TEMPTATION AND TAXATION

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PURPOSE OF THIS PAPER

• Experimental evidence suggests that many individuals exhibit preference reversals: they reverse preference from a larger, later reward to a smaller, earlier reward as the delays to both rewards decreases.

• Motivated by this evidence, we ask a question of macroeconomic interest: should savings be subsidized and, if so, by how much?
• Modelling multiple selves (Strotz/Phelps-Pollak/Laibson): quasi-hyperbolic, or quasi-geometric, discounting (the so-called $\beta$-$\delta$ model).
  – Uses game theory: an intertemporal game between different selves.

• The Gul-Pesendorfer (GP) model of temptation and self-control. It develops a theory of preferences over choice sets.
  – Bases dynamic decision theory on revealed-preference arguments.
WE CONTEND. . .

• . . . that the lab evidence on reversals does not lead inevitably to the conclusion that people are irrational (split into multiple selves). GP instead show that preference reversals can be “rationalized.”

• We can, thus, think of people as having preferences over choice sets. Such preferences can, in principle, be elicited from more lab experiments.

• An important disadvantage of the multiple-selves model is that is hard to use for normative questions: which self’s utility do we use for comparing policies?

• The GP model, in contrast, does allow normative analysis. So we apply the GP approach in order to answer our policy question.
We specialize the GP formulation. We assume a form which reproduces Laibson-like behavior as a special case. It has two new parameters, capturing the nature and the strength of temptation.

We specify choice sets of agents in a standard way: price taking with proportional taxes, i.e., tax policy changes the slopes and intercepts of budget sets.

This is macro: in our policy analysis, we want to allow for the possibility that policy affects individual welfare both directly and indirectly through changes in equilibrium prices. To this end, we study a general equilibrium model with capital.
IMPLEMENTATION OF GP (cont’d)

- To develop intuition, we first analyze a two-period model: here we show, under quite general conditions, that the government should subsidize savings.

- We then study a more “quantitative” (much-longer-horizon) model: we embed temptation into the standard growth model.
  - We characterize steady states.
  - We find closed-form global dynamics for a special case.
  - We solve a more general case numerically; on this we base our quantitative experiments.

Thus we generalize standard optimal growth theory.
CALIBRATION OF PREFERENCES

• For our quantitative analysis, how do we measure the two new preference parameters?

• Since we have not yet performed the needed new lab experiments, we design questions whose answers we can interpret (perhaps by introspection).

• In particular, these questions allow us to interpret different possible choices for the new parameters in terms of the costs of self-control and of the “inability to commit”.

MAIN QUANTITATIVE FINDINGS

• The growth model with temptation is (nearly) observationally equivalent to the standard model. We take comfort in this since our main goal is normative not positive.

• Yes, savings should be subsidized.

• By how much? The answer depends critically on whether preferences are such that consumers can resist temptation.
  – If they can, optimal subsidies are very small.
  – If they can’t, policy can play a larger role.
PREFERENCES OVER CHOICE SETS

• Gul and Pesendorfer develop a representation theorem for preferences over choice sets.

• In their framework, choice sets cannot be compared simply by looking at their best elements. Instead, the utility of a fixed choice depends on the choice set (through its most “tempting” element).
The preference representation has two key elements $U$ and $V$.

- $U$ determines the *commitment* ranking (i.e., the utility of singleton sets).
- $V$ determines the *temptation* ranking (i.e., $V$ gives higher values to more tempting elements).
- Actual behavior maximizes $U(x) + V(x)$.
- $V(x) - \max_{\tilde{x} \in A} V(\tilde{x})$ is the disutility (or cost) of self-control. If this cost is zero, the individual *succumbs to temptation*.
- The indirect utility of a set $A$ is:

$$W(A) = \max_{x \in A} \{U(x) + V(x)\} - \max_{\tilde{x} \in A} V(\tilde{x})$$
THE TWO-PERIOD CONSUMPTION-SAVINGS MODEL

• Consumption today and tomorrow.

• Neoclassical production.

• Standard budget set (borrowing and lending at $r$).

• General equilibrium.

• With $\tilde{u}(c_1, c_2)$ playing the role of $U$ and $\tilde{v}(c_1, c_2)$ the role of $V$, let the temptation function $\tilde{v}$ have a stronger preference for present consumption. For example, let

$$\tilde{u}(c_1, c_2) = u(c_1) + \delta u(c_2)$$

and

$$\tilde{v}(c_1, c_2) = \gamma (u(c_1) + \beta \delta u(c_2)),$$

with $\beta < 1$. 

THE INDIVIDUAL’S PROBLEM IN THE TWO-PERIOD MODEL

\[
\max_{(c_1, c_2)} \{ \tilde{u}(c_1, c_2) + \tilde{v}(c_1, c_2) \} - \max_{(\tilde{c}_1, \tilde{c}_2)} \tilde{v}(\tilde{c}_1, \tilde{c}_2)
\]

\[
\equiv
\max_{(c_1, c_2)} \{(1 + \gamma)u(c_1) + \delta(1 + \beta\gamma)u(c_2) \} - \max_{(\tilde{c}_1, \tilde{c}_2)} \gamma\{ u(\tilde{c}_1) + \delta\beta u(\tilde{c}_2) \}
\]
POLICY IN THE TWO-PERIOD MODEL

- **Command policy**: The government chooses for the consumer, eliminating self-control problems. The command policy is therefore first-best: it maximizes $u(c_1) + \delta u(c_2)$ and there is no disutility of self-control.

