Now or Later?
Present-Bias and Time-Inconsistency in Intertemporal Choice

Procrastination Talk, 15 October 2014

Now or Later?
Present-Bias and Time-Inconsistency in Intertemporal Choice

or

"When the timing gets flexible, the slow turn pro."
--Knute Rockne (planned but never delivered)

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(with large debts to David Laibson, Ted O'Donoghue, and Matthew Rabin; material from their slides is used with permission)

Behavioral economics explains phenomena like time-inconsistent intertemporal choice and procrastination as the product of "present-biased" preferences and possible naivete about the choices of one's own future selves.

I will start with an overview of those ideas and the supporting evidence.

I will then illustrate their uses in thinking about economic and social policy.

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Present bias and naivete:

● Qualify the standard arguments for consumer sovereignty and laissez faire

● May provide a rationale for "libertarian paternalism"

● May provide a rationale even for some coercive policies

Standard economic model of intertemporal choice

Present bias, time-inconsistency, and procrastination are biases (only) relative to the standard "fully rational" model: time-separable utility with exponential discounting (Ramsey 1928 *Economic Journal*, Samuelson 1937 *REStud*).

In the standard model, the individual chooses as if to maximize:

$$U_t = u_t + \delta u_{t+1} + \delta^2 u_{t+2} + \delta^3 u_{t+3} + \cdots$$

The trade-off between receiving "utils" today and receiving them with a given delay is then independent of when that delay occurs:

If you prefer 10 utils now to 15 utils next week, you must also prefer 10 utils in 25 weeks to 15 utils in 26 weeks.

The choices of a planner with time-separable utility and exponential discounting are "time-consistent", in that her/his current and later selves agree on the ranking of plans.

The mere passage of time, with no new information, doesn't change the ranking.

Thus the planner can simply choose a plan that maximizes lifetime utility at the start, without worrying about later selves disagreeing with or overturning it.

(Although I will ignore the possibility here, receiving new information over time could affect a time-consistent planner's preferences over decisions, which normally vary with the information received.

But new information cannot alter a time-consistent planner's ranking of plans *contingent* on the resolution of uncertainty, as optimal plans must normally be.)

Time-inconsistency and present bias

For a time-consistent planner, other things equal, if it's beneficial to do something next week/month/year/etc., it's (even more) beneficial to do it now. But many people don't act that way.

Familiar quotations you would never hear from a time-consistent planner:

● Next month, I'll quit smoking.

● Next week, I'll catch up on the required reading.

● Tomorrow morning, I'll wake up early and exercise.

● After Christmas, I'll start eating better.

● Next weekend, I'll send in this rebate form.

● Next month, I'll start saving for retirement.

● Da mihi castitatem et continentiam, sed noli modo. (Give me chastity and continence—but not yet.)—Saint Augustine of Hippo

Not only do these quotations all reflect time-inconsistency, they are all inconsistent in the same direction: All excessively favor gratification (or avoiding nongratification) now, at the expense of future gratification (or avoidance).

Excessively favoring gratification now at the expense of future gratification can usefully be modeled via "present-biased" preferences, on which more below.

Future bias would yield quotations you seldom hear:

● I plan to watch more TV next year.

● I plan to eat more cookies and doughnuts next year.

● I plan to smoke more cigarettes next year.

● I plan to borrow more on my credit card next year.

● I plan to exercise less next year.

● I plan to wake up later next year.

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One possible exception:

● John Maynard Keynes's last words: "I wish I had drunk more champagne".
  (But he was a workaholic, so perhaps even this was present bias.)

