6). We are unable to reject the null that the coefficients are of equal size for any of the three regression specifications. Therefore, any further interpretation warrants some caution. However, the transition from a slightly larger coefficient for former smokers in column (1) to smaller coefficients in columns (2) and (3) might be due to the health controls. As we observe mostly older quitters (retirees who quit smoking within the last nine years), some of them might have given up smoking for health reasons. This would explain a similar (or even stronger) effect on retirement timing for this group. Once we control for health, this effect diminishes.

Table F.1. Robustness for Table 4.
This table presents regression coefficients of five logistic regressions with the indicator *Retirement Regret* as the dependent variable. The included variables are as defined in the Appendix. Robust standard errors are displayed in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10%-level, respectively.

	Retirement Regret				
	(1)	(2)	(3)	(4)	(5)
Inconsistency Indicator	1.064				
	(0.37)***				
Number Inconsistent Answers		0.502	0.499	0.562	0.491
		(0.17)***	(0.18)***	(0.21)***	(0.20)**
Impatience			0.007	–0.050	–0.039
			(0.10)	(0.11)	(0.12)
Actual Retirement Age				0.012	–0.010
				(0.05)	(0.06)
Age				–0.009	–0.003
				(0.04)	(0.04)
Gender				–0.682	–0.486
				(0.71)	(0.76)
Married				–0.324	–0.694
				(0.59)	(0.65)
Number of Children				–0.005	–0.032
				(0.19)	(0.22)
Education				–0.216	0.040
				(0.29)	(0.34)
Retirement Benefits [log]				0.600	0.680
				(0.47)	(0.55)
Satisfaction Retirement Benefits				–0.408	–0.515
				(0.13)***	(0.14)***
Risk Aversion					0.148
					(0.20)
Loss Aversion					–0.007
					(0.19)
Financial Literacy					–0.358
					(0.24)
Life Expectancy					0.024
					(0.03)
Private Pension Insurance					–0.448
					(0.51)
Constant	–1.735	–1.631	–1.657	–3.177	–3.601
	(0.26)***	(0.23)***	(0.42)***	(4.98)	(6.74)
Observations	185	185	185	167	158

Table F.2. Robustness for Table 7.
This table presents regression coefficients of five logistic regressions with the indicator *Private Pension Insurance* as the dependent variable. The included variables are as defined in the Appendix. Robust standard errors are displayed in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10%-level, respectively.

	Private Pension Insurance Indicator				
	(1)	(2)	(3)	(4)	(5)
Inconsistency Indicator	–0.193				
	(0.09)**				
Number Inconsistent Answers		–0.087	–0.084	–0.112	–0.110
		(0.05)*	(0.05)*	(0.05)**	(0.05)**
Impatience Scale [1-7]			–0.031	–0.023	–0.021
			(0.03)	(0.03)	(0.03)
Age				–0.001	–0.001
				(0.00)	(0.01)
Gender [male=1]				–0.018	–0.076
				(0.13)	(0.14)
Married				0.290	0.288
				(0.12)**	(0.12)**
Number of Children				–0.032	–0.046
				(0.05)	(0.05)
Education [0-2]				0.078	0.068
				(0.08)	(0.08)
Income [Log]				0.308	0.306
				(0.07)***	(0.07)***
Risk Aversion					–0.088
					(0.04)**
Loss Aversion					–0.024
					(0.04)
Financial Literacy					–0.026
					(0.05)
Life Expectancy					0.014
					(0.01)**
Constant	0.615	0.594	0.707	–1.790	–2.357
	(0.06)***	(0.05)***	(0.11)***	(0.48)***	(0.84)***
Observations	2277	2277	2270	2072	2046

Table F.3. SAVE: Retired earlier than planned.
The Table shows six linear probability models (OLS) with an indicator of earlier than planned retirement as the dependent variable. Among the controls, changes in variables (Δ) are defined as the change from the wave prior to retirement to the retirement wave. Income is defined as income prior to retirement. All other variables are taken from the wave in which the participant retired. All five imputations of the SAVE data are used. Coefficients and standard errors are calculated according to Rubin (1987). ***, **, and * indicate statistical significance at the 1%, 5%, and 10%-level, respectively.

	Earlier Than Planned					
	(1)	(2)	(3)	(4)	(5)	(6)
Smoker	0.325	0.305			0.269	0.274
	(0.09)***	(0.12)**			(0.10)***	(0.11)**
Overdraft Indicator			0.344	0.35	0.28	0.312
			(0.10)***	(0.14)**	(0.10)***	(0.13)**
Δ Health Status		-0.074		-0.037		-0.057
		(0.09)		(0.08)		(0.08)
Δ Satisfaction Health		-0.024		-0.029		-0.019
		(0.03)		(0.03)		(0.03)
Δ Prologned Illness		0.004		0.008		0.058
		(0.13)		(0.12)		(0.12)
Age		-0.027		-0.026		-0.024
		(0.01)***		(0.01)**		(0.01)**
Gender		-0.043		-0.02		-0.035
		(0.12)		(0.12)		(0.11)
Married		-0.043		-0.062		-0.015
		(0.14)		(0.12)		(0.12)
Number Children		0.054		0.066		0.059
		(0.04)		(0.03)**		(0.04)
Education		-0.062		0.002		-0.018
		(0.07)		(0.08)		(0.07)
Income [log]		0.222		0.208		0.192
		(0.07)***		(0.07)***		(0.06)***
Constant	0.290	0.395	0.308	0.387	0.242	0.321
	(0.05)***	(0.11)***	(0.05)***	(0.12)***	(0.05)***	(0.11)***
R^2	0.094	0.323	0.090	0.324	0.152	0.384
Obs.	123	75	123	75	123	75

