Lesson 5 Guide

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1 Lesson 5: Consumption

1.1 Consumption as part of GDP

Consumption accoutns for roughly 2/3 of GDP in the United States. This dictates that it becomes a very important aspect around policy making. From 2001-2007 consumption grew by roughly 3% per year. During the great recession however consumtion fell 0.25% in 2008 and 0.6% in 2009.

1.2 Consumption Theories

In this lesson we look at consumer choice between consumption and saving (or future consumption).

- Theory 1: Intertemporal Choice (Irving Fisher)
  - we look at this
- Theory 2: Keynesian Consumption Function (Econ 104)
- Theory 3: Permanent Income Hypothesis (Friedman)
- Theory 4: Life-Cycle Hypothesis (Modigliani)

1.3 Theory of Intertemporal Choice

1.3.1 3 steps to this theory

1. Define the Intertemporal Budget Constraint
2. Define the consumer preferences
3. Show the optimal consumption bundle

1.4 Assumptions

1. Individuals live in a 2 period world
    - Period 1 vs Period 2
    - Current vs Future
    - Today vs Tomorrow
2. No Income/Wealth is left over
    - anything saved in period 1, is consumed in period 2
    - anything borrowed in period 1, is paid back in period 2
3. Savings rate = borrowing rate

1.5 Terminology

Y_i = Income in period i (Y_1 vs Y_2)
W_i = Wealth in period i
C_i = Consumption in period i

$(Y_i + W_i)$ = i-Period's resources

With 2 time periods:

- $(Y_1 + W_1)$ = current resources
- $(Y_2 + W_2)$ = future resources
    - Combined they are lifetime resources

1.6 Intertemporal Budget Line

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## `geom_smooth()` using method = 'gam' and formula 'y ~ s(x, bs = "cs")'
```

```
## Warning: Removed 224 rows containing non-finite values (stat_smooth).
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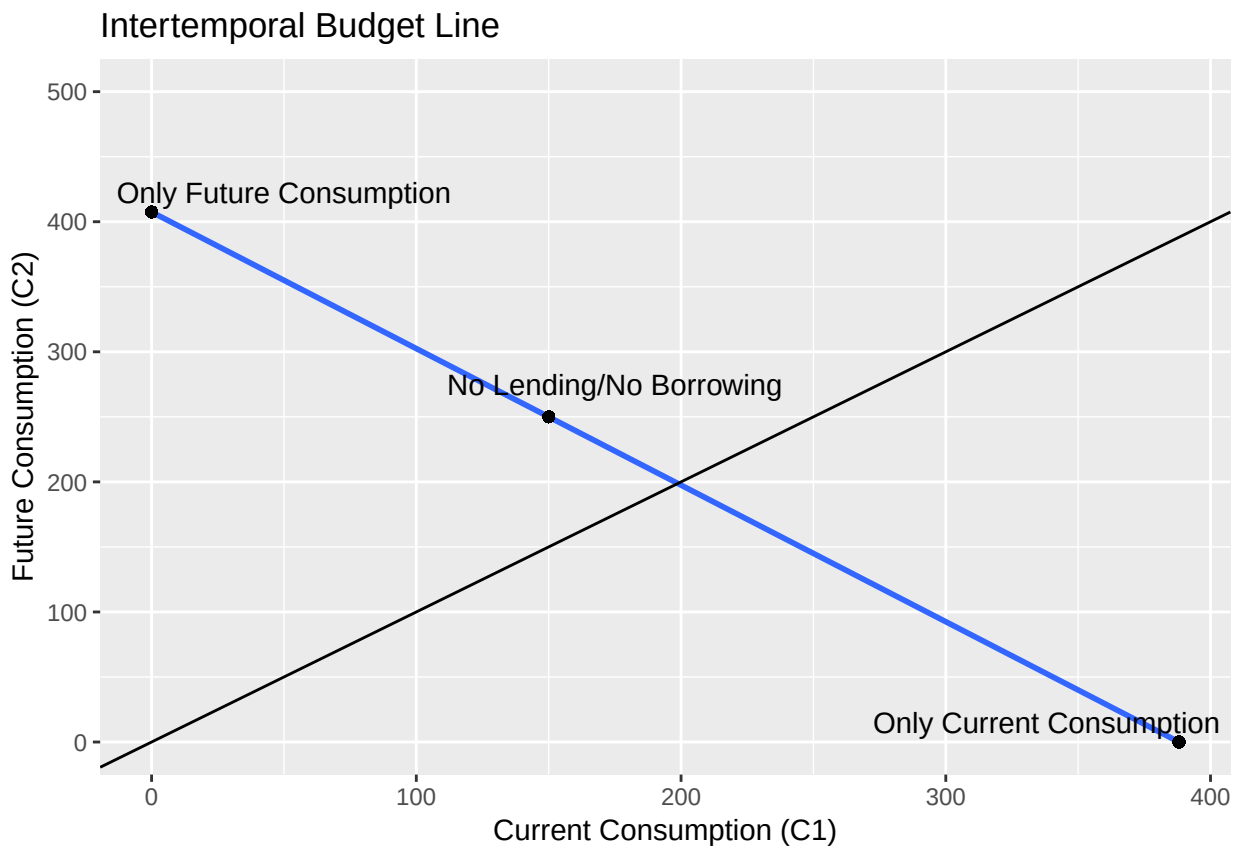