"Excessively" relative to what? The standard exponential discounting benchmark.
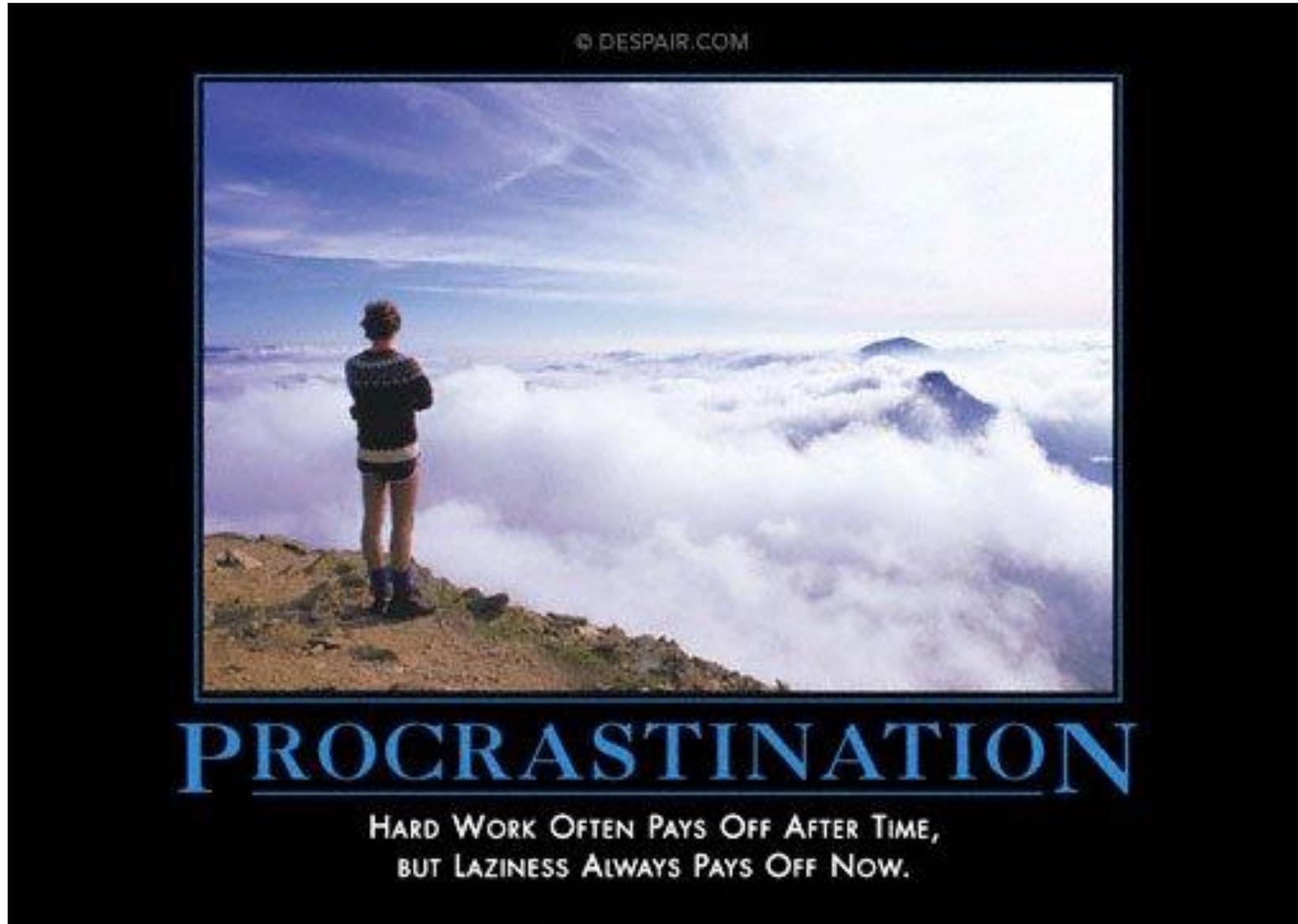

Moe:
"This thing can **flash fry** a **Water Buffalo** in **40 seconds.**"

Homer:
"Ohhhh, **40 seconds**! But I want mine Now."

As the familiar quotations also illustrate, a common symptom of present-biased preferences is procrastination, whereby the current self defers nongratification in pursuit of a long-term goal while planning for some future self to pursue it.

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PROCRASTINATION

HARD WORK OFTEN PAYS OFF AFTER TIME,
BUT LAZINESS ALWAYS PAYS OFF NOW.

Procrastination is a prominent problem (numbers from 2011; I'll update soon…):

● With 14,800,000 Google hits, 33% more prominent than ennui with 11,100,000, but 47% less important than plagiarism with 27,800,000.

● Far less prominent than pride with 418,000,000; lust 216,000,000; wrath 148,000,000; greed 114,000,000; or envy 110,000,000.

