Slides 4 : Consumer

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Consumption/Saving Problem

- Previous class: we saw that finance allow to increase productivity of the economy (supply side)
- This week: Finance allows to increase welfare by allowing households to smooth consumption over time

- Let us examine the saving decisions of a household that is infinitely lived, has utility function u and impatience given by $\beta < 1$. Its utility is given by

$$\max \sum_{t=0}^{\infty} \beta^t u(c_t)$$

- The household receives a labor income y_t every period. Denote a_t the wealth of an household at the beginning of period t. Each period, a household can use its wealth to consume or to save, earning an interest rate $R > 1$. Formally, the household problem is

$$\max \sum_{t=0}^{\infty} \beta^t u(c_t)$$

$$\forall t a_{t+1} = R(a_t + y_t - c_t)$$

Solution Method 1

- We can iterate the budget constraint

$$
\begin{aligned}
a_0 &= c_0 - y_0 + R^{-1}a_1 \\
&= c_0 - y_0 + R^{-1}(c_1 - y_1 + R^{-1}a_2) \\
&= (c_0 + R^{-1}c_1) - (y_0 + R^{-1}y_1) + R^{-2}a_2 \\
&= \dots \\
&= \sum_{t=0}^{\infty} R^{-t}c_t - \sum_{t=0}^{\infty} R^{-t}y_t + \lim_{T\to+\infty} R^{-T}a_T
\end{aligned}
$$

Assuming that $\lim_{T\to+\infty} R^{-T}a_T = 0$, we obtain

$$
\sum_{t=0}^{+\infty} R^{-t}c_t = a_0 + \sum_{t=0}^{+\infty} R^{-t}y_t \tag{1}
$$

- The problem of the household can be rewritten as

$$
\max_{c_0, c_1, \dots} \sum_{t=0}^{+\infty} \beta^t u(c_t)
$$

$$
\sum_{t=0}^{+\infty} R^{-t}c_t = a_0 + \sum_{t=0}^{+\infty} R^{-t}y_t
$$

Solution Method 1

- We can see it as an intratemporal choice where a household with total wealth $a_0 + \sum_{t=0}^{+\infty} R^{-t} y_t$ decides between $0, 1, \ldots, t, \ldots$ goods with prices $1, R^{-1}, \ldots, D^{-t}, \ldots$.
- We can apply lagrangian method:

$$\mathcal{L}(c_0, .., c_t, \ldots, \lambda) = \sum_{t=0}^{+\infty} \beta^t u(c_t) - \lambda(\sum_{t=0}^{T-1} R^{-t} c_t - a_0 - \sum_{t=0}^{+\infty} R^{-t} y_t)$$

The First Order Conditions are

$$\forall t \geq 0 \ \frac{\partial \mathcal{L}}{\partial c_t} = 0$$
$$\Rightarrow \forall t \geq 0 \ \beta^t u'(c_t) = R^{-t} \lambda \tag{2}$$

Solution Method 2

If you are not familiar with lagrangian method, here is an alternative derivation

- Suppose we are at the optimum, and let us examine a change between dc_t and dc_{t+1} that still satisfies budget constraint, i.e. such that

$$Rdc_t + dc_{t+1} = 0$$

- The change in utility is

$$\begin{aligned} dU &= d(\sum_{s=0}^{+\infty} \beta^s u(c_s)) \\ &= \sum_{s=0}^{+\infty} \beta^s d(u(c_s))) \\ &= \beta^t du(c_t) + \beta^{t+1} du(c_{t+1}) \\ &= \beta^t u'(c_t) dc_t + \beta^{t+1} u'(c_{t+1}) dc_{t+1} \\ &= (u'(c_t) - \beta R u'(c_{t+1}))\beta^t dc_t \end{aligned}$$

- At optimum, change in utility is zero, so this means that

$$u'(c_t) = \beta R u'(c_{t+1})$$

Special case where $\beta R = 1$

In this slide only, assume $\beta R = 1$.

- Equation 2 gives

$$u'(c_t) = \lambda$$

  so consumption is constant over time $c_t = u'^{-1}(\lambda)$
- We find the value of λ to satisfy the budget constraint Equation 1

$$c \sum_{t=0}^{+\infty} R^{-t} = a_0 + \sum_{t=0}^{+\infty} R^{-t} y_t$$
$$\Rightarrow c = (1 - \frac{1}{R})(a_0 + \sum_{t=0}^{+\infty} R^{-t} y_t)$$

- How does consumption change after an unexpected one period drop in y_0? How does consumption change after an unexpected permanent drop in y_t?

