

# Marginal Analysis, Utility, and Diminishing Marginal Returns (DKent)

## *Reasoning at the Margin in Economics*

### Chapter Focus

Economists often explain choices by asking what changes when one more unit is added or one less unit is taken away.

In this chapter, you will learn how marginal thinking applies to consumer decisions, business production, personal time management, and macroeconomic reasoning.

The main practical rule is simple: continue an activity as long as the marginal benefit is at least as large as the marginal cost; stop when the next unit costs more than it is worth.

## Introduction

When you study economics, you quickly learn that good economic reasoning rarely asks only whether something is good or bad in general. Instead, economists usually ask a more precise question: what happens if you do a little more or a little less? That question is the beginning of marginal analysis. You do not usually decide whether studying is useful; you decide whether one more hour of studying is worth the time you must give up. A business does not usually decide whether workers are helpful; it decides whether one more worker adds enough output to justify the wage. A government does not usually decide whether a program has any benefit; it decides whether expanding that program by another dollar, another mile, or another service produces benefits greater than its additional cost.<sup>1</sup>

Marginal analysis is one of the most practical tools in economics because it helps you move from broad opinions to disciplined choices. It does not require you to believe people are perfect calculators. It simply teaches you to look at the relevant tradeoff. Scarcity forces you to choose, and because many choices can be adjusted a little at a time, the next unit often matters more than the average unit.<sup>2</sup> This is why an economist may say that the past cost of a concert ticket should not determine whether you attend if you are sick, or that a factory should compare the added output of another machine with the added cost of buying and operating that machine.

This chapter explains three connected ideas. First, marginal analysis shows how economists reason about additional benefits and additional costs. Second, utility explains how consumers receive satisfaction from goods, services, and experiences. Third, diminishing marginal returns explains why adding more of one input to a fixed resource eventually produces smaller increases in output. These ideas appear in microeconomics, but they also support macroeconomic reasoning. Consumer decisions shape aggregate demand, business production affects productivity and costs, and public policy often requires careful thinking about whether additional spending produces enough additional benefit.

## Learning Objectives

- Explain what economists mean by “marginal” and distinguish marginal values from total and average values.
- Use the marginal benefit and marginal cost rule to evaluate personal, business, and policy choices.
- Define utility, marginal utility, and diminishing marginal utility in a way that avoids the common mistake of equating utility with moral worth or usefulness.
- Apply the idea of utility maximization under a budget constraint, including the equal marginal utility per dollar rule.
- Explain diminishing marginal returns in production and distinguish it from diminishing marginal utility.
- Connect marginal reasoning to macroeconomic topics such as productivity, cost pressures, aggregate demand, and policy evaluation.

## 1. What Economists Mean by “Marginal”

The word marginal means additional, extra, or incremental. A marginal decision asks what changes because of one more unit of an activity. If you study one more hour, the marginal benefit is the added improvement in your understanding or grade expectation, and the marginal cost is the value of what you gave up during that hour. If a firm hires one more employee, the marginal product is the extra output created by that additional worker. If a city adds one

more police officer, the marginal benefit might include a reduction in response time or crime risk, while the marginal cost includes salary, training, equipment, and alternative uses of public money.

Marginal thinking is different from total thinking. Total benefit refers to all the benefit received from all units consumed or produced. Marginal benefit refers only to the extra benefit from the next unit. Total cost refers to the full cost of all units; marginal cost refers only to the extra cost of the next unit. Average values divide totals by the number of units. These distinctions matter because an average can hide what is happening at the edge of the decision. A student may have studied five hours with strong overall results, but the sixth hour may add very little because the student is tired. A restaurant may have profitable total sales, but staying open one more hour may lose money if the added revenue is less than the added labor and utility costs.

Economists often summarize rational marginal choice with a simple rule: continue an activity as long as the marginal benefit is greater than or equal to the marginal cost; stop when the marginal cost of the next unit exceeds the marginal benefit. This rule appears throughout economics, from consumer choice to business production to public policy.<sup>3</sup> It is not a claim that people always behave perfectly. Instead, it is a disciplined way to organize the relevant question: is the next step worth taking?

Concept	Plain-English Meaning	Example
Total benefit	The overall benefit from all units combined.	The total learning gained from all five hours of studying.
Marginal benefit	The added benefit from one more unit.	The extra learning gained from the sixth hour of studying.
Total cost	The overall cost of all units combined.	The total time and energy spent on all hours of studying.
Marginal cost	The added cost from one more unit.	The lost rest, work time, or family time caused by the sixth hour.
Average value	The total divided by the number of units.	Average learning per hour across all hours studied.