● But close behind sloth with 15,900,000 (not counting those with toes), and easily tops gluttony with 5,450,000.

● (For comparison: Obama 723,000,000 Google hits; Lady Gaga 479,000,000; The Simpsons 159,000,000; Emma Watson 92,300,000; Marx (not counting Groucho) 90,900,000; Keynes 51,000,800.)

Future bias would make people accelerate unpleasant tasks or defer gratification.

English actually has a word for this:

● "Preproperation" (456 Google hits and counting).

Less casual evidence

With exponential discounting, plausible discounting for a year from now implies implausibly low (virtually zero) discounting for a day or a week from now.

Thaler (1981 *Economics Letters*) asked subjects to choose between money now versus more money later, hypothetically (but works for real choices too):

- What amount makes you indifferent between $15 today and $X in 1 month? Typical response: X = 20. Implied discount rate: 345% per year.

- What amount makes you indifferent between $15 today and $X in ten years? Typical response: X = 100. Implied discount rate $\simeq$ 19% per year.

Shapiro (2005 *J. Public Economics*) examined consumption patterns among food-stamp recipients, and found that over the month between food-stamp deliveries, a family's caloric intake declines by about 10-15 percent.

Survey evidence revealed rising desperation over the month, suggesting that high elasticity of intertemporal substitution is not a likely explanation.

Households with more short-run impatience (estimated from hypothetical intertemporal choices) were more likely to run out of food during the month.

To explain these patterns with a standard exponential-discounting model would require calibration with an extreme annual discount *factor* of 0.23.

Models like those discussed below explain the patterns more gracefully.

Read, Loewenstein, and Kalyanaraman's (1999 J. *Behavioral Decision Making*) and others found similar results for real choices in kind, avoiding some confounds.

Subjects chose among 24 movie videos.

● Some were "lowbrow": e.g *Four Weddings and a Funeral*

● Some were "highbrow": e.g. *Schindler's List*

(The canonical highbrow movie:

A man seeks answers about life, death, and the existence of God as he plays chess against the Grim Reaper during the Black Death.)

Results:

● Choosing for tonight: 66% of subjects chose lowbrow.

● Choosing for next Tuesday: 37% chose lowbrow.

● Choosing for second Tuesday: 29% chose lowbrow.

Badger et al. (2007 *J. Health Econ.*) on recovering heroin addicts' monetary equivalent of an extra dose of Bupronorphine (like Methadone, reduces craving).

Elicited willingness to pay for second dose (still attractive to addicts) from 13 long-term heroin addicts regularly receiving a single dose: $10? $20?...$100?

Subjects told (truthfully) that one of their choices, randomly selected, would be implemented: Thus had incentive to choose according to true preferences.

Half of the subjects were asked when more deprived (2 hours before scheduled dose), half when less deprived (right after scheduled dose).

Half were asked about a dose today, half about a dose on their next visit.

(Subjects were always experienced; and were always asked about a second dose, to be delivered in the satiated state.)

	Immediate	Delayed 5 days
Satiated	$50	$35
Deprived	$75	$60

Present bias ($50 > $35 and $75 > $60, even though the delay is not that long).

Also "projection bias" ($75 > $50 and $60 > $35, even though it is always known that the second dose will be delivered in the satiated state).

	Immediate	Delayed 5 days
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Deprived	$75	$60

Consumer sovereignty?

The "multiple selves" tension between a present biased person's present and future preferences muddies "revealed preference" judgments about welfare.

What should we infer from their elicited willingnesses to pay that an extra dose of Bupronorphine is worth to these people?

	Immediate	Delayed 5 days
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Most behavioral economists think the right answer is $35.

Why? Because they think the ideal is to decide ahead of time, avoiding present bias; and in the satiated state, avoiding projection bias: first row, second column.

Put another way, they favor the preferences of people's long-run, satiated selves (just as people's own judgments about their past decisions often do).

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(But don't forget that it was economists who got to define "bias" here.)

Why is it only "most" behavioral economists who think the right answer is $35?

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Why is it only "most" behavioral economists who think the right answer is $35?

There are behavioral libertarians, who think it's wrong to deny the rights of current and/or deprived selves, even if they are biased.

