

Foundations of Economic Analysis & Explanation

Lecture 7: Utility Theory and Consumer Preference

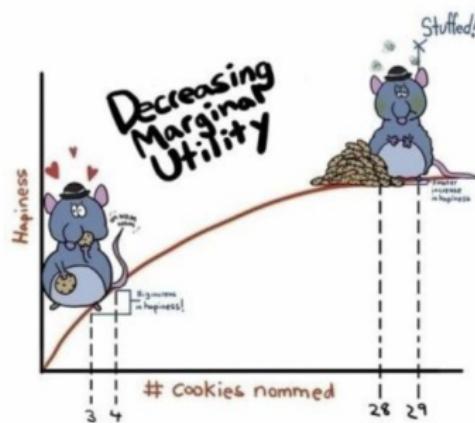
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OVERVIEW

- Economic Thought: Utilitarianism
- Law of Diminishing Marginal Utility
- Social Welfare Function and Equity
- Consumer Choice and Preference
- Key Decision-Making Principles



This lecture reviews the evolution of some ingrained concepts and ideas in analyzing individual happiness and social welfare—utilitarianism, which is one of the most powerful and persuasive approaches to normative ethics in the history of philosophy. The law of diminishing marginal utility is modeled and the key decision-making principles summarized.

Questions for Discussion

Think-pair-share: discuss with your peers and write down summary answers.

- ① What's utilitarianism? What are the aims of human action for utilitarians?
- ② According to utilitarianism, what is utility (and its principle)? how to measure utility?
- ③ How is Mill's exposition and measurement of utility different from Bentham's?
- ④ What is the law of diminishing marginal utility? Does it apply to all decision making?
- ⑤ What are the major obstacles of utility measurement and theory? Is it a reliable theory?
- ⑥ What is a social welfare function? What is it used for? What are the differences between various social welfare functions? Does the social welfare function always (and truly) exist?
- ⑦ What is the most essential economic principle for decision making?

Recap: Individual as a Decision Unit

- Economics is the study of choice under scarcity.
- People makes choices, individually and collectively.
- Theories or models are pictures that simplify reality. Irrelevant details are stripped away to concentrate on essentials that can explain most of the fact.
- Theoretically, economists model individuals or a society as an economic agent aiming to maximize utility.
- The logic of utility analysis is the central topic in this lecture. What is utility? Who coined the term? How was it developed? What are its relevance today and applications?

OUTLINE

- ① Utilitarianism and Utility
- ② Diminishing Marginal Utility
- ③ Social Welfare Functions
- ④ Decision-Making Principles

Utilitarianism: Pioneers

Utilitarianism is a theory in normative ethics holding that the proper course of action is the one that maximizes utility, usually defined as maximizing happiness and reducing suffering. Classic utilitarianism's two most influential contributors are Jeremy Bentham and John Stuart Mill.



Jeremy Bentham

(1748-1832)



John Stuart Mill

Utility and Utilitarianism: Bentham

The term utility was introduced by the British philosopher and jurist Jeremy Bentham (1748-1832). He declared :

Nature has placed mankind under the governance of two sovereign masters, pain and pleasure. It is for them alone to point out what we ought to do... By the principle of utility is meant that principle which approves or disapproves of every action whatsoever according to the tendency it appears to have to augment or diminish the happiness of the party whose interest is in question: or, what is the same thing in other words to promote or to oppose that happiness.

Jeremy Bentham (1789) *Introduction to the Principles of Morals and Legislation*

Bentham: Dimensions of Pleasure and Pain

- In his *Introduction to the Principles of Morals and Legislation* (1789), Bentham suggested the measurement of quantities of pleasure and pain (primarily for the purpose of constructing a more rational system of civil and criminal law).
- Four dimensions of pleasure and pain were distinguished for the individual: (1) intensity, (2) duration, (3) certainty, and (4) propinquity.
- The first two dimensions are clearly relevant to the measurement of a pleasure, but the latter two are better treated as two of the factors which influence an individual's response to a particular pleasure or pain.
- Bentham did not give explicit directions for calculating a given pleasure and indeed devoted a long chapter (vi) to "Circumstances Influencing Sensibility," which listed no less than thirty-two circumstances (such as age, sex, education, and firmness of mind) that must be taken into account in carrying out such a calculation.

George Stigler (1950) The Development of Utility Theory I. *Journal of Political Economy*, 58-4, pp. 307-327.