In this slide only, assume $u(c) = \log(c)$.

- Equation 2 gives

$$\frac{\beta^t R^t}{c_t} = \lambda$$

- Plugging this into budget constraint, we get

$$\sum_{t=0}^{+\infty} R^{-t} \frac{\beta^t R^t}{\lambda} = a_0 + \sum_{t=0}^{+\infty} R^{-t} y_t$$

  That is

$$\lambda = \frac{\frac{1}{1-\beta}}{a_0 + \sum_{t=0}^{+\infty} R^{-t} y_t}$$

- We obtain

$$c_t = \beta^t R^t (1-\beta)(a_0 + \sum_{t=0}^{+\infty} R^{-t} y_t)$$

- If $\beta R > 1$, consumption increases over time. If $\beta R < 1$, consumption decreases over time

Conclusion

- When facing a time varying income process, households borrow and save to smooth consumption over time $\rightarrow$ debt is welfare improving.
- Househols with negative saving $a_t < 0$ must expect high income growth in the future

The real costs of credit access: Evidence from the payday lending market

What are Payday Loans?

- Payday advance loans are a short-term source of liquidity used by low- to moderate-income customers.
- Loans typically have two to four week maturities, principal balances of $200 to $1000 and fees of $15 to $20 per $100 principal balance.
- Requires recent bank account statement. In surveys of payday borrowers, the vast majority of respondents report family income between $15,000 and $50,000, while only seven percent of borrowers re- port family incomes below $15,000
- Some states prohibit payday lending: Massachussets, New Jersey, and New York

Identification Strategy

- Identifying the effects of payday lending is difficult because loan access is not randomly assigned. In particular, location decision of lenders and regulatory decisions of state legislators depend on the haracteristics of population

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- Identifying the effects of payday lending is difficult because loan access is not randomly assigned. In particular, location decision of lenders and regulatory decisions of state legislators depend on the haracteristics of population
- Idea: compare, within the same states and within the same year, two households in a state that prohibit payday loan, one close to the border with another state, the other far from the border.

Identification Strategy

- For a household i in a state that does not allow payday lending, and with an income between $15,000$ and $50,000$, denote c its county and s its state and t the year

$$Y_{icst} = \alpha + \theta D_c + \eta_{st} + \epsilon_{icst}$$

  - D_c is 1 if the center of their county is within 25 miles of a different states, and 0 otherwise.
  - η_{st} is state year fixed effects (a set of dummies for each state x year)
- In words, measure the effect of payday loanding as the difference in Y between households living close to the border and households living far from the border in a given state and year that is neighboring a state with deregulated payday lending.

Dependent variable	Any Family Hardship	Difficulty Paying Bills	Moved out	Cut Meals	No Phone	Any Care Pospone
Mean	0.292	0.203	0.012	0.169	0.017	0.179
D_C	0.053	0.050	0.010	0.011	0.006	0.045
	(0.019)	(0.016)	(0.006)	(0.011)	(0.006)	(0.016)
N		24,973	24,973	24,835	24,424	17,581

- In words, access to payday loan increases probability of family hardship by 5.3 percentage points, difficulty of paying bills by 5 percentage points ...

Placebo Test

- The assumption is that the difference between households living close to the border and those not living close to the border is determined by payday loan
- Some states do not have a border with deregulated states.
  $\Longrightarrow$ placebo test: check no differences between households that live close to the border and households that live far from the border for these states
- We know that households with income less than $15,000 or greater than $50,000 hardly use payday income
  $\Longrightarrow$ placebo test: check no differences between households with income higher than $50,000 that live close to the border and households with $50,000 that live far from the border

Quasi Hyperbolic Discounting

- Suppose I give you a choice
    1. 80 dollar today vs 100 in a year

Hyperbolic Discounting

- Suppose I give you a choice
    1. 80 dollar today vs 100 in a year
    2. 80 dollar in five years vs 100 in six years
- With exponential discounting, you have to give the same answer in both cases

$$u(50) \geq \beta u(100) \Rightarrow \beta^5 u(50) \geq \beta^6 u(100)$$

Hyperbolic Discounting

- Hyperbolic discounting refers to the tendency to increasingly choose a smaller-sooner reward over a larger-later reward as the delay occurs sooner rather than later in time
- “patience in the long run and impatience in the short run”
- Hyperbolic discounting is everywhere
  - Read and van Leeuwen (1998): Food experiment. Choose for Next Week: Fruit (74%) or Chocolate (26%). Choose for Today: Fruit (30%) or Chocolate (70%).
  - Read, Loewenstein and Kalyanaraman (1999): Video experiment. Choose for Next Week: Low-brow (37%) or High-brow (63%). Choose for Today: Low-brow (66%) or High-brow (34%)