1.6.1 Points to observe

- Y-intercept = Only Future consumption (C_2)
- X-intercept = Only Current consumption (C_1)
- intserction of IBL and y = x is $C_1 = C_2$ (Consumption Smoothing)
- No-Lending/No-Borrowing Point
  - $C_1 = Y_1 + W_1$
  - $C_2 = Y_2 + W_2$
- Slope = -(1 + r)
  - r = real interest rate

1.7 Math of IBL

Assumption 2: PVLC = PVLR

Present Value Lifetime Consumption (PVLC)

$$C_1 + \frac{C_2}{(1+r)} + \frac{C_3}{(1+r)^2} + \frac{C_4}{(1+r)^3} + ... + \frac{C_n}{(1+r)^{n-1}}$$

Present Value Lifetime Resources (PVLR)

$$(Y_1 + W_1) + \frac{(Y_2 + W_2)}{(1+r)} + \frac{(Y_3 + W_3)}{(1+r)^2} + \frac{(Y_4 + W_4)}{(1+r)^3} + ... + \frac{(Y_n + W_n)}{(1+r)^{n-1}}$$

When n = 2 you get our IBL:

$$C_1 + \frac{C_2}{(1+r)} = (Y_1 + W_1) + \frac{(Y_2 + W_2)}{(1+r)}$$

Put it into `y = mx + b` form:

$$C_2 = -(1+r) * C_1 + ((Y_1 + W_1)(1+r) + (Y_2 + W_2))$$

1.8 Shifts of the IBL

```
## `geom_smooth()` using method = 'gam' and formula 'y ~ s(x, bs = "cs")'

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## `geom_smooth()` using method = 'gam' and formula 'y ~ s(x, bs = "cs")'

## Warning: Removed 129 rows containing non-finite values (stat_smooth).

## `geom_smooth()` using method = 'gam' and formula 'y ~ s(x, bs = "cs")'

## Warning: Removed 320 rows containing non-finite values (stat_smooth).
```
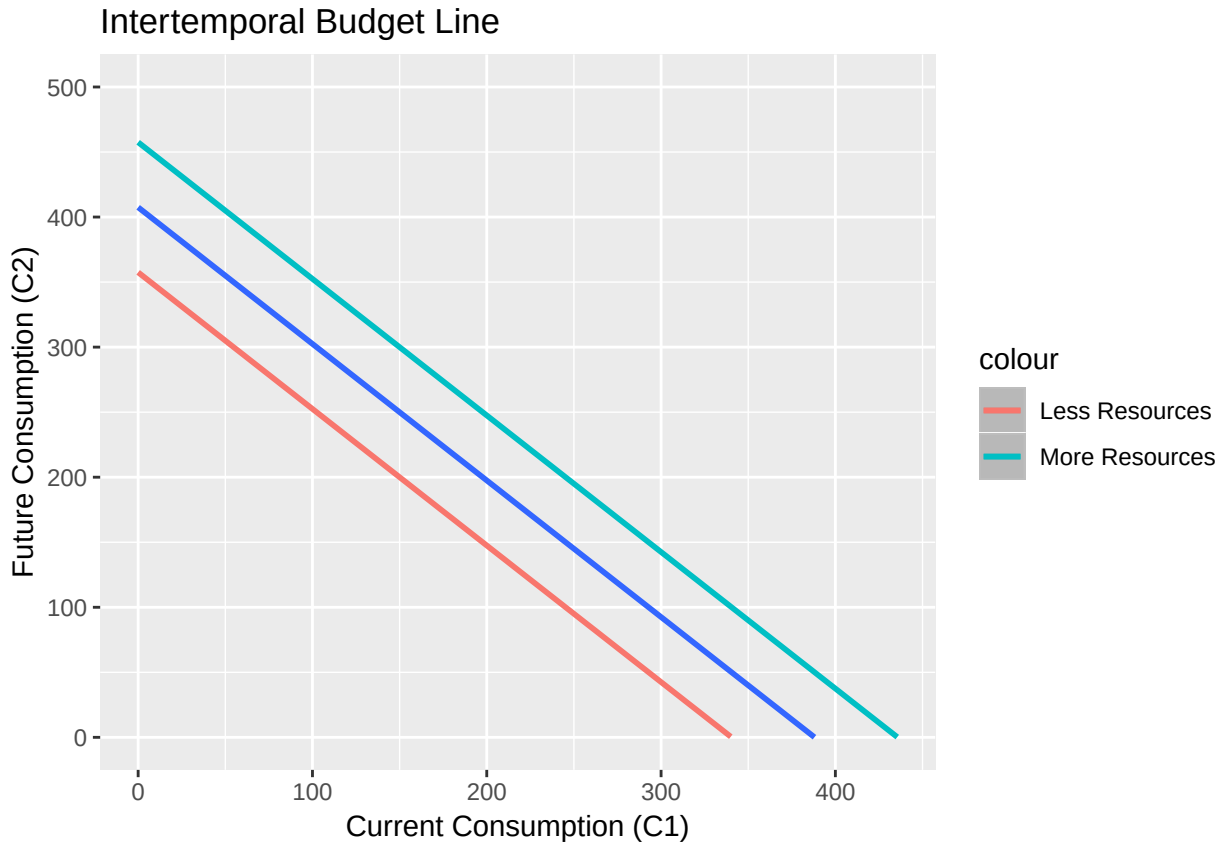
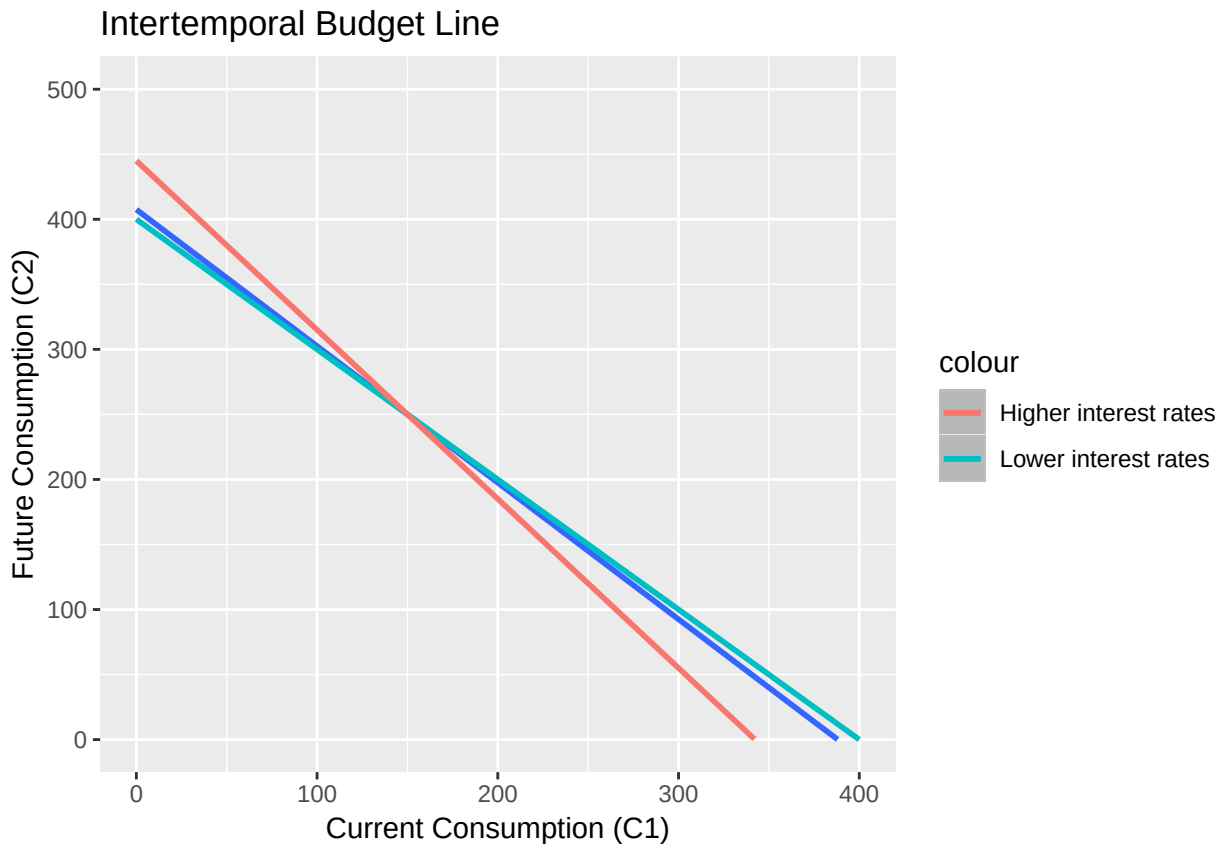



