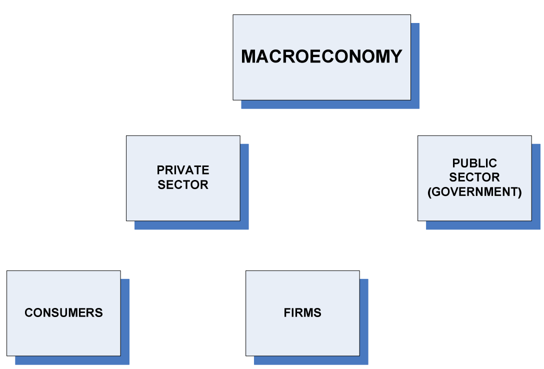
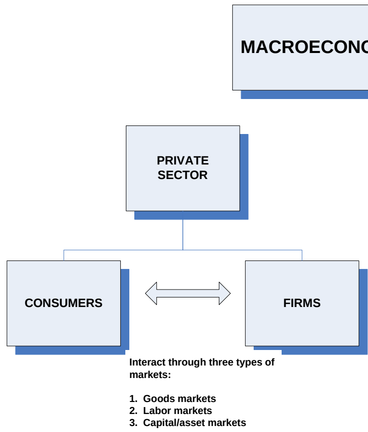
MACROECONOMIC THEORY AND POLICY: OVERVIEW

JANUARY 26, 2009

BUILDING BLOCKS OF AN ECONOMY



Building Blocks of an Economy



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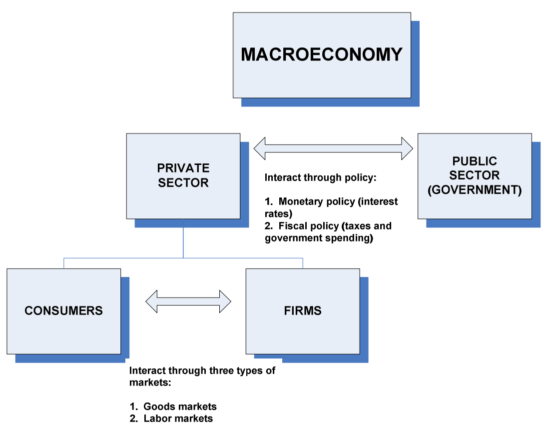

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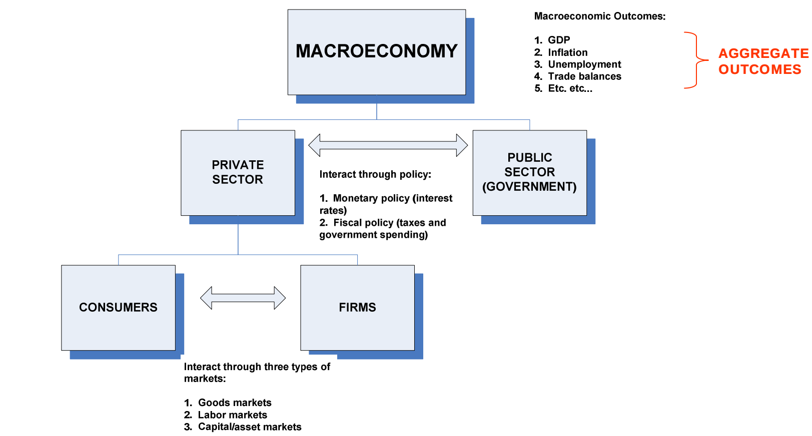

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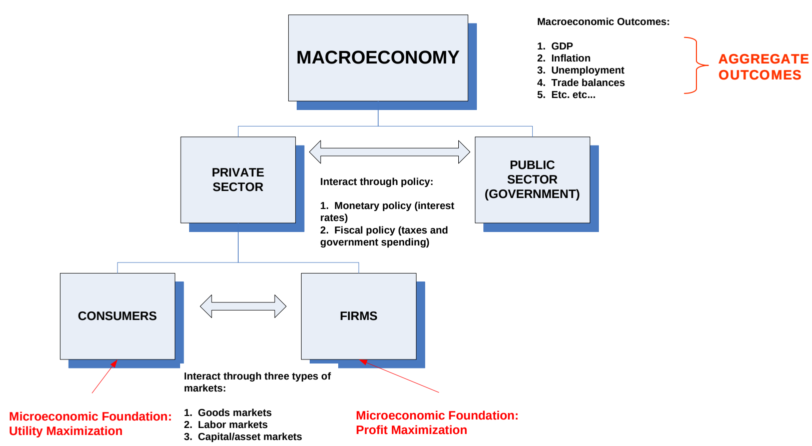