## 2. Why the Margin Matters More Than the Average

Average thinking is useful, but it can mislead you when the decision is about adjustment. Suppose a small business says, “Our average revenue per hour today has been high, so we should stay open longer.” That may be wrong. The relevant question is not whether the day has been profitable so far, but whether the next hour will bring in enough additional revenue to cover the additional costs. A strong average for the whole day does not guarantee that the last hour is worth operating.

The same point applies to your own choices. Imagine that you have already spent three hours preparing for an exam. The average benefit per hour may be high. Yet the fourth hour may be less valuable if you already understand the main concepts, or it may be more valuable if it helps you master the hardest material. The marginal question helps you focus on the next hour rather than on a vague feeling that “studying is good.” Good economics does not merely praise or condemn an activity; it asks how much of the activity is worth doing.

Marginal analysis also helps you avoid the sunk cost fallacy. A sunk cost is a cost that has already been incurred and cannot be recovered. If you bought a nonrefundable ticket for a concert but become ill, the price of the ticket is sunk. You should compare the marginal benefit of attending now with the marginal cost of attending now. The old ticket price should not control the decision because it cannot be changed. The same logic applies to businesses that continue failing projects only because they have already spent money on them. The past may explain how you arrived at the choice, but the margin tells you what decision remains.<sup>4</sup>

This is one reason economics can be both realistic and humane. Marginal thinking recognizes that people face limits. You cannot do everything, buy everything, learn everything, or produce everything. You must decide which next use of time, money, labor, land, or capital is most valuable compared with its cost.

### Practical Rule for Students

Do not ask only, “Is this good?” Ask, “Is one more unit of this activity worth what I must give up?”

That question can apply to studying, working, spending, saving, driving farther for a cheaper price, or taking on another responsibility.

The margin is where many real decisions happen.

### 3. Marginal Benefit, Marginal Cost, and the Decision Rule

Marginal benefit is the additional benefit from one more unit of an activity. Marginal cost is the additional cost of one more unit. The marginal decision rule is easy to state: if marginal benefit exceeds marginal cost, doing more increases net benefit; if marginal cost exceeds marginal benefit, doing more reduces net benefit. The best choice is usually found where marginal benefit and marginal cost are equal, or as close to equal as possible, given the available units.<sup>5</sup>

The reason this rule works is that each additional unit changes the total net benefit. Net benefit is total benefit minus total cost. If the next unit adds more benefit than cost, total net benefit rises. If the next unit adds more cost than benefit, total net benefit falls. In a graph, the efficient or optimal quantity often appears where the marginal benefit curve intersects the marginal cost curve. In a table, it appears at the last unit for which marginal benefit is at least marginal cost.

Consider a student choosing how many hours to study for a test. The first hour may produce a large gain because it introduces the chapter. The second hour may add more understanding. Later hours may help, but the benefit may shrink as the easiest improvements have already been made. At the same time, the marginal cost of studying may rise as fatigue increases or as the student gives up more valuable alternatives. The optimal study time is not necessarily the maximum possible study time. It is the amount at which the next hour no longer adds enough benefit to justify the cost.

This example also shows why marginal analysis is not selfish in a narrow sense. Costs include more than money. They include time, energy, risk, stress, lost sleep, and the value of other responsibilities. Benefits also include more than money. They include learning, security, health, relationships, and long-term opportunities. Economic reasoning becomes stronger, not weaker, when it identifies the true benefits and costs of the next choice.

Hours Studied	Marginal Benefit of This Hour	Marginal Cost of This Hour	Decision
1	Very high: basic concepts become clear	Low: easy time to give up	Study
2	High: practice problems improve	Moderate	Study
3	Moderate: weak areas improve	Moderate	Study if benefit still exceeds cost
4	Low to moderate: smaller improvement	High: fatigue and lost sleep rise	Question carefully
5	Low: very little additional learning	Very high	Probably stop

### 4. Utility: Satisfaction, Preference, and Choice

Utility is the satisfaction, benefit, or preference fulfillment a person receives from consuming a good, service, or experience. In economics, utility does not mean that a product is morally good or practically useful. A candy bar may provide utility to one person, while a textbook may provide utility to another. Utility is about how a person ranks alternatives according to preferences, not about whether society approves of those preferences.<sup>6</sup>