- **Taxation policy in competitive equilibrium**: The gov’t taxes income and investment (savings) at proportional rates in the first period. It chooses the tax rates to maximize consumer welfare given a budget-balancing constraint.

  **Result**: The optimal tax on investment ($\tau$) is negative.

  **Intuition**: Consider a small decrease in $\tau$ from zero. This has no effect on $\tilde{u} + \tilde{v}$ because the consumer is picking savings optimally. But temptation utility $\tilde{v}$ decreases: a consumer who deviates to save less receives a smaller subsidy but pays the same tax (since the tax is based on realized equilibrium behavior), so the temptation is less attractive.
The optimal tax on investment is:

\[ \tau = \frac{1 + \beta \gamma}{1 + \gamma} - 1. \]

The tax is zero if \( \gamma = 0 \) or \( \beta = 1 \). The tax is negative if \( \gamma > 0 \) and \( \beta < 1 \).

The optimal allocation is the same as under the command policy. But welfare is lower because of the self-control cost.
The two-period model determines preferences over two-period choice problems.

Longer-horizon choice problems are defined recursively: every choice problem requires choosing today’s consumption and tomorrow’s choice problem.

A natural “backwards iteration” delivers preferences over longer-horizon choice problems.
QUASI-GEOMETRIC TEMPTATION (cont’d)

• The individual’s problem for very long horizons:

\[
W(k) = \max_{k'} \{u(f(k) - k') + \delta W(k') + V(k, k')\} - \max_{\tilde{k}'} V(k, \tilde{k}'),
\]

where: \( V(k, y) \equiv \gamma \{u(f(k) - y) + \beta \delta W(y)\} \).

• Notice:

1. When \( \gamma = 0 \) or \( \beta = 1 \), the consumer does not have self-control problems: standard model.
2. When \( \beta = 0 \): temptation by immediate consumption as in Gul and Pesendorfer.
3. This framework can rationalize preference reversals if \( \gamma > 0 \) and \( \beta \neq 1 \).
Can show that if $\beta \neq 1$ and $\gamma$ goes to infinity, we obtain the Laibson case (the $\beta$-$\delta$ model).

- The agent puts so much weight on the temptation that he succumbs to $\beta$-$\delta$ behavior.
- He views the future period utils as being compared with $\delta$’s alone.

This approach tells us how to evaluate policy (which “self’s” utility function to use) in the Laibson limit case: the current self maximizes $V$, but $W$ corresponds to his utility. This is, in effect, utility as perceived by his most recent self.
MACROECONOMIC APPLICATIONS

• We consider long horizons: the limit of the finite-horizon problems.

• We study competitive equilibrium under two kinds of parametric restrictions:
  1. *Logarithmic utility, Cobb-Douglas production, and full depreciation:* full analytical solution of recursive competitive equilibria.
  2. *Isoelastic utility and no restrictions on technology:* analytical characterization of steady state and computational analysis of dynamics.
STEADY STATES AND DYNAMICS

• The steady-state interest rate depends on the elasticity of intertemporal substitution.

• When utility is logarithmic, there is observational equivalence with the standard model (as in Barro).

• When utility is not logarithmic, there is not observational equivalence, but the departures are not large.
INTERPRETING THE NATURE ($\beta$) AND THE STRENGTH ($\gamma$) OF THE TEMPTATION

• Question #1: How much better off would a consumer be if he were relieved of his self-control problems but could not change his equilibrium allocation? This is a measure of the cost of self-control.

• Question #2: How much better off would a consumer be if he were relieved of his self-control problems and could choose a new allocation given that all other consumers’ allocations remain at the equilibrium one? This is a measure of the “inability to commit”.
PARAMETER VALUES

• Annual model

• Discount rate $\delta$ equals 0.95.

• Depreciation rate equals 0.1.

• Cobb-Douglas production with capital’s share equal to 0.36.

• Elasticity of intertemporal substitution equals 0.5, 1 (log), and 2.

• Vary $(\beta, \gamma)$ to yield desired answers to welfare questions #1 and #2.
### QUANTITATIVE FINDINGS

<table>
<thead>
<tr>
<th>$\beta$</th>
<th>$\gamma$</th>
<th>Self-control and commitment costs</th>
<th>Optimal subsidy</th>
<th>Welfare gains (as % of cons.)</th>
<th>Pct. increase in $\bar{k}_{ss}$</th>
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<td>0.938</td>
<td>1.061</td>
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</table>
INTERPRETATION OF FINDINGS

• The optimal subsidy depends mainly on $\Delta$, the difference between the answers to Q#1 and Q#2.

• Moral: tax policy is not a convenient tool for eliminating costs of self-control, but it is effective for inducing consumers to choose differently.

• In the log case, in fact, the optimal subsidy induces the same allocation that would be chosen under full commitment. But welfare is lower because the self-control cost is unaffected.

• General equilibrium effects—decreases in the returns to saving as consumers save more in response to tax changes—are important quantitatively. Changes in prices offset most of the partial equilibrium welfare gains.
CONCLUSIONS

• Should you subsidize savings? Yes.
  – To answer this question, we use and specialize a normative model of temptation and self-control based on GP.
  – We incorporate the GP framework into a standard macroeconomic general equilibrium model.
  – Positive findings: observational equivalence nearly holds and the multiple-selves \((\beta-\delta)\) model appears as a special case.

• How large should subsidies be?
  – Small unless consumers succumb to temptation.
  – Policy is not effective for reducing the disutility of self-control, but it is effective for inducing consumers to choose differently.