Introduction:

- motivates how extend microfoundation approach using general equilibrium theory for macroeconomics.
- highlights new elements of text: $AD - AS$ static and dynamic context
- explains business cycles with basic comparative statics of goods and time endowment changes.
- role of human capital explained
- text outlined in terms of margins of economic activity.
- Concepts of permanent income and wealth traced across book,
- single agent and heterogeneous agent approach outlined.

Learning objective

- See approach of using only microeconomics to derive macroeconomics.
- complete overview of the text
- reference to pull together all of the separate chapters of the book.
- See basic consumption demand and its development
Who made it happen

- Paul Samuelson’s PhD *Foundations of Economic Analysis* (1947)
  - beginning of modern economic analysis, such as comparative statics.
  - Robert E. Lucas, Jr., 2001 "Professional Memoir": “Samuelson ... was teaching you the basics....Like so many others in my cohort, I internalized its view that if I couldn’t formulate a problem in economic theory mathematically, I didn’t know what I was doing. I came to the position that mathematical analysis is not one of many ways of doing economic theory: It is the only way. Economic theory is mathematical analysis. Everything else is just pictures and talk.”
- R.D.G. 1968 *Macro-Economic Theory*, but no utility maximization
  - This text uses recursive utility; aggregate supply and demand of Samuelson.
  - extends general equilibrium approach of Barro’s *Macroeconomics*.
- "Who Made it Happen": historical flavor to evolving concepts.
- People make economics science develop, so view it that way.
Macroeconomics has had a history of divorcing itself from the need to derive its equilibrium conditions, which is the basis of microeconomics.

- Sets of equilibrium conditions presented, but not strictly not derived from consumer and firm maximization
- Microeconomics is the study of how the consumer and firm do maximize subject to constraints,
- thereby giving the supply and demand of goods and the factor markets of labor and capital.
- Modern macroeconomics has returned to microeconomic foundation of deriving the equilibrium conditions through optimization problems using microeconomic principles:

thus "Microfoundations approach to macroeconomics."
microfoundations approach extremely popular in modern macroeconomics, but many ad hoc elements are nonetheless found in most work.

microfoundations approach is subject to compromise in order to better explain certain aggregate events.

now compromise more often takes place by adding in the ad hoc features into the optimization problem itself.

This way all of the equilibrium conditions are still derived.

exceptions though, with equilibrium conditions simply added onto the model after optimization.

the text shows how much of macroeconomics covered in pure microfoundations method.

only standard utility and production technology plus goods and time constraints

account for all of the equilibrium conditions of the text.

One ad hoc departure for fixed price, later made endogenous with banking to explain depressions.
Methodologically consistent structure from the beginning to the end, with each chapter building upon the last.

Every model solution is an explicit analytic solution.

For dynamic model all variables including the state variable are found analytically.

Every model can be solved and graphed using their exact functional forms:

- within each market in terms of supply and demand
- within general equilibrium factor market: isoquant and isocost
- within general equilibrium output market: goods-leisure or goods-labor, production possibility curve.

Centralized Economy

- Consumer maximizes utility subject to the technology of goods production,
- acts as both consumer and firm simultaneously.
- prices and profit not explicit or necessary for solution.
Decentralization of Markets

- to get $AS - AD$, with prices and profit explicit
  - consumer consumes and owns firm, while the firm does the production.
  - profit of the firm part of consumer income
  - consumer maximizes utility subject to budget constraint.
  - firm maximizes same budget constraint, in form of profit, subject to production technology.

- Budget-constraint/profit-line separation of the centralized economy
  - without prices and profit into the decentralized economy with prices, profits;
  - consumer and firm problems imply supply and demand functions for goods, labor and capital as functions of the relative prices.

- Relative Prices Take Prominent Role
  - consumer and firm problems now allow goods, labor and capital markets to be explicit.
  - $AS - AD$ of goods, labor and capital derived in functional forms.
  - Supply and demand of quantities depend on relative prices, exogenous parameters, and "State variable".
Static versus Dynamic General Equilibrium

- Static aggregate demand and supply is standard to some extent
  - in goods market, labor market, and capital market,
  - relative price of goods to labor is $1/w$, of labor to goods is wage $w$.

- Rare: dynamic aggregate supply, and demand of goods, labor, capital markets,

- Growth theory enters: interest rate $r$, tied up intricately with economy’s growth rate $g$.

- Equilibrium capital integral part of dynamic solution.

- New approach of this textbook: $AS - AD$ in dynamic baseline neoclassical model.


