2.0 CONSUMER THEORY

Professor's Note: Please be patient. These notes are close to completion but still need some work.

2.1 Consumer Behavioral Assumptions

- Unlimited wants
- Limited income
- Rational behavior

Consumer behavior determines demand. Consumer behavior is characterized using several key assumptions. One, people have unlimited wants. Secondly, they have limited income. This limitation forces consumers to make choices. They must decide which wants can be satisfied. They may classify needs into broad categories. Consumers must decide how much money to budget to meet needs in housing, transportation, nutritution, entertainment, etc. Within those categories specific goods and services must be selected. From these basic assumptions you can deduct that consumers maximize satisfaction within their budget. Note that the terms income and budget are used interchangibly.

The last major assumption, rational behavior, requires several properties. What does rationality imply? That choice making follows some established criteria. First, let's suppose that a consumer can compare two different goods to establish which one is preferred or if they are the same. This property is known as completeness and would seem logical to require consumers to have an ability to compare and choose. Secondly, if an object is compared to its self, it would be at least as good as its self. While this may seem trival, consider the case where it does not hold, that would certainly be considered irrational. This is called the property of reflexivity. Finally, let's consider three goods, Pepsi, Coke, and tea. Let's say that Pepsi is preferred to Coke and that Coke is preferred to tea. Wouldn't it make sense that Pepsi is preferred to tea? Called the property of transitivity, this helps to ensure consistency in choices. In short, rationality requires consumers to have an ability to make consistent choices.

Utility

In economics, we say that maximizing satisfaction is maximizing utility. Another way of expressing utility that may make more sense to you is to use the term benefit. They attempt to maximize their welfare. What determines utility? More specifically, what defines the utility function? Since utility cannot be measure directly, it is measured by what is consumed. The methodology is to correlate utility with consumption. Such a function could show utility increasing as consumption increase but at a decreasing rate. This tracks real world consumer behavior. Mathematically, a wide range of equations could work such as:

$U = xy \quad U = x^2y \quad U = x^2 + y^2$ ...

where x and y represent quanitities of different goods.

Let's start with an example of utility showing how to calculate average utility, and marginal utility using the table below. Let's say we are drinking coffee. The very first cup of coffee gives us three units of utility (call it benefit). The second cup of coffee gives us an additional 2 units of utility. Not quite as satisfying as the first one but good nevertheless. A third cup of coffee gives one additional unit of utility. As is true for many economic functions, additional quantities consumed continue to increase our utility but at a decreasing rate. This effect is known as decreasing returns to scale. The additional utility from each cup is the margainal utility. Marginal Utility is computed as the change in total utility divided by the change in quantity. Average Utility is total utility divided by quantity. Note the relationship between average utility and marginal utility, as marginal utility decreases so does average utility. If marginal utility were increasing, so would the average utility. As long as marginal utility is

positive then total utility is increasing. If is negative then total utility would decrease. Could marginal utility actually be negative? Of course, if you drink too much beer you would get sick. That would certainly be a negative utility.

Q	Total Utility	Average Utility	Marginal Utility
1	3	3	3
2	5	2.5	2
3	6	2	1
4	6	1.5	0

There are two approaches commoningly taken at this point in principles of microeconomics textbooks; one is to derive a marginal utility methodology and the other to use a graphical analysis involving indifference curves. The marginal utility methodology assumes that utility can be precisely measured (a cardinal approach where mathematical operations such as division, multiplication, etc. can be applied to the number series) versus the indifference curve methodology where consumers are capable of determing an ordinal order but cannot say that one good is twice as desirable as another. Both approaches seek to determine quantity of goods demanded at a given price.

2.2 Marginal Utility Approach

Remember products and services are consumed because they deliver usefulness, satisfaction, or utility. The number of units consumed depends on the utility of the last unit consumed compared to that of other products, given a limited income. Remember, as quantity consumed increases, the marginal utility per unit drops. Consumers consume products with the highest marginal utility first. If income is not limited then consumption will increase until the last unit does not generate a positive marginal utility. Consumers maximize utility given a limited income. Maximum satisfaction when the budget is spent is achieved when the ratio of marginal product to price is equal for all goods and services consumed.

$MP_0/P_0 = MP_1/P_1 = . . . = MP_n/P_n$

View the ratio of marginal product to price as a measure of value. Do we have a concept of value? Consider a typical shopping trip looking for a cleaner in a supermarket. On the shelf is brand X that has a price of $2.00 for one liter while brand ZZ has a price of $2.00 for one liter. Suppose that brand ZZ has four times the strength of brand X, consumers will probably pick brand ZZ and if they dilute it to the strength of brand X to end with four times the amount of product at the same price.

Determination of consumption

Q	Pepsi		Tacos	
	MU	MU/P	MU	MU/P
1	20	40	14	19
2	15	30	12	16
3	10	20	10	13
4	5	10	8	11
5	0	0	6	8
P	.50		.75	

Given an income or budget of $3.00, how many Pepsi's and taco's would be bought? Since consumer's maximize satisfaction, they will buy items with the highest value first. Value is established as the ratio of MU to P. As long as the remaining buget is greater than zero, consumer's will continue to buy goods.

In this scenario 3 Pepsi's and 2 tacos are purchased.

The first item purchsed is a Pepsi, since it has the highest MU/P ratio, 40. In fact, the first three purchases will be Pepsi's, since the 3rd has a Mu/P ratio of 20 which is higher than the highest ratio for tacos at 19. Now $1.50 has been spent out of the original $3.00 income leaving $1.50 to be spent. The next highest ratios belong to taco's at 19 and 16. At this point, the entire $3.00 budgeted for food has been spent.

