

# Phases of the Marginalist Revolution



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"The conclusion to which I am ever more clearly coming is that the only hope of attaining a true system of Economics is to fling aside, once and for ever, the mazy and preposterous assumptions of the Ricardian School. Our English Economists have been living in a fool's paradise. The truth is with the French School, and the sooner we recognize this fact, the better it will be for the world."

(William Stanley [Jevons](#), *Theory of Political Economy*, 1871: p.xliv-xlv).

"If, instead of welcoming inquiry and criticism, the admirers of a great author accept his writings as authoritative, both in their excellences and in their defects, the most serious injury is done to truth. In matters of philosophy and science, authority has ever been the great opponent of truth. A despotic calm is usually the triumph of error. In the republic of the sciences, sedition and even anarchy are beneficial in the long run to the greatest happiness of the greatest number."

(William Stanley [Jevons](#), *Theory of Political Economy*, 1871: p.275-6)

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The crux of the [Neoclassical theory of value](#) is the notion of *subjective scarcity*. The Neoclassical answer to the famous "water-diamond" paradox is that diamonds are naturally more valuable than water *not* because diamonds are costlier to produce (the [Classical](#) answer), but rather because diamonds are more scarce than water. Some may object to this distinction: if diamonds are very costly to produce, then one should expect to see somewhat less of them around, thus the cost-of-production and rarity arguments seem to boil down to the same thing. Adam [Smith](#) seems to imply this when he writes:

"[T]he value of [precious] metals has, in all ages and nations, arisen chiefly from their scarcity, and that their scarcity has arisen from the very small quantities of them which nature has any where deposited in one place, from the hard and intractable substance with which she has almost every where surrounded those small quantities, and consequently from the labour and expence [*sic*] which are every where necessary in order to penetrate and get at them." (A. [Smith](#), 1776: p.563).

But this is not quite true for Neoclassicals. The Neoclassical notion of *scarcity* is *not* merely that something is "rare", but rather that it is *perceived as rare* by consumers. To take Lionel [Robbins](#)'s (1932: p.46) famous example, bad eggs may be "rare", but if people do not desire bad eggs, then even one bad egg is already "too many" in their eyes and thus will not have much value. In contrast, if people's desire for diamonds is very great indeed, then in their perception, even a large number of diamonds may be "too few" in their eyes, thus they will have a high price. Consequently, the Neoclassical concept of *scarcity* is quite distinct from the Classical notion: the *subjective* element of desire is an integral part of the story.

There are thus two essential ingredients of Neoclassical value theory: (1) that the relative values of things arise from their relative scarcity and (2) that subjective desires are an integral part in determining the relative scarcity. Both of these notions have an old history predating 1871-4, but they were not always wedded together. Some economists believed that rarity gave rise to value without thinking too hard about whether rarity was a subjective or objective thing; in contrast, others have thought that subjective notions such as utility and demand were important in determining price, but did not really connect it to scarcity.

### **(A) Scarcity and Utility in the Classical Schema**

The [Classicals](#) -- Adam [Smith](#), David [Ricardo](#), John Stuart [Mill](#), Karl [Marx](#), etc. -- believed in neither of these ideas. Following the pattern set by Richard [Cantillon](#) (1755), they argued that subjective desires and scarcity may be important factors in determining *market* (or *temporary* or *short-run*) prices, but they

insisted that the *natural* (or *equilibrium* or *long-run*) prices were determined solely by relative costs of production (usually, relative labor costs).

The [Classicals](#) perceived rarity to be an aberration: if goods can be *produced* -- i.e. created -- then there is no inherent scarcity of them. Consequently, scarcity prices were what [Ricardo](#) called "monopoly prices" -- i.e. the prices which arose only "when by no possible device their quantity can be augmented; and where, therefore, the competition is wholly on one side -- amongst the buyers." (Ricardo, 1817: p.165) and thus "their price is limited only by the extent of the power and will of purchasers" (*ibid.*) But this is *not* the natural, long-run price. "The exchangeable value...of a commodity which is at a monopoly price is nowhere regulated by the cost of production." (Ricardo, *ibid.*) Thus, scarcity may play a role in the short-run (when quantities are fixed), but not in the long-run.

They had granted that rarity might be a determinant of value in a few cases, "rare statues and pictures, scarce book and coins, wines of a peculiar quality" ([Ricardo](#), 1817: p.6) -- goods which cannot be produced and thus whose value is regulated by "monopoly prices". But these cases were so exceptional that they could be safely ignored. At best, as our earlier quotation from Smith indicates, they were willing to discuss scarcity as a foundation of value only insofar as it *arose* from high costs of production. Certainly, whatever lip service they paid to scarcity, they did not incorporate it into their central theoretical schema.

Utility was a slightly different story. The Classicals confused utility of a good with its *usefulness*. They agreed that a good must have usefulness if it is to be produced. The mercantilist Nicholas [Barbon](#) was perhaps the first to explicitly claim that price was influenced by utility: "the Value of all Wares arise from their Use; Things of no Use, have no Value, as the English phrase is, *They are good for nothing.*" ([Barbon](#), 1690: p.13). In this, he was followed up by John [Locke](#) (1692) and John [Law](#) (1705).

Richard [Cantillon](#) (1755) -- like all the [Classicals](#) thereafter -- acknowledged that a good must have utility in order to be produced. But utility itself did not determine the *relative prices* of the goods. It is relative costs of production that will determine the natural prices of goods. Utility merely determines that a good will be produced, period. That's where its role both begins and ends. Utility is of no further use beyond that.

Why did the Classicals cut utility's role so short? The reason is that utility seemed to run into trouble when confronted with the old water-diamond paradox set forth by John [Law](#) (1704: p.4) and made famous by Adam [Smith](#) (1776: p.44-5). As Smith noted, water is useful to humans, diamonds are useless to humans, thus water should have a higher "use-value" or "utility" than diamonds. But clearly, water commands a lower "exchange-value" than diamonds. Thus, like [Aristotle](#) before them, the Classicals gave up on the utility-value connection: it seems as if utility simply could not be incorporated successfully into a theory of natural price.

