# Consumption Smoothing, Savings, Credit and Insurance

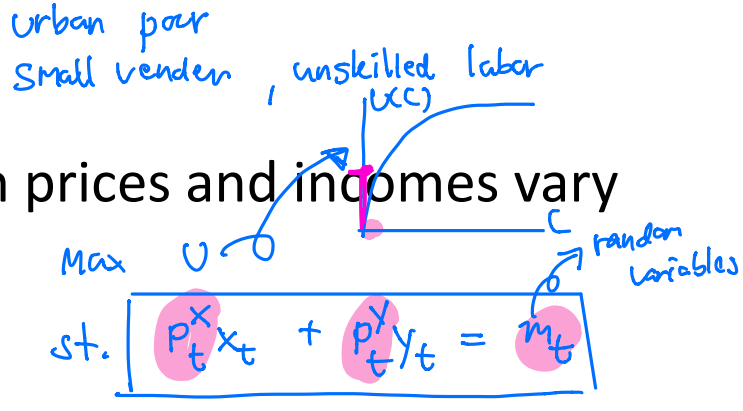
PART1:CONSUMPTION SMOOTHING

EE 461 Sem 2/2020

# Why is consumption smoothing important?

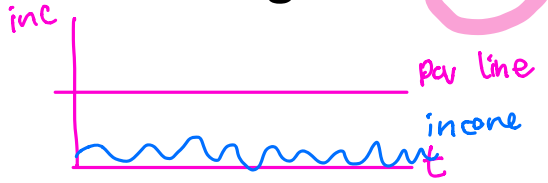
- The majority of people in poor countries are engaged in agriculture, and their livelihoods are often subject to great uncertainty, from weather and nature calamities, from sickness, and from fluctuations in the prices of their crops.

- In budget (constraint), both prices and incomes vary unpredictably overtime.



# Why is consumption smoothing important?

- The incomes of farm households in developing countries are notorious for being both low and uncertain.

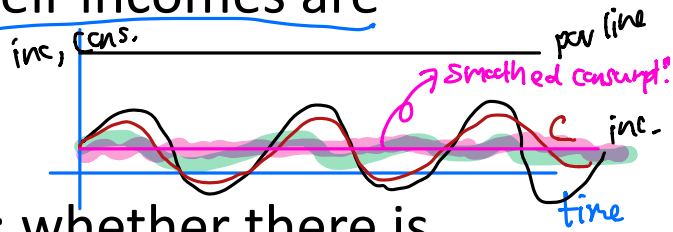



- Policies that increase the incomes of farmers may well be different from those that decrease income variability. There may be a trade-off between these two goals:

Increasing income level vs. Decreasing income risk.

# Why is consumption smoothing important?

- Individuals close to subsistence need to free consumption from income, so that they are not driven to extremities simply because their incomes are temporarily low.




- Basic question for policy makers: whether there is need for interventions to stabilize incomes or to provide public safety nets in order to ensure stable consumption and to keep people from falling into poverty traps.

To maximize utility, people prefer to have smooth consumption across periods, than having fluctuating consumption level across period

# Why is consumption smoothing important?

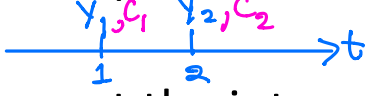
- To understand how people deal with fluctuations in their incomes is to understand the smoothing mechanisms.
- The smoothing mechanisms can take a number of forms:
  - Saving
  - Credit
  - Insurance

# Smoothing mechanisms

- Saving: By laying aside some income in good times, people can accumulate balances for use in bad times.
- Diversifying incomes
- Credit and Insurance: Risks can be pooled, either through formal financial intermediaries or through more informal networks of personal credit or social insurance, at the local or national levels.

# Consumption smoothing: Theory

- An individual can use savings to transfer consumption now to the future and can use borrowings to transfer consumption in the future to now.
- Suppose that an individual lives for 2 periods. She earns $y_1$ in period 1, and $y_2$ in period 2.




- In period 1, she can save or borrow, at the interest rate $r$.
- Her utility over consumption is each period is $U(c_1)$ and $U(c_2)$
- She discounts utility from future consumption at rate $\delta$.