The substitution effect illustrated under marginal utility

Q	Pepsi		Tacos	
Q	MU	MU/P	MU	MU/P
1	20	80	14	19
2	15	60	12	16
3	10	40	10	13
4	2	8	8	11
5	0	0	6	8
P	.25		Tacos	

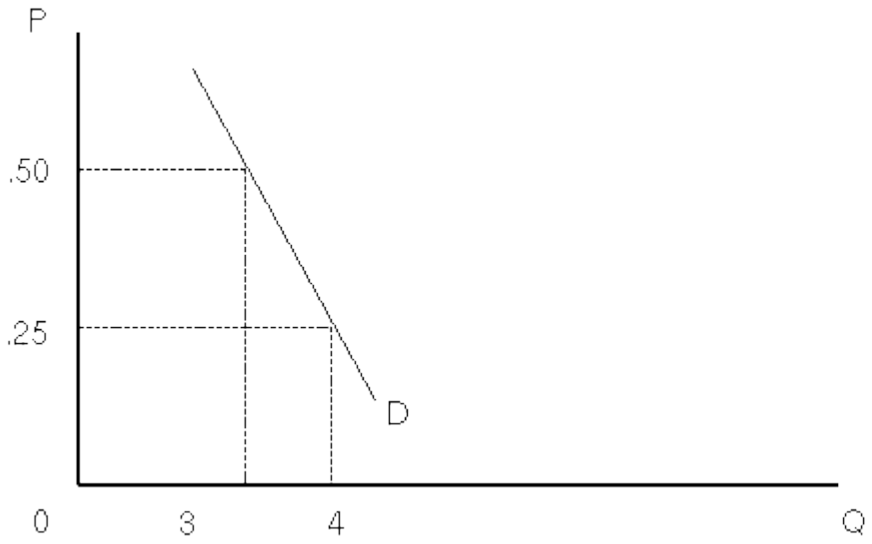
In this example, we change Pepsi's MU slightly to show that taco consumption is increased to 3 when Pepsi's price is lowered.

Deriving the demand curve under marginal utility

Let's vary the price of Pepsi by lowering it to $.25

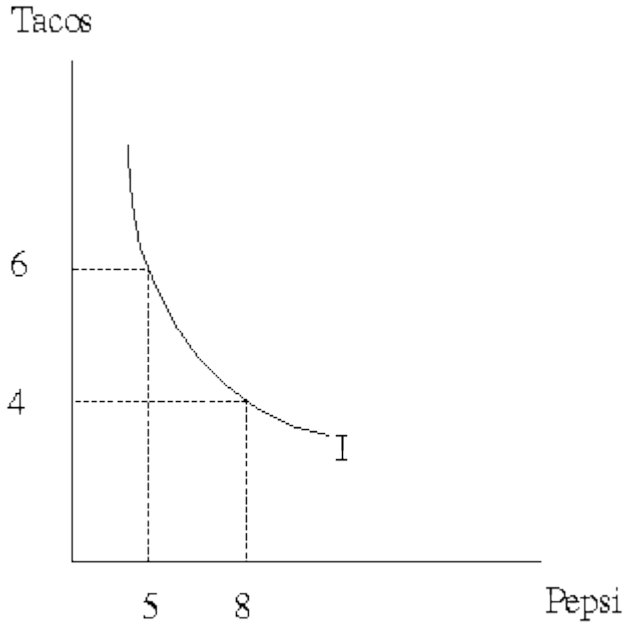
Q	Pepsi		Tacos	
	MU	MU/P	MU	MU/P
1	20	80	14	19
2	15	60	12	16
3	10	40	10	13
4	5	20	8	11
5	0	0	6	8
P	.25		.75	

Note that the MU/P ratios for tacos are unaffected. Now 4 Pepsi's are purchased at a price of .25 compared to 3 Pepsi's purchased at a price of .50. These data points are graphed below to construct the demand curve.



2.3 Indifference Curve Approach

The indifference curve approach approaches the same problem of consumer choice from a different view. Let's start by defining an indifference curve, it is the set of possible combinations of goods (two goods for this analysis) over which a consumer is indifferent. In other words, given a combination of five Pepsi's and six tacos against another combination of eight pepsi's and four tacos, either combination is considered equally desirable.

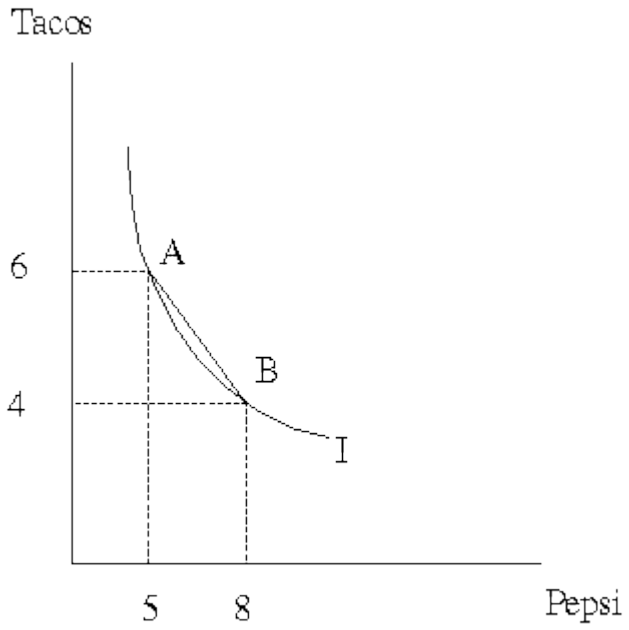


Properties of Indifference Curves

- Negative slopes
- Increase by shifting to the northeast

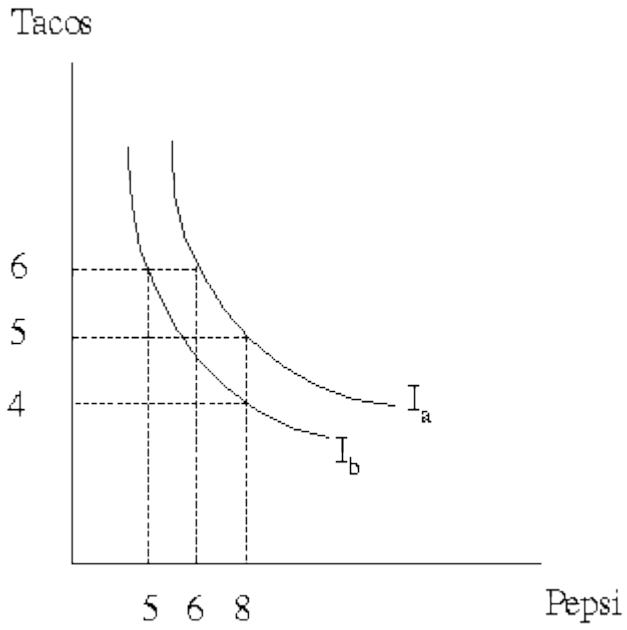
- Nonintersecting
- Continuous curves

There are several important properties that all indifference curves have. One, Indifference curves have a negative slope. If one of a good is consumed in a greater quantity then less of the other one has to be consumed. The amount of good that is given up is the opportunity cost of gaining the other good. The rate at which this happens is called the Marginal Rate of Substitution. It is the slope of the indifference curve at the point or segment of the curve.