Early economists such as William Stanley Jevons and Alfred Marshall helped develop the language of utility and marginal utility as a way to explain consumer demand.<sup>7</sup> Modern economics usually treats utility as an ordinal concept. Ordinal utility means economists generally care about preference ranking—whether a person prefers bundle A to bundle B—rather than trying to measure happiness in exact units. You do not need to prove that a slice of pizza gives “ten units” of happiness. You only need to understand that, at a given moment, you may prefer the first slice to the second slice, the second slice to the third, and so on.<sup>8</sup>

Marginal utility is the additional satisfaction from consuming one more unit of a good or service. Total utility is the overall satisfaction from all units consumed. If you are hungry, the first sandwich may produce a high marginal utility. The second may still be enjoyable, but it may add less satisfaction than the first. The third may add very little, and a fourth may even make you uncomfortable. The law of diminishing marginal utility states that, holding other things constant, the marginal utility from each additional unit of a good tends to decline as more units are consumed during a given period.<sup>9</sup>

This principle helps explain why demand curves slope downward. If the marginal utility of additional units falls, a consumer is usually willing to pay less for later units than for earlier units. The first bottle of water on a hot day may

be extremely valuable; the fifth bottle in the same hour is less valuable. Price must often fall to encourage a consumer to buy more units because the extra satisfaction from those additional units is lower.

Diminishing marginal utility does not mean that total utility must fall immediately. Total utility can continue rising even as marginal utility declines. If each additional slice of pizza still gives some positive satisfaction, total utility rises, but by smaller and smaller amounts. Total utility begins to fall only when marginal utility becomes negative. This distinction is important because students often confuse “less additional satisfaction” with “less total satisfaction.” The word marginal is the key.

Slices of Pizza	Total Utility	Marginal Utility	Interpretation
1	20	20	The first slice gives a large increase in satisfaction.
2	35	15	Total utility rises, but the second slice adds less than the first.
3	45	10	Total utility still rises, but at a slower rate.
4	50	5	The fourth slice adds only a little satisfaction.
5	50	0	The fifth slice adds no extra satisfaction.
6	45	-5	The sixth slice lowers total satisfaction.

### 5. Consumer Choice and Utility per Dollar

Because income is limited, you cannot simply buy every good that provides positive utility. A consumer must compare alternatives within a budget constraint. A budget constraint shows the combinations of goods and services that a consumer can afford at given prices and income. The central question becomes: how can you spend limited income in a way that produces the highest possible satisfaction?<sup>10</sup>

The practical marginal rule for consumer choice is to compare marginal utility per dollar. Marginal utility per dollar is the added satisfaction from the next unit of a good divided by its price. If the next dollar spent on tacos gives more additional satisfaction than the next dollar spent on coffee, then reallocating money toward tacos increases total utility. A consumer maximizes utility when the marginal utility per dollar is equal across goods, after considering the available budget. In simple form, the condition is  $MU_x/P_x = MU_y/P_y$  for the last units purchased.<sup>11</sup>

This rule may sound mathematical, but the intuition is familiar. Suppose you are choosing between a meal and a movie ticket. The meal costs less and gives high satisfaction because you are hungry. The movie ticket may also provide satisfaction, but if its price is much higher, the added satisfaction per dollar may be lower. You would normally spend your limited money where the next dollar produces the greatest value to you. Once the best opportunities are used, the next-best options become more attractive until the marginal satisfaction per dollar is balanced.

The utility-per-dollar rule also explains why price changes alter consumption. If the price of a good falls, its marginal utility per dollar rises, at least initially. The good becomes more attractive relative to alternatives. This helps explain the substitution effect: when a good becomes cheaper, consumers tend to substitute toward it and away from relatively more expensive goods. In macroeconomics, many individual consumer decisions combine to shape aggregate demand. A change in prices, incomes, expectations, or interest rates can influence millions of marginal spending choices.<sup>12</sup>

You should also notice that utility analysis does not require every person to value goods the same way. One student may use extra income for gasoline, another for books, another for music, and another for savings. Economics does not need identical preferences to analyze choice. It needs a clear understanding that people face tradeoffs and respond to incentives at the margin.

Good	Price	Marginal Utility of Next Unit	MU per Dollar
Coffee	\$4	16	4.0
Lunch	\$8	40	5.0
Movie rental	\$5	15	3.0

In this example, the next dollar spent on lunch gives the highest marginal utility per dollar. If the consumer has enough income and the units are realistic, lunch is the strongest next purchase. After buying lunch, however, the marginal utility of another lunch would probably fall, and the comparison would need to be made again.