Of course, Smith's error was to confuse "utility" with "use-value". The concept of "utility" handed down by the [Scholastics](#) to the modern 18th Century economics by writers such as Samuel [von Pufendorf](#)

(1675) was to connect utility to *desiredness* and not to *usefulness*. Diamonds may be "useless", as Smith asserted, but they could still have utility in the sense that they are *desired*. With the notable exceptions of Jean-Baptiste [Say](#) and Nassau [Senior](#), the misleading argument by Adam Smith was accepted by the rest of the Classical School.

At best, utility (like scarcity) will have a prominent role to play in [Classical](#) theory *only* for the temporary case of short-run market prices. Indeed, [Cantillon](#) (1755) was the first to suggest a clear supply *and* demand mechanism for the determination of market prices which includes both utility and scarcity (inexplicably, a lot of Anglo-Saxon literature tends to credit Sir James [Steuart](#) (1767) for this). But for long-run natural prices, neither utility nor rarity have a role in the Classical schema.

### **(B) The Franco-Italian Tradition: Subjective Scarcity**

Some writers during the [Classical](#) period refused to relegate the utility explanation to a temporary or minor phenomenon and disputed the cost-of-production solution to the water-diamond paradox. The most notable of the disputants was Jean-Baptiste [Say](#) (1803, 1815, 1828). Although a follower of [Smith](#) in many other respects, he rejected Smith's labor theory of value. Or rather, he argued that utility and thus demand must play a part in the determination of natural price. At times, he went quite far in this pursuit. James Maitland Earl [Lauderdale](#) (1804) also rejected Smith's theory and proposed a *long-run* demand-and-supply mechanism.

The Classics were not amused: David [Ricardo](#) (1817: Ch. 20) and John Stuart [Mill](#) (1845, 1945) took both Say and Lauderdale to task for their heresy. For instance, Ricardo writes:

"M. Say acknowledges that the cost of production is the foundation of price, and yet in various parts of his book he maintains that price is regulated by the proportion which demand bears to supply. The real and ultimate regulator of the relative value of any two commodities is the cost of their production, and not the respective quantities which may be produced, nor the competition amongst the purchasers." ([Ricardo](#), 1817: p.231)

However, we should note that the resistance of the [Classicals](#) was not mere pig-headedness or simply a reiteration of Smith's "use-value" confusion. As particularly expressed by J.S. Mill (1845), if one was to acknowledge the role of both demand and supply in long-run price-determination, one is effectively mixing together mathematically heterogeneous things which cannot be juxtaposed upon each other.

"It seems to me necessary, when we mean to speak of the *ratio* between the demand for a commodity & the supply of it, that the two quantities should be, in the mathematical sense, homogeneous -- that both of them should be estimated in numbers of the same unit." (J.S. [Mill](#), 1945: p.143)

Although insisting on the importance of subjective utility in price determination, Law, Say and

Lauderdale were less clear about the role of rarity in all of this. This is understandable given the traditional difficulty of distinguishing a costly item from a rare item. Objectively-determined rarity had been of central importance in the work of Bernardo [Davanzati](#) (1588), Juan [de Lugo](#) (1642) and Pierre [de Boisguilbert](#) (1695), but the connection with utility was not immediately and clearly made.

The first explicit recognition of scarcity, i.e. subjectively-determined rarity, as the source of value is contained in the remarkable work of Ferdinando [Galiani](#) (1751). Galiani's brilliant performance was followed up by the anti-Physiocrat philosopher, Abbé [Condillac](#) (1776). Condillac explicitly employed both utility and rarity in determining scarcity and value and was willing to confront the Classical solution directly. As he wrote, "a thing does not have value because of its cost, as some suppose; but it costs because it has value." Condillac's argument was reiterated in a relatively obscure note by the ambiguous [Physiocrat](#), Jacques [Turgot](#) (1769).

It is evident, then, that [Say's](#) groping for a subjectivist theory of price was not isolated. There was already a somewhat long history in [France](#) and [Italy](#). Under Say's own influence, this Franco-Italian tradition sustained itself in these countries throughout the 19th Century. The ground-breaking work of French [proto-marginalist](#) economists such as Louis Auguste Say (1822) (J.B. Say's brother), Auguste [Walras](#) (1831) (L. Walras's father), Augustin [Cournot](#) (1838) and Jules [Dupuit](#) (1844) can thus be seen as natural outgrowths of a long tradition and not merely a series of brilliant isolated sparks of insight. It was upon this tradition that Léon [Walras](#) was to draw in composing his 1874 masterpiece..

In Germany, another ambivalent follower of Smith and popular textbook writer, Johann Friedrich [Rau](#) (1827) did not discard the role of demand entirely -- indeed he showed how demand-and-supply diagrams can be used to determine price explicitly! In addition, the weight of the [German Historical School](#) ensured that the [Classical Ricardian](#) theory never penetrated very deeply in Germany either. Together, this can perhaps explain the German-language contributions to the utility-*cum*-scarcity tradition, such as F.B.W. [Hermann](#) (1832), Hans von [Mangoldt](#) (1863) and, above everything, Hermann Heinrich [Gossen](#) (1854). Carl [Menger](#) was thoroughly soaked in Rau and Hermann before trying his hand in 1871.

In Great Britain, where the [Ricardians](#) reigned supreme, the subjective scarcity notion had more trouble catching on. Nonetheless, the idea had been hatched by Nassau [Senior](#) (1836) and his associates at [Oxford and Dublin](#) -- Richard [Whately](#) (1832), William F. [Lloyd](#) (1837) and Mountiford [Longfield](#) (1834). These fledgling Neoclassicals did not mince their words when confronting the Classics. As Whately asserts heretically, "It is not that pearls fetch a high price *because* men have dived for them; but on the contrary, men dive for them because they fetch a high price." ([Whately](#), 1832: p.253).

These tentative efforts in Britain, however, were smashed by John Stuart [Mill's](#) *Principles of Political Economy* (1848), a weighty restatement of the [Classical Ricardian](#) doctrine. It was with Lloyd, Whately and company in mind that Mill went on to assert that "Happily, there is nothing in the laws of Value which remains for the present or any future writer to clear up; the theory of the subject is complete"

(Mill, 1848: Ch. III.1).

