

MARKETS, MATHS AND VALUE: SMITH VERSUS JEVONS

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Abstract. Can market prices misrepresent the value of commodities? I address this question from a historical perspective, comparing the views of Adam Smith and William Stanley Jevons. Smith held that the value of a unit of labor was, in some sense, objective, and could be used to approximate the true value of a commodity. Since market prices do not always track this value, and since we always face uncertainty when determining whether or not they do, there is reason to be skeptical that market prices accurately represent the value of commodities. In contrast, Jevons defines value as a ratio of utilities that only has meaning in a market context. This definition increases the precision with which Jevons can formulate his economic theory, but it precludes any possibility that market prices could misrepresent the value of a commodity. I encourage the reader to question the wisdom of granting markets this infallibility.

INTRODUCTION

Piety, Euthyphro contends, is that which is dear to the gods, and impiety is that which is not dear to them. Well put, Socrates replies, but do the gods love that which is pious simply because it is so? Or is it pious because the gods love it?

Markets are today's fickle gods and we are still caught on the horns of Plato's ancient dilemma. Do markets generate prices determined by the value of the goods and services traded? Or is the value of goods and services determined by market prices? Modern oracles of economic science have embraced the second alternative and developed an increasingly technical theoretical apparatus on its foundation. Yet devastating housing bubbles and debt crises still elude analysis, suggesting perhaps that we – both consumers and economists, devotees and priests – have more to learn about what value is and how it is reflected in market prices. As a preliminary investigation, I propose a historical exposition of this quandary as it surfaces in the comparison of classical and neo-classical economic reasoning about exchange value, as embodied in the work of Adam Smith and William Stanley Jevons.

In order to circumvent a stilted rehearsal of Econ 101 and a series of largely irrelevant qualifications, I allow myself the oversimplification that Smith and Jevons have an approximately similar understanding of market dynamics. Scarcity and desire, production and consumption, supply and demand interactively determine the market price of commodities. Granting this relatively common ground, the present aim is to contrast their respective interpretations of the

value represented by that market price and its roots in their divergent etiologies of individuals' commercial choices and actions. By stipulating an objective measuring rod, Smith's labor theory of value enables his now antiquated distinction between a good's market price and its natural price. The natural price is the true value of the good and markets can sometimes get it wrong. In contrast, Jevons' pioneering mathematical analysis of utility commits him to a view of markets as infallible indicators of commodities' true worth.

In the first section of the paper I am concerned to show that a Smithian market price can misrepresent the exchange value of a commodity. Such misrepresentation is made possible by a definition of exchange value that is practically unmeasurable but completely independent of a market context. In the second section I argue that a Jevonsonian market price cannot misrepresent the exchange value of a commodity. This infallibility is a logical consequence of Jevons' utilitarian definition of exchange value, a definition which he explains is absolutely necessary if the analysis of human wants and desires is to be made precise and scientific. I could not say if this increase in precision is worth the loss of a healthy skepticism about market prices; I argue here only that such an exchange has been made. Whether the trade-off was worthwhile is undoubtedly a question of faith.

I. SMITH AND THE LABOR THEORY OF VALUE

After explaining the causes and character of the division of labor and discussing the origin of money, Smith (1776) sets out three distinctions in Book I of *The Wealth of Nations*: use value versus exchange value, real price versus nominal price, and natural prices versus market prices. Fleshing out the meaning and implications of these distinctions will clarify the sense in which a market price can misrepresent the value of a commodity.

i. Use value versus Exchange value

Use value denotes what Smith calls the utility of an object – simply, its usefulness. Exchange value denotes the purchasing power of an object, that is, how much can be gotten in exchange for it. Smith does not posit or explain any relationship between these first two types of value. Citing water as highly useful but hardly exchangeable and diamonds as hardly useful but highly exchangeable, he remarks that these different values are frequently incommensurate, but there is no necessary relationship between them. He raises the distinction mainly to focus his ensuing exposition on the proper measure, components and determinants of exchange value. If he does conceive a relationship between value in use and value in exchange, he does not mention it in the canonical water/diamonds example (Smith 1776: I.4.13). Later on we will see how Jevons' mathematization of utility enables him to pin down and justify a necessary relationship between these conceptions of value.