# Consumption smoothing: Theory

- An individual maximizes

intertemporal Utility Maximization problem

$$\max_{c_1, c_2} U(c_1) + \delta U(c_2)$$

subject to

saving in period 1

(1.) $c_1 + s = y_1$

(2.) $c_2 = y_2 + (1 + r)s$

# Consumption smoothing: Theory

- Intertemporal budget constraint:

(1.) $s = y_1 - c_1$

(2.) $c_2 = y_2 + (1 + r)s$

- Combining (1.) and (2.), we have:

$c_2 = y_2 + (1 + r)(y_1 - c_1)$

$(1 + r)c_1 + c_2 = (1 + r)y_1 + y_2$, or

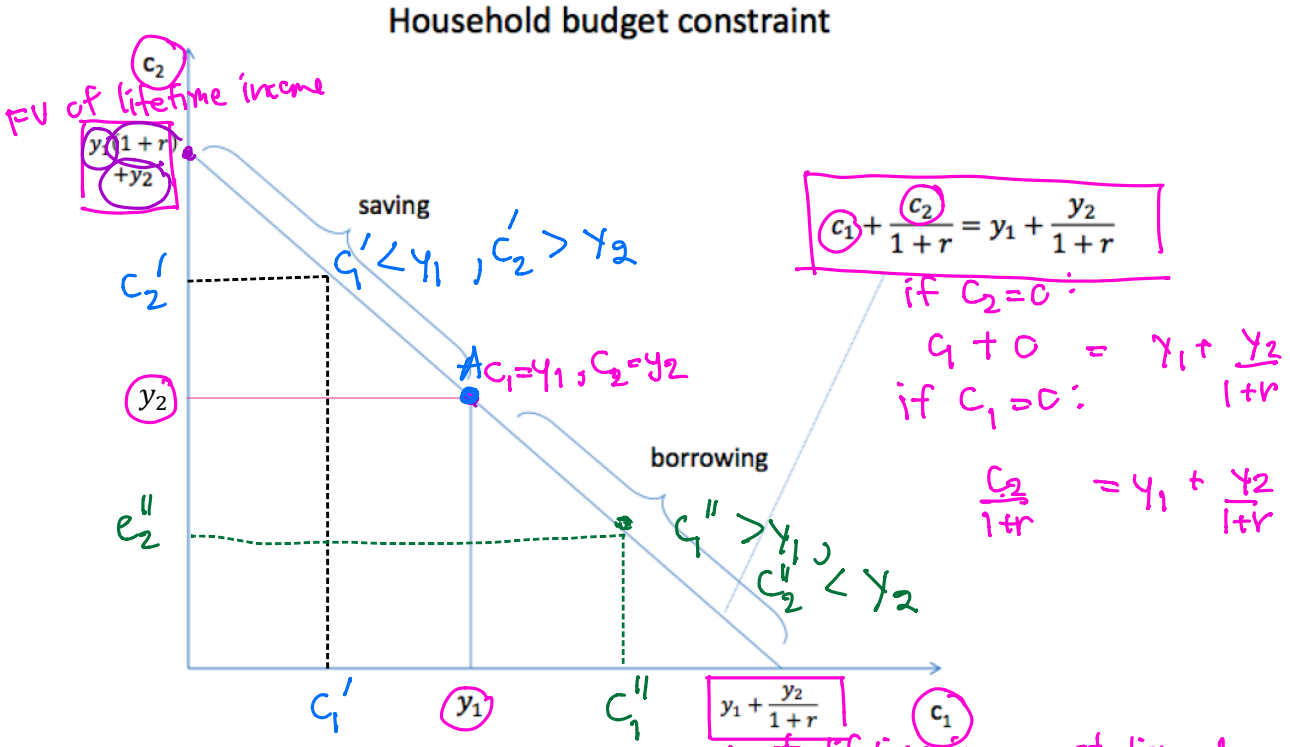
$c_1 + \frac{c_2}{1+r} = y_1 + \frac{y_2}{1+r}$

FV of Cons = FV of inc.