In the above graph, in moving from point A to point B, 2 tacos were given up to gain 3 Pepsi's. The 2 tacos represent the opportunity cost. The ratio -2/3 tacos/Pepsis, the slope of the line segment connecting points A and B, is the Marginal Rate of Substitution. It quantifies how many tacos must be given up for one Pepsi.

Second, as indifference curves shift to the northeast, the level of benefit is increasing. In our example here, every point on indifference curve, I_1 is preferred over every point on indifference curve I_0. The set of graphed indifference curves is frequently called an indifference curve mapping.

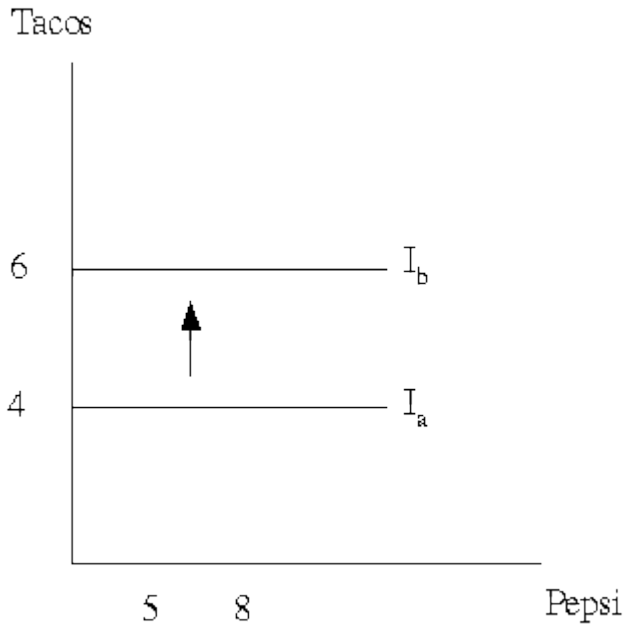


In this example, on indifference curve, I_b, the consumer is indifferent between 6 tacos with 5 Pepsi's, and 4 tacos with 8 Pepsi's, but any combination on I_a would be preferred to any combination on I_b. For example, at 6 tacos on I_b there are 5 Pepsi's but 6 Pepsi's on I_a. Concurrently, there are 4 tacos but 5 tacos on I_a. Since consumers prefer more rather than less, I_a is preferred over I_b.

Third, indifference curves are smoothly continuous. This just means any combinations of goods can be considered including fractional quantities.

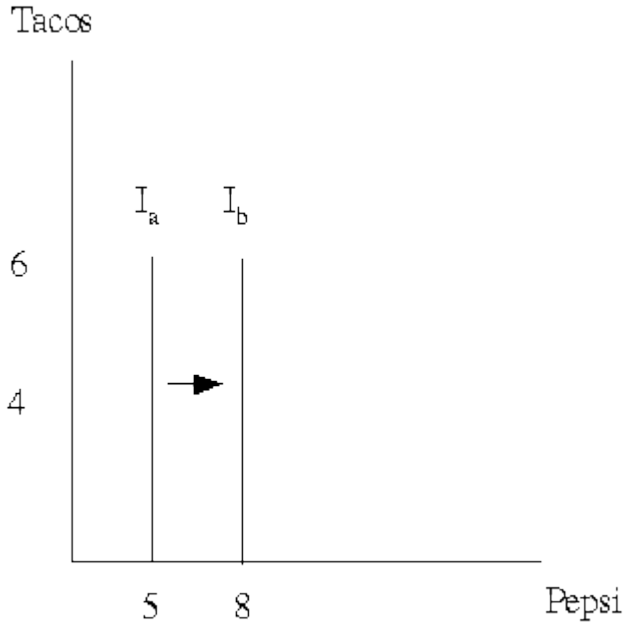
Preference for Tacos

In the indifference curve below, utility is only increased when consumption of tacos are increased.



Preference for Pepsi

In the indifference curve below, utility is only increased when consumption of Pepsi is increased.



Budget Lines

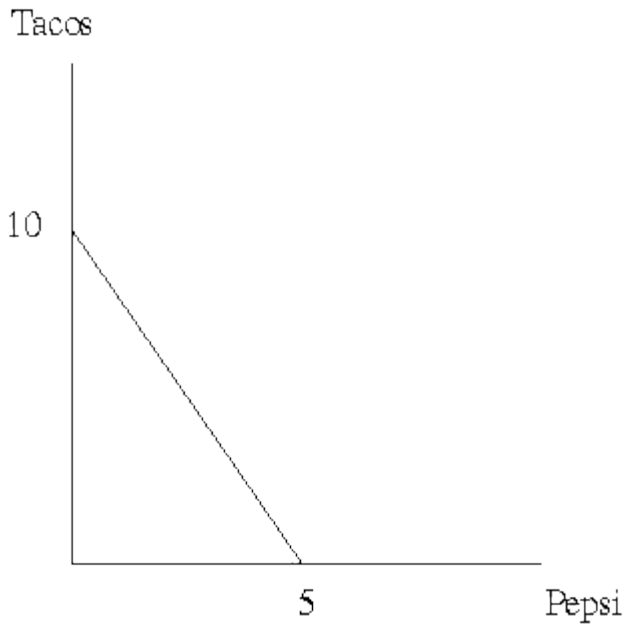
While the indifference curve gives us the possible combinations, it does not give us which curve nor

the one point on that curve is in economic equilibrium, what is needed is the income or budget constraint. The income or budget line is the possible combinations of goods that can be purchased given the level of money income and the prices of each good.

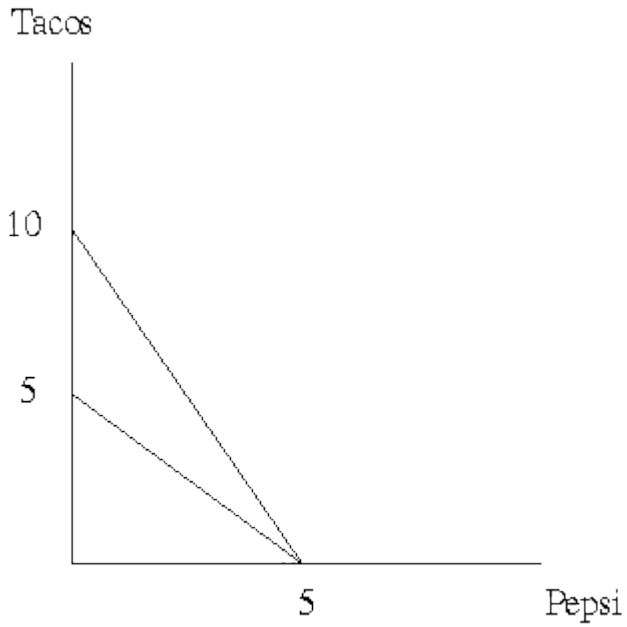
Budget lines have similar properties to indifference curves. They have negative slopes. They increase as they shift to the northeast. The equation for the income budget line is given below. It is the sum of item prices times their quantites.The slope of the budget line is the ratio of prices: $- P_x/P_y$. Where y is the price on the vertical axis and x is the price on the horizontal axis.