## 6. Diminishing Marginal Returns in Production

Diminishing marginal returns is a production concept. It explains what happens when a firm adds more of one variable input, such as labor, to at least one fixed input, such as a building, machine, truck, kitchen, or acre of land. At first, adding workers may increase output rapidly because workers can specialize and use the fixed resource more effectively. Eventually, however, the fixed resource becomes crowded or stretched. Each additional worker adds less output than the previous worker. This is the law of diminishing marginal returns.<sup>13</sup>

The key phrase is “holding at least one input fixed.” Diminishing marginal returns is most clearly a short-run concept. In the short run, a firm may be able to hire more workers but not immediately expand the size of its factory. If the firm could also expand the factory, add more machines, and redesign the production process, the result might be different. Long-run growth can come from more capital, better technology, improved skills, and more efficient organization. But when one important input is fixed, adding more and more of another input eventually produces smaller marginal gains.<sup>14</sup>

A simple restaurant example makes the idea clear. One cook in a kitchen may produce twenty meals per hour. A second cook may raise total output to fifty meals because the two workers can divide tasks. A third cook may raise output to seventy-five meals. But a fourth cook may add only ten more meals because the kitchen is becoming crowded. A fifth cook may add only three more meals, or may even slow everyone down. The issue is not that workers suddenly become lazy. The problem is that the fixed kitchen limits how productively additional labor can be used.

Diminishing marginal returns helps explain why marginal cost eventually rises. If each additional worker adds less output, the cost of producing each additional unit tends to rise. Suppose each worker costs the same wage. When a new worker adds many meals, the labor cost per additional meal is low. When a new worker adds only a few meals, the labor cost per additional meal is high. This relationship between diminishing marginal product and rising marginal cost is central to the short-run cost curves used in economics.<sup>15</sup>

It is important not to confuse diminishing marginal returns with negative returns. Diminishing marginal returns begins when each additional input adds less extra output than the previous input. Total output may still be rising. Negative marginal returns occur only when an additional input actually reduces total output. The fourth worker may still increase total meals, but by less than the third worker did. That is diminishing marginal returns, not negative returns.

Diminishing marginal returns is also different from diminishing marginal utility. Diminishing marginal utility concerns satisfaction from consumption. Diminishing marginal returns concerns output from production. Utility belongs on the consumer side of the economy; marginal returns belong on the producer side. Both involve the word diminishing because additional units eventually add less, but they apply to different decisions.

Workers	Total Output per Hour	Marginal Product of Labor	What Is Happening?
0	0	—	No labor, no output.
1	20	20	The first worker uses the kitchen.
2	50	30	Specialization increases output rapidly.
3	75	25	Output rises, but marginal product begins to fall.
4	88	13	The kitchen becomes crowded.
5	93	5	The fixed kitchen severely limits added output.

## 7. Why Diminishing Returns Matters for Macroeconomics

Although diminishing marginal returns is often introduced in microeconomics, it matters for macroeconomics because macroeconomic performance depends on productivity. Real GDP grows when an economy produces more final goods and services. That growth can come from more labor, more physical capital, better human capital, improved technology, stronger institutions, and more efficient production. Yet an economy cannot usually rely forever on simply adding more of one input while other inputs remain fixed. If the capital stock, technology, and organization of production do not improve, additional labor may eventually add less output per worker.<sup>16</sup>

This is why economic growth is not merely a matter of working more hours. A nation can raise output by increasing labor input, but sustained increases in real GDP per capita usually require improvements in labor productivity. Productivity rises when workers have better tools, better training, better infrastructure, and better technology. Marginal reasoning helps you see why. If each additional worker is given too little capital or outdated technology, the marginal product of labor may be low. If workers receive better capital and skills, the production possibilities of the economy can expand.

Diminishing returns also helps explain why short-run cost pressures can appear when firms try to expand output quickly. If factories, trucks, equipment, and skilled managers are fixed in the short run, firms may need to pay overtime, use less efficient shifts, or crowd more labor into existing facilities. Output can rise, but marginal cost may rise as well. In macroeconomic terms, when many firms face rising marginal costs, additional aggregate demand may lead partly to higher output and partly to higher prices, depending on how close the economy is to capacity.<sup>17</sup>

For public policy, marginal analysis encourages careful thinking about tradeoffs. A policy may be beneficial at a small scale but less effective at a larger scale. For example, the first dollars spent repairing the worst roads may produce large benefits, while later dollars spent on lower-priority projects may produce smaller benefits. The first training program for unemployed workers may reach people who can benefit quickly, while additional programs may serve harder cases with lower immediate returns. This does not mean the later spending is always wrong. It means the decision should compare additional benefits with additional costs rather than assuming that more of a good program is always equally good.