The exchange value of any commodity, Smith (1776: I.5.1) writes, “is equal to the quantity of

labour which it enables him to purchase or command.” This is so for two reasons. First, it is, for Smith, a self-evident premise that every person is better off or worse off to the extent that she or he “can afford to enjoy the necessities, conveniences, and amusements of human life.” Successful pursuit and enjoyment of these goods just *is* valuable; it is constitutive of wealth. Second, these goods are procured or achieved through labor, either one’s own or, especially in a developed commercial society, someone else’s. The more labor at one’s disposal, the wealthier one is. Whenever a commodity is purchased with money or bartered in exchange for other goods, the items exchanged represent units of labor saved, units that would have been otherwise expended in pursuit of necessities, conveniences and amusements. These units of labor saved may or may not be roughly equal to the units of labor needed to produce the acquired commodity and bring it to market, referred to by later value theorists as the ‘labor embodied’ in the commodity. Assuming the equality of these amounts of labor, however, will simplify the exposition of Smith’s two remaining distinctions, so I leave the separation of labor-commanded from labor-embodied to a more Prodician commentator.¹

For our purposes, Smith (1776: I.5.2) holds simply that commodities derive their exchange value from labor because “[t]he real price of every thing, what every thing really costs to the man who wants to acquire it, is the toil and trouble of acquiring it”. That is to say, exchange value measures what you have to give up in order to get something, and in almost all cases what you will be giving up is labor. It certainly seems then that a ‘unit of labor’ is a reasonable unit in which to express measurement of exchange value. Exactly how to standardize this unit, however, is a seriously intractable problem, as we will see in the next sub-section.

ii. Real price versus Nominal price

The real price, denoted in units of labor, stands in contrast to the nominal price of a commodity, denoted in units of money. Real prices, as defined in the last paragraph, are, by that definition, accurate representations of exchange value.

Nominal prices are not. Whether due to the changing availability of precious metals in Smith’s day or to the fluctuating credibility of sovereign states in our own, money is “a commodity which is itself continually varying in its own value, [and thus] can never be an accurate measure of the value of other commodities.” The real versus nominal distinction hereby warrants our attention because it provokes Smith to his starkest declaration of the objective, immutable value of human labor, which I quote at length for its significance. He proclaims:

“Equal quantities of labour, at all times and places, may be said to be of equal value to the labourer. In his ordinary state of health, strength and spirits; in the ordinary degree of his skill

¹ Prodicus was an ancient Greek sophist caricatured by Plato as one inclined to make fine distinctions between terms very close in meaning.

and dexterity, he must always lay down the same portion of his ease, his liberty, and his happiness. The price which he pays must always be the same, whatever may be the quantity of goods which he receives in return for it. Of these, indeed, it may sometimes purchase a greater and sometimes a smaller quantity; but it is their value which varies, not that of the labour which purchases them. At all times and places that is dear which it is difficult to come at, or which it costs much labour to acquire; and that cheap which is to be had easily, or with very little labour. Labour alone, therefore, never varying in its own value, is alone the ultimate and real standard by which the value of all commodities can at all times and places be estimated and compared. It is their real price; money is their nominal price only” (1776: I.5.7).

So not only is the exchange value of a commodity equal to the labor it places at the disposal of its owner (i.e., saves her from expending in pursuit of wealth), but one unit of that labor is, to the laborer, worth the same at all times and places. Labor is, in this qualified sense, an objective, consistent metric of the value of commodities.

Certain qualifications are appropriate because, even granting that the value of labor to a single laborer may be equal across time and space, the value of labor may vary across laborers and will almost certainly not match the value attached to labor by those who demand it (i.e., firms and other employers). Putting aside the issue of interpersonal comparisons, note that employers value labor for what they can exchange it for or produce with it. This is the real price of labor and it will vary, as Smith (1776: I.5.15) points out, with the value of the other goods on the market and the availability and quality of productive capital. On top of this and his later division of labor into productive and unproductive categories, Smith (1776: I.6.3) also readily admits that species of labor requiring “an uncommon degree of dexterity and ingenuity,” or “superior hardship and superior skill,” are naturally more highly prized than easier, more common exertions.