And, what would *non*-behavioral economists do?

They would most likely refuse to answer, on the grounds that such questions are meaningless for people with irrational biases.

Quasi-hyperbolic discounting

How can we model present-biased preferences? Consider "quasi-hyperbolic" discounting (also known as simply "hyperbolic", or "β, δ"; Phelps-Pollak 1968 *REStud*, Laibson 1997 *QJE*, O'Donoghue and Rabin 1999 *AER*):

$$\text{Discount factor } D(\tau) \equiv \begin{cases} 1 \text{ if } \tau = 0 \\ \beta\delta^\tau \text{if } \tau = 1,2,\dots \end{cases}$$

(Tractably approximates (*non*-quasi-)hyperbolic discounting : $D(x) = 1/(1 + k\tau)$.)

● Can write a quasi-hyperbolic intertemporal utility function as

$$U_t = u_t + \beta\delta u_{t+1} + \beta\delta^2 u_{t+2} + \beta\delta^3 u_{t+3} + \cdots$$

$$= u_t + \beta(\delta u_{t+1} + \delta^2 u_{t+2} + \delta^3 u_{t+3} + \cdots)$$

β = 1 gives us back the standard exponential-discounting model.

But plausibly, β << 1 and δ < 1. E.g. β = 2/3 (for one day) and δ ≈ 0.95.

When β < 1, the present-biased quasi-hyperbolic β, δ model generates a conflict between earlier and later selves, and the kind of time-inconsistency it causes.

Less mechanical, richer, but less tractable alternative

In "dual process theory" (see for example Kahneman *AER* 2003 or *Thinking, Fast and Slow*), choice is the product of an interaction between two systems:

- System 1: Fast, automatic, frequent, emotional, stereotypic, subconscious.

- System 2: Slow, effortful, infrequent, logical, calculating, conscious.

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Applications are *not* limited to intertemporal choice; but in that context:

- System 2 plans diet menus and dreams about its future selves' fashion options.

- System 1 munches potato chips and wonders why it bought only one bag.

Having both Systems 1 and 2 confers an adaptive advantage because sometimes a fast but imperfect decision is better than a slow but more ideal one.

But both systems are always "on", and interfere with one another to some extent.

Less-than perfect triage ("duage"?) of decision authority yields choices that seem systematically biased from a narrowly rationality based viewpoint.

Time-inconsistency and procrastination

Special case of "β, δ" to simplify math and build intuition: β = 1/2 and δ = 1:

$$D(\tau) = \{1, \beta\delta, \beta\delta^2, \beta\delta^3, \ldots\} = \{1, \tfrac{1}{2}, \tfrac{1}{2}, \tfrac{1}{2}, \ldots\}.$$

The short-run self is extremely impatient: Relative to the current period, all future periods are weighted much less.

But the long-run self is infinitely patient: All future periods are weighted equally.

Note that just as the "present" moves as time passes, the present-bias effect of the β moves.

Example (Akerlof 1991 *AER*; O'Donoghue and Rabin 1999 *AER*): Suppose exercise has benefit today of - 6 (i.e. a cost), and delayed total future benefit of 8.

● Choose today to exercise today? No.

$$-6 + \frac{1}{2}8 = -2 < 0$$

● Choose today to exercise tomorrow (with commitment to such a plan)? Yes.

$$0 + \frac{1}{2}(-6 + 8) = 1 > 0$$

● But choose tomorrow to exercise tomorrow (without a prior commitment)? No again (even though there is still a total delayed future benefit of 8).

$$-6 + \frac{1}{2}8 = -2 < 0$$

In general, the effect of present bias on decisions (including commitments) is sensitive to timing: Do benefits precede costs or are they simultaneous?

Naivete versus sophistication regarding one's own future behavior

Dellavigna and Malmendier (2006 *AER*) found, analyzing health club members' gym usage over time:

- Average cost of gym membership: $75 per month

- Average number of monthly visits: 4

- Average cost per visit: $19

- Cost of "pay per visit": $10

(The monthly club contract has automatic renewals, and there seems to be procrastination in cancelling, in the form of a lag between last usage and cancellation that is positively correlated with overpayment in the initial months.)