Despite Mill's abrupt interception, the grumbling continued. By the 1860s, the Classical Ricardian doctrine had come under siege, not only from the usual suspects (e.g. [Carlyle](#), [Ruskin](#), [Cliffe Leslie](#)) but, more importantly, from their own. The gutting of the wages fund doctrine by [Thornton](#), [Sidgwick](#) and [Walker](#), and the wide-ranging assault on the "vulgar economists" by Karl [Marx](#), had dented the confidence of Classical theory. As a consequence, a window of opportunity opened in Britain during this time for outcasts such as Richard [Jennings](#) (1855), William E. [Hearn](#) (1864), Fleeming [Jenkin](#) (1870) and Henry Dunning [Macleod](#) (1857, 1881), to pursue subjective scarcity and/or supply-and-demand mechanisms in their work. Thus the claim that William Stanley [Jevons](#) was working in a vacuum in 1871 with little more than [Bentham](#) to draw upon, is not strictly correct.

[Note: Emil Kauder (1957) has argued that the reason for the retarded acceptance of subjective scarcity theory in English economics and the predominance of labor-cost theories was due to differing philosophical and religious traditions. Protestant Britain was wary of the hedonistic conception of utility, and the labor-cost theories seemed quite more compatible with its work-oriented Puritanical traditions. Thus it is in Catholic countries, like France and Italy, where sensualism is not altogether dead, that we find the great exponents of subjective scarcity theory. This is an interesting hypothesis, but it does not perfectly fit with the facts and certainly overlooks more straightforward explanations.]

### **(C) The Holy Grail: Marginal Utility**

Discussions of utility, scarcity and the mechanism of demand and supply, however suggestive, were not well-integrated in the efforts of the early proto-Neoclassical economists. The great missing ingredient was the connection between utility and demand. Auguste [Walras](#) (1831) and Mountiford [Longfield](#) (1834) attempted an explicit connection, but their theories ended tied up in knots. As was to be discerned later, the key to successful integration was *marginal utility* -- specifically, *diminishing marginal utility*.

The concept of diminishing marginal utility -- i.e. that equal increments of a good yield diminishing increments of utility -- was already widely known. Daniel [Bernoulli](#) (1738) had employed this concept to solve the [St. Petersburg Paradox](#). The [utilitarian](#) Jeremy [Bentham](#) (1789, 1802) had certainly stated the idea. [Lloyd](#) (1833), [Senior](#) (1836), [Jennings](#) (1855) and [Hearn](#) (1864) were well aware of diminishing marginal utility as well. The question was one of connecting it to demand, which these writers failed to do clearly.

#### **(i) Auguste Cournot**

The idea of a demand function itself was proposed by Charles [D'Avenant](#) (1699), who even attempted to estimate one for wheat (on the basis of data allegedly provided by Gregory [King](#) (1696)). The first concrete expression of a demand function was accomplished by Pietro [Verri](#) (1760). Thereafter silence reigned until the enormous leap of Augustin [Cournot](#) (1838). Cournot did not bother with the niceties of

utility; his concern was focused on demand functions directly which he considered to be deducible from empirical fact. He was the first to express the demand function in algebraic form as  $D = F(p)$  and the first to draw demand-and-supply functions in price-quantity space ([Cournot](#), 1838: p.92, Fig. 6). This, of course, was not all: in addition to demand functions, Cournot introduced the concepts of marginal revenue, marginal cost, the concept of the profit-maximizing firm, monopoly, duopoly, perfect competition and, of course, his famous "reaction functions". But marginal utility was nowhere in sight. As he argued, the "accessory ideas of utility, scarcity, and suitability to the needs and enjoyments of mankind...are variable and by nature indeterminate, and consequently ill suited for the foundation of a scientific theory" ([Cournot](#), 1838: p.10).

## **(ii) Jules Dupuit**

The first successful connection between marginal utility and demand was accomplished by the French engineer Jules [Dupuit](#) (1844). His remarkable effort at developing a cost-benefit analysis of public works led him to draw the demand curve in price-quantity space. Unlike Cournot, Dupuit did not rest his demand curve on empirical intuition but rather identified the demand curve *as* the marginal utility curve itself. Dupuit's basic idea was this: as quantity rises, the marginal utility of the good declines. Consequently, one should also say that as the quantity rises, the willingness of a person to pay for that good declines. Thus, the concept of diminishing marginal utility should translate itself into a downward-sloping demand function.

Of course, [Dupuit](#)'s logic was suspect in at least one place: marginal utility is particular to an individual, while market demand is an aggregate, so something must be said about the interpersonal comparability of utility in order to proceed with the connection. Dupuit skimmed on this. Nonetheless, the important point was that the connection was made between demand and utility. Dupuit, however, did not draw a supply curve and thus did not get price-determination into his story.

[Dupuit went on to define "relative utility" (what later became known as [Marshall](#)'s "consumer surplus") as the area under the demand/marginal utility curve above the price and used it as a measure of the welfare effects of different prices -- yielding his famous conclusion that public welfare is maximized when the price (in his case, the toll rate on a bridge) is zero.]

## **(iii) H.H. Gossen**

The final step came from Hermann Heinrich [Gossen](#) (1854). Unlike Dupuit, Gossen clearly distinguished the marginal utility curve from the demand curve. Gossen posited that demand is derived from the utility-maximizing choices of the consumer. Gossen's "Three Laws" can be stated as follows:

- (1) the amount of utility derived from the consumption of a good declines with each additional unit of that commodity (i.e. diminishing marginal utility, or, to use Gossen's term, "diminishing worth of the last atom".)

(2) a person maximizes his utility when he distributes his income among various goods so that he obtains the same amount of satisfaction from the last unit of each good or, if money is being used, he obtains the same amount of satisfaction from the last unit of money spent upon each commodity (i.e. equality of the ratio of marginal utilities to the ratio of prices, i.e.  $MU_i/p_i = MU_j/p_j$  for any two goods  $i, j$ ).

(3) a good has value only when the demand for it exceeds supply (i.e. subjective scarcity is source of value).