Utilitarianism and Utility: Bentham

- Jeremy Bentham brought the principle of utility (to be understood much more broadly than is customary in economics) to the forefront of discussion in England at the beginning of the nineteenth century.
- Bentham's work, *An Introduction to the Principles of Morals and Legislation*, opens with a statement of the principle of utility.
- In Chapter IV, Bentham introduces a method of calculating the value of pleasures and pains, which has come to be known as the hedonic calculus.
- Bentham says that the value of a pleasure or pain, considered by itself, can be measured according to its intensity, duration, certainty (uncertainty) and propinquity (remoteness).
- Bentham believed that the pursuit of pleasure and the avoidance of pain were the twin aims of all human action.

George Stigler (1950) The Development of Utility Theory I. *Journal of Political Economy*, 58-4, pp. 307-327.
https://en.wikipedia.org/wiki/Jeremy_Bentham

Bentham on Utility and Policy

- Bentham's philosophy, Utilitarianism, held that self-interest—understood as pleasure or happiness—should be "maximized" and pain "minimized" (Bentham, incidentally, coined both terms). And, as with individual self-interest, so too with the public interest.
- According to Bentham, the aim of legislation and public policy was to promote "**the greatest happiness of the greatest number.**"
- James Mill (1773-1836, the father of John Stuart Mill) agreed, after a fashion. Formerly a dour Scots Presbyterian and still something of a Platonist, he took a dim view of unalloyed hedonism. Like Plato, he ranked the pleasures in a hierarchy, with the sensual pleasures subordinated to the intellectual ones.

<https://plato.stanford.edu/entries/james-mill/#AllBen>

Utilitarianism: John Stuart Mill

John Stuart Mill (1806-1873) was an English philosopher and political economist. He has been called "the most influential English-speaking philosopher of the nineteenth century." The canonical statement of Mill's utilitarianism can be found in his book, *Utilitarianism*. Although this philosophy has a long tradition, Mill's account is primarily influenced by Jeremy Bentham and Mill's father James Mill. Here is how Mill defines the principle of utilitarianism:

...that pleasure and freedom from pain are the only things that are desirable as ends, and that everything that is desirable at all is so either for the pleasure inherent in it or as means to the promotion of pleasure and the prevention of pain.

The doctrine that the basis of morals is utility or the greatest happiness principle, holds that actions are right in proportion as they tend to promote happiness, wrong in proportion as they tend to produce the reverse of happiness. By 'happiness' is meant pleasure and the absence of pain; by 'unhappiness' is meant pain and the lack of pleasure. To give a clear view of the moral standard set up by the theory, much more needs to be said, especially about what things the doctrine includes in the ideas of pain and pleasure, and to what extent it leaves this as an open question.

—John Stuart Mill, *Utilitarianism* (1863)

John Stuart Mill: Pleasure as an Intrinsic Value

The utilitarian doctrine is, that happiness is desirable, and the only thing desirable, as an end; all other things being only desirable as means to that end.

—John Stuart Mill, Utilitarianism (1863)

Mill argues that pleasure is an intrinsic value for all actions.

- ① Intrinsic value is the reason someone does an action for the sake of doing it. (Value is not something we each determine for ourselves or something that is always extrinsic—always dependent on other goals. Is this right?)
- ② The chain of reasons behind any action can always be traced back to creating pleasure or avoiding pain. (Human beings are ultimately driven by concern for pleasure. Is this right? Are there important projects in life that ultimately end in suffering, or at the very least have goals totally divorced from pleasure?)
- ③ So, the intrinsic value of all activities is utility. (from 1, 2).

For Mill, the final end is pursuing the greatest happiness for the greatest number of people, no matter if it is "vicious" or "virtuous" by other standards. (For Aristotle, the goal of human life is to rationally pursue happiness over the course of a life. This happiness is defined by an individual's function, which is achieved by living virtuously.)