Table F.4. SAVE: Robustness test on owning private pension insurance.
This table presents a robustness test of Hypothesis 4. It shows the results of six linear probability models with the indicator *Private Pension Insurance* as the dependent variable for the sample consisting of non-retirees (in SAVE wave 2010). All variables are as defined in the Appendix. All five imputations of the SAVE data are used. Coefficients and standard errors are calculated according to Rubin (1987). ***, **, and * indicate statistical significance at the 1%, 5%, and 10%-level, respectively.

	Private Pension Insurance					
	(1)	(2)	(3)	(4)	(5)	(6)
Smoker	–0.069	–0.059	–0.043			
	(0.04)*	(0.04)	(0.04)			
Overdraft [1-4]				0.015	0.012	–0.030
				(0.02)	(0.02)	(0.02)
Health Status		0.002	–0.043		0.009	–0.07
		(0.03)	(0.03)		(0.04)	(0.04)*
Satisfaction Health		0.012	0.01		0.01	0.014
		(0.01)	(0.01)		(0.01)	(0.01)
Prologned Illness		–0.12	–0.032		–0.127	–0.06
		(0.05)**	(0.05)		(0.06)**	(0.06)
Age			–0.011			–0.016
			(0.00)***			(0.00)***
Gender			–0.113			–0.048
			(0.05)**			(0.07)
Married			0.118			0.079
			(0.04)***			(0.05)
Number of Children			0.045			0.049
			(0.01)***			(0.02)**
Education			–0.003			–0.032
			(0.03)			(0.03)
Income [log]			0.027			0.027
			(0.01)***			(0.01)***
Financial Literacy			0.06			0.04
			(0.02)***			(0.02)**
Life Expectancy			0.002			0.002
			(0.00)***			(0.00)***
Constant	0.375	0.351	0.422	0.375	0.346	0.935
	(0.02)***	(0.12)***	(0.23)*	(0.05)***	(0.16)**	(0.3)***
R^2	0.003	0.026	0.206	0.000	0.020	0.234
Observations	558	558	558	400	400	400

Table F.5. Attrition rates for smokers and non-smokers in the SAVE Panel.
The table shows the attrition rates for smokers and non-smokers in the subsamples of retirees and non-retirees between 2008 and 2011.

PANEL A: Retirees								
Year	**Smoker**	**Drop Out**	**%**	**Non-Smoker**	**Drop Out**	**%**	**TOTAL**	**%**
2008	171			807			978	
2009	150	21	12.3%	703	104	12.9%	853	12.8%
2010	138	12	8.0%	659	44	6.3%	797	6.6%
2011	111	27	19.6%	553	106	16.1%	664	16.7%
PANEL B: Non-Retirees								
Year	**Smoker**	**Drop Out**	**%**	**Non-Smoker**	**Drop Out**	**%**	**TOTAL**	**%**
2008	567			1,034			1,601	
2009	468	99	17.5%	873	161	15.6%	1,341	16.2%
2010	430	38	8.1%	797	76	8.7%	1,227	8.5%
2011	307	123	28.6%	567	230	28.9%	874	28.8%

Table F.6. SAVE: Robustness test including former smokers.
The table shows results of three cross-sectional regressions with Actual Retirement Age as the dependent variable. The regressions replicate columns (1) to (3) in Table 9. Former Smoker is an indicator for participants that used to smoke in at least one of the SAVE waves 2001-2009 but do not smoke in wave 2010. ***, **, and * indicate statistical significance at the 1%, 5%, and 10%-level, respectively.

	Actual Retirement Age		
	(1)	(2)	(3)
Smoker	−3.918	−3.843	−2.953
	(0.79)***	(0.79)***	(0.80)***
Former Smoker [0/1]	−3.944	−3.550	−2.743
	(1.15)***	(1.14)***	(1.11)**
Health Status		1.579	1.357
		(0.48)***	(0.47)***
Satisfaction Health		−0.026	−0.02
		(0.15)	(0.14)
Prolonged Illness		0.434	0.669
		(0.56)	(0.54)
Gender			1.381
			(0.48)***
Married			−0.768
			(0.49)
Number of Children			0.106
			(0.16)
Education			0.796
			(0.24)***
Income [Log]			−0.268
			(0.06)***
Financial Literacy			−0.11
			(0.20)
Life Expectancy			0.144
			(0.03)***
Private Pension Insurance			−4.38
			(1.05)***
Constant	59.727	54.549	43.889
	(0.23)***	(1.50)***	(2.98)***
R^2	0.050	0.080	0.160
Observations	907	907	905