Of Gossen's three laws, the second is perhaps the most remarkable. The idea that, at the margin, the consumer substitutes between goods so that he obtains the same marginal utility (in terms of money) across goods yields the downward-sloping demand curve for each of the goods. To see this, merely note that when the price of a good rises, the marginal utility in terms of money ( $MU_i/p_i$ ) declines and thus, by Gossen's first law (diminishing marginal utility), less of that good will be bought. The foundations of the Marginalist Revolution were thus in place.

#### **(D) The Revolution of 1871-4**

H.H. [Gossen](#)'s (1854) work had already anticipated much of the Marginalist Revolution. However, this "ingenius idiot", as [Schmoller](#) called him, was an unknown man -- a retired Prussian civil servant -- whose work was entirely neglected. His work was only accidentally discovered in 1878 during a search by [Jevons](#) for fellow travellers. As such, the works of [Jevons](#), [Menger](#) and [Walras](#) came forth without the benefit of Gossen's insights.

##### **(i) William Stanley Jevons**

William Stanley [Jevons](#) developed his results on marginal utility (which Jevons called "final degree of utility") independently and first announced them in an abstract of a 1862 lecture (published in 1866). The publication of Fleeming [Jenkin](#)'s (1870) diagrammatic representation of the demand-and-supply mechanism led Jevons to quickly write and publish his own 1871 treatise, *Theory of Political Economy* in order to establish priority. Jevons couched his construction in the context of *pure exchange*. Specifically, assuming two goods (call them  $x_1$  and  $x_2$ ) and two agents (call them A and B), then in equilibrium, Jevons proposed that:

$$MU_1^A/MU_2^A = -dx_2/dx_1 = MU_1^B/MU_2^B$$

where  $MU_i^h$  is the marginal utility of good  $x_i$  to household  $h$ . The term  $dx_1$  is the amount of good  $x_1$  given by agent A to agent B and  $dx_2$  is the amount of good  $x_2$  given by agent B to agent A. Thus, for agent A, the marginal utility of good  $x_1$  after amount  $dx_1$  has been surrendered divided by the marginal utility of good  $x_2$  after amount  $dx_2$  has been gained, is inversely related to the exchange ratio  $dx_2/dx_1$ .

The analogous reasoning applies for agent B. Thus: "*The ratio of exchange of any two commodities will be the reciprocal of the ratio of the final degrees of utility of the quantities of commodity available for consumption after the exchange is completed.*" ([Jevons](#), 1871: p.95).

Through the medium of a market, the exchange ratio can be expressed as prices, i.e.  $-dx_2/dx_1 = p_1/p_2$ , so that this can be rewritten as:

$$MU_1^A/p_1 = MU_2^A/p_2 = MU_1^B/p_1 = MU_2^B/p_2$$

so not only does [Gossen's Second Law](#) hold for every single consumer, but it also holds across consumers.

However, Jevons got somewhat tangled up in this derivation. In particular, he was not quite sure how to get from  $dx_1/dx_2$  to  $p_1/p_2$  or back again. His difficulty stems in part from his wariness of the difference between bilateral exchange between two people and multi-lateral exchange via the medium of the market. However, he confused himself a bit in this respect. Apparently, he believed it was easier to determine exchange ratios in bilateral exchange than in competitive situations - thus he tried to reduce his "market" situation into one of simple bilateral exchange. He did so with the help of two pieces of scaffolding: (1) by constructing "trading bodies" ([Jevons](#), 1871: p.88-90), so that the enormous mass of heterogeneous traders in markets could be reduced to a pair of what would today be called "representative agents" that would exchange with each other; (2) then via arbitrage-theoretic reasoning -- in his famous "Law of Indifference" ([Jevons](#), 1871: p.90-5) -- he goes on to argue for price-taking agents so that, *by definition*,  $dx_1/dx_2 = p_1/p_2$ .

Ten years later, Francis Ysidro [Edgeworth](#) (1881) was to show that Jevons's instincts should be reversed: determining the exchange ratio between two bilateral trading bodies, Edgeworth argued, is in fact *more* difficult than determining the exchange ratio when there are numerous, heterogeneous agents in a competitive market situation. Edgeworth's demonstration of the [indeterminacy of exchange ratios](#) in bilateral exchange was captured in his famous notion of the "contract curve" and the "core". His [famous conjecture](#), that indeterminacy is eliminated when the number of traders increases ("perfect competition"), however, was not picked up immediately.

[Jevons](#) established equilibrium in pure exchange, but, not having a good theory of production, was unable to construct the familiar "supply-and-demand" theory with variable output levels. His resolution was considerably unsatisfying. Jevons argued, as [Gossen](#) had before him, that labor supply was governed by disutility of labor: the greater the amount of work, the greater the marginal disutility of labor. Consequently, he went on to argue, by [Gossen's Second Law](#), that the marginal utility of consuming a good must be equal to the marginal disutility of producing it. In other words, the quantity of a good produced is determined by the intersection of a downward-sloping marginal utility of consumption curve and an upward sloping marginal disutility of labor curve.

With the quantity of the good thus determinate, [Jevons](#)'s next step was quickly and sloppily reasoned: once the supply of the good is given, then we can apply the pure exchange scenario we had before to determine the price of the good. This entire story is summarized by Jevons in a famous "catena":

"Cost of production determines supply;  
Supply determines final degree of utility;  
Final degree of utility determines value"

(W.S. [Jevons](#), 1871: p.165)

The first line seeks to explain the output-determination process we have just summarized: namely, how higher or lower wages shift around the the marginal utility of income/disutility of labor curves so that output level, i.e. supply, changes. The second line merely states that once we have supplies of goods determined, we know what marginal utility of those goods will be; finally, the third line summarizes the pure exchange process.

This is confusing. The immediate temptation is to remove all the intermediate steps and reduce the catena to the simple claim that "cost of production determines value", a complete restatement of the [Classical theory](#) of [Ricardo](#) and [Mill](#)! Obviously, Jevons did not quite want to put it this way. Wages ought not to be hanging in the air by themselves. Unlike Classical theory, Jevons argued, the value of labour "is determined by the value of the produce, not the value of the produce by that of the labour." ([Jevons](#), 1871: p.166). Thus, years later, Alfred [Marshall](#) would invert Jevons's catena into its proper order:

"Utility determines the amount that has to be supplied,  
The amount that has to be supplied determines cost of production  
Cost of production determines value."