<https://godandgoodlife.nd.edu/digital-essays/utilitarianism-john-stuart-mill/>

Mill: The Higher and Lower Pleasures Argument

Epicurus was an early Greek philosopher who argued that seeking moderate pleasure is the greatest good and pathway to a good life. Mill explains that there are different levels of pleasures that ultimately weigh more less in our calculations about what to do. He rejects a purely quantitative measurement of utility and says:

Every Epicurean theory of life that we know of assigns to the pleasures of the intellect, of the feelings and imagination and of the moral sentiments a much higher value as pleasures than to those of mere sensation. But it must be admitted that when utilitarian writers have said that mental pleasures are better than bodily ones they have mainly based this on mental pleasures being more permanent, safer, less costly and so on—i.e. from their circumstantial advantages rather than from their intrinsic nature. And on all these points utilitarians have fully proved their case; but they could, quite consistently with their basic principle, have taken the other route—occupying the higher ground, as we might say. It is quite compatible with the principle of utility to recognize that some kinds of pleasure are more desirable and more valuable than others. In estimating the value of anything else, we take into account quality as well as quantity; it would be absurd if the value of pleasures were supposed to depend on quantity alone.

Utilitarianism: Summary on the Basics

- ① Utilitarianism is the theory that actions are right insofar as they produce happiness and wrong insofar as they produce unhappiness. For instance, suppose Jeffrey is choosing between going to the movies tonight or staying home and meditating. If Jeffrey enjoys the movies, but does not enjoy meditating, and nobody else will be affected, then he should go see a movie because it creates more happiness. Pursuit of happiness is the relevant reason in deciding what to do.
- ② Utility is the property in an object, action, or other activity that produces pleasure. Disutility is the property that produces the opposite of pleasure (pain, boredom, frustration, etc). The goal of utilitarianism is to try to maximize utility, thereby creating the most good for the greatest number of people.
- ③ The greatest happiness principle holds that we should pursue actions that produce the greatest amount of overall happiness. Crucially, utilitarians think we must take into account the utility of everyone (everything) affected by a given decision. We should maximize overall utility.

<https://godandgoodlife.nd.edu/digital-essays/utilitarianism-john-stuart-mill/>

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Bentham: Measurement of Utility

In a manuscript written about 1782, Bentham attempted to set forth more clearly the precise measurement of utility. We are given a definition of the unit of intensity:

The degree of intensity possessed by that pleasure which is the faintest of any that can be distinguished to be pleasure, may be represented by unity. Such a degree of intensity is in every day's experience: according as any pleasures are perceived to be more and more intense, they may be represented by higher and higher numbers: but there is no fixing upon any particular degree of intensity as being the highest of which a pleasure is susceptible.

Theory of Legislation, p. 398.

Bentham: Measurement of Utility

Bentham argues that, although utility does not increase as fast as income, for small changes the two move proportionately, so we may measure pleasures through the prices they command:

If then between two pleasures the one produced by the possession of money, the other not, a man had as lief enjoy the one as the other, such pleasures are to be reputed equal. But the pleasure produced by the possession of money, is as the quantity of money that produces it: money is therefore the measure of this pleasure. But the other pleasure is equal to this; the other pleasure therefore is as the money that produces this: therefore money is also the measure of that other pleasure

Unfortunately, this procedure is illegitimate; we cannot use an equality (or, more strictly, a constancy of the marginal utility of money) that holds for small changes to measure total utilities.

George Stigler (1950) The Development of Utility Theory I. *Journal of Political Economy*, 58-4, p. 310.

Bentham: Marginal Analysis

Bentham was particularly concerned with the problem of equality of income, proceeding to establish a set of propositions on the utility of wealth:

- 1) *Each portion of wealth has a corresponding portion of happiness;*
- 2) *Of two individuals with unequal fortunes, he who has the most wealth has the most happiness;*
- 3) *The excess in happiness of the richer will not be so great as the excess of his wealth.*

George Stigler (1950) The Development of Utility Theory I. *Journal of Political Economy*, 58-4, p. 310.

But the quantity of happiness will not go on increasing in anything near the same proportion as the quantity of wealth—ten thousand times the quantity of wealth will not bring with it ten thousand times the quantity of happiness. It will even be matter of doubt whether ten thousand times the wealth will in general bring with it twice the happiness.

. . . the quantity of happiness produced by a particle of wealth (each particle being of the same magnitude) will be less and less at every particle; . . .

Works of Jeremy Bentham (1843) III, 229; IV, 541.

Measuring Utility in Practice

- Scientific methods require scientists to build a theory from real life phenomena, observations, or facts. Scientists can transform observations into data via various measurement techniques.
- Measure, in nature, is to compare to rank different properties or features: big or small; high or low; more or less; heavy or light... Provided that options may go countless, we have to resort to numbers. Therefore, it seems straightforward to apply cardinal measure to utility analysis.
- For utilitarians, determining the right thing to do is a matter of adding up the potential utility an action will produce for the sentient creatures affected. Jeremy Bentham called this the "Felicific Calculus" – the mathematical approach to happiness that characterizes utilitarian thinking.