Green (Shifts up/right): * Increase in Y_1, Y_2, W_1, W_2

Red (Shifts down/left): * Decrease in Y_1, Y_2, W_1, W_2

1.9 Rotation of the IBL

```
## `geom_smooth()` using method = 'gam' and formula 'y ~ s(x, bs = "cs")'

## Warning: Removed 224 rows containing non-finite values (stat_smooth).

## `geom_smooth()` using method = 'gam' and formula 'y ~ s(x, bs = "cs")'

## Warning: Removed 200 rows containing non-finite values (stat_smooth).

## `geom_smooth()` using method = 'gam' and formula 'y ~ s(x, bs = "cs")'

## Warning: Removed 316 rows containing non-finite values (stat_smooth).
```



An increase in r (real interest rate) correponds to a steeper slope and a decrease in r corresponds to a shallower slope. This makes sense since the slope is -(1 + r)

1.10 Preferences

The question: what combination of C_1 and C_2 would make an individual equally happy?

Use an indifference curve.

```
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## `geom_smooth()` using method = 'gam' and formula 'y ~ s(x, bs = "cs")'

## Warning: Removed 224 rows containing non-finite values (stat_smooth).

## `geom_smooth()` using method = 'gam' and formula 'y ~ s(x, bs = "cs")'

## Warning: Removed 160 rows containing non-finite values (stat_smooth).

## `geom_smooth()` using method = 'gam' and formula 'y ~ s(x, bs = "cs")'

## Warning: Removed 640 rows containing non-finite values (stat_smooth).
```