Although members' behavior looks time-inconsistent, present bias alone is not enough to explain it:

If members' correctly predicted their future decisions, they wouldn't join the gym.

Ariely and Wertenbroch (2002 *Psychological Science*) ran experiments using course term papers and proofreading tasks.

The term paper subjects were 99 professionals in an executive-education course at MIT, where three short papers were required in the course.

Each paper had a deadline, with a 1% grade penalty per day late for all subjects.

Two treatments were run "between subjects" in different sections:

● No Choice: Exogenous, evenly spaced deadlines.

● Free Choice: Each student free to chose own deadlines (or not).

What would a person who knew s/he was time-consistent choose (with imperfect predictability of task completion times, even without self-control problems)?

What would a libertarian choose, time-consistent or not?

Results

In the free-choice group, 37/51 people imposed deadlines on themselves.

● Average deadline for paper 1 was 42 days before end of term.

● Average deadline for paper 2 was about 26 days before end of term.

● Average deadline for paper 3 was about 10 days before end of term.

Average grades in the no-choice section were 89, > 86 in the free-choice section.

● People chose to make costly commitments, which is consistent with present bias and some degree of sophistication.

● But the chosen commitments were far from optimal, again suggesting naivete.

Subjects were also recruited for proofreading tasks and paid for performance, with a $1 penalty per day late for all subjects, and a $0.10 penalty for errors:

"Sexual identity is intrinsically impossible," says Foucault; however, according to de Selby [1], it is not so much sexual identity that is intrinsically impossible, but rather the dialectic, and some would say the satsis, of sexual identity. Thus, D'Erlette [2] holds that we have to choose between premodern dialectic theory and subcultural feminism imputing the role of the observor as poet."

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There were three such texts, and three treatments were run between subjects in different groups:

● No Choice: Exogenously imposed, evenly spaced deadlines of seven days for each text.

● End deadline: All three texts due at the end of 21 days.

● Free Choice: Each student chose his own deadlines for each text, within the 21-day window.

Results

● Subjects in the free-choice group spaced out their deadlines.

● Performance (freedom from errors and on-time delivery) was highest in the no-choice treatment, followed by the free choice and end deadline treatments.

● Again subjects chose to make costly commitments, but their chosen commitments were far from optimal.

Present bias alone is again not enough to explain subjects' choices. They need enough sophistication to see the point of commitments, but also some naivete.

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● "Naifs" falsely believe their future selves will maximize today's preferences:

—Solution concept: maximization (mispredict future discount rates)
—Dellavigna and Malmendier prediction: never exercise (but join gym)

● "Sophisticates" have rational expectations (Strotz 1957 *REStud*).

—Solution concept: subgame perfect equilibrium (multiple-selves tension turns a person into a game among her/his current and future selves)
—Dellavigna and Malmendier prediction: never exercise (and don't join gym)

● "Partial naivete" (O'Donoghue and Rabin 2001 *QJE*; won't talk about here)

—Solution concept: subgame perfect equilibrium, using $\hat{\beta}$ such that $\beta < \hat{\beta} < 1$. (Nests naifs, with $\hat{\beta} = 1$, and sophisticates, with $\hat{\beta} = \beta$.)

Commitment

Even partial naivete implies some willingness to pay for commitment.

Wertenbroch (1998 *Marketing Science*) finds that consumers tend to buy "temptation goods" in small packages, foregoing volume discounts.

Oster and Scott-Morton (2005 *BE Advances in Economic Analysis & Policy*):

- Magazines like *People* sold on newsstands at high price relative to subscription.

- Magazines like *Foreign Affairs* sold on newsstands at low price relative to subscription.

- But, disproportionately, magazines like *People* are sold on newsstands and magazines like *Foreign Affairs* are sold by subscription.

Thus firms know that consumers are present biased and may value commitment, and market dry and tempting magazines accordingly.

However:

● We see surprisingly little endogenous commitment for commitment's sake.

● Most commitment is ancillary (e.g. obligatory monthly mortgage payments).