<https://godandgoodlife.nd.edu/digital-essays/utilitarianism-john-stuart-mill/>

Utility: Cardinal Measure

Bentham and economists alike thought that utility, like length or weight, could be measured quantitatively. Utility measured this way belongs to cardinal measures.

Example:

At lunch, little Tommy is super hungry, but only could eat hot dogs because it is "free" and convenient. How much utility is derived from Tommy's hot dog consumption? What is his optimal consumption decision?

Quantity Consumed	Total Utility	Marginal Utility
1	10	10
2	18	8
3	23	5
4	25	2
5	22	-3
6	15	-7

$$\text{Note: } MU = \Delta TU / \Delta Q$$

Total utility is the sum of utilities from all consumption units. Marginal utility is the additional or extra utility derived from the last consumption unit.

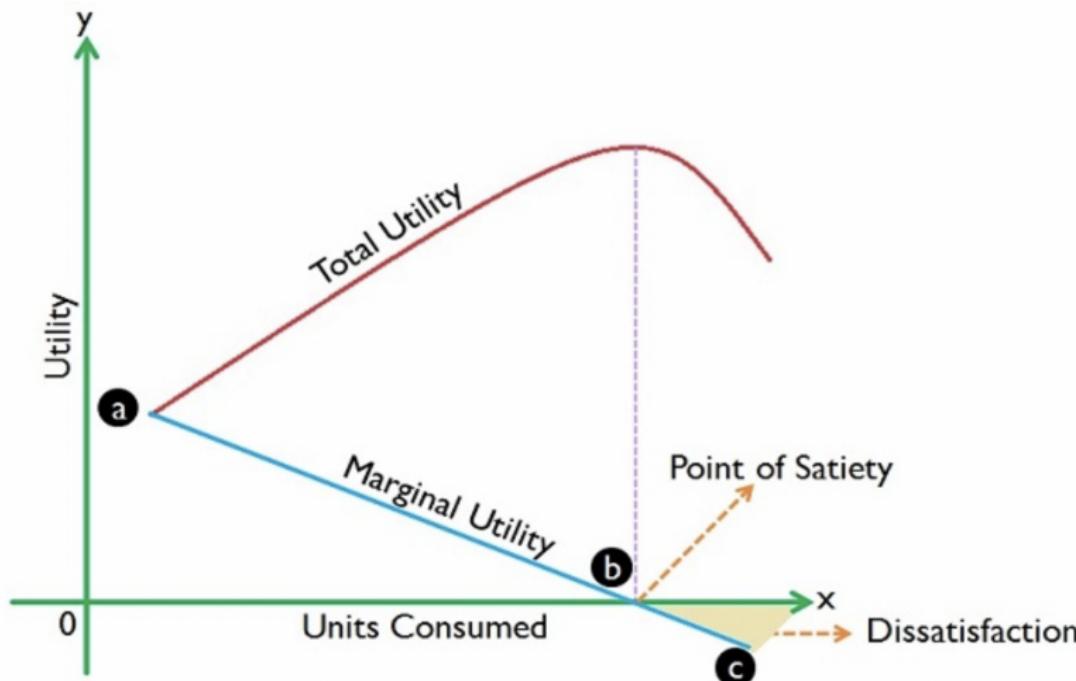
The Law of Diminishing Marginal Utility

- The principle of diminishing marginal utility states that as more and more of a good is consumed, consuming additional amounts will yield smaller and smaller additions to utility, ceteris paribus.
- Example: When you are thirsty, you get great utility from a glass of water. Once your thirst is quenched, the second and third glasses are less and less appealing. Feeling waterlogged, you will eventually refuse water altogether.
- Notice that, as long as marginal utility is greater than zero, the corresponding total utility is still rising, but with a decreasing rate.
- Can you draw the graphs for total utility and marginal utility as consumption quantity increases?