$Y = P_0Q_0 + P_1Q_1 + \ldots + P_nQ_n$

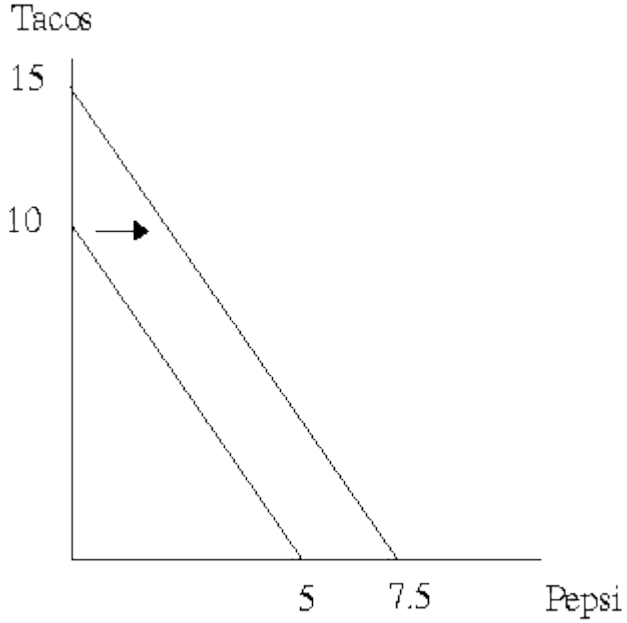
Examples



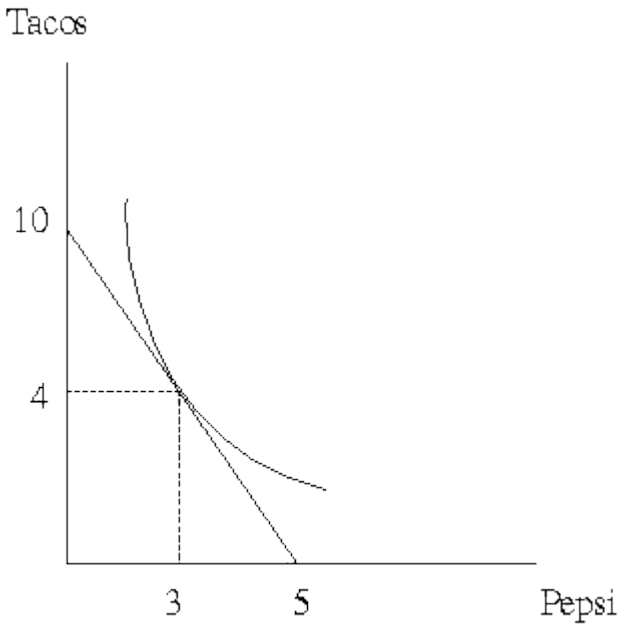
Given a money income of $5, Pepsi price of $1.00, and taco price of .50, a maximum of 5 Pepsi's can be bought or 10 tacos. These points are plotted as the vertical and horizontal intercepts accordingly. Any combination on the line can be purchased. The point that will be purchased will the one and only one point that is tangent to an indifference curve (it will be the highest indifference curve, maximizing utility, that can only touch the budget line at one point). At this point the optimal combination of goods can be determined.



By increasing the price of tacos to $1.00, the budget line rotates inward. Instead of being able to buy 10 tacos (income of $5 / price of .50 per taco), now only 5 tacos can be bought (income of $5 / price of $1.00 per taco).

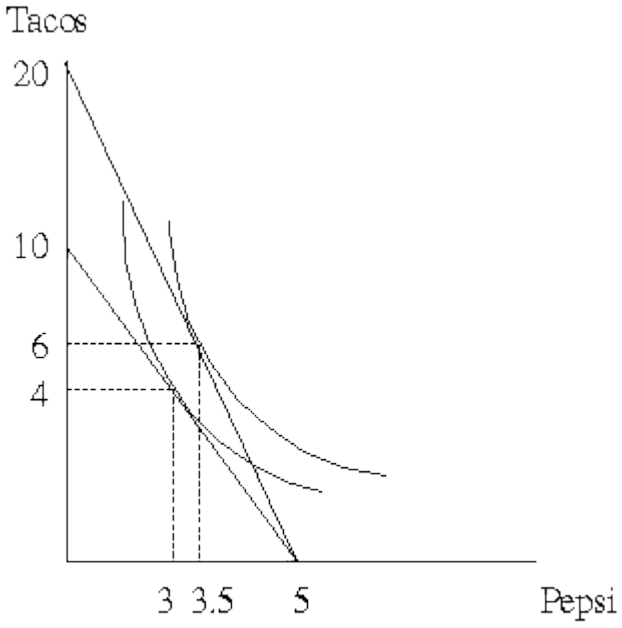


Increasing income causes the budget line to shift outward. At the original prices, increasing the income to $10 would double the quantities of Pepsi and tacos that could be bought to 10 Pepsi or 20 tacos.

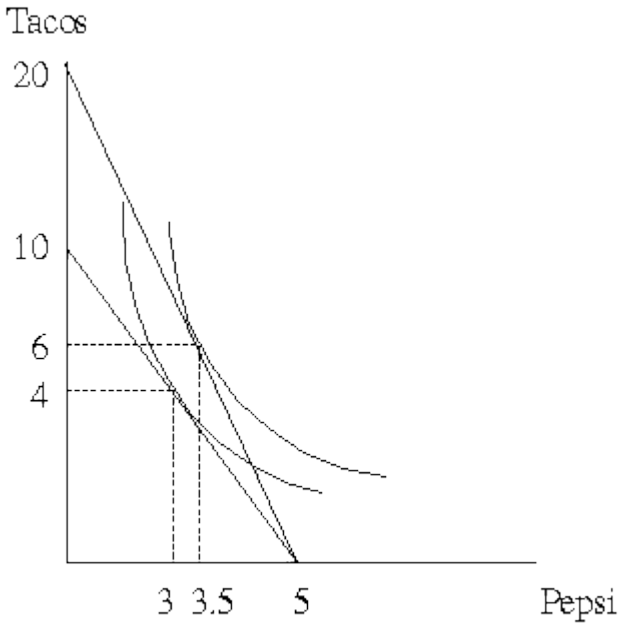


Ok, let's put these together. In the graph above, at the point where the budget line is tangent to the indifference curve, our customer will consume 4 tacos and 2 Pepsi's.