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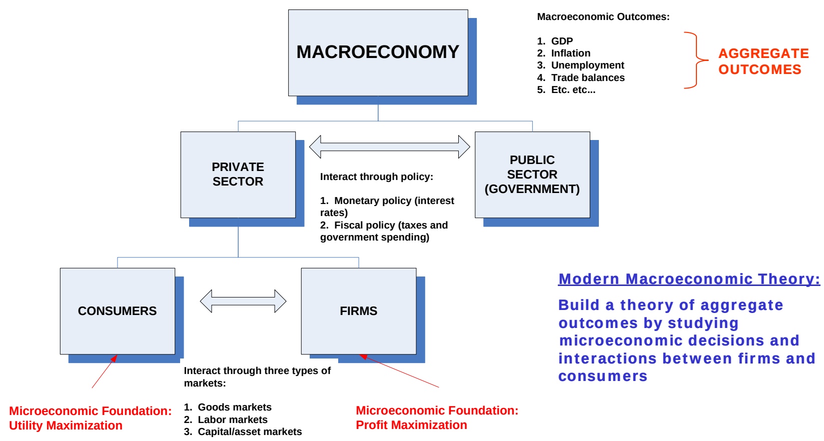

Modern Macroeconomic Theory:

Build a theory of aggregate outcomes by studying microeconomic decisions and interactions between firms and consumers

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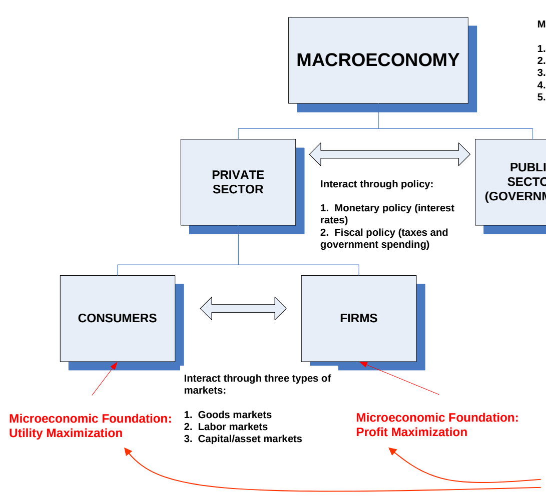

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Can we feasibly model the decisions of *every* consumer and firm and *every* interaction between them?...

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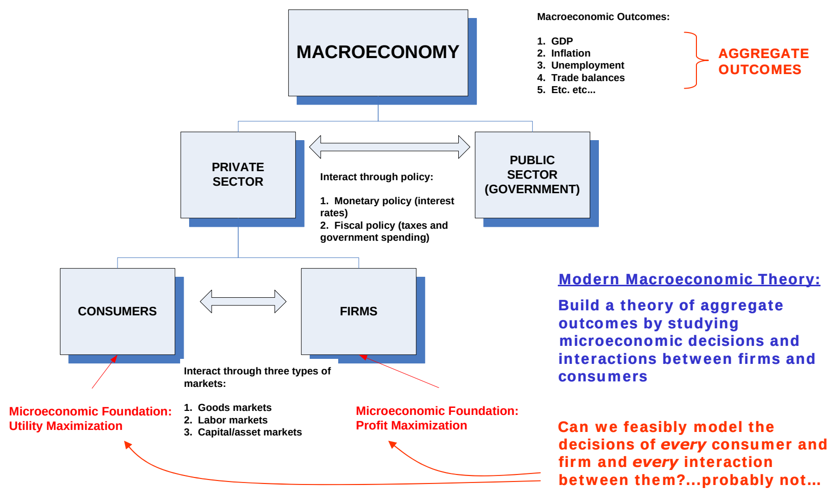

Modern Macroeconomic Theory:

Build a theory of aggregate outcomes by studying microeconomic decisions and interactions between firms and consumers

Can we feasibly model the decisions of *every* consumer and firm and *every* interaction between them?…probably not…