(A. [Marshall](#), 1890: p.674)

Without deriving demand and supply functions from his marginal utility/disutility schedules, Jevons discussion is quite confusing. It was Alfred [Marshall](#) (1890: Ch. 3; Math. App.), that got Jevons' out of this knot by deriving it formally. Now, as stated,  $MU_i/p_i$  is the marginal utility of dollar spend on good  $x_i$ . By [Gossen's Second Law](#),  $MU_i/p_i = MU_j/p_j$  for all goods  $i, j$ . Consequently, we can define the marginal utility of *income* (what Marshall called the marginal utility of *money*) as:

$$MU_Y = MU_i/p_i = MU_j/p_j = \dots$$

Jevons, as we know, was clearly aware of this and even offered the identity  $MU_i = p_i MU_Y$  in his work ([Jevons](#), 1871: p.146). But how is one to construct a demand function? Marshall's process is to follow Jevons in assuming that the marginal utility of income  $MU_Y$  is a *constant*. Doing so, we immediately

recognize that differentiating with respect to quantity demanded  $x_i$ :

$$dMU_i/dx_i = (dp_i/dx_i) \cdot MU_Y$$

so that:

$$dx_i/dp_i = MU_Y / (\partial MU_i / \partial x_i)$$

as, by the rule of diminishing marginal utility,  $dMU_i/dx_i < 0$ , then  $dx_i/dp_i < 0$ , so a rise in the price of good  $x_i$  leads to a decrease in demand for it. Thus, the demand curve is downward-sloping.

[Note: the [constancy of the marginal utility of income](#) is a dubious assumption, discussed more fully elsewhere. Effectively, what it does to eliminate the famous "income effect" of a change in price (note that this is *not* the same as saying that all other prices are held constant! rather, intercommodity effects are neutralized). However, this also implies that as  $p_i$  rises and  $x_i$  falls, total expenditure on this good,  $p_i x_i$ , is unchanged, i.e. the demand function is unit elastic. Marshall was uncomfortable with this assumption, thus he cautioned that this was only approximately true, provided that the expenditure by a consumer on any particular good is only "a small part of his total resources" ([Marshall](#), 1890: p.279). The derivation of demand from utility without the constant marginal utility of income assumption had to wait until Vilfredo [Pareto](#) (1892)]

## (ii) Carl Menger

Carl [Menger](#)'s (1871) contribution was more clear, but less formal. Although he did not name it explicitly, he introduced the concept of diminishing marginal utility in general discussion. He just referred to the decreasing "importance of the satisfaction of needs" and used numerical examples (Menger, 1871: p.127) to illustrate the idea. [Note: the term "marginal utility", *Grenznutzen*, was only introduced by Friedrich [von Wieser](#) (1889); in his work, Menger uses the term "utility" in the same misleading sense Adam Smith did, i.e. in terms of objective "use-value"]. As a result, Menger comes to the Marginalist conclusion:

"Value is therefore nothing inherent in goods, no property of them, but merely the importance we attribute to the satisfaction of our needs, that is, to our lives and well-being, and in consequence carry over to economic goods as the exclusive causes of the satisfaction of our needs." ([Menger](#), 1871: p.116)

[Menger](#) did not bother to derive a demand function, but his discussion of exchange, in many ways, supersedes that of Jevons. In particular, he defined prices as "only incidental manifestations of [exchange], symptoms of an economic equilibrium between the economies of individuals." (Menger, 1871: p.191). Prices, then, are formed by market processes of exchange and the nature of the process can

vary depending on a variety of factors, notably in the degree of competitiveness. In his famous Chapter 5, Menger outlines the process of price-formation from a bargaining process between two individuals, under monopoly, duopoly and, finally, competition. Although he was not consistent (e.g. at one time recognizing the indeterminacy of prices in bilateral exchange, and then retreating from this elsewhere), Menger's analysis of the market process was highly suggestive and marked the approach of the [Austrian School](#) in years to come.

Two other points insisted upon by [Menger](#) are worth mentioning. Firstly, his distinction between economic goods and non-economic (i.e. free) goods was given central importance (Menger, 1871: p.94-109). He underlined the fact that one cannot *assume* that goods have prices; whether a good is free or not is a *result* of the final equilibrium configuration and thus is *endogenous* to the problem. Secondly, Menger (1871: p.149-74) outlined the important theory of imputation. As only utility can confer value, then the value of factors of production ("goods of higher order") which have no utility in and of themselves must be determined by the prices of outputs ("goods of lower order"). This is the heart of the Neoclassical treatment of [production as "indirect exchange"](#).

### (iii) Léon Walras

The contribution of Léon [Walras](#) (1874) outshines both Jevons, Menger and all other predecessors in clarity, rigor and insight. It is in Walras where we find the most careful, complete and visionary statements of the Marginalist Revolution. As Schumpeter expressed it, with characteristic lack of restraint:

"Walras is in my opinion the greatest of all economists. His system of economic equilibrium, uniting, as it does, the quality of a "revolutionary" creativeness with the quality of classic synthesis, is the only work by an economist that will stand comparison with the achievements of theoretical physics. Compared with it, most of the theoretical writings of that period - and beyond - however valuable in themselves and however original subjectively, look like boats beside a liner, like inadequate attempts to catch some particular aspects of Walrasian truth." (J. A. [Schumpeter](#), 1954: p.827)

The details of Walras's general equilibrium system are [given elsewhere](#)., so we shall note only a few of his contributions here. Walras adopted the notion of marginal utility and the scarcity theory of value from his father, Auguste [Walras](#) (1831). However, Auguste Walras did not manage to connect the two concepts. Already in his early work, we find the young Léon Walras following his father in claiming that the value of goods depends on both utility *and* rarity ("*rareté*"). Walras then was holding on to an *objective* definition of rarity, defining a good as rare if "it is offered to general demand in a limited quantity" ([Walras](#), 1860: p.8).