Let's consider what happens when the price of tacos change. Let's say that the new price for a taco is .25. Now the budget line rotates upward.



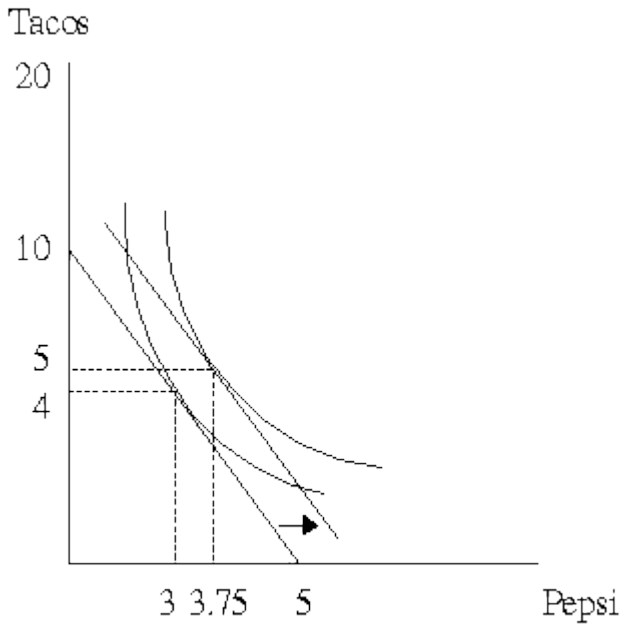
At the new point of tangency, xx tacos are consumed and yy Pepsi's. The change can be broken down into two different effects, an income effect and a substitution effect. The income effect arises from a cheaper taco the increases the real purchasing power of income. With a cheaper taco there is more money to buy both more tacos and Pepsi's. The substitution effect arises from the fact that tacos are cheaper. Our fine food gourmet may decide to substitute tacos for Pepsi.



At the new equilibrium, 6 tacos and 3.5 Pepsi's will be consumed.

Income Effect

First, let's show the income effect. To do that we shift the original budget line to the point of tangency



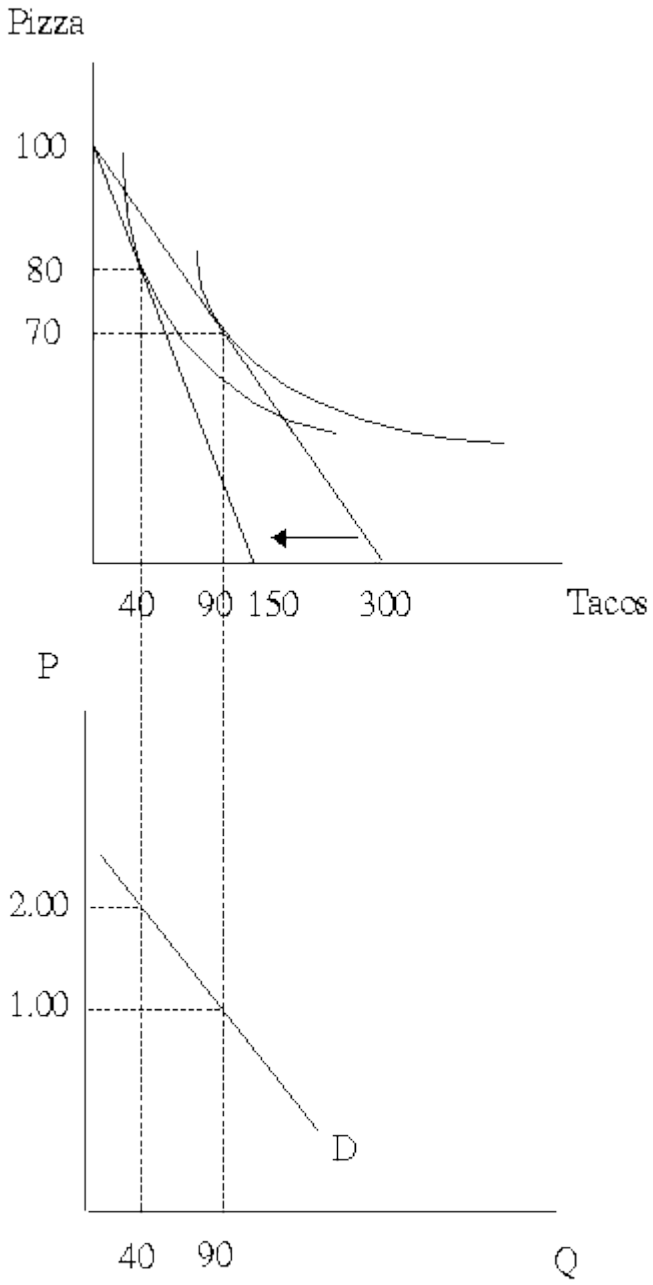
with the new indifference curve.

According to the income effect, 3.75 Pepsi's and 5 tacos will be consumed. This is an additional .75 Pepsi's (3.75 -3) and 1 taco (5-4).

Substitution Effect

To find the substitution effect, subtract the income effect from the new equilibrium. Here the substitution effect resulted in one additional taco (6-5) and .25 less Pepsi's (3.75-3.5).

Derivation of the Demand Curve



By replotting the results of the change in the price of tacos, we can graph the demand curve. For a linear demand curve we need only two points. From the above we have at a price of $2.00, 40 tacos, and at a price of $1.00 we have 90 tacos. Note that a similar result occurs using the marginal utility

approach. At any given utility level (which determines the quantity bought) by varying the price, the nubmer of items purchased changes.

