# Contents: *Economics with Calculus*
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## Chapter 1: Introduction

The introductory chapter provides a crisp explanation of the scope of economics and the topics to be covered in this text. The table listing one week's research output by National Bureau of Economic Research Associates reveals the range of topics studied by academic economists. Charts and tables show how the phenomenal growth of the US economy has been interrupted by bouts of inflation and unemployment. A chart contrasts the behavior of fixed versus flexible exchange rates.

## Chapter 2: Production Possibilities

The second chapter introduces the production transformation curve and puts it to work by using the model to explain opportunity cost, the gains from trade, efficient resource allocation and the principle of comparative advantage. As the first application of maximization behavior, I show how relative prices determine the output choice for a revenue-maximizing producer.

Because I think it is essential to give concrete applications of theoretical constructs, I use GDP data in developing a rough estimate of the production transformation curve revealing the remarkable mobilization of the US economy for World War II. As a second application, I present Alan Manne's linear programming analysis of the allocation of petroleum resources in the Korean War.

I postpone the traditional introductory chapter discussion of economic methodology until the end of this chapter in order that I can clarify basic concepts by referring to the production transformation curve model and the analysis of maximizing behavior.

## Chapter 3: Supply and Demand: Where do Prices Come From?

Chapter 3 explains how prices are determined in a competitive marketplace.  There are numerous applications.  The extended discussion of tax incidence reveals the power of the analytical techniques developed in this chapter.  In the concluding section I contrast market allocation with democratic decision-making and introduce Hotelling's median voter model.

This chapter introduces the essential concept of partial derivative, which is *not* covered in the standard Calculus Advanced Placement Course.

## Chapter 4: Maximizing Satisfaction

The economic analysis of consumer behavior disappoints the student preparing for a career in marketing while raising intriguing issues for the more philosophically inclined.  I gradually strengthen the student's skill at solving constrained maximization problems.  I start the analysis of consumer maximization with the simplest case of two consumers and one good, contrasting Bentham's greatest happiness principle with Rawls argument for maximizing the position of the least advantaged.  I discuss Sen's objection to Utilitarianism.  Then I explain consumer maximization and find the demand curve generated with a Cobb-Douglas utility function.  I also develop indifference curves and generate the box diagram.

I use the method of substitution rather than Lagrangian multipliers when solving constrained maximization problems in the text because most students whose background in the calculus is limited to an AP course or the equivalent find learning Lagrangian multipliers a time consuming struggle.  The appendix explains Lagrangians for the interested reader.

## Chapter 5: The Business Enterprise: Theory of the Firm

This chapter starts with an institutional discussion of different forms of business organization. The extended discussion of accounting (the language of business) is more relevant than ever, thanks to the Enron and Arthur Andersen scandals.

I use the Cobb-Douglas production function extensively in this and subsequent chapters, rather than getting involved with more complicated functional forms. I derive the short and long run cost functions from the production function and show that a profit maximizing monopolist will set output where marginal cost equals marginal revenue.

The discussion of optimal lot size and just in time shows how the theory of the firm can be applied to solve practical business problems.

## Chapter 6: Market Structure

I start with an explanation of how competitive markets work, going behind the supply curve of Chapter 3.  Then I investigate the efficiency of competition and the deadweight loss of monopoly and move on to discuss the theory of monopolistic competition and oligopoly.  The chapter concludes with a terse discussion of antitrust policy.

## Chapter 7: Distribution: Who Gets What?

This chapter examines a host of distributional issues.  I start with a review of evidence on income inequality, explaining the construction of Lorenz curves and the calculation of the Gini coefficient.  Then I move on to the marginal productivity theory of wages.  I show how labor's share is determined if the aggregate production function is Cobb-Douglas.  Then I discuss how government transfer programs and tax policy affect the distribution of income.

## Chapter 8: Monitoring Economic Performance

I postpone until this chapter the explanation of the distinction between micro and macroeconomics because it is much easier for students to understand once they have been exposed to microeconomics.

I discuss at length how unemployment and inflation are measured because I find that students with quantitative interests often find the details intriguing. I motivate the discussion by presenting considerable historical data.

The appendix reviews compound interest and discusses the pricing of bonds.

## Chapter 9: GNP Accounting and the Multiplier

This chapter could be subtitled "Depression Economics." After discussing basic national accounting concepts we consider the government spending multiplier. Using an admittedly simplified model we find that the magnitude of the multiplier depends on both the marginal propensity to consume out of disposable income and on leakages between GDP and disposable income – taxes, corporate retained earnings, depreciation, etc. Scatter-plot parameter estimates for the United States suggest that the multiplier is about 3.45. We then find that this preliminary (strawman?) estimate is much too large because the oversimplified multiplier model neglects such complications as the life-cycle/permanent income hypothesis. I point out that the analysis also neglects capacity constraints and the influence of monetary policy and other complications that will be analyzed in subsequent chapters. I explain that a much smaller estimate of the multiplier is generated with a Federal Reserve Board econometric model.

# Chapter 10: Money, Prices and Output

This chapter presents a sequence of macro-models.  Starting with the multiplier, we move on to the IS curve and then to the IS-LM model.  Next we derive the short-run aggregate demand curve from IS-LM, given the nominal money supply.  Finally, we explain that if wages and prices are flexible  in the long run then the aggregate supply curve is vertical and money is a veil.  Table 1 summarizes the sequence of models and tallies the endogenous and exogenous variables.

# Chapter 11: Dynamics, Expectations and Inflation

How markets adjust to equilibrium is the central theme unifying this chapter's discussion of micro and macro issues.  After a brief look at the cobweb model and a discussion of options, speculation and hedging, we examine the stock market.  Then we take a detailed empirical look at the Phillips curve explanation of the rate of inflation. We show how changes in the rate of productivity growth shift the Phillips curve and explain that the simplest version of the relationship failed because it neglected the role of expectations.  We show that under rational expectations the Phillips curve is vertical and explain the Lucus supply function.  Finally, we examine the Taylor

Rule and look at fiscal and monetary policy simulations generated by a Federal Reserve Board econometric model.

## Chapter 12: Growth and Development

After a brief discussion of Malthus, we consider a classical growth model in which the law of diminishing returns coupled with the subsistence theory of wages generates an unhappy stationary state. The rest of the chapter addresses various shortcomings of the classical model. I analyze a neoclassical growth model in the spirit of Solow but complicated by diminishing returns; we determine the conditions under which long run decay rather than growing living standards will prevail. I look more deeply at the way in which the rate of population growth responds to rapidly rising living standards and use a simplistic overlapping generation model to explore how declining population growth affects the demand for teachers, the dependency ratio, and the savings rate. Then I turn to Hotelling's analysis of the way in which the market allocates exhaustible resources over time. Finally, a model of renewable resources shows how the absence of appropriately assigned property rights can lead to over-fishing and the collapse of the fish population.

# Appendix: Further Reading

# Appendix: Web Sites