Macroeconomics also uses marginal ideas in other ways. The marginal propensity to consume measures how much additional consumption results from an additional dollar of income. The marginal propensity to save measures the additional saving from an additional dollar of income. Firms compare marginal revenue and marginal cost when deciding output. Workers compare marginal benefits and costs when deciding labor supply. Marginal reasoning is therefore not a side topic. It is part of the language of economic analysis.

## 8. Common Mistakes to Avoid

One common mistake is to treat marginal analysis as a defense of greed. That is not correct. Marginal analysis is a method for comparing additional benefits and costs. The benefits may include compassion, safety, fairness, health, education, or spiritual and family priorities. The costs may include hardship imposed on others, risk, or long-run consequences. Marginal analysis does not tell you to ignore values; it tells you to be honest about tradeoffs.

A second mistake is to confuse marginal with small. A marginal change is an incremental change, but incremental changes can be large in importance. One additional bridge, one additional nurse in an emergency room, one additional interest-rate increase, or one additional week of unemployment benefits may have major consequences. Marginal analysis asks about the next unit, not about whether the next unit is trivial.

A third mistake is to confuse marginal utility with total utility. If the marginal utility of a good declines, that does not mean total utility is falling. Total utility rises as long as marginal utility remains positive. The added satisfaction is smaller, but it is still added satisfaction.

A fourth mistake is to confuse diminishing marginal returns with lower quality workers. Diminishing returns can occur even when every worker is equally capable. The problem is usually the fixed input. If too many workers must share the same machine, kitchen, office, or acre of land, the marginal product of additional labor falls because the fixed resource becomes a bottleneck.

A fifth mistake is to ignore time. Marginal choices are made within a time period. The marginal utility of a second glass of water is low if you just drank one, but it may be high tomorrow after a long walk. The marginal product of labor may be low in a small factory today, but higher next year if the firm expands the building and buys better equipment.

## Summary

Marginal analysis teaches you to reason about the next unit. Instead of asking only whether an activity is good in general, you ask whether doing a little more of it produces benefits greater than its additional costs. This method applies to study time, consumer purchases, business hiring, production decisions, and public policy. The central rule is

to continue an activity as long as marginal benefit is at least as great as marginal cost, and to stop when the next unit costs more than it is worth.

Utility explains consumer satisfaction and preference. Total utility measures overall satisfaction from all units consumed, while marginal utility measures the additional satisfaction from one more unit. Diminishing marginal utility means additional units usually add less satisfaction as consumption increases during a given period. This helps explain downward-sloping demand and the consumer's need to allocate a limited budget according to marginal utility per dollar.

Diminishing marginal returns explains production when one input is fixed and another input is increased. Adding more workers to a fixed kitchen, factory, farm, or office may first raise output quickly, but eventually each additional worker adds less output. This concept helps explain rising marginal cost and connects to macroeconomic issues such as productivity, real GDP growth, short-run cost pressures, and the limits of simply adding more labor without more capital, technology, or training.

The deeper lesson is that economics is not just about money. It is about disciplined reasoning under scarcity. When you learn to think at the margin, you learn to identify the actual choice in front of you, compare the relevant tradeoffs, avoid sunk cost mistakes, and understand why additional units often matter differently from earlier units.

## Worksheet: Marginal Analysis, Utility, and Diminishing Marginal Returns

Directions: Answer each item in complete sentences unless the question asks for calculations. Show your work for all problems. These questions are designed to move beyond definitions, so explain your reasoning at the margin.

### 1. Study-time decision problem

A student is deciding how many hours to study for a macroeconomics exam. The table shows the expected marginal benefit and marginal cost of each additional hour.

Hour 1: MB = 30, MC = 8

Hour 2: MB = 24, MC = 10

Hour 3: MB = 18, MC = 12

Hour 4: MB = 13, MC = 14

Hour 5: MB = 9, MC = 18

How many hours should the student study according to marginal analysis? Explain why the answer is not necessarily the hour with the highest total benefit.

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### 2. Total, average, and marginal

A food truck sells 80 meals in four hours, for an average of 20 meals per hour. During the fifth hour, it expects to sell only 9 meals. Labor, electricity, and cleanup for the fifth hour cost \$95. Each meal brings in \$11 of revenue. Should the truck stay open for the fifth hour? Use marginal reasoning, not average reasoning.