So while a unit of labor would perfectly measure the exchange value of a good if such a unit were available, there are, for Smith, at least two barriers to any specification and valuation of the unit based on real-world observations. First, it is impossible to standardize a quantity of labor expended that can consistently apply to laborers of differing skill levels working at varying levels of intensity. A ‘man-hour’ is a commonly heard unit of labor that blatantly fails to capture either of these sources of variation. Perhaps one could speak of an hour’s labor by a college graduate with such-and-such IQ working at full intensity, but even these controls seem drastically inadequate to capture the constancy to be sought in an appropriate unit. After all, one person’s ‘full intensity’ is another’s half-hearted lackluster. The second barrier to the specification of a unit of labor as a metric of exchange value is that, even if the quantity could be appropriately standardized somehow, the value of that standardized quantity would be unknowable. The only way the exchange value of something can be specified is by noting how much of another good would be exchanged for it. If the values of all other goods, other than labor, are always changing across time and locale, then it will be impossible to identify a constant value of a unit of labor

(even if the quantity of labor is pinned down), since at one time the unit of labor will exchange for, say, two bushels of wheat, at another for four, and at another for some commodity completely incommensurable with wheat.

With these considerations in mind, it is clear that the value of a unit of labor is, for all practical purposes, unmeasurable. Nonetheless, Smith's avowed commitment to the intertemporal and interspatial objectivity of the value of labor to the laborer herself, in combination with his reference to labor as "the only universal, as well as the only accurate measure of value," (Smith 1776: I.5.17) justifies attributing to Smith a belief in the objective reality of a good's value. He must think there is a, perhaps unknowable, truth of the matter, otherwise it would be meaningless to speak of the accuracy of any measure. While "the exchangeable value of every commodity is ... estimated by the quantity of money [or] by the quantity either of labour or of any other commodity which can be had in exchange for it," such an estimate is merely that. An estimate. The real value being estimated is something else entirely, less well-defined, more abstract and more peripheral to Smith's concrete explanations of the nature and causes of wealth. It is likely that he treats the reality of the value of labor much the way he treats that of moral virtue in *The Theory of Moral Sentiments*, namely, by leaving it unaddressed. V.M. Hope (1989: 84), commenting on Smith's moral ontology, notes his "careful avoidance of the topic." Smith "is anxious not to take issue with whether virtue is in the mind of the critic or the external world," Hope writes, but "he would not dream of saying that moral propriety and excellence have no external reality." I think the same can be said of his view of the value of labor.

iii. Natural prices versus Market prices

The final distinction, between natural prices and market prices, highlights the discrepancy between the cost of producing a good and bringing it to market and the amount that consumers are willing to pay for it once it is there. Smith posits that in an advanced economy in which all the land has been appropriated, the labor-commanding value of any commodity is composed of contributions from the land, labor and capital needed to produce and distribute it. He explains that each of these contributions will earn a natural rate, determined by the sophistication of the economy, the type of commodity and the relations between owners of these factors. The natural rate of each factor ideally corresponds to the value of the labor it commands on its own. Smith continues:

"When the price of any commodity is neither more nor less than what is sufficient to pay the rent of the land, the wages of the labour, and the profits of the stock employed in raising, preparing, and bringing it to market, according to their natural rates, the commodity is then sold for what may be called its natural price" (1776: I.7.4).

The commodity is then sold, he says, "precisely for what it is worth." The market price at which it is actually sold, however, reflects its scarcity and the intensity of consumer desire for it. This

market price will tend to “gravitate” towards the natural price, but various accidents affecting supply and demand will oftentimes prevent the market from accurately valuing the commodity (Smith 1776: I.7.15).

II. JEVONS AND MARGINAL UTILITY

In the very first sentence of the Introduction to his *Theory of Political Economy* Jevons has already designated his subject matter a scientific one. By way of explanation he says, “It is clear that Economics, if it is to be a science at all, must be a mathematical science,” for the simple reason that it deals with quantities (Jevons 1871: 3). Whether expressed in words or mathematical symbols, economic reasoning entails comparisons between greater and lesser quantities of goods, capital, people, labor, wealth and, crucially, pleasures and pains.

These last two quantities are crucial because, for Jevons, Economics is not just a science, it is a moral science. That is, it concerns itself with principles of human choice, action and interaction – specifically, of course, commercial interaction. His theory of choice and action is thoroughly utilitarian, meaning that a comparison of the pleasures and pains expected from a course of action is the sole motivational factor behind it. Following Jeremy Bentham, Jevons (1871: 23) writes that, “pleasure and pain include all the forces which drive us to action. They are explicitly or implicitly the matter of all our calculations, and form the ultimate quantities to be treated in all the moral sciences.” This is not to deny the existence of nobler, “higher” motives of uprightness, honor or duty; however, as a “mechanics of utility and self-interest,” Jevons’ theory treats only “the lowest rank of feelings [aimed] at supplying the ordinary wants of man at the least cost of labour” (Jevons 1924: 27). Because his theory of value and exchange is ultimately grounded in this utilitarian behavioral framework, it is worth examining it a bit more closely.