It was only in an 1873 article preceding his *Elements* (1874) that Léon Walras took the leap and made the connection by noting that "*rareté* is *personal* or *subjective*" (Walras, 1874: p.146). Walras used the

term *rareté* for "marginal utility". At least for the case of bilateral trade, this is an extremely fortuitous use of language -- for what does marginal utility of a particular good represent other the intensity with which that good is needed and thus the degree to which its absence is felt? If my marginal utility for eggs is greater than yours, then eggs are perceived by me as being *more scarce* than they are perceived by you.

[Walras](#)'s use of the term *rareté* keeps *the* fundamental Neoclassical idea of subjective scarcity at all times in the forefront of our minds and does not let it slip out of sight. However, moving beyond exchange between two parties, the connection becomes more tenuous: scarcity is a market-wide phenomenon; marginal utility is an individual phenomenon, and thus his use of the term *rareté* for marginal utility may be confusing in the case of economy-wide exchange.

The rest of [Walras](#)'s work is sheer brilliance. Recognizing the multi-good nature of exchange, all of Walras's analysis proceeds with multiple markets. No oversimplifying *ceteris paribus* assumptions are made. Alone among the early Marginalists, Walras provided a proper derivation of the demand curve from utility functions via the use of household budgets ([Walras](#), 1874: Ch. 8, 11.). If anything is demanded, something else must be offered in exchange; consequently the aggregate value of what is offered must equal the aggregate value of what is demanded. As a result, for any bundle of goods demanded  $x = [x_1, x_2, \dots, x_n]$  and for a given set of endowments  $e = [e_1, e_2, \dots, e_n]$ , it must be that:

$$p_1x_1 + p_2x_2 + \dots + p_nx_n = p_1e_1 + p_2e_2 + \dots + p_ne_n$$

Walras's recognized that the need for a *numeraire* good enabled him to fix one price, e.g.  $p_1 = 1$ . In this case:

$$x_1 + p_2x_2 + \dots + p_nx_n = e_1 + p_2e_2 + \dots + p_ne_n$$

where  $p_2, p_3$ , etc. are the prices of goods  $x_2, x_3$ , etc. in terms of the price of good  $x_1$ . Now, Walras used an additively separable utility function so that the utility of a bundle  $x$  can be written as:

$$U(x) = u_1(x_1) + u_2(x_2) + \dots + u_n(x_n)$$

where  $u_i(x_i)$  is the utility from good  $x_i$ . Substituting the budget constraint into the first of these separate utilities:

$$U(x) = u_1(e_1 + p_2e_2 + \dots + p_ne_n - p_2x_2 - \dots - p_nx_n) + u_2(x_2) + \dots + u_n(x_n)$$

which, upon maximization, yields for any good  $x_i$  the following first order condition:

$$\partial U / \partial x_i = -(\partial u_1 / \partial x_1) \cdot p_2 + \partial u_2 / \partial x_2 = 0$$

or letting  $MU_i = \partial u_i / \partial x_i$ , then we obtain the result:

$$MU_1 = MU_i / p_i$$

for every  $i = 1, \dots, n$ . This is [Gossen's Second Law](#) once again.

As we have  $n$  goods, we have  $n-1$  such equations. The addition of the aggregate budget constraint equation implies we have a total of  $n$  equations. What about unknowns? As prices are given, then all we have to do is determine the amounts demanded/supplied by agents,  $x_1, \dots, x_n$ . With an equal number of equations and unknowns, we are there and can express our resulting individual demand functions as:

$$x_i = x_i(p_1, \dots, p_n)$$

for  $i = 1, \dots, n$ . He aggregates these into market demand/supply functions by horizontal summation over households. Equilibrium is achieved when market demand is equal to market supply in each market. [Walras](#) goes on to his unique discussion of the stability of equilibrium via his *tatonnement* price adjustment process, to which we [refer elsewhere](#). Finally, Walras goes beyond the other pioneering Marginalists in proceeding, in later chapters, to incorporate [production](#), [capital](#) and [money](#) into his general equilibrium model in a complete and consistent manner.

[Note: William Jaffé (1976) has noted that "instead of climbing up from marginal utility to the level of his general equilibrium system, [Walras](#) actually climbed down from that level to marginal utility". This seems evident from reading Walras. As such, at least in Walras's case, one might be tempted to play down the influence of the French utility-*cum*-scarcity tradition in favor of the *other* French tradition of "grand systems" of general equilibrium (cf. [Cantillon](#), 1755; [Quesnay](#), 1759, [Turgot](#), 1766; [Isnard](#), 1781).]

## **(E) Consolidation: the Great Flood**

The works of [Jevons](#), [Menger](#) and [Walras](#) were met with different reactions. [Jevons](#)'s *Theory* received various notices and reviews, some of them sympathetic, many of them hostile (Alfred [Marshall](#)'s (1872) review was noticeably lukewarm). At any rate, one could not fail to notice it. Even textbooks written in the Classical tradition, such as John E. [Cairnes](#) (1874) and Henry [Sidgwick](#) (1883), were forced to make some note or other about Jevons's new theory.

In contrast, a complete silence surrounded Léon [Walras](#)'s *Elements* -- the only notice of the existence of this book were Walras's own follow-up publications, most of them also duly ignored. Walras became aware of Jevons's existence in 1874 and gracefully acknowledged his priority. They took to each other immediately and made a joint effort to spread the word. Something akin to a division of labor ensued: Jevons went off digging up illustrious predecessors in order to enhance the pedigree of the new doctrine

while Walras endeavored to establish communication with virtually every important economist of the day. [Jevons's](#) task proved to be more rewarding: in his efforts, he helped unearth [Cantillon](#), [Cournot](#) and [Gossen](#) out of their obscurity. In contrast, [Walras](#) just found shut doors and impatient listeners. Only a handful of the economists he contacted responded positively to the new ideas. In frustration, he turned to contemporary mathematicians, only to be dismissed once again.