● Very little is gratuitous and advertised as such (e.g. Christmas clubs).
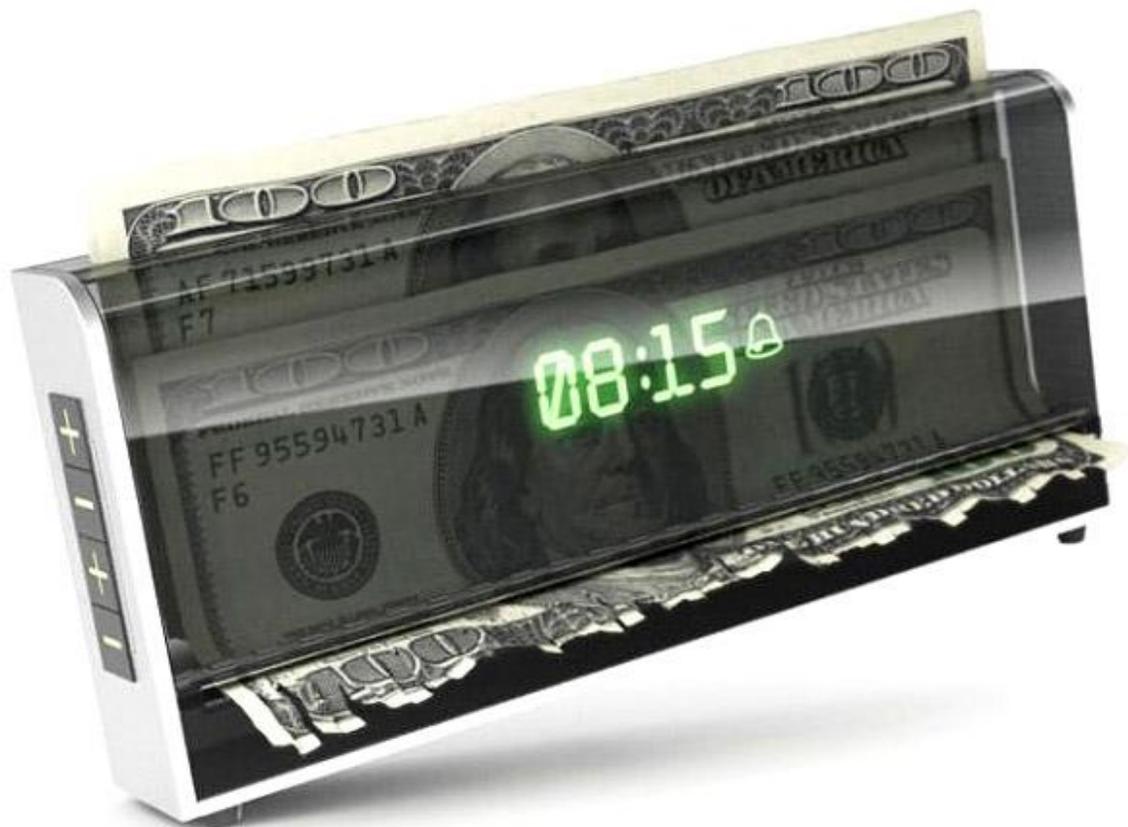
Exceptions: the commitment website StickK.

(Due to behavioral economists Dean Karlan and Ian Ayres, so may not count.)

Clocky, an alarm clock that plays annoying tunes while running away from you, unless you get up to catch it and turn it off http://www.nandahome.com/.

Another alarm clock: "Get up now! Or a donation to [your favorite odious charity] will be automatically deducted from your account".

ALARM SET 6:30AM
$11 PENDING TO GOP
6:15:29 AM
$832 TOTAL DONATED
WPA ENABLED-E*TRADE

SNŪZNLŪZ

$11 PENDING TO GOP
$832 TOTAL DONATED

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Applications

(See also Camerer, Issacharoff, Loewenstein, O'Donoghue, and Rabin, "Regulation for Conservatives…", 2003 *Penn Law Review*)

Thaler and Benartzi's (2004 *JPE*) "Save More Tomorrow" plan

"Our goal was to design a program to help those employees who would like to save more [for retirement], but lack the willpower to act on this desire. [The] plan gives workers the option of committing themselves now to increase their savings rate later. Once employees join, they stay in the plan until they opt out."

Plan exploits workers' present bias (and money illusion) by delaying most of its cost until later (and linking it to nominal raises), and by using present bias and delay to reduce a worker's incentive to opt out.