Representative-Agent Macroeconomics

- **Consumer A: Consumed $50 in Year X**
- **Consumer B: Consumed $75 in Year X**
- **Consumer C: Consumed $100 in Year X**
- **Consumer D: Consumed $125 in Year X**
- **Consumer E: Consumed $150 in Year X**

No other consumers in the economy

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- A simplistic approach – turns out to yield surprisingly rich results, insights, and predictions

Logistics

Review of Consumer Theory

January 26, 2009

Utility Functions

- Describe how much "happiness" or "satisfaction" an individual experiences from "consuming" goods – the benefit of consumption

- Marginal Utility
  - The extra total utility resulting from consumption of a small/incremental extra unit of a good
  - Mathematically, the (partial) slope of utility with respect to that good

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Basics of Consumer Theory

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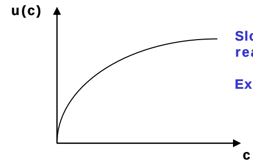
- **Readily extendable to N-good case: $u(c_1, c_2, c_3, c_4, \ldots, c_N)$**

UTILITY FUNCTIONS

- **One-good case**



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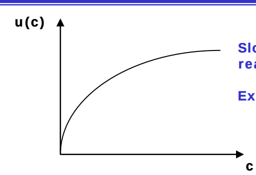

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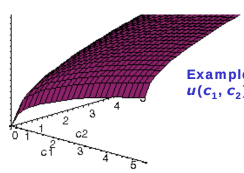

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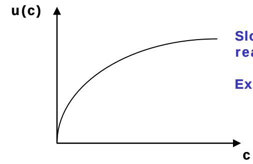

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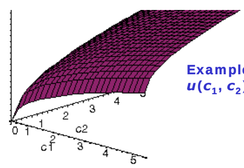

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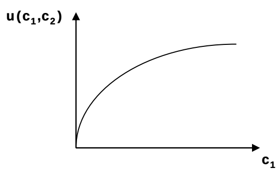
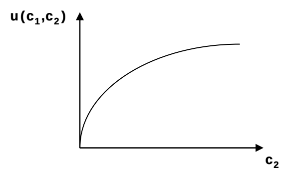
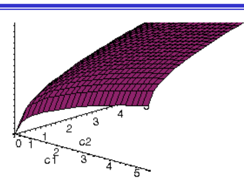
Viewed in good-by-good space



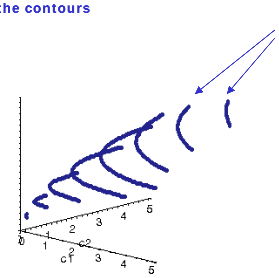


UTILITY FUNCTIONS

Alternative views



Emphasizing the contours



Indifference Curve: the set of all consumption bundles that deliver a particular level of utility / happiness

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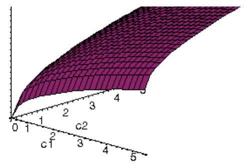

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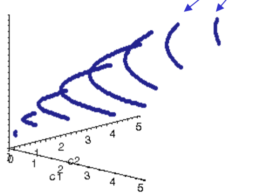

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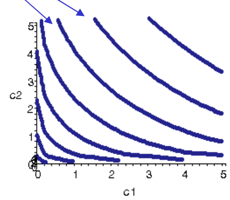
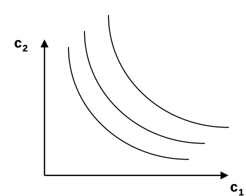
Viewing only the contours



UTILITY FUNCTIONS

- **Marginal Rate of Substitution (MRS)**
  - **Maximum** quantity of one good consumer is **willing** to give up to obtain **one** extra unit of the other good
  - Graphically, the (negative of the) slope of an indifference curve



  - MRS is itself a **function** of c_1 and c_2 (i.e., $MRS(c_1, c_2)$)
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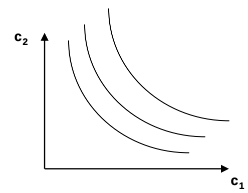

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- Summary: whether graphically- or mathematically-formulated, utility functions describe the benefit side of consumer optimization

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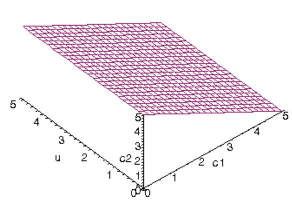