$$\Delta MU / \Delta Q < 0$$

$$MU = \Delta TU / \Delta Q = TU_2 - TU_1 / Q_2 - Q_1$$

Total Utility and Marginal Utility



<https://forestrypedia.com/total-utility-and-marginal-utility/>

Marginal Revolution

- Working in complete independence of one another—William Stanley Jevons (1835–1882) in Manchester, England; Leon Walras (1834–1910) in Lausanne, Switzerland; and Carl Menger (1840–1921) in Vienna—each scholar developed the theory of marginal utility to understand and explain consumer behavior.
- The theory held that the utility (value) of each additional unit of a commodity—the marginal utility—is less and less to the consumer. "Value," said Jevons, "depends entirely upon utility."
- This statement marked a significant departure from the classical theory of value, which stated that value derived from the labor used to produce a product or from the cost of production more generally. Thus (marginal revolution) began the neoclassical school, which is still the paradigm in economic analysis today.

<https://www.econlib.org/library/Enc/bios/Jevons.html>

Diamond-Water Paradox Revisited

- Adam Smith struggled with what came to be called the paradox of "value in use" versus "value in exchange."
- The marginalist explanation: The total utility or satisfaction of water exceeds that of diamonds. We would all rather do without diamonds than without water. But almost all of us would prefer to win a prize of a diamond rather than an additional bucket of water.
- To make this last choice, we ask ourselves not whether diamonds or water give more satisfaction in total, but whether one more diamond gives greater additional satisfaction than one more bucket of water; our answer will depend on how much of each we already have.
- Though the first units of water consumed every day are of enormous value to us, the last units are not. The utility of additional (or marginal) units continues to decrease as we consume more and more.

<https://www.econlib.org/library/Enc/Marginalism.html>

Cardinal Utility - What and How?

- An important property of cardinal measure is that we can make linear or nonlinear transformation between two scales.
- For example, temperature can be measured in many ways, but a thermometer can be scaled to show degrees in Fahrenheit and Celsius scales. $F = (9 \div 5) \times C + 32$
- More examples: $Kilogram \times 2.2 = Pounds$; $Feet \times 12 = Inch$
- How can we transform utility scales across standards?
- How about aggregating utilities from consuming different goods? Say bread and butter (complements), or, coffee and tea (substitutes). Can we simply add up two independent utilities?

Cardinal Utility - Whose and When?

- Unlike some other properties of goods we are trying to describe (e.g. length, weight, temperature), we don't know exactly the measurement unit of utility.
- First, how to compare utility across individuals, say kids and adults? Second, how to take into account of cultural and religious variations, say Hindu and Muslim? Last but not least, is it the same in different weather conditions?
- Utility is subjective and fickle, varying by person over time across space.
- Can we apply a standardized utility function to model a representative agent in the society?

Case Study: The Utility of Money and Income

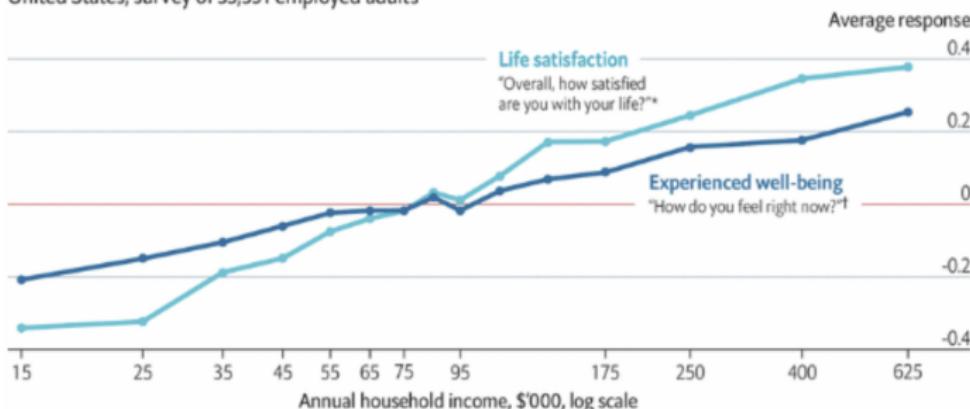
- In 2010 Daniel Kahneman and Angus Deaton, both of Princeton University, found that happiness, as measured by people's own perception of their emotional well-being, levelled off when annual incomes reached around \$75,000 (or \$90,000 today).
- In a Gallup poll last year, residents in the top 10% of countries by GDP per person scored their life situation as seven out of ten on average, compared with just four for those in the bottom 10%. But what difference do individual earnings make?
- More recently, Matthew Killingsworth of the UC Berkeley finds that happiness continues to increase even as income ascends to plutocratic proportions, with two caveats. First, the more happiness you want, the more expensive it gets. And second, money is not nearly as important as other factors.