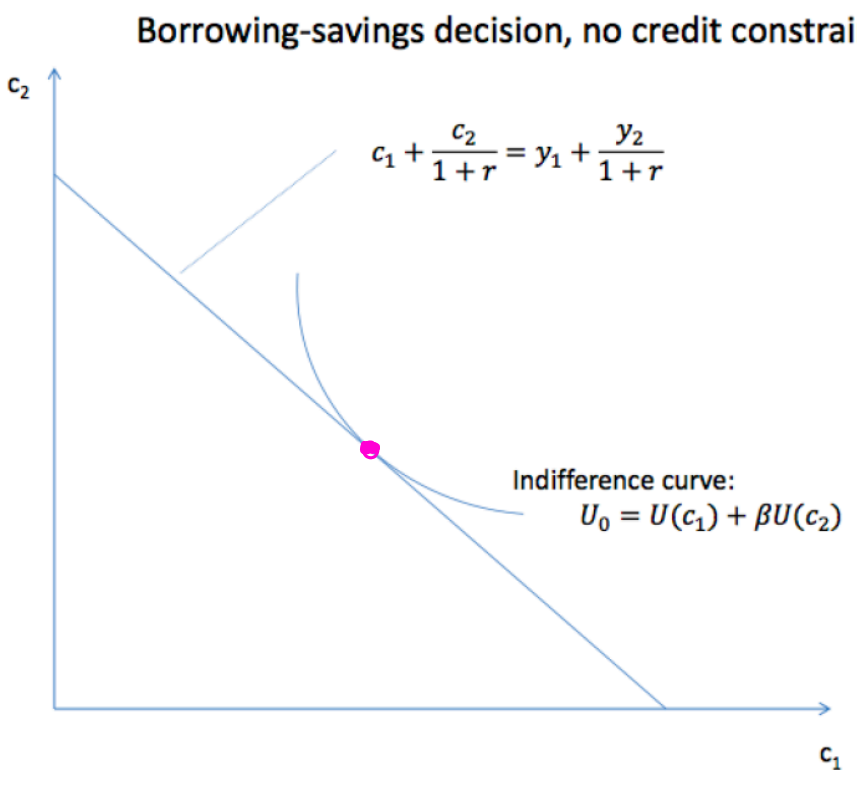
PV of Cons = PV of inc.

- The first term is the present value of lifetime consumption.
- The second term is the present value of lifetime income.