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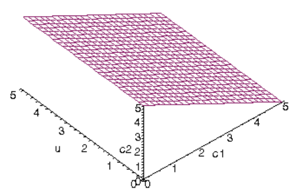
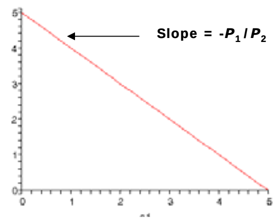


Plotted in 2D-consumption-space



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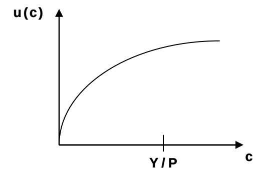

The Graphics of Consumer Theory

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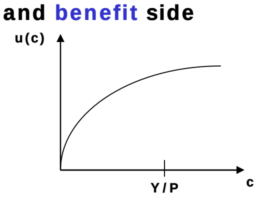

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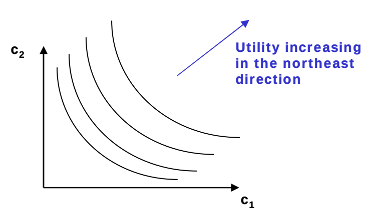

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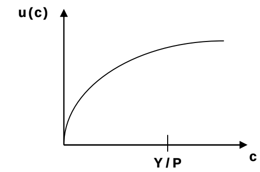

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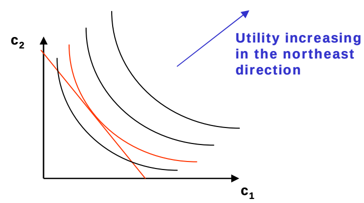

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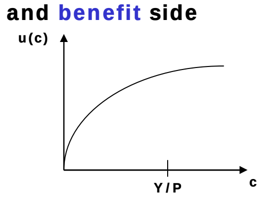

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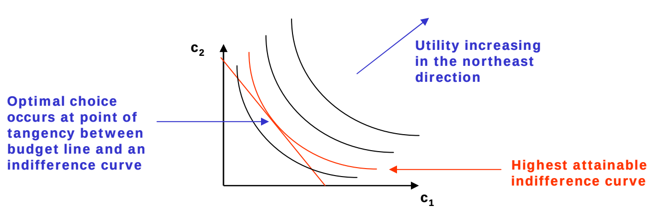

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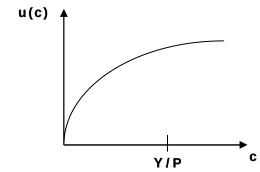

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At the optimal choice,
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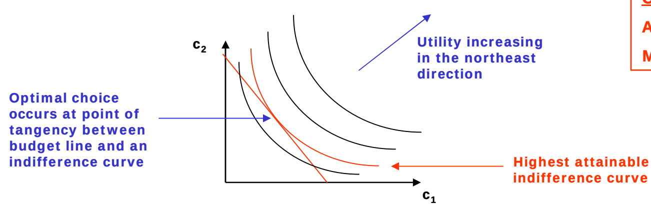

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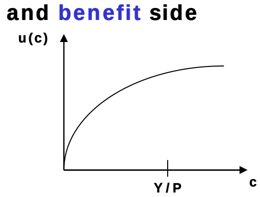

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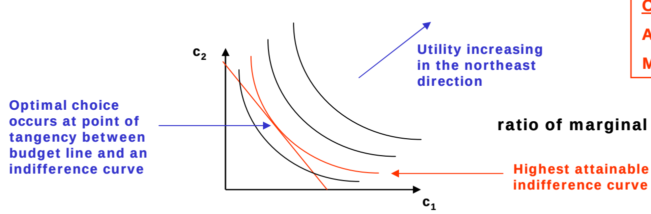
ratio of marginal utilities = price ratio



LAGRANGE ANALYSIS

- **Consumer optimization a constrained optimization problem**
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$$L(x, y, \lambda) = f(x, y) + \lambda g(x, y)$$

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  - **Step 2: Compute first-order conditions with respect to x, y, and λ**

$$f_x(x, y) + \lambda g_x(x, y) = 0$$
$$f_y(x, y) + \lambda g_y(x, y) = 0$$
$$g(x, y) = 0$$