Tests with individual employers show that: (a) a high proportion of workers, 78%, joined, (b) 80% of them stayed in through their fourth pay raise, and (c) over the 40 months, their average saving rates increased from 3.5% to 13.6%.

Libertarian paternalism: Remarkably, the plan helps workers overcome self-control problems, while almost completely preserving their freedom of choice, and not distorting the choices of workers who do not have self-control problems.

(But even that has not allowed the plan to escape the wrath of libertarians.)

Heidhues and Kőszegi's (2010 *AER*) analysis of credit markets

Much experience with credit cards, subprime mortgages, etc. suggests that many consumers overborrow, do not comply fully with repayment terms, and pay abusively large penalties for small deviations from compliance.

In theory, with time-consistent or self-aware borrowers, such things would not happen in a competitive (or even a monopolistic) credit market.

Present bias seems to be part of the explanation, because the initial terms offered borrowers are usually much more favorable than the eventual terms.

But present-bias alone is not enough, because much such borrowing, e.g. to purchase a durable good, has up-front effort costs and mostly delayed benefits.

There is a certain kind of economist who thinks that competition among firms will police real-world contractual markets, eliminating abusive practices even if consumers have behavioral biases.

Heidhues and Kőszegi examined that belief by studying firms' contract choices, borrowers' loan-repayment behavior, and borrowers' welfare in a model of a competitive credit market where borrowers are present-biased and may be naive.

(Studying competitive markets is a natural rhetorical choice here, but the results would be very similar for a monopolistic market.)

Heidhues and Kőszegi's model focuses on the effects of present bias and naivete by assuming that firms know everything about borrowers and borrowers know everything about firms and themselves; except that less-than-fully-sophisticated borrowers don't know their own true βs.

For non-present-biased, time-consistent borrowers, naïve behavior is (by definition) the same as sophisticated behavior.

For such borrowers, or even for present-biased but sophisticated borrowers, a firm's equilibrium contracts are Pareto-efficient (in the sense that no feasible contract could make both borrower and lender better off); and rules against abusive credit practices are nonbinding and unnecessary.

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In the standard model of contracting (competitive or monopolistic), the firm proposes a contract and the borrower then says Yes (under competition, to the best contract that any firm has offered) or No. Yes yields a binding contract, and No ends the process without a contract. (Richer models yield similar outcomes.)

Then, if the borrower can accurately predict the consequences of any contract, a firm thinking of proposing an inefficient contract could do better by eliminating the inefficiency: Not because it cares about the borrower's welfare, but because eliminating the inefficiency allows it to charge the borrower more.

Thus, for non-present-biased and time-consistent, or for sophisticated borrowers, competitive or monopolistic contracts must (in theory) be Pareto-efficient.

Because abusive credit practices are Pareto-inefficient, this argument shows that both present bias and some degree of naivete are needed to explain them.

Heidhues and Kőszegi find that for present-biased, time-inconsistent, and less than perfectly sophisticated borrowers, a competitive firm's profit-maximizing contract has cheap "baseline" (what a naïve borrower expects) repayment terms; but they are inefficiently front-loaded and noncompliance incurs a large penalty.

The terms are inefficient because the firm chooses them to appeal to the initial self that must be induced to sign the contract, whose naivete distorts trade-offs.

Large penalties are also inefficient because they exceed the cost of noncompliance to the firm; but a naïve borrower doesn't expect to pay them, and these incorrect expectations also distort her/his trade-offs.

In equilibrium, naïve borrowers borrow more than sophisticated borrowers.

And, although their use of the credit is for future consumption, they are induced to back-load repayment, thereby incurring large unanticipated penalties.

As a result, naïve borrowers have discontinuously lower welfares than otherwise identical sophisticated borrowers.

Not only does competition *not* help to police the market, competitive firms *must* exploit naïve time-inconsistent consumers or be priced out of the market.

Mildly coercive paternalism: Prohibiting firms from charging large, non-cost-based penalties for deferring small amounts of repayment—akin to recent U.S. regulations—can raise welfare.

Importantly, some such coercive regulations can benefit naïve consumers without hurting sophisticated consumers: libertarian paternalism again.