- Plus key comparative statics focusing on goods and time endowment,
  - later seen as real business cycle $RBC$ sectoral productivities.
Tricks of Dynamic Analysis

- Analyzed stationary equilibrium: no "transitional dynamics".
- Comparative statics: only movement from one stationary equilibrium state to another.
- Dynamic analysis requires a "balanced growth path (BGP) equilibrium"
  - All variables grow at same BGP rate $g$.
  - Growth rate may be assumed (exogenous growth), or derived endogenously (endogenous growth).
- What makes the modern dynamic analysis in fact dynamic?
  - the accumulation of capital $k$, a fundamental "state" variable
  - $k$ must be the correct value consistent with the $AS - AD$ equilibrium.
- $AS - AD$ a function of the equilibrium state variable
- Comparative statics:
  - new state variable when change any exogenous parameter of model.
  - move to new stationary BGP equilibrium with new $k$.
- Complex part: computing the state variable.
Recursive Framework

- Optimization problem a function of the state variable
- avoids cumbersome infinite horizon approach
- simple structure of two time periods
- Parts 2 and 3 build the static elements of $AS - AD$ analysis
- as consistent with dynamic recursive $AS - AD$ in Part 4,
- derivation of the capital stock is provided in Chapter 10.
Dynamic General Equilibrium Output and Input Dimensions

- Shows supply and demand in goods and labor markets,
- with the goods market being called the AS – AD analysis.
- Shows general equilibrium output and leisure:
  - using "production possibility curve"
  - and utility level curves.
- And general equilibrium inputs in terms of labor and capital,
  - with isoquant curves,
  - isocost lines and
  - factor ratio rays.
Part 1: consumption depends upon permanent income;
Part 2: consumer balances goods versus leisure, "intratemporal" margin;
Part 3: consumer balances goods today versus goods tomorrow, "intertemporal" margin;
Part 4: consumer balances simultaneously intratemporal and intertemporal margins;
Part 5: intertemporal investment in human and physical capital: two intertemporal margins.
Part 6: smoothing of consumption across state-space and time, extending Arrow-Debreu;
Part 7: government effects consumption smoothing through tax structure.
how taxes on goods, labor and capital affect the economy
this decreases ability to smooth consumption.
"Wedges" driven between the consumer and producer
less work and less consumption with goods and labor taxes,
less investment and consumption over time with capital taxes.
Using human capital, goods, labor, and capital taxes all decrease growth rate.
All taxes decrease permanent income stream
Government can have more positive effect than negative incentive effects.
Regulations likewise act like taxes.
Chapters 3 and 6 have labor, goods and capital taxes in a static environment.
Chapter 9: labor tax in dynamic baseline model.
Chapter 19: dynamic model, and labor, capital and goods taxes.
Chapter 20: dynamic model with inflation tax, similar to a labor tax.
Comparative statics are used to show a typical business cycle.

Focus on sectoral productivity changes; as goods and time endowment changes.

Goods sector, human capital, and banking sectoral productivities.

Basic puzzle: too much smoothing if only goods sector productivity change;

no change in labor employed in static and dynamic model.

Yet business cycles formulated this way: from goods sector productivity change.

A problem because change in labor employment rate key business cycle feature.

Examine ad hoc price fixity to exacerbate cycle.

Better way: time endowment, plus human capital and banking productivity changes.
Text include long tradition in human capital study.
Changes in employment accomplished first by time endowment changes exogenously.
Human capital sectoral productivity change endogenizes time endowment changes.
Use separate sector for human capital investment.
Labor flows from "non-market" human capital sector to the goods sector, and back.
Endogenizes growth rate and explains trends and tax effect on growth.
Banking in General Equilibrium

- Banking in general equilibrium: transfer income across uncertain states;
- intermediate investment through costly banking.
- No longer a "frictionless" world without cost of intermediation.
- Capture costly transfers of entire large financial intermediation industries.
- Shows "consumption tilting" in extension of the Arrow-Debreu theory and how fall in banking productivity can cause bank-led deep recession.
- Allows a concept of aggregate risk, and how to optimally insure banking.
- No longer need fixed prices for major recession; just bank productivity fall.
Initially consumer directly invests in physical capital and rents it to firm.
Then consumer assumed no longer to invest directly in physical capital;
instead use financial intermediation through banks (Chapter 16),
or invest in ownership shares of firm, getting back profit dividends,
while firm invests in capital directly(Chapter 17).
Public finance of the government by the consumer through bonds.
Full government wealth constraint and Ricardian equivalence (Chapter 18).
Maastrict Treaty debt and deficit limits analyzed.
A theme of the book is that just two basic types of margins explain behavior:

- marginal rate of substitution between goods and time (leisure) during the period
- marginal rate of substitution between goods, or time, over time or across states of nature.

Goods-leisure margin links goods to time during the period: real wage $w$ key.

Intertemporal/interstate margin links transfer of goods/time across time, states of nature:

- to investment set aside for such transfers during current period,
- based on return to capital.