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### 3. Utility table calculation

A consumer's total utility from streaming movie rentals is: 1 rental = 28, 2 = 50, 3 = 66, 4 = 76, 5 = 80, 6 = 78.

Calculate marginal utility for each rental after the first. Identify where marginal utility becomes negative and explain what happens to total utility at that point.

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**4. Utility per dollar**

Suppose the next sandwich gives a consumer 36 units of marginal utility and costs \$9. The next cup of coffee gives 18 units of marginal utility and costs \$3. The next bus ride gives 20 units of marginal utility and costs \$5. Which purchase gives the highest marginal utility per dollar? Explain how the answer would guide a consumer with limited income.

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**5. Consumer reallocation problem**

A student buys two goods: books and meals. The last dollar spent on books gives 6 units of marginal utility, while the last dollar spent on meals gives 10 units. Has the student maximized utility? If not, describe the direction of adjustment and explain what should happen to marginal utility per dollar as the student reallocates spending.

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**6. Diminishing marginal returns calculation**

A small print shop hires workers with one fixed printing machine. Total daily output is: 0 workers = 0, 1 = 40, 2 = 95, 3 = 135, 4 = 160, 5 = 172, 6 = 176. Calculate the marginal product of each worker. At what point do diminishing marginal returns begin? Explain your answer carefully.

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**7. Diminishing returns versus negative returns**

Using the print shop in question 6, identify whether negative marginal returns occur. Explain the difference between diminishing marginal returns and negative marginal returns in your own words.

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**8. Production and marginal cost**

Assume each worker in question 6 costs \$120 per day. For each additional worker, divide the wage by that worker's marginal product to estimate the labor cost per additional unit of output. What happens to labor cost per additional unit as marginal product falls? Why does this help explain rising marginal cost?

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**9. Sunk cost fallacy**

You paid \$70 for a nonrefundable ticket to an event. On the day of the event, you are exhausted and would rather rest. Attending would require two hours of driving and four hours at the event. Use marginal analysis to explain why the \$70 should not be the deciding factor. What benefits and costs should be considered instead?

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**10. Public policy marginal analysis**

A city has \$1 million to spend on road repairs. The first \$250,000 would repair the most dangerous intersections. The second \$250,000 would repair heavily used commuter roads. The third \$250,000 would improve residential streets with moderate traffic. The fourth \$250,000 would beautify low-traffic roads. Explain why the marginal benefit of each additional \$250,000 may decline. Should the city automatically spend the full \$1 million on roads? Explain.

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**11. Macro application: productivity**

A country increases employment rapidly, but the capital stock and technology do not grow. At first, real GDP rises quickly. Later, real GDP continues to rise but by smaller amounts per additional worker. Use diminishing marginal returns to explain this pattern. What would the country need for sustained increases in real GDP per capita?

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**12. Demand and diminishing marginal utility**

Explain how diminishing marginal utility supports the law of demand. Then give one example where your willingness to pay for the first unit of a good is higher than your willingness to pay for later units.

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**13. Marginal analysis and ethics**

Some students think marginal analysis means choosing whatever produces the most money. Write a paragraph explaining why this is too narrow. Include at least two nonmonetary benefits or costs that could belong in marginal analysis.

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**14. Short-run versus long-run production**

A factory is crowded, and adding more workers produces smaller increases in output. Management says, “Workers are less productive now, so hiring is pointless forever.” Explain what is wrong with this statement. Use the difference between the short run and the long run.

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**15. Integrated critical thinking problem**

A college has limited funds to improve student success. It can spend money on tutoring, advising, library hours, or classroom technology. Explain how administrators could use marginal analysis to allocate funds. What information would they need? Why might the best allocation change over time?

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**Endnotes**

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12. Pindyck and Rubinfeld, *Microeconomics*, chap. 4; Mankiw, *Principles of Economics*, chap. 4.
13. Nicholson and Snyder, *Microeconomic Theory*, chap. 9; Pindyck and Rubinfeld, *Microeconomics*, chap. 6.
14. Pindyck and Rubinfeld, *Microeconomics*, chaps. 6–7.
15. Mankiw, *Principles of Economics*, chap. 13; Greenlaw, Shapiro, and MacDonald, *Principles of Economics 3e*, chap. 7.
16. Samuelson and Nordhaus, *Economics*, chaps. 24–25; Mankiw, *Principles of Economics*, chaps. 25–26.
17. Samuelson and Nordhaus, *Economics*, chaps. 30–32; Mankiw, *Principles of Economics*, chaps. 33–34.

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