<https://www.economist.com/graphic-detail/2021/02/05/money-buys-happiness-but-euphoria-comes-dear>

Money Buys Happiness, but...

The grinn coefficient

United States, survey of 33,391 employed adults



Source: "Experienced well-being rises with income, even above \$75,000 per year", by Matthew A. Killingsworth, PNAS 2021

* "Not at all" to "extremely"

† "Very good" to "very bad"

Money might not guarantee happiness, but income tends to correlate with contentment. Previous research showed life satisfaction levelling off at high incomes. Now it seems to keep climbing. The catch is that the next dollar a person makes will cheer them slightly less than the last one did.

<https://www.economist.com/graphic-detail/2021/02/05/money-buys-happiness-but-euphoria-comes-dear>

Money, Happiness, and Policy

- Mr. Killingsworth finds that only a small percentage of the overall variation in happiness is explained by differences in income; health, religion, employment and family all matter.
- The research offers two lessons for politicians who want to improve people's moods. First, helping the poorest is a bargain. In happiness terms, a dollar goes further for someone earning \$20,000 a year than for someone on \$40,000.
- Second, economic growth, much maligned as a yardstick of progress, is important as long as it doesn't come at the expense of other measures of well-being.
- Happiness relies on many factors, but a more prosperous future is probably a more contented one too.

<https://www.economist.com/graphic-detail/2021/02/05/money-buys-happiness-but-euphoria-comes-dear>

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Individual and Social Welfare

- Suppose all individual utility functions are expressed and centralized by a super computer. How to estimate a society's aggregate utility for the purpose of making public choice?
- Social Welfare Function: describes the well-being of society as a whole in terms of the utilities of individual members. A social welfare function is useful when evaluating policies that affect some members of society differently than others.
- One such function, the utilitarian, weights everyone's utility equally and consequently maximizes the total utility of all members of society.
- Each social welfare function can be associated with a particular view about equity.

Four Views of Social Equity

- ① Egalitarian—all members of society receive equal amounts of goods
- ② Rawlsian—maximize the utility of the least-well-off person
- ③ Utilitarian—maximize the total utility of all members of society
- ④ Market-oriented—the market outcome is the most equitable

The four views of equity move roughly from most to least egalitarian. While the egalitarian view explicitly requires equal allocations, the Rawlsian puts a heavy weight on equality (otherwise, some people would be much worse off than others). The utilitarian is likely to require some difference between the best- and worst-off members of society. Finally, the market-oriented view may lead to substantial inequality in the allocations of goods and services.

Bentham: Utility and Social Policy

Bentham was particularly concerned with the problem of equality of income, and this raised the question of comparisons of the utilities of persons who might differ in a good number of circumstances:

It is to be observed in general, that in speaking of the effect of a portion of wealth upon happiness, abstraction is always to be made of the particular sensibility of individuals, and of the exterior circumstances in which they may be placed.

Differences of character are inscrutable; and such is the diversity of circumstances, that they are never the same for two individuals. Unless we begin by dropping these two considerations, it will be impossible to announce any general proposition. But though each of these propositions may prove false or inexact in a given individual case, that will furnish no argument against their speculative truth and practical utility. It is enough for the justification of these propositions—1st, If they approach nearer the truth than any others which can be substituted for them; 2nd, If with less inconvenience than any others they can be made the basis of legislation

Thus, he achieved interpersonal comparisons, not by calculation, but by assumption, justified by the desirability (somehow determined) of its corollaries.

George Stigler (1950) The Development of Utility Theory I. *Journal of Political Economy*, 58-4, pp. 307.

Bentham: Utility of Income and Wealth

Having surmounted this obstacle no better than subsequent economists, Bentham proceeded to establish a set of propositions on the utility of income and wealth:

- ① Each portion of wealth has a corresponding portion of happiness.
- ② Of two individuals with unequal fortunes, he who has the most wealth has the most happiness.
- ③ The excess in happiness of the richer will not be so great as the excess of his wealth.

Each of these propositions was elaborated, and the utility calculus was used to defend equality ("The nearer the actual proportion approaches to equality, the greater will be the total mass of happiness"), although equality was finally rejected in favor of security of property.