# Consumption smoothing: Theory



# Consumption smoothing with no credit constraint




can freely save & borrow as much as her income & mkt. allow

# Credit constraint

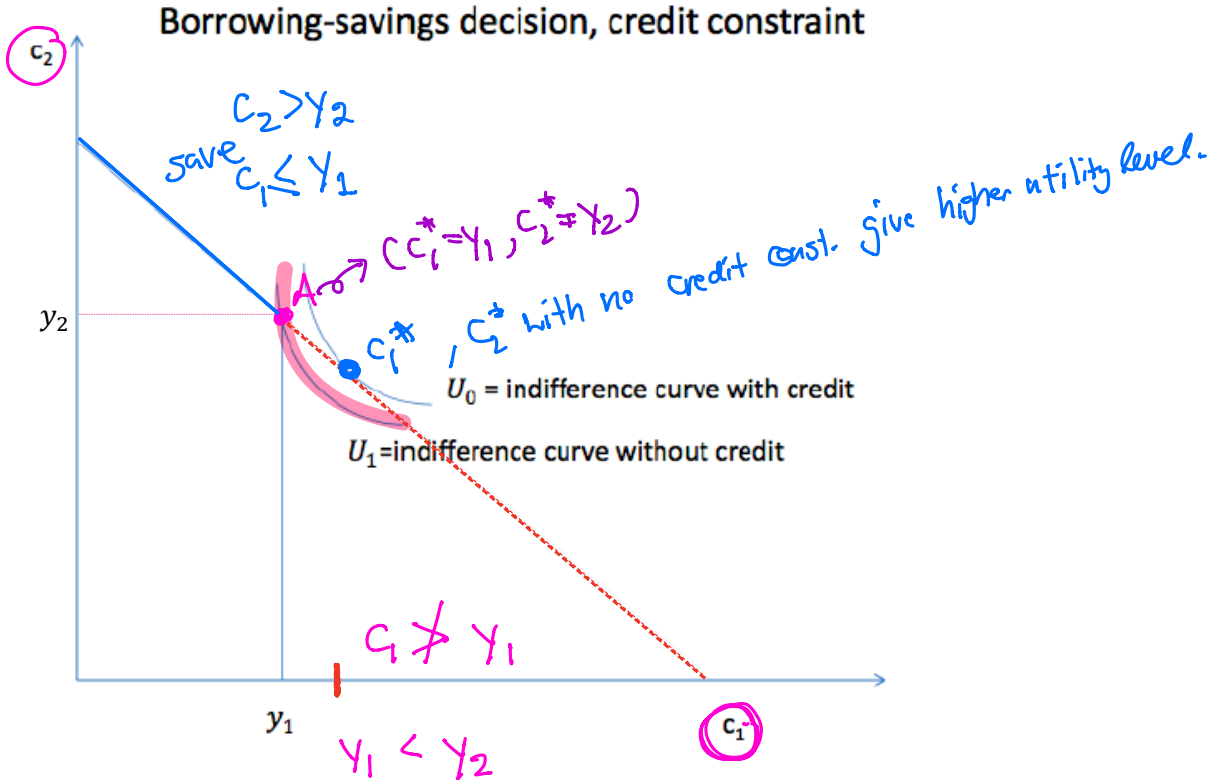
- Suppose that an individual cannot borrow. This implied that she faces the additional constraint:

$$c_1 \leq y_1$$

: cannot borrow from future income.

- This can hurt overall utility if income is very low in $y_1$ relative to $y_2$.

# Credit constraint



# Consumption smoothing without credit constraint

- FOC (Euler's equation): $mu(c_1) = \delta(1+r)\, mu(c_2)$
- If $\delta(1+r) = 1$, then $mu(c_1) = mu(c_2)$, and $c_1 = c_2 = c$.
- From intertemporal budget constraint, $c$ is a ~~function~~ of (expected) lifetime income.

To take away
① $c^*$ is constant overtime ⇒ we have smoothed consumption.
② $c^*$ is a fraction of lifetime income.

$\max_{c_1, c_2} u(c_1) + \delta u(c_2)$
s.t. $(1+r)c_1 + c_2 = (1+r)y_1 + y_2$

$\max_{c_1} U = u(c_1) + \delta u((1+r)y_1 + y_2 - (1+r)c_1)$

FOC: $\frac{dU}{dc_1} = mu(c_1) + \delta mu(c_2)(-(1+r)) = 0$

$mu(c_1) - \delta(1+r)mu(c_2) = 0$

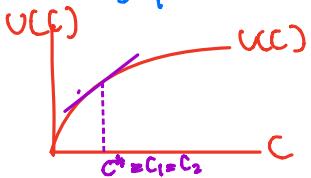
$mu(c_1) = \delta(1+r)mu(c_2)$

if $\delta(1+r) = 1$

$mu(c_1) = mu(c_2) \Rightarrow c_1 = c_2 = c^*$

$(1+r)c^* + c^* = (1+r)y_1 + y_2$

$c^* = \frac{(1+r)}{(2+r)}\left[y_1 + \frac{y_2}{1+r}\right]$



# Consumption smoothing without credit constraint

## The permanent income hypothesis: Intuition

(Friedman, 1957, Theory of consumption function)

The basic intuition: individuals would wish to smooth consumption and not let it fluctuate with short run fluctuations in income.

# Consumption smoothing without credit constraint

## The permanent income hypothesis: Intuition

(Friedman, 1957, Theory of consumption function)

The hypothesis is to answer why income is more volatile than consumption and why the long run marginal propensity to consume out of income is higher than the short run one.

Var(Inc.) > Var(Cons.)

MPC of Longrun Inc > MPC of SR Inc.

# Consumption smoothing without credit constraint

## The permanent income hypothesis

(1.) Individuals consume a constant fraction of the "permanent income". The consumption plan does not depend on the transitory components and is constant over time.