To emphasize his intended meaning of the word *utility*, Jevons (1924: 43) explains that it is a quality or “circumstance of things arising out of their relation to man’s requirements.” “Requirements” should here be understood in the broadest possible sense, encompassing or coincident with Smith’s “necessaries, conveniences, and amusements.” The important point is that utility is not an intrinsic quality of a thing, but a relational quality. Specifically, it is a quality that commodities acquire when they bear a certain relation to “the will or inclination of the person immediately concerned” (Jevons 1924: 39). Jevons (1924: 38-39) extols Bentham’s seminal specification of that relation as one that “perfectly expresses the meaning of the word [utility] in Economics,” and quotes him as saying:

“By utility is meant that property in any object, whereby it tends to produce benefit, advantage, pleasure, good, or happiness (all this, in the present case, comes to the same thing), or (what comes again to the same thing) to prevent the happening of mischief, pain, evil, or unhappiness to the party whose interest is considered.”

The strength of any commodity's tendency to promote happiness (i.e. its amount utility) has a magnitude that Jevons (1924: 47) treats "as a quantity of two dimensions, one dimension consisting in the quantity of the commodity, and another in the intensity of the effect produced upon the consumer." It is his analysis of this quantity by means of differential calculus that marks Jevons' unique and catalytic contribution to the sea change in economic reasoning historically known as the marginal revolution. A brief explication of this analysis will help clarify Jevons' conception of value as it relates to Smith's two notions of value in use and value in exchange.

As a consumer acquires more and more of a commodity, one dimension of utility is increasing (the quantity possessed) and the other is decreasing (the intensity of the consumer's desire for more) since most things lose their usefulness or appeal in overabundance. This phenomenon, known today as decreasing marginal utility, is represented in Fig.1 (with quantity on the x-axis and intensity of desire on the y-axis) and helps Jevons illustrate three kinds of value where Smith saw only two. The "Total Utility" experienced by a consumer as result of his possessions, represented by the total area under the curve, is equivalent to Smith's value in use. This total utility, or value in use, of a commodity, however, is not very helpful for explaining behavior. The economist really wants to know how a person's utility depends on very small additions or subtractions of the commodity, since this information ostensibly enables the moral scientist to know whether the person will want more or less of it. But the way in which utility (U) varies with an infinitesimally small change in the quantity of commodity (X), can be identified, Jevons explains, by expressing U as a function of X and then taking the derivative of that function with respect to X. The "degree of utility of the last addition, or the next possible addition of a very small, or infinitely small, quantity to the existing stock," is represented by the line ng and dubbed by Jevons (1924: 51) the "Final Degree of Utility." This is what economists today call marginal utility. The ratio of the marginal utilities of two commodities, Jevons demonstrates, is equal to the inverse of their ratio of exchange, that is, the amount one commodity exchanged for one unit of another. It is this ratio, what Smith referred to imprecisely as exchange value, that Jevons holds to be the proper representation of the value of a commodity. He insists that "the word Value, so far as it can be correctly used, merely expresses the circumstance of [a good's] exchanging in a certain ratio for some other substance" (Jevons 1924: 77). Value derives from a ratio of utilities.

To justify his treatment of utility as a quantity amenable to measurement, ratios and mathematical analysis, Jevons (1924: 9-10) requires that observable economic behavior accurately reveal the true pains and pleasures of market participants. While "there can be no doubt that pleasure, pain, [and] utility, ... are all notions admitting of quantity", he reasonably doubts the possibility of exact or direct measurement of these subjective feelings. The only way they can be quantified is by comparison with each other in the mind of a single individual, as when the pain endured by forfeiting the cost of an additional loaf of bread, for instance, is compared to the pleasure of consuming it. Even then measurement of these feelings is achieved only indirectly, by observing their effects on the voluntary "buying and selling, borrowing and lending, labouring and resting,

producing and consuming” (Jevons 1924: 11) they induce.