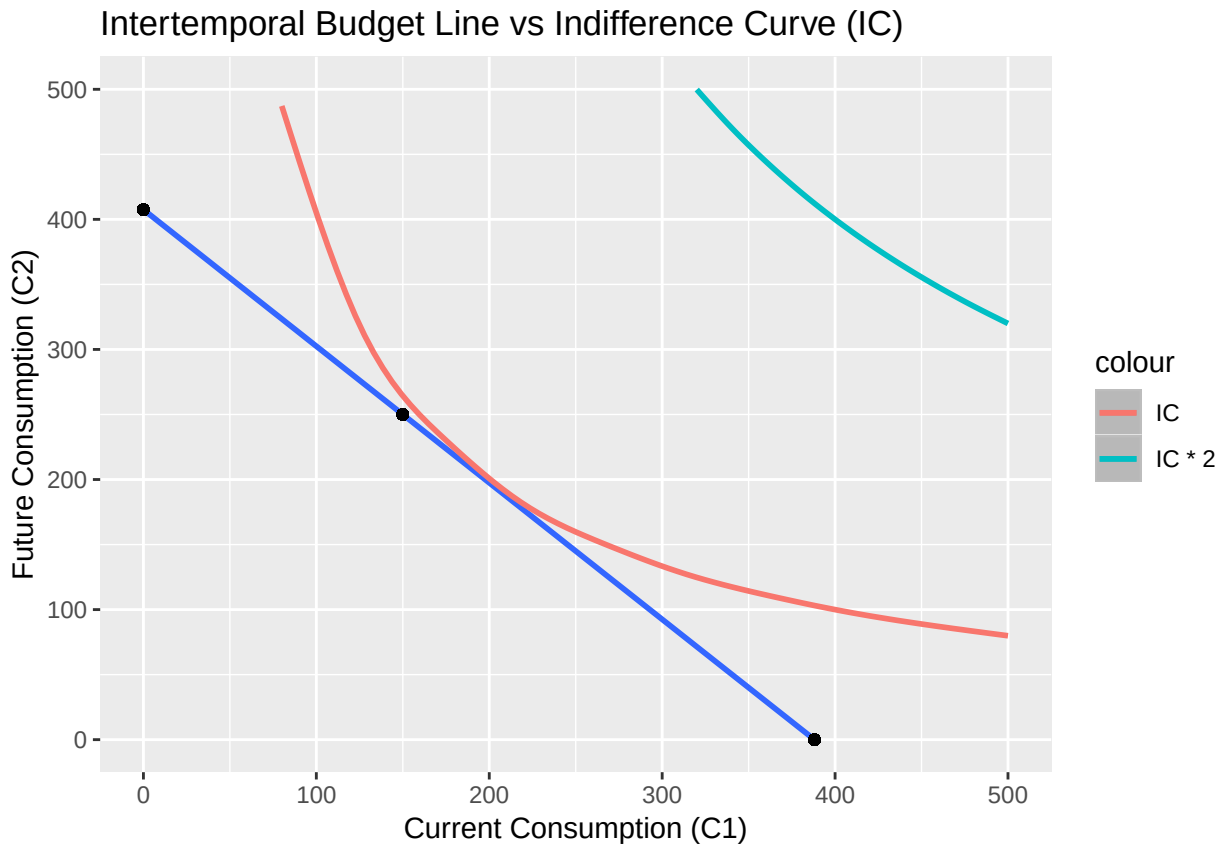

The indifference curve used in the example is at a utility of 200 for a cobb douglas utility function of $U = C_1^{0.5} * C_2^{0.5}$

If "Marissa" always consumptions smooths, then you want to find the point on the graph where $C_1 = C_2$

1.10.1 To find C*:

1. Preference ($C_1 = C_2$)

2. IBL (PVLR = PVLC)

$$C_1 + \frac{C_2}{(1+r)} = (Y_1 + W_1) + \frac{(Y_2 + W_2)}{(1+r)}$$

Replace C_2 with C_1, since they are equal when smoothing

$$C_1 + \frac{C_1}{(1+r)} = (Y_1 + W_1) + \frac{(Y_2 + W_2)}{(1+r)}$$

$$(1+r) * C_1 + C_1 = (1+r)(Y_1 + W_1) + (Y_2 + W_2)$$

$$C^* = \frac{(1+r)(Y_1 + W_1) + (Y_2 + W_2)}{(2+r)}$$

What if "Sam" prefers to consume twice as much in the future period?

1. $C_1 = 0.5 * C_2$
2. IBL

$$C_1^* = \frac{(1+r)(Y_1 + W_1) + (Y_2 + W_2)}{(3+r)}$$

How does changes in r (real interest rate) affect consumption?

1.11 Substitution Effect

If r increases, then C_1 is more expensive for both borrowers and savers.

Therefore, C_1 goes down and C_2 goes up, for both types.

- Sub into "cheaper" good

1.12 Income Effect

If r increases

- Borrower has less real income, so all consumption goes down
- Saver has more real income, so all consumption goes up

When looking at data, when the real interest rate increases, C_1 decreases, so the substitution effect is stronger than the income effect.