[Menger](#), who did not exactly cooperate with the Jevons-Walras efforts, went on his own crusade. His 1883 *Investigations* provoked prominent German-speaking economists such as Gustav [Schmoller](#) into a bruising debate on methodology. This *Methodenstreit* enhanced general awareness of Menger's new theory, but it also bogged him down. In the end, it was somewhat self-defeating: although his fame and reputation were greatly increased in [Austria](#), the entire university system in [Germany](#) itself was closed to him and his followers.

The Marginalist Revolution really began only to take off in the 1880s with the publication of the works of a younger generation which had begun to read up on their works. The wide dissemination of the work of two close disciples of Menger, Friedrich [von Wieser](#) (1884, 1889) and Eugen [von Böhm-Bawerk](#) (1886, 1889), gave the theories of the [Austrian School](#) wider attention.

The mathematical tone of Jevons's and Walras's own works attracted a slew of technically-gifted young economists throughout the world. Among these we can count the Englishmen Francis Ysidro [Edgeworth](#) (1881) and Philip H. [Wicksteed](#) (1888), the Austrians Rudolf [Auspitz](#) and Richard [Lieben](#) (1889), and, a little later, the American Irving [Fisher](#) (1892) and the Swede Knut [Wicksell](#) (1893).

The trickle of the 1880s turned into the flood of the 1890s, particularly after the joint discovery of the [marginal productivity theory of distribution](#) by the American economist John Bates [Clark](#) (1890, 1899), Knut [Wicksell](#) (1893), Philip H. [Wicksteed](#) (1894) and Enrico [Barone](#) (1895). The Marginalist Revolution then went into high gear with the publications of Maffeo [Pantaleoni](#) (1889), Vilfredo [Pareto](#) (1892, 1896-7, 1906), Knut [Wicksell](#) (1898, 1901, 1906) and Giovanni B. [Antonelli](#) (1886). Details on the consolidation of the Neoclassical theory of value by these economists are found elsewhere.

Nonetheless, the most significant event of the 1890s was the publication of Alfred [Marshall's](#) *Principles of Economics* (1890). This is notable not so much for the research or insights which it generated, but rather because it was the first really successful Neoclassical textbook. It was through Marshall that the Marginalist Revolution became palatable to contemporary economists -- Marshall's extremely conciliatory attitude towards the displaced [Classical](#) School was the sugar that permitted it be swallowed by fellow academics. Through its wide adoption as a university textbook, Neoclassical theory was delivered to a wider public. The infamous "demand-and-supply" diagram with the reversed axes that has since become the standard staple of economics textbooks was a centrepiece of Marshall's book. In other countries, the works of Knut [Wicksell](#), Maffeo [Pantaleoni](#), Etienne [Antonelli](#) and others gained wide textbook usage, but in English-speaking countries, despite several efforts at displacement (e.g. by

[Wicksteed](#) (1910)), the successive editions of Alfred Marshall's *Principles* remained *the* dominant text at least until the 1930s.

[Note: Alfred [Marshall](#) irritatingly continued to insist time and time again that he had basically formed most of his ideas before he had read [Jevons](#)'s 1871 volume (cf. Marshall notes and letters in Pigou, 1925), and thus that he should be counted as one of the original "revolutionaries". He pointed to two 1879 articles printed for "private circulation" as evidence of his habit of coming up with new ideas, but not rushing them to publication. However, most historians of economics have concluded that Marshall claims to originality have no basis. It is quite apparent that Marshall *did* derive most of his own theory *after* reading Jevons. For further notes on Marshall and his role in the Marginalist Revolution, see Whitaker (1975), Maloney (1985) and Mirowski (1990). In contrast, we should note that John Bates [Clark](#) (1885) *did* arrive at his utility-based theory of price while quite ignorant of the work of Jevons, Menger and Walras -- and thus Clark, but not Marshall, should be given high marks for originality.]

### **(F) Aftermath: the Great Drought**

Although sharing the same underlying Neoclassical theory of value, the different emphasis, approaches and methods of the various pioneering Marginalists on details such as production, money, capital, dynamics, etc. led to the segmentation of the Neoclassical school into various largely independent "schools of thought", rather than consolidation into a "monolithic" Neoclassical edifice. The [Cambridge Neoclassicals](#) followed [Marshall](#)'s approach, the [Austrian School](#) followed [Menger](#) [Böhm-Bawerk](#) and [Wieser](#), while the [Chicago School](#) followed a combination of both Marshall and the Austrians. Naturally, the [Stockholm School](#) followed [Wicksell](#), and one can even divide the [Lausanne School](#) further into subsequently distinct [Walrasian](#) and [Paretian](#) traditions.

However, this segmentation should be treated with caution. Some Neoclassical economists, such as [Jevons](#), [Wicksteed](#) and [Fisher](#) failed to belong to or develop behind them any clear "school of thought". Furthermore, there was a good degree of cross-pollination among schools -- for instance, the influence of the [Austrians](#) on the [Swedes](#) (and vice-versa) is well-documented. Finally, there were occasions when several economists attempted to hammer the disparate contributions of the different schools of thought together into a single, all-encompassing "Neoclassical" theory. Such efforts are discernable, for instance, in the 1930s, 1960s and the 1980s, although not always successful.

Finally, we should note that the "Marginalist Revolution" had severer growing pains than this brief account indicates. Initiated in 1871-4, it only began to be noticed in the 1880s and by the late 1890s it was already running out of steam. In the early part of the twentieth century, the Marginalist Revolution was, in fact, *retreating* on many fronts. The great splash in the 1880s excited both support and opposition and, as a result, it advanced quickly and generated great professional debates that helped it become better known. However, a mere two decades later, we begin to notice that Neoclassicism seemed more and more to have become a peripheral "fringe" movement in the economics profession as a whole.

The reasoning for the Neoclassical retreat in the 1900s is largely because, to many contemporaries, it seemed to be descending into "quackery". Originally, the Neoclassicals had promised that their approach would provide a more sound, "scientific" explanation of economic phenomena than the alternative [Classical](#), [Institutional](#) or [Historical](#) approaches. However, its Achilles' heel was the very notion of "marginal utility". Marginal utility, let us be frank, is hardly a scientific concept: unobservable, unmeasurable and untestable, marginal utility is a notion with very dubious scientific standing. As Stigler notes, "Had specific tests been made of the implications of theories, the unfruitfulness of the ruling utility theory as a source of hypotheses in demand would soon have become apparent" (G.J. [Stigler](#), 1950).