(2.) Changes in permanent income(expected long-term average income earned over the entire life cycle), rather than changes in temporary income in a period, are what drive the changes in a consumer's consumption patterns.

People spread out transitory changes in income over time to make the consumption constant.

# Permanent vs. Transitory income

- Suppose that $y_1$ and $y_2$ can be broken up into a permanent and a transitory component:

$$y_1 = y_1^T + y^P$$

$$y_2 = y_2^T + y^P$$

# Permanent vs. Transitory income (Friedman, 1957, Theory of consumption function)

- The permanent component $y^P$ is to be interpreted as the nonhuman wealth it owns; the personal attributes of the earners, such as their training, ability, personality; the attributes of the economic activity of ,the earners, such as the occupation, the location of the economic activity, and so on.
- It is analogous to the "expected" value of a probability distribution.

# Permanent vs. Transitory income (Friedman, 1957, Theory of consumption function)

- The transitory component $y^T$ is to be interpreted as reflecting all "other" factors, factors that are likely to be treated as "accidental" or "chance" occurrence. It also can be thought of as cyclical fluctuations in economic activity.
- For any considerable group of consumer units, the resulting transitory components tend to average out.

# Permanent vs. Transitory income

- The mean measured income of the group would equal the mean permanent component, and the mean transitory component would be zero.
- Consumption will be determined solely by expected permanent income $y^P$, not by stochastic current income.
- Any excess (shortfall) in current income, relative to permanent income, will be (dis)saved so as to smooth consumption over the full time horizon.

# Permanent vs. Transitory income

- **What is the marginal propensity to consume (MPC) in each period out of permanent income and transitory income?**
- MPC = the fraction of the income that is consumed.
- IF (a.) there is no credit constraint

  (b.) $\delta(1+r)=1$,

  THEN $mu(c_1)=mu(c_2)$, and $c_1=c_2$.

➢ Consumption is expected to be stable over time.

➢ An increase in permanent income by $\Delta y^P$ will increase consumption in each period by $\Delta y^P$ .

➢ Implication: consumption should be constant over time and equal to permanent income if $y^P$ doesn't change.

➢A permanent change in income will yield a MPC out of permanent income equal to 1.

# Empirical investigation of the permanent income hypothesis (PIH)

- Consumption is a function of permanent and transitory incomes, along with other independent variables:

$$c_t = \alpha + \beta y_t^P + \gamma y_t^T + \theta Z_t + \epsilon_t$$

- Strict test for the PIH:

$$H_0: \beta = 1, \gamma = 0$$
$$H_a: \beta < 1, \gamma > 0$$

# Empirical investigation of the permanent income hypothesis (PIH)

- General results: positive correlation (less than one) of consumption with transitory income and a sub-unit correlation of consumption with permanent income.

- As long as a greater share of transitory income than permanent income is saved, then households are indeed smoothing consumption relative to income.

# Empirical investigation of the permanent income hypothesis (PIH)

- Weak form test for the PIH (test for incomplete consumption smoothing):

$$H_0: \beta = \gamma$$
$$H_a: \beta > \gamma$$

- Typical findings are in favor of the alternative hypothesis
- There is evidence of consumption smoothing relative to stochastic incomes (transitory incomes) in most data sets.

# Empirical investigation of the permanent income hypothesis (PIH)

- The estimation specification is potential biased due to endogeneity and/or correlated measurement errors that arise from trying to come up with reasonable measure for $y^P$ and $y^T$.

- $y^T$ will be determined simultaneously with consumption, thereby producing spurious correlation.

# Empirical investigation of the permanent income hypothesis (PIH)

- Choosing an instrument for $y^P$ and $y^T$ that is not a determinant of consumption.
- Instrument for $y^P$ : education, value of initial asset holdings, long-run rainfall averages
- Instrument for $y^T$ : deviation of rainfall from long-run local average, deviations from expected harvest period profits

# Empirical investigation of the permanent income hypothesis (PIH): Paxson(1992)

- Paxson(1992) tests the implications of this model using data from rural Thai households.
- Cross-sectional surveys taken in 1975/76, 1981, and 1986

# Empirical investigation of the permanent income hypothesis (PIH): Paxson(1992)

- Permanent income is defined over a short time horizon, as expected income for year t conditional on the resource and information of the household at the beginning of the period.

