

Advanced Modern Macroeconomics

Analysis and Application

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Overview of Advanced Macroeconomics

Chapter 1: Overview of the Text

- 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
- Stokey, Lucas, Prescott, 1989 *Recursive Methods in Economic Dynamics*:
 - 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.

The Microfoundations Approach

Building Macro from Micro: New Elements

- 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."

Pure Microfoundations

- 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.

Building Macro from Micro: Modern Elements

- 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.
- Central margin of Part 2, and central margin of Part 3, static: same two central margins of Dynamics Part 4.
- 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.

- 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.

Consumption Smoothing

- Part 1 : consumption depends upon permanent income;
- Part 2 : consumer balances goods versus leisure, "intra-temporal" margin;
- Part 3 : consumer balances goods today versus goods tomorrow, "inter-temporal" margin;
- Part 4 : consumer balances simultaneously intra-temporal and inter-temporal margins;
- Part 5 : inter-temporal investment in human and physical capital: two inter-temporal margins.
- Part 6 : smoothing of consumption across state-space and time, extending Arrow-Debreu;
- Part 7 : government effects consumption smoothing through tax structure.

Taxes, Regulations and Inefficiencies

- 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 and Business Cycles

- 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).
- Maastricht Treaty debt and deficit limits analyzed.

Content by Two Margins

- 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

$$c^d = wl^s + \Pi.$$

$$T = l^s + x$$

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

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

$$c^d = \frac{1}{1 + \alpha} (wT + \Pi). \quad (1)$$

$$y_P \equiv wT + \Pi,$$

$$c^d = \frac{y_P}{1 + \alpha}. \quad (2)$$

$$AD: \frac{1}{w} = \frac{T_t}{c^d(1 + \alpha) - \Pi}.$$

$$\frac{c_1}{c_0} = \frac{1 + \hat{r}}{1 + \rho}. \quad (3)$$

$$c_t^d = \frac{1}{1 + \alpha} [w_t T_t + (r - \delta_k) k_t]. \quad (4)$$

$$\frac{c_t}{c_{t-1}} = \frac{1 + r_t - \delta_k}{1 + \rho}, \quad (5)$$

$$c_t^d = \frac{1}{1 + \alpha} (w_t T_t + \rho k_t). \quad (6)$$

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

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

$$y_t^d = c_t^d + \delta_k k_t = \frac{1}{1 + \alpha} (w_t T_t + [\rho + \delta_k (1 + \alpha)] k_t). \quad (7)$$

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

$$1 + g_t \equiv \frac{c_t}{c_{t-1}} = \frac{1 + r_t - \delta_k}{1 + \rho},$$
$$c_t^d = \frac{1}{1 + \alpha} [w_t + \rho(1 + g)k_t]. \quad (8)$$

$$y_{Pt} = w_t T_t + \rho(1 + g)k_t,$$
$$W_t = \frac{w_t T_t + (r_t - \delta_k - g)k_t}{r_t - \delta_k - g} = \frac{w_t T_t}{\rho(1 + g)} + k_t.$$

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

$$AD: \frac{1}{w_t} = \frac{T_t}{y_t^d (1 + \alpha) - k_t [\rho(1 + g) + (\delta_k + g)(1 + \alpha)]}.$$

Endogenous Growth and Consumption

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

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

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

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

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

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

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

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.