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"Exploitative Contracting in a Life Cycle Savings Model"

Description of the data and files uploaded to the Data Archive of the *Review of Economics and Statistics*

1) General information

Analysis in the above paper relies on use of proprietary data. Therefore, I had applied for exemption from the *Review's* Data Availability Policy at the time of the initial submission. The files uploaded to the Data Archive contain MATLAB code that uses data described below as an input to produce the results reported in the paper. The code has been run in MATLAB R2018b (9.5.0.944444) on Windows 10 OS (64-bit). Below, I provide a description of the dataset as well as the code.

2) Data

The data used in the analysis is an output of the simulation code developed by D. Laibson, P. Maxted, A. Repetto and J. Tobacman for their 2018 working paper titled "Estimating Discount Functions with Consumption Choices over the Lifecycle" (LMRT-18). This version of the paper, including a detailed description of the life-cycle model, can be found here:

https://www.dropbox.com/s/khoyt5hz9ci1qfy/Estimating%20Discount%20Functions.pdf?dl=0

The authors have shared with me a piece of their code which, for a given specification of the household preference parameters and the economic environment, simulates life-cycle paths of consumption and wealth accumulation of 10,000 households that differ in their income stream realisations but are otherwise identical. The names of the relevant files are:

- `batchmsm20160515dbr_naif1_singleRun.m` – simulates behaviour of a fully naïve, present-biased household;
- `batchmsm20160515dr_exp_singleRun.m` – simulates behaviour of a time-consistent household.

When called, the above return data comprising the following (period-invariant) scalar variables (some of which act also as inputs into the simulation):

- `ans` – value of the loss function used in the GMM estimation procedure (see equation (7) in LMRT-2018);

- `delta` – long-run discount factor (δ);
- `beta` – short-run discount factor (β);
- `rho` – CRRA parameter (θ);
- `betahat` – agent's belief about their future short-run discount factor (β_hat);
- `alpha` – utility weight attached to the bequest motive (α);
- `THETA` – rate of return on the illiquid asset Z (R^Z);
- `R` – rate of return on positive holdings of the liquid asset X (R^X);
- `DEL_negX` – rate of return on negative holdings of the liquid asset X (R^{CC});
- `avgIncomeOverLifecycle` – average disposable income over the life cycle;
- `mean(effhh_size_)` – average household size over the life cycle;

and the following (period-specific) 1x71 vector variables:

- `age_` - household age (the first entry corresponds to the age of 20);
- `effhh_size_` - household size;
- `death` – probability of dying prior to period *t*, conditional on surviving until *t-1*;
- `zpen_eval` – penalty for withdrawing from the illiquid asset (κ_t);
- `avgY_` - average disposable income;
- `avgZ_` - average holdings of the illiquid asset;
- `avgX_` - average holdings of the liquid asset;
- `avgTC_` - average household consumption.

In the above, the term "average" refers to outcomes averaged over the 10,000 income stream realisations.

3) MATLAB code

`01 calibration loop.m`

This script iterates over a pre-specified grid for the values of household preference parameters and stores those values that minimise the GMM estimator's loss function. When employing this procedure, I had initially cantered the grid around the values estimated by LMRT-18 and subsequently adjusted it by centring on the loss-minimising parameters values from a preceding iteration. The associated results are displayed in Table A1 in the online appendix.

`02 hh data generating loop.m`

This script produces the relevant household-side data for a given specification of household preferences and the economic environment, labelled `recalibrated_data`. It iterates over different values of `THETA` - the rate of return on the illiquid asset Z - and stores variables corresponding to the naïve agent's actual (suffix `_naif`) and predicted (suffix `_TC`) behaviour separately.

`03a outside option data generating loop.m`

This script augments `recalibrated_data` with variables required to calculate the agent's perceived utility from their outside option – corresponding to the lack of access to illiquid asset

Z and modelled by setting the rate of return to -0.25, so that the agent's optimal holdings of the illiquid asset are zero throughout the life cycle.

03b contract evaluation loop.m

This script calculates the naïve agent's willingness to pay (`fmax`) for access to the illiquid asset for different values of `THETA`. It saves the augmented data as `recalibrated_data_with_eval`.

04a firm calibration benchmark.m

This script calibrates the firm-side of the model according to the procedure described in the paper, assuming the benchmark specification of the firm's cost function. The corresponding results are reported in Table 1 in the paper. One of the key variables produced by the calibration is `phi` which for simplicity represents the equilibrium fee level as a fraction of the agent's willingness to pay. For firm-side parameters that are not uniquely determined, the next steps of the analysis can be repeated for alternative parametrisations as a robustness check. Note that this doesn't affect the quantitative results.

04b firm POSTcalibration benchmark.m

This script completes the firm-side calibration exercise and subsequently analyses properties of the equilibrium contract, which are summarised in the paper's section 3.2. First, it backs out the Hotelling parameter (ξ) which rationalises the equilibrium fee consistent with the mark-up level targeted by the calibration. Second, it recalculates the firms' profits to double-check the relevant equilibrium conditions. Third, it checks whether there exist any Pareto-improving contracts which would improve the agent's actual lifetime utility while keeping the firms' profit constant at the current equilibrium level. Fourth, it calculates the consumption-equivalent welfare loss associated with the naïve agent choosing the equilibrium contract rather than a Pareto-efficient one. The CE welfare loss is calculated in two ways, depending on whether the lifetime utility is evaluated from the perspective of the first period or from the perspective of a randomly chosen period. Fifth, it calculates the impact of the contract choice on the agent's wealth holdings at retirement. Sixth, it produces Figure 3.

04c graphs for paper.m

This script produces Figures 1 and 2. It also performs the calculations underlying the discussion on the magnitude of forecasting errors.

05a policy count ceiling.m

This script produces results reported in Table 2, i.e. the effects of a policy intervention imposing a ceiling on fees. It first finds a candidate for the new equilibrium and then verifies the relevant

equilibrium conditions. Finally, it compares the firms' and the agent's outcomes to those attained under laissez-faire.

`05b policy count competition.m`

This script produces results reported in Table 3, i.e. the effects of a policy intervention targeting the degree of competition. First, for a given mark-up at the laissez-faire rate of return targeted by the policymaker, it finds a value for the Hotelling parameter that would rationalize it. Second, it finds the new equilibrium by checking which contract on the (modified) iso-profit curve maximises the agent's perceived utility and then verifies the remaining equilibrium condition. Third, it compares the firms' and the agent's outcomes to those attained under laissez-faire.

`05c policy count penalty.m`

This script produces results reported in Table 4, i.e. the effects of a policy intervention targeting the liquidity of the pension asset. First, given data on household's behaviour under an alternative specification of the withdrawal penalty schedule (produced using a procedure equivalent to that yielding `recalibrated_data_with_eval`) and for a given parametrisation of the firm side, it finds the new equilibrium by checking which contract on the (modified) iso-profit curve maximises the agent's perceived utility and then verifies the remaining equilibrium condition. Subsequently, it identifies a Pareto-efficient contract, which may differ from the one under the baseline withdrawal penalty schedule. Finally, it compares the firms' and the agent's outcomes to those attained under laissez-faire.