Quasi Hyperbolic Discounting

- A way to model hyperbolic preferences is to define utility in period t as

$$U_t = u(c_t) + \delta \sum_{\tau=1}^{+\infty} \beta^\tau u(c_{t+\tau})$$

with $\delta \leq 1$

- Exponential preferences are particular case $\delta = 1$
- Mos of the discounting takes place between the current period and the immediate future. There is less additional discounting between future periods.

Let us solve a portfolio problem with quasi hyperbolic discounting with $u(c) = \log c$ and no income ($y_t = 0$)

- At time 0, the household problem is

$$\max \log(c_0) + \delta \sum_{\tau=1}^{+\infty} \beta^{\tau} \log(c_{t+\tau})$$

$$\sum_{t=0}^{+\infty} R^{-t} c_t = a_0$$

- Using lagrangian method,

$$\mathcal{L}(c_0, \dots, c_t, \dots) = \log(c_0) + \delta \sum_{t=1}^{+\infty} \beta^t \log(c_t) - \lambda(\sum_{t=0}^{+\infty} R^{-t} c_t - a_0)$$

We get

$$\frac{1}{c_0} = \lambda$$

$$\frac{\delta \beta^t}{c_t} = R^{-t} \lambda \text{ for } t \geq 1$$

- Plugging these equations into budget constraint, we get

$$
\begin{aligned}
a_0 &= \frac{1}{\lambda} + \sum_{t=1}^{+\infty} R^{-t} \frac{\delta \beta^t R^t}{\lambda} \\
&= \frac{1}{\lambda}(1 + \delta \sum_{t=1}^{+\infty} \beta^t) \\
\Rightarrow \lambda &= \frac{1 + \frac{\delta\beta}{1-\beta}}{a_0}
\end{aligned}
$$

- We obtain

$$
\begin{aligned}
c_0 &= \frac{1}{1 + \frac{\delta\beta}{1-\beta}} a_0 \\
c_t &= \delta \beta^t R^t c_0
\end{aligned}
$$

- In period 1, the agent wants to reoptimize consumption, and so she wants

$$
\begin{aligned}
c_1 &= \frac{1}{1+\frac{\delta\beta}{1-\beta}} a_1 \\
&= \frac{1}{1+\frac{\delta\beta}{1-\beta}} R(a_0 - c_0) \\
&= \frac{1}{1+\frac{\delta\beta}{1-\beta}} R \frac{\delta\beta}{1-\beta} c_0 \\
&= \frac{\beta\delta R c_0}{1+(\delta-1)\beta} \\
\forall t \geq 2 \; c_t &= \delta\beta^t R^t c_1
\end{aligned}
$$

- Note that the value that the agent wants to consume at date $t = 1$ is higher than what she planned at date $t = 0$

$$c_1 = \frac{\beta\delta R c_0}{1+(\delta-1)\beta} > \delta\beta R c_0$$

since $1/(1+(\delta-1)\beta) < 1$. In other words, preferences are inconsistent.
- Note that we implicitly assumed that, when the agent at time 0 plans her future consumption, she did not not forecast that her future self would deviate from her plans ("naive" agent).
- A "sophisticated" would like to find a way to limit consumption at time 1 so that $c_1 = \delta\beta R c_0$

Golden Egg Model

- Now assume that the agent knows that she is going to be inconsistent next period
- She cannot borrow. Moreover, she has access to liquid or illiquid account. Money in the illiquid account can be transferred to the liquid account, but only after one period.
- Each period is divided in 4 sub periods
  1. Both assets produce a return of R
  2. Consumer gets access to the liquid asset l_t
  3. Consumers decides current consumption $c_t \leq l_t$
  4. Consumer decides new asset allocation between liquid and illiquid asset
- The agent wants to make sure that $c_1 = \delta\beta R c_0$. Therefore she decides to consume c_0 today, put $\delta\beta c_0$ in liquid account, and the rest of the money in illiquid account
- Next period, the agent consumes all her liquid account $l_1 = R\delta\beta c_0$, and transfers $\delta\beta^2 R c_0$ from illiquid account to liquid account ...