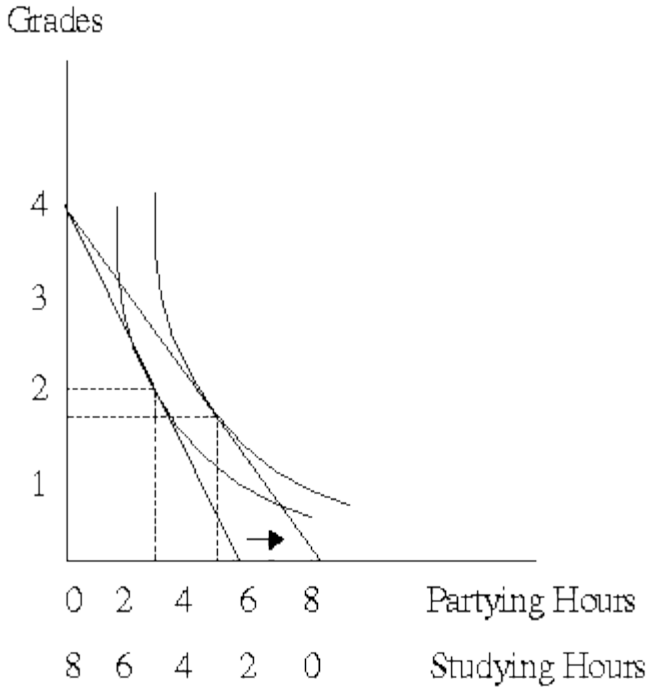
The determinants of demand are easily incorporated into this analysis. A change in tastes and preferences would rotate the indifference curve. A change in income would shift the budget line. An increase in a complementary price would cause the less of good x to be purchased. An increase in a substitute's sprice will cause more of good x to be purchased.

2.4 Applications of Consumer Theory

Let's look at some applications of consumer theory to economic problems and cases.

Another Comprehensive Example: Grades vs. Studying

Many a professor has lamented the low pass rates in some classes. Yet when tests are made simpler, the pass rates may not change. In fact, often grades change little, and worse, attendance drops. Why?



An easier professor decreases the cost of studying. Consequently, the budget line rotates outward. Accordingly, the opportunity cost of partying has decreased, more partying could be enjoyed while maintaining the same level of academic performance.

The shallower slope of the indifference curve means the student values higher grades. To gain an increase in study time, she would gladly trade-off party time. The opportunity cost of partying is lower grades. However, an easier professor lowers the opportunity cost of paryting. Only a minimal amount of studying is needed to attain satisfactory grades, and a just a little more to attain high grades. Consequently, the point of tangency of the indifference curve to the budget line changes. It moves northward as indicated on the graph. Study time decreases from 30 to 5 hours, and more partying (it increases from 10 to 35) is incurred.

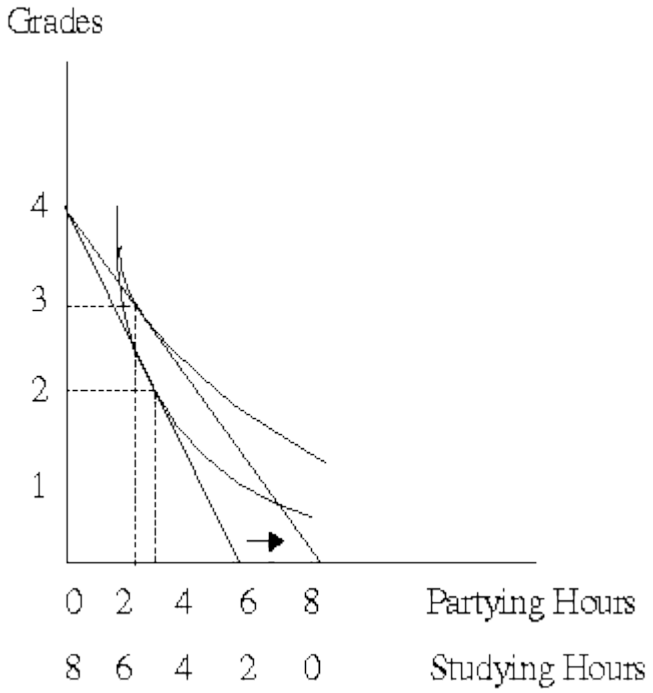
In this equilibrium the student puts in fewer study hours and earns a slightly lower grade. With fewer study hours, more party hours are available. It is no surprise that this student is on a higher indifference

curve, that is, happier.

Let's keep in mind what the label of an easier professor may mean. Not all hours of studying are equal that is equally effective at accomplishing academic performance. For some classes exam material is well defined, making study effort effective and efficient. For other classes, no one has a clue as to what to study nor how to study for it. The former may be considered an "easy" professor.

Students maximize their utility between partying and successful passing of courses. Effort to pass courses requires hours of studying. The slope of the budget line reflects the effort in hours of studying to achieve a set grade level. A steeper slope requires more effort, a shallower slope less effort.

In the prior example, we clearly had a student who favored partying. Suppose we had a more balanced student, what would be the outcome?



from the above example, this student is inspired to do more since it is easier or now at least possible to do more. Previously, it took 5 hours of studying to gain a 2.0 average. Now for 6 hours of studying, a 3.2 average can be gained.

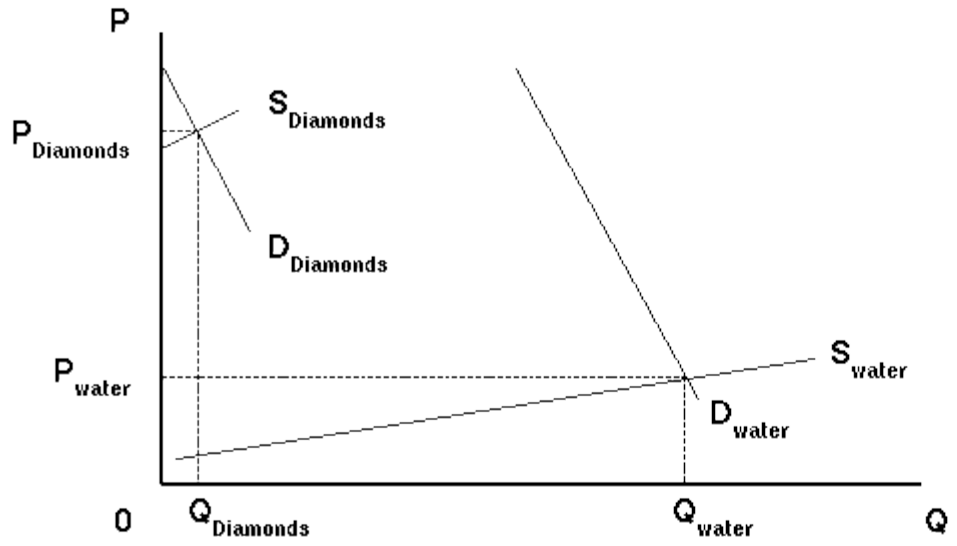
Note some of the obvious results, partyer's do not take hard professors. Average students knowing that it is possible to achieve higher grades - may study more for an easier professor. Under a harder professor, the cost of achieveing a high grade is so high that many settle for a low grade.