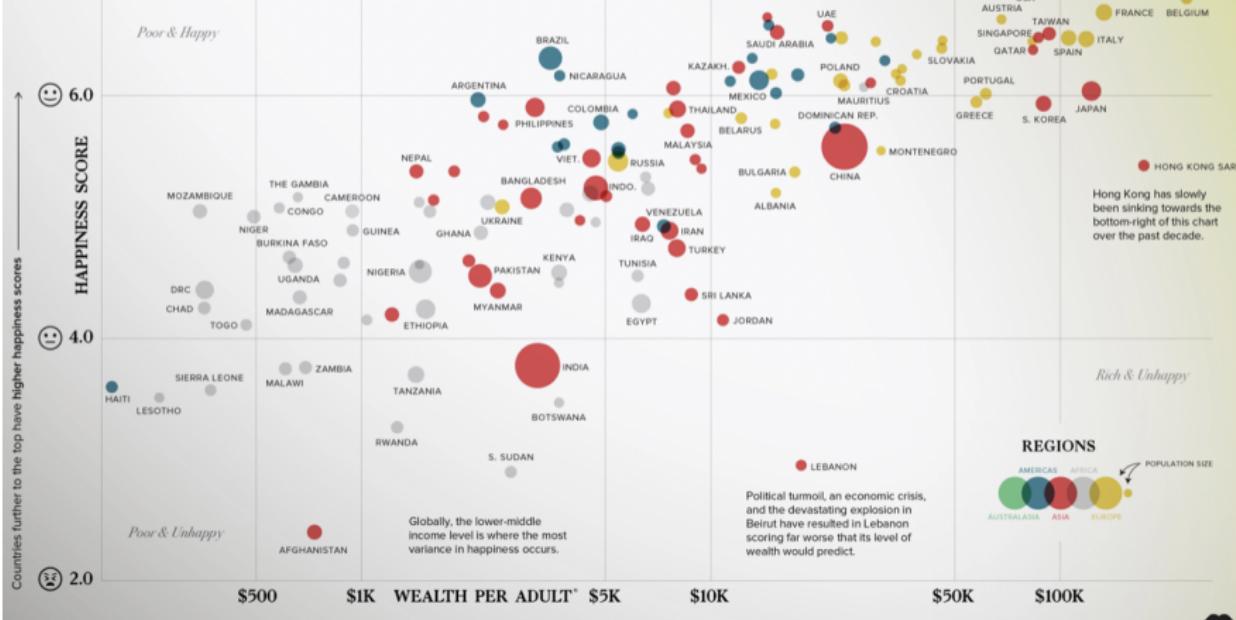
George Stigler (1950) The Development of Utility Theory I. Journal of Political Economy, 58-4, pp. 308.

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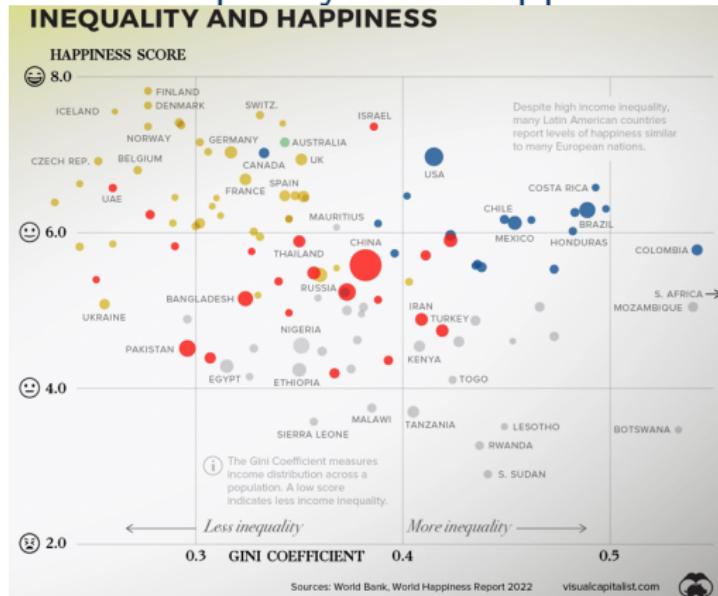
A GLOBAL LOOK AT WEALTH AND HAPPINESS

Are richer countries also the happiest?

This chart compares wealth per adult with happiness scores in each country.