- Being able to invest in illiquid account allows the agent to tie her hands
- More generally, investing in illiquid asset is a nice way to force youself to save
- What happens if financial technology change and now the agent can borrow against her illiquid account in period 1?

Import Competition and Household Debt

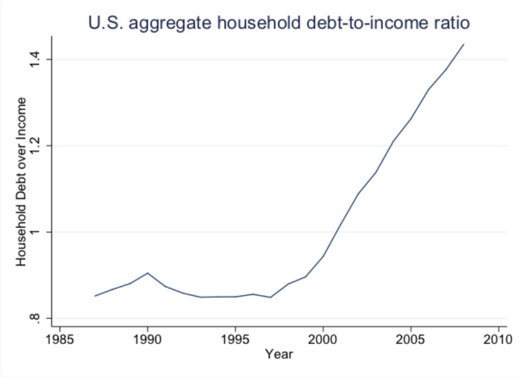


Figure 1: Increase in household debt-to-income in the 2000s

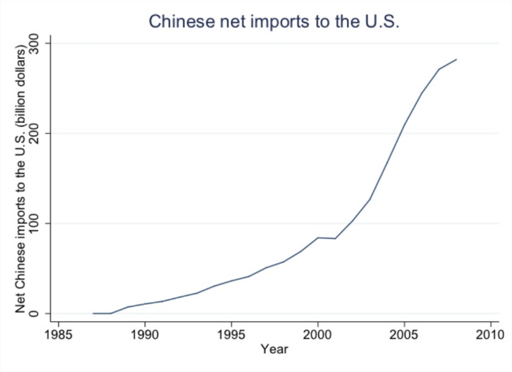


Figure 2: Increase in Chinese net imports the 2000s

- Are these two figures linked?
- Competition from China $\Rightarrow$ wage decreases/unemployment increases $\Rightarrow$ higher borrowing?

- Idea: compare increase in debt in regions that manufacture goods that China imports (electronics, etc) vs regions that do not (food, stone, furniture, etc)

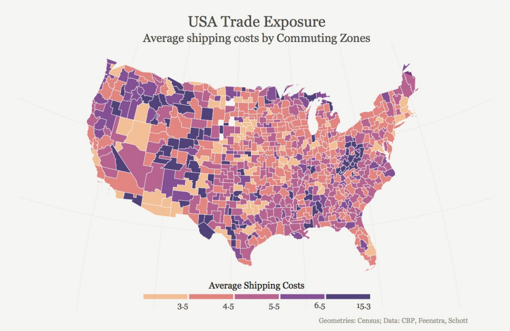
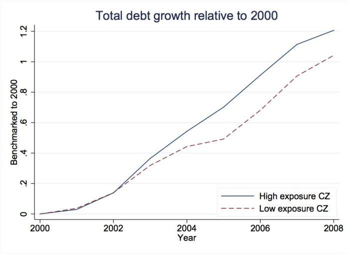


Figure 5
Average Shipping Costs by Commuting Zones
Note: This figure presents the distribution of shipping costs across commuting zones.

- The shipping cost (SC) in an industry is the average shipping cost of industry goods (High SC: Food, Furniture, Stone., VS Low SC: electronics)
- The average shipping cost in a Commuting Zone (CZ) is defined as

$$\overline{SC} = \sum_{\text{industry } i \in CZ} s_i SC_i$$

with s_i labor share of each industry



Panel B. Debt to income ratio

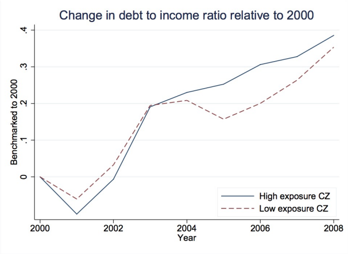


Figure 2

Household Debt Across High and Low Exposure Areas

Note: This figure presents the cumulative debt growth (panel A) and change in debt to income ratio (panel B) for Commuting Zones in the top (low exposure) and bottom (high exposure) quintiles of shipping costs measured prior to 1999.

- A one standard deviation in SC leads to a 1 percentage point increase in net import penetration from China between 2000 and 2007 (the average is 4% over the same period) to a drop in domestic output by 12% and to a drop in domestic employment by 6% over the same period.
- The increase in household debt triggered by import competition is accounted for by refinancing loans rather than new purchase loans.

- We cannot 100% disprove the rational consumption/saving model
    1. Although the displacement effect of import penetration seems permanent in hindsight, it might have been perceived as transitory initially
- Still, hyperbolic discounting sounds like an important explanation