Broad investment concept allows forming of insurance broadly.
Consumption, Permanent Income and Wealth

\[ c^d = w l^s + \Pi. \]

\[ T = l^s + x \]

\[ c^d = w (T - x) + \Pi. \]

\[ x = \frac{\alpha c^d}{w}. \]

\[ c^d = \frac{1}{1 + \alpha} (w T + \Pi). \]  \hspace{1cm} (1)

\[ y_P \equiv w T + \Pi, \]

\[ c^d = \frac{y_P}{1 + \alpha}. \]  \hspace{1cm} (2)

\[ AD : \frac{1}{w} = \frac{T_t}{c^d (1 + \alpha) - \Pi}. \]
\[
\frac{c_1}{c_0} = \frac{1 + \hat{r}}{1 + \rho}.
\]

\[
c_t^d = \frac{1}{1 + \alpha} \left[ w_t T_t + (r - \delta_k) k_t \right].
\]

\[
\frac{c_t}{c_{t-1}} = \frac{1 + r_t - \delta_k}{1 + \rho},
\]

\[
c_t^d = \frac{1}{1 + \alpha} \left( w_t T_t + \rho k_t \right).
\]

\[
y_{Pt} = w_t T_t + \rho k_t,
\]

\[
W_t = \frac{w_t T_t + (r - \delta_k) k_t}{r - \delta_k} = \frac{w_t T_t}{\rho} + k_t.
\]

\[
y_t^d = c_t^d + \delta_k k_t = \frac{1}{1 + \alpha} \left( w_t T_t + \left[ \rho + \delta_k (1 + \alpha) \right] k_t \right).
\]

\[
AD : \frac{1}{w_t} = \frac{T_t}{y_t^d (1 + \alpha) - \left[ \rho + \delta_k (1 + \alpha) \right] k_t}.
\]
Growth and Consumption

\[ 1 + g_t \equiv \frac{c_t}{c_{t-1}} = \frac{1 + r_t - \delta_k}{1 + \rho}, \]

\[ c_t^d = \frac{1}{1 + \alpha} \left[ w_t + \rho (1 + g) k_t \right]. \quad (8) \]

\[ y_{Pt} = w_t T_t + \rho (1 + g) k_t, \]

\[ W_t = \frac{w_t T_t + (r_t - \delta_k - g) k_t}{r_t - \delta_k - g} = \frac{w_t T_t}{\rho (1 + g)} + k_t. \]

\[ y_t^d = \frac{1}{1 + \alpha} \left( w_t T_t + k_t \left[ \rho (1 + g) + (\delta_k + g) (1 + \alpha) \right] \right). \quad (9) \]

\[ AD : \frac{1}{w_t} = \frac{T_t}{y_t^d (1 + \alpha) - k_t \left[ \rho (1 + g) + (\delta_k + g) (1 + \alpha) \right]}. \]
Endogenous Growth and Consumption

\[ c_t^d = \frac{1}{1 + \alpha} \left[ w_t (1 - l_{Ht}) h_t + \rho (1 + g) k_t \right]. \] (10)

\[ c_t^d = \frac{1}{1 + \alpha} \left[ w_t \left( 1 - \frac{g + \delta_h}{A_H} \right) h_t + \rho (1 + g) k_t \right]. \] (11)

\[ c_t^d = \frac{1}{1 + \alpha} \left[ w_t T_t h_t + \rho (1 + g) k_t \right], \] (12)

\[ y_{Pt} = w_t T_t h_t + \rho (1 + g) k_t, \]

\[ W_t = \frac{w_t T_t h_t + (r_t - \delta_k - g) k_t}{r_t - \delta_k - g} = \frac{w_t T_t h_t}{\rho (1 + g)} + k_t. \]

\[ y_t^d = \frac{1}{1 + \alpha} \left[ w_t \left( 1 - \frac{g + \delta_h}{A_H} \right) h_t + k_t \left[ \rho (1 + g) + (\delta_k + g) (1 + \alpha) \right] \right], \]

\[ AD : \frac{1}{w_t} = \frac{\left( 1 - \frac{g + \delta_h}{A_H} \right) h_t}{y_t^d (1 + \alpha) - k_t \left[ \rho (1 + g) + (g + \delta_k) (1 + \alpha) \right]} \] (13)
A Methodological Outline

- Closed Economy Methodology
- Centralized Economy
- Decentralized Economy
- Open Economy Heterogeneous Agent Methodology

\[ c^d = c_A^d + c_B^d; \]
\[ c^s = c_A^s + c_B^s. \]

\[ c^d = c_A^d + c_B^d = c_A^s + c_B^s = c^s. \]

\[ c^d = 400c_A^d + 600c_B^d = 400c_A^s + 600c_B^s = c^s. \]

- Need both goods and labor market clearing with Endogenous Growth.