While not graphed, students who strongly prefer to study over partying, do well with either a hard professor or an easy professor.

The Paradox of Value: Diamonds vs. water

Why are diamonds, which are not essencial for life, more expensive than water, which is? The answer lies in consumer surplus. Water is more valuable to life and there is a willingness to pay for it. Since water is relatively abundant in the universe, it is cheap. Diamonds are not vital to life but since there is little natural supply (so far, it is believed that other planets may have more of it) relative to demand, the

price is high and there is very little consumer surplus.



Giffen Goods

Could consumption of a good actually increase when the price increases? Yes, under a very specific set of circumstances. One, the income effect must be greater than the substitution effect. Secondly, this must be an income inferior good. Finally, the consumption of the income inferior item must be a large percentage of expenditures. Normally, income inferior items are not a large part of the family budget. A good meeting these criteria is called a Giffen good.

This happened in 19th century Ireland. The Great Potato Famine occurred wherein Irish peasants forced to pay higher prices for potatoes actually increased their purchases of potatoes. Realize that these potatoes were imported from America. Potatoes were a major portion of the diet and food expenditures were a major portion of the family budget. As food is important, when potato prices increased, expenditures on other nonessential items were reduced to accomodate food expenditures.

Just a little history of Ireland may be helpful here, the English controlled Ireland at that time and while Ireland is very green and just about any vegetable can be grown there, the English Lords chose not to help out the starving Irish peasants even though Ireland at that time grew plenty of food to feed everyone. The lords exported the food surplus causing tremendous hatred which eventually erupted into a rebellion which achieved Irish independence. Not one of the shining hours of the British empire. But the food problem prompted mass migrations of Irish to America, Canada, and Australia. I myself am a product of this Irish migration. Economics influences history.

Changing Consumption Patterns

Suppose that the government would like to lower consumption of gasoline and increase consumption of a substitute such as hydrogen, what would be the best way to accomplish this task? Gasoline could be taxed and a tax credit given to purchasers of hydrogen. If government only taxed gasoline, the utility of consumers would be lowered. Unhappy consumers tend to vote incumbents out of office. Happy consumers vote for incumbents. By offering a tax credit for hydrogen combined with a tax on gasoline, the government achieves its objectives while increasing the welfare of its citizens.

Let's say the average gasoline consumption is $700, assuming a price of $1.50 per gallon or approximately 470 gallons. By adding a tax of .50 per gallon and offering a tax credit or subsidizing hydrogen so that it cost about .10 per liter (there about 8 liters to a gallon). Based on the new prices, consumers now purchase 50 gallons of gasoline (for the lawnmower) but purchase 3,500 liters of hydrogen. Let say in terms of energy (energy is measured in joules by the way) more energy is used. The consumer is now enjoying a higher standard of living. In the graph, this is reflected by the higher indifference curve.

In fact, the government may attempt to lower the price of hydrogen by a number of means. They could subsidize production, or spend money on research and development that would eventually lower production costs.

Other Applications

Consumer theory enables a value to be put on consumer preferences. If a government wants to correct a market failure, then consumer theory helps to quantify the choices as well as the loss associated with the market failure. Not surprisingly, many applications of consumer theory can be found in public economics and public finance. Further extensions to consumer theory include uncertainty and risk aversion. Assymetric information, moral hazard, and adverse selection draw heavily on consumer theory.

STUDY GUIDE

Fill-in-the-Blank

General

1. _____ is the additional utility gained from the consumption of one additional item.
2. Average utility is _____ divided by _____.
3. The change in utility from consumption of an additional unit is called _____.
4. Basic assumptions of consumer behavior are _____.
5. The limitation of choice forces consumers to make _____.
6. _____ requires that consumers can consistently order preferences.
7. _____ indicates a finite number of choices between two products.
8. A consumer is said to be _____ between two goods if each is equally desirable or not.
9. _____ is the satisfaction achieved from aggregate (total) consumption.

Marginal Utility

10. Decreasing price will cause consumption to increase as the marginal utility-to-price ratio is _____.
11. If less coffee is consumed then marginal utility would _____, but total utility would _____.
12. In equilibrium, quantities of each good will vary, the marginal utility-to-price ratio will _____.
13. Given MU/P = 6 and price = $3, then the marginal utility must be _____.
14. To maximize utility consumers select the quantity of various goods where the _____ ratio is equal.

Indifference Curves

15. At the point of tangency between the _____ and the _____
16. The slope of the budget line is calculated as _____.

17. Consumers maximize _____ at the point where the budget line is tangent to the indifference curve.
18. For an increase in one of its prices, the budget line will _____.
19. Increasing income will cause the budget line _____.
20. An increase in price will cause the quantity consumed of another good to _____ for a substitute good.
21. Consumption of a good increases as the income line shifts outward due to _____ effect.
22. A good is a(n) _____item if as the budget line rotates inward consumption of the other good drops.
23. If the indifferent curve rotates then that change is due to a change in _____.
24. Given an income of $800 and a price of $10, the maximum number of pizzas that can be purchase are ___.
25. The slope of the budget line with a soda price of $1.00 and pizza price of $5 is ___. (Soda is on the vertical axis)
26. If 3 burgers are given up to gain one pizza, then the marginal rate of substitution is ___.

Fill-in-the-Blank Solutions

General

1. Marginal utility
2. total utility, quantity
3. marginal utility
4. unlimited wants, limited income, rational behavior
5. choices
6. Transitivity
7. The completeness assumption
8. indifferent
9. total utility

Marginal Utility

10. increasing
11. increase, decrease
12. be equal
13. 18: 6 * 3 = 18
14. marginal utility to price

Indifference Curves

15. budget line, indifference curve
16. $-P_x/P_y$
17. utility
18. rotate inward
19. to shift outward
20. increase
21. income
22. complementary
23. tastes and preferences
24. 80: $800 / 10 = 80
25. -5: -5 / 1 = -5

26.-3: -3 / 1 = -3

True/False

General

1. As more pizzas are being consumed then the MU is increasing.
2. When marginal utility is greather than average utility then total utility is decreasing.
3. Average utility will not be negative.