However, it was given the benefit of the doubt in the 1880s by contemporary economists as a tentative hypothesis that was helpful to economic analysis, but which, hopefully, could be dispensed with later. But it quickly became apparent that rather than being a small part of the Neoclassical paradigm, it was increasingly becoming the "all" of Neoclassicism. *Everything* was beginning to be reduced with almost religious devotion into this nebulous hedonistic concept and thus seemed less and less "scientific". As Henry L. [Moore](#), an early disciple of Walras, wrote:

"In the closing quarter of the last century, great hopes were entertained by economists with regard to the capacity of economics to be made "an exact science". According to the view of the foremost theorists, the development of the doctrine of utility and value had laid the foundation of scientific economics in exact concepts, and it would soon be possible to erect upon the new foundation a firm structure of interrelated parts which, in definiteness and cogency, would be suggestive of the severe beauty of the mathematico-physical sciences. But this expectation has not been realized." (H.L. [Moore](#), 1914: p.84-85)

The indulgence contemporary economists had granted to the Neoclassical marginal utility hypothesis in the 1880s was largely withdrawn by the 1900s. In contemporary eyes, Neoclassicals were "quacks": they had promised a "scientific" approach and instead yielded up a "religious" approach to economics. Contemporary economists echoed with approval the merciless ridicule that Thorstein [Veblen](#) heaped upon Neoclassical quackery. As Jacob Viner was to lament in 1925:

"In the scientific periodicals, however, in contrast with the standard treatises, sympathetic expositions of the utility theory of value have become somewhat rare. In their stead are found an unintermittent series of slashing criticisms of the utility economics." (J. [Viner](#), 1925).

By and large, economists throughout the world withdrew from Neoclassicism and moved back into what seemed like "more serious science": i.e. the empirical approach of the [Institutional](#) and [Historical](#) schools. There were a few isolated exceptions: at Cambridge, Chicago and Vienna, Neoclassical dominance was maintained through the early part of the 20th Century. At the University of [Cambridge](#) (UK), Neoclassicism survived because it was a pretty self-contained place anyway -- "everything is in

Marshall", they believed (although things changed considerably after [Sraffa's](#) 1926 attack, and particularly, after [Keynes's](#) 1936 *General Theory*). The University of [Chicago](#) survived as a Neoclassical bastion in good part because of it was composed of a few strong personalities -- esp. Frank [Knight](#), Jacob [Viner](#), Henry [Schultz](#) -- who were gripped by siege mentality (witness their extensive journal forays in defense of Neoclassical methodology). The third exception was the University of [Vienna](#) -- which was also energized by a siege mentality and wilful personalities. However, the [Austrian](#) Neoclassicals held on there only until the end of the First World War, when they were finally dispersed. Consequently, for nearly thirty years, Neoclassical economics was effectively moribund, being slowly pushed forward by a handful of economists hidden away at [Cambridge](#), [Chicago](#) and a few other scattered places .

### **(G) The Paretian Revival**

This state of affairs changed drastically during the 1930s, when the Neoclassicals began rolling back in. The most significant institutional event was the "reconquest" of the [London School of Economics](#) by Lionel [Robbins](#) in the early 1930s -- and a parallel "half-conquest" of [Harvard](#) by Joseph [Schumpeter](#) and Wassily [Leontief](#). The formation of the [Cowles Commission](#) and the Econometric Society put the Neoclassicals back in touch with each other and the research energy that emerged was remarkable. Paradoxically, Hitler's armies contributed to this process: by expelling many economists from Central Europe, they effectively forced them to reassemble together at places like the LSE, Cowles and other institutions.

But it was the theoretical achievements of the 1930s on the part of a handful of a few young technically-minded economists that saved Neoclassical economics. The [Hicks-Allen](#) "ordinalist" revolution and Paul [Samuelson's](#) "revealed preference" approach helped remove much of the quackery that stained utility theory. It gained an empirical plausibility which had been missing before -- or at least, in the words of one contemporary economist, it was no longer "repugnant to our logic to suppose that [experiments] can be made" (Ricci, 1933: p.15). [Welfare economics](#), firstly via A.C. [Pigou](#) and then through the hands of Harold [Hotelling](#), Oskar [Lange](#), Maurice [Allais](#) and the [L.S.E.](#) economists (John [Hicks](#), Abba [Lerner](#), etc.), demonstrated that there was still something quite *useful* in the hypothesis. At any rate, [Cassel's](#) resurrection of the [Walrasian general equilibrium system](#), the consolidation of the Neoclassical [theory of production](#), the empirical efforts of [Shultz](#) and [Douglas](#), and even [Hayek's](#) foray into macroeconomics were all done on the basis of demand functions -- without utility -- thereby demonstrating that there remained huge swathes of Neoclassical theory were not *too* reliant on that dubious hedonistic concept. All these theoretical developments helped lend "scientific" teeth to Neoclassicism that were previously missing.

The rest of the story is too well-known. After the fervor of the 1930s -- the "[Paretian revival](#)" as we have chosen to call it -- Neoclassical theory managed to displace virtually all other theories and approaches from economics. Thus, the "Marginalist Revolution" was not something that just happened in the 1870s, but, in fact, it took at least six decades to entrench itself. Cheekily, some historians have preferred to call the early period merely the "Marginalist Insurrection".

Some would argue it took even longer to attain its monopoly over the economics profession. At least four other important paradigmatic challenges were hatched during the 20th Century which slowed down the Neoclassical ascendancy or at least prevented its complete dominance: [Monopolistic Competition](#), the [Keynesian Revolution](#), [Classical-Sraffian counter-revolution](#) and the rise of [Game Theory](#). By the 1980s, the first three had been "beaten back" by the Neoclassicals with different degrees of success; Game Theory, however, has proven to be a far more resilient beast and might conceivably yet undo considerable parts of Neoclassical theory, and perhaps the Marginalist Revolution as a whole, in the future.

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