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- **Consumer optimization a constrained optimization problem**
  - **Maximize some function (utility function)…**
  - **…taking into account some restriction on the objects to be maximized over (budget constraint)**
- **Lagrange Method: mathematical tool to solve constrained optimization problems**
- **General mathematical formulation**
  - **Choose (*x*, *y*) to maximize a given objective function *f*(*x*,*y*)…**
  - **…subject to the constraint *g*(*x*,*y*) = 0 (Note formulation of constraint)**
  - **Step 1: Construct Lagrange function** (Lagrange multiplier: λ)

$$L(x, y, \lambda) = f(x, y) + \lambda g(x, y)$$

  - **Step 2: Compute first-order conditions with respect to *x*, *y*, and *λ***

$$f_x(x, y) + \lambda g_x(x, y) = 0$$
$$f_y(x, y) + \lambda g_y(x, y) = 0$$
$$g(x, y) = 0$$

Rationale: setting first derivatives to zero isolates maxima (or minima…technically, need to check second-order condition…)

LAGRANGE ANALYSIS

- **Step 3: Solve the system of first-order conditions for *x*, *y*, and *λ***
  - **Often most interested in simply eliminating the multiplier…**

LAGRANGE ANALYSIS

- **Step 3: Solve the system of first-order conditions for *x*, *y*, and *λ***
  - **Often most interested in simply eliminating the multiplier…**
  - **…**
  - **…**
  - **…**
  - **Optimality condition: at the optimum (*x**, *y**)**

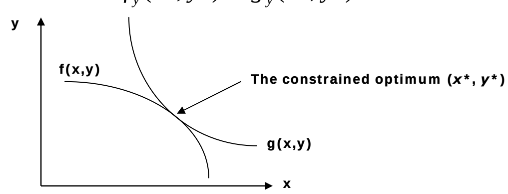
$$\frac{f_x(x^*,y^*)}{f_y(x^*,y^*)} = \frac{g_x(x^*,y^*)}{g_y(x^*,y^*)}$$

LAGRANGE ANALYSIS

- **Step 3: Solve the system of first-order conditions for *x*, *y*, and *λ***
  - **Often most interested in simply eliminating the multiplier…**
  - **…**
  - **…**
  - **…**
  - **Optimality condition: at the optimum (*x**, *y**)**

$$\frac{f_x(x^*,y^*)}{f_y(x^*,y^*)} = \frac{g_x(x^*,y^*)}{g_y(x^*,y^*)}$$

Graphical interpretation: at the constrained optimum, the function *f*(.) is tangent to the function *g*(.)



Lagrange Analysis

- Apply Lagrange tools to consumer optimization
- Objective function: $u(c_1,c_2)$
- Constraint: $g(c_1,c_2) = Y - P_1c_1 - P_2c_2 = 0$

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- **Step 1:** Construct Lagrange function

$$L(c_1,c_2,\lambda) = u(c_1,c_2) + \lambda\left[Y - P_1c_1 - P_2c_2\right]$$

- **Step 2:** Compute first-order conditions with respect to c_1, c_2, λ

LAGRANGE ANALYSIS

- **Apply Lagrange tools to consumer optimization**
- **Objective function:** $u(c_1,c_2)$
- **Constraint:** $g(c_1,c_2) = Y - P_1c_1 - P_2c_2 = 0$

- **Step 1: Construct Lagrange function**

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- **Step 2: Compute first-order conditions with respect to** c_1, c_2, λ

- **Step 3: Solve (with focus on eliminating multiplier)**

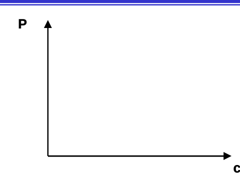
$$\frac{u_1(c_1^*,c_2^*)}{u_2(c_1^*,c_2^*)} = \frac{P_1}{P_2}$$

OPTIMALITY CONDITION

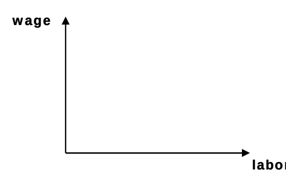
i.e., MRS = price ratio

THE THREE MACRO (AGGREGATE) MARKETS

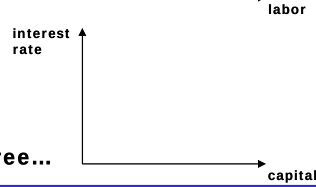
- **Goods Markets**



- **Labor Markets**



- **Capital / Savings / Funds / Asset Markets**



- **Will put micro-foundations under all three…**