Marginal Utility

4. Increasing the marginal utility for a good generally causes less of that product to be consumed.
5. Total utility is the satisfaction gained from consuming the total quantity of that good.
6. Marginal utility can never be negative.
7. Decreasing a product's price increases its utility.
8. MU/P is equal for all goods in equilibrium.
9. If MU/P for tacos equals 4 versus 5 for soda then either fewer tacos will be consumed or more soda will be consumed.

Indifference Curves

10. For an income inferior item, as the budget line shifts inward, consumption increases.
11. An increase in the price of good Y would cause the vertical intercept of the budget line to change.
12. An increase in the price of good X would cause the slope of the budget line to decrease.
13. Steepening the total utility curve would cause marginal utility to increase.
14. Where MRS = $-P_y/P_x$ is the equilibrium condition necessary to maximize utility subject to an income constraint.

Applications

15. Commuters may be willing to pay more for a lifter vehicle because of the utility gained in saving time traveling to work.
16. Workers may be willing to live further away from work enduring longer commutes because the utility of suburban space compared to its cost is greater than living in the city.
17. Advertising could be viewed as an attempt to increase the utility of the good.
18. By taxing pollution we are lowering its utility.

True/False Solutions

General

1. False
2. False, with MU > AU then AU is increasing.
3. True

Marginal Utility

4. False, more of that good would be consumed.
5. True
6. True
7. False, utility or usefulness is independent of price but lowering price increase MU/P which

gives it a better value. Therefore, consumers buy more.

8. True
9. True

Indifference Curves

10. True
11. True
12. True
13. True
14. True

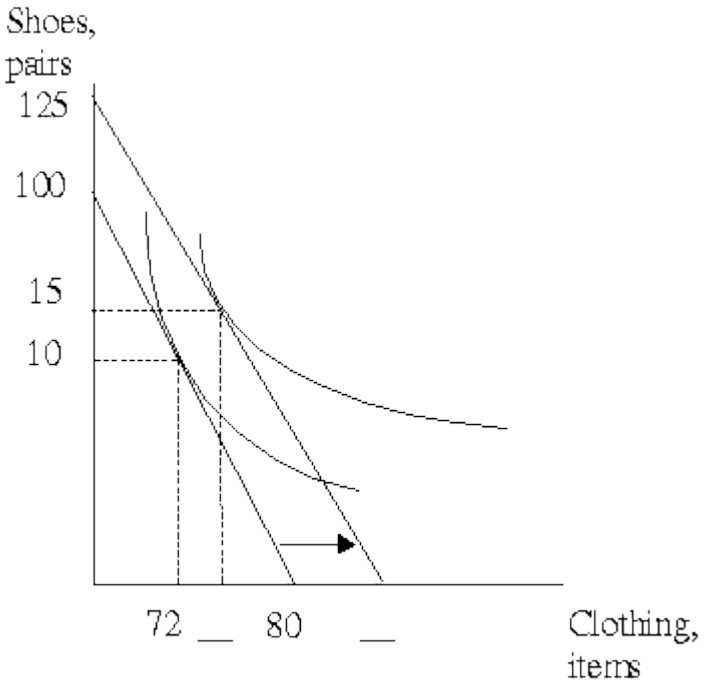
Applications

15. True
16. True
17. True
18. False, we increase its price. By decreasing the MU/P ratio, less of the product will be consumed, hopefully, lowering pollution.

Problems & Exercises

Food Servings	MU Pizza	MU Pepsi	MU Salad
1	200	70	140
2	160	60	100
3	120	55	60
4	80	50	20
5	40	45	0
6	20	40	0
7	10	35	0
Calories	500	100	10

1. Given the table above, answer the following questions:
    a. Given a consumption limit of 1,000 calories per day, how many servings of pizza, pepsi, and salad will be eaten?
2. Suppose the limit is raised to 1,500 calories per day, how many servings of pizza, pepsi, and salad will be eaten?



3. Given the graph above, answer the following questions.
    a. Given a shoe price of $40, what is the income?
4. What is the price of clothing?
5. What is the amount of clothing consumed at the inter budget line?
6. How many shoes are consumed as the income line shifts outward?
7. What type of good would shoes be considered?
8. Where is utility highest?
9. What is the slope of the inter budget line?

Problems and Exercises Solutions

    a. 4 Salads, 4 Pepsi's, and 1 Pizza
2. 4 Salads, 4 Pepsi's, and 2 Pizzas
    a. $4,000; $40 * 100
3. $50; $4,000/80
4. 72 items; $4,000 - (10 * $40)
5. 15 pairs; $5,000 - (88 * $50)
6. income normal
7. Where the budget line hits the farest right indifference curve. In this case at the point where 15 pairs of shoes are bought.
8. rise/run = 100/80 = 1.25

Activities and Discussion

1. Explain how the income effect or the substitution effect could affect the following.
    1. long distance usage
2. travel
3. internet radio and video
4. long distance education

5. TV viewing
6. newspaper purchases
7. Given that you wanted to reduce consumption of certain recreational drugs, in terms of consumer theory what would be more likely to be successful?
8. How would to try measure marginal utility?
9. Explain and rank income and substitution effects for the following:
    1. home
10. car
11. coffee
12. Restate the results for number one for an increase in income.
13. Explain how a change in tastes and preferences in favor of Coke would affect an indifference curve Pepsi and Coke.

Selected Definitions

Average Utility
Total utility divided by consumption.

Budget Line
Combinations of goods that can be purchased with income.

Completeness
The concept that consumer choices are completely described by preferences.

Correlation
Strength of relationship between two variables.

Income Effect
When consumption of a good changes due to a change in real income.

Indifference Curve
Set of combinations of two goods that a consumer is equally likely to choose.

Marginal Rate of Substitution
The rate of change between two products on an indifference curve. The amount of one good given up to gain a unit of another.

Marginal Utility
Change in utility caused by a one unit change in consumption.

Nonsatiation
The concept that consumers are never satisfied, that more is better.

Substitution Effect
Effect on purchases when another good when prices changes.

Transitivity
Consistency of choice when more than two items are considered.

Utility
Satisfaction attained upon consumption of a good or service.

Selected References

www.dismal.com

www.stat-usa.com