- Measure of permanent income:
  - Landholdings
  - Demographic composition of the household
  - (age/sex/education of household members)

# Empirical investigation of the permanent income hypothesis (PIH): Paxson(1992)

- Transitory income is the difference between realized and expected income.

- Measure of temporary income:
  - Deviations from mean rainfall in the household's region, in each quarter of the past year
  - Rainfall in any given quarter is plausibly random, and is not serially correlated, so that deviations from means in one quarter do not translate into deviations in subsequent quarters

# Empirical investigation of the permanent income hypothesis (PIH): Paxson(1992)

- Hypothesis: Marginal propensity to save out of transitory income should be higher than MPS out of permanent income(weak form)
- Two-step estimation strategy:
- Regress income on predictors of permanent and transitory income

$$Y_{irt} = \beta_t + \beta_r + \mathrm{X}^{\mathrm{P}}_{\mathrm{irt}}\beta_1 + \mathrm{X}^{\mathrm{T}}_{\mathrm{irt}}\beta_2 + \epsilon_{irt}$$

- $Y_{irt}$ income of household i in region r in year t
- $\mathrm{X}^{\mathrm{P}}_{\mathrm{irt}}$ components of permanent income
- $\mathrm{X}^{\mathrm{T}}_{\mathrm{irt}}$ components of transitory income

# Empirical investigation of the permanent income hypothesis (PIH): Paxson(1992)

- Predict $\hat{Y}_{irt}^{P}$ using estimated coefficients $\hat{\beta}_1$.

$$\hat{Y}_{irt}^{P} = \hat{\beta}_1 \mathrm{X}_{\mathrm{irt}}^{\mathrm{P}}$$

- Predict $\hat{Y}_{irt}^{T}$ using estimated coefficients $\hat{\beta}_2$.

$$\hat{Y}_{irt}^{T} = \hat{\beta}_2 \mathrm{X}_{\mathrm{irt}}^{\mathrm{T}}$$

- Then use these predicted components of income in the equation:

- $s_{irt} = \alpha_0 + \alpha_1 \hat{Y}_t^P + \alpha_2 \hat{Y}_t^T + \theta Z_t + u_{irt}$
- where $s_{irt}$ is savings in household i in region r in year t.

# Empirical investigation of the permanent income hypothesis (PIH): Paxson(1992)

TABLE 4—TWO-STEP AND MAXIMUM-LIKELIHOOD ESTIMATES OF SAVINGS EQUATIONS

| | Two-step | | | Maximum likelihood | | |
|---|---|---|---|---|---|---|
| Variable | SAVE1 | SAVE2 | SAVE3 | SAVE1 | SAVE2 | SAVE3 |
| $\hat{Y}^P$ $(\alpha_1)$ | 0.2773<br>(5.40) | 0.4400<br>(8.94) | 0.1824<br>(2.73) | 0.2514<br>(4.86) | 0.4210<br>(8.51) | 0.1649<br>(2.45) |
| $\hat{Y}^T$ $(\alpha_2)$ | 0.7362<br>(4.28) | 0.8039<br>(4.87) | 0.7340<br>(3.21) | 0.7546<br>(4.32) | 0.8015<br>(4.84) | 0.8294<br>(3.50) |

- MPS are not exactly 0 and 1, but the relative magnitudes are consistent with the theory.

# Additional readings

- Deaton(1997) “The Analysis of Household Surveys: A Microeconometric Approach to Development Policy”, Chapter 6
- Paxson(1992) “Using Weather Variability to Estimate the Response of Savings to Transitory Income in Thailand”
- Ray(1998) Development Economics, Chapter 14, 15
- Townsend, R. M. (1995) "Financial systems in Northern Thai villages.”
- Karlan, Dean and A. L. Ratan (2014) “Saving by and for the poor: a research review and agenda”