<https://www.visualcapitalist.com/relationship-between-wealth-and-happiness-by-country/>

Income Inequality and Happiness



Note: The Gini Coefficient is a tool that allows us to measure income distribution and inequality across a population, and applies a score to that population. Simply put, a score of 0 would be "perfect equality," and 1 would be "perfect inequality" (i.e. an individual or group of recipients is receiving the entire income distribution).

<https://www.visualcapitalist.com/relationship-between-wealth-and-happiness-by-country/>

What Exactly is Utility (Function)? A Summary

- If we cannot find a utility function to model a wide range of consumption decision, then the theory is quite ad hoc.
- Since ranking is easier than calculating in comparison, what modern economists call utility reflects nothing more than the rank ordering of preference.
- Therefore, utility can also be measured by ordinal ranks.
- Utility is the variable whose relative magnitude indicates the direction of preference. In finding his or her preferred position, the individual is said to maximize utility.
- Now it's time to introduce three axioms of preference for comparing multiple goods and services in consumption.

Does Social Utility Function Exist?

- To consistently aggregate preferences and derive a social welfare function, majority voting must satisfy three conditions: Dominance, Transitivity, Independence of irrelevant alternatives.
- Thus, majority voting can consistently aggregate individual preferences if and only if preferences are restricted to take a certain form. In fact, there is no good way to consistently aggregate these preferences. More on this in public goods.
- Arrow's Impossibility Theorem: There is no social decision (voting) rule that converts individual preferences into a consistent aggregate decision without either (a) restricting preferences or (b) imposing a dictatorship.

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Utility and Preferences

Utility is derived ultimately from consumption. Utility function therefore reveals consumers' preferences. A consumption basket (or bundle) is a list with specific quantities of one or more goods. For example, a bundle (combination) of goods purchased from the market can be listed in the table below. Which bundle should be more preferable?

Market Basket	Units of Food	Units of Clothing
A	20	30
B	10	50
C	40	20
D	30	40
E	10	20
F	10	40

The Laws of Preference: Comparison

The Axiom of Comparison: A person can compare any two baskets A and B of commodities. Such a comparison must lead to one of the three following results: he or she

- prefers basket A over B;
- prefers basket B over A;
- is indifferent between A and B.

$$\bullet \quad A \succ B$$

$$\bullet \quad A \prec B$$

$$\bullet \quad A \sim B$$

The Laws of Preference: Transitivity

The Axiom of Transitivity: Consider any three baskets of goods A, B, and C.

- If a consumer prefers A to B, and also prefers B to C, he or she must prefer A to C.
- Similarly, a person who is indifferent between A and B, and is also indifferent between B and C, must be indifferent between A and C.

The Laws of Preference: Insatiateness

The Axiom of Insatiateness: Goods are assumed to be desirable—i.e., to be good. Consequently, consumers always prefer more of any good to less.

- In addition, consumers are never satisfied or satiated; more is always better, even if just a little better.
- To explain the theory of consumer behavior, we will ask whether consumers prefer one market basket to another.

Ranking Preferences

Orange

B



A



D



C



- $A \succ B$
- $A \succ C$
- $A \succ D$
- $B \succ D$
- $C \succ D$
- $B ?? C$

Apple

Optimal Decision Principles: Summary

- Rationality=Economic Man=Self-Interest
(maximum benefit and minimum cost)
- Opportunity Cost: $\text{Min}\{\text{O.C.}(i) = \text{max value}(j)\}$
- Exchange Condition: $UV_B \geq EV = P \geq UV_S$
- Benefit-Cost Comparison: $\text{Max}\{\text{TB} - \text{TC} = \text{NB}\}$
- Marginal Equalization: $\text{MB} \geq \text{MC}$
- Optimality Condition: 1) $\text{MB} = \text{MC}$; 2) $\text{Max}\{\text{NB}\}$

Optimal Consumption Principles: Application

At lunch, little Tommy is super hungry. He likes hot dogs because it is cheap and fast. What is the optimal consumption quantity?

Q	P	Total Utility	Marginal Utility	Marginal Cost	Total Cost	Net Benefit	Opportunity Cost
1	1	10	10				
2	1	18	8				
3	1	23	5				
4	1	25	2				
5	1	22	-3				
6	1	15	-7				

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World Happiness Report <https://worldhappiness.report/archive/>

202001 Why Finland and Denmark are Happier than the U.S. | CNBC 25:45 (w)