If such market behavior were potentially uninformative or misleading with regard to the individual’s preferences, then no inferences about the relative utility of various courses of action would be justified and utility would lose its claim to quantifiability. In order to defend this claim, and the integrity of Economics as a mathematical science, Jevons (1924: 13) pronounces that “we cannot make a choice, or manifest the will in any way, without indicating thereby an excess of pleasure in some direction.” In other words, he assumes economic behavior always reveals the truth about pains and pleasures.

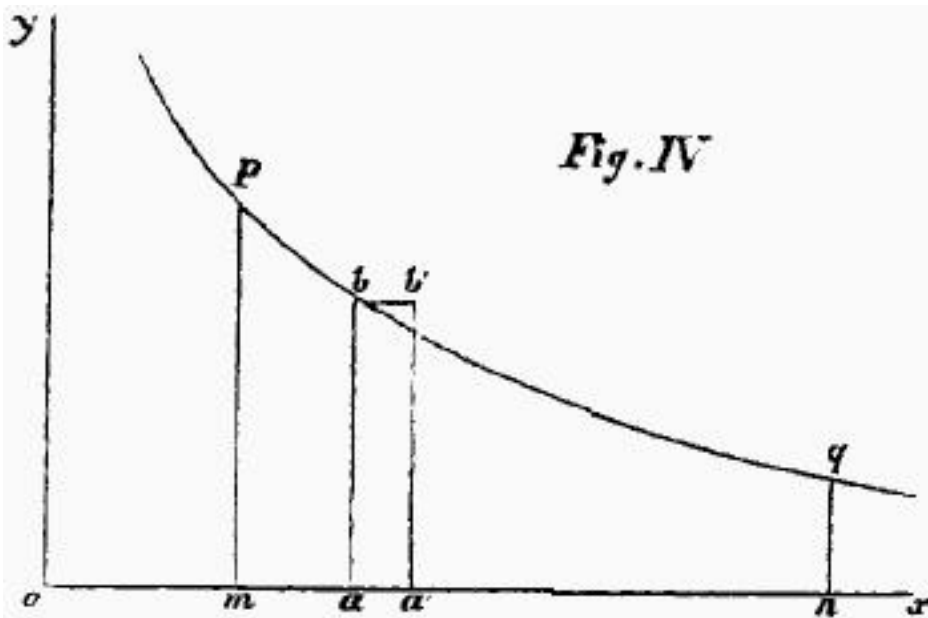


Fig. 1 The law of variation of the degree of utility (Jevons, 1871)

Essential as this pronouncement is for the validity of his quantitative treatment of utility, it has the further consequence that the price of a good in a perfect market cannot possibly misrepresent the value of that good. Market prices, arising from the aggregated behavior of well-informed buyers

and sellers, do not estimate an exogenously determined worth of the exchanged commodity. Instead, the worth of a commodity has become inseparable from the esteem attached to it by the trading parties. More than inseparable, its worth is *defined* by the intensity of that esteem or need; Jevons’ marginal utility analysis of market equilibria premises that valuable things are, by definition, the things that we want. Moreover, they are valuable because we want them and are more or less so in accordance with the strength or weakness of our desire. As simply a collective expression of this desire, market prices become an infallible indicator of worth.

CONCLUSION

I suspect that any earnestly attempted cost-benefit analysis of the mathematization of economic reasoning, would, for a variety of interesting but hardly germane reasons, soon become self-defeating and uninformative. Nonetheless, the preceding discussion has identified at least one apparent pro and con of mathematization. To Jevons' credit, his differential calculus of utility enables him to uncover three conceptions of value where Smith saw only two. Moreover, his mathematical notation deftly characterizes the precise relationship between these conceptions; namely, between a commodity's total utility, marginal or final degree of utility and ratio of exchange. This characterization would serve as a reference point, if not a stepping stone, for subsequent theorists conducting similar marginal analyses of other important economic concepts, such as productivity or cost. Jevons pioneered a method of reasoning that now undergirds almost all of economic thought.

To achieve such precision, however, and simultaneously maintain that his quanta of utility represent some actual human motive, rather than a merely handy construction, Jevons identifies market behavior with an excess of pleasure over pain in the mind of the consumer. This identification, combined with the stipulation that the value of a commodity is most correctly conceived as its ratio of exchange with another, leaves no room for thought of a true value other than that indicated by the market. Whereas Smith's market price was kept from converging to the good's true, labor-commanding value by the scarcity of the good or the intensity of consumer desire for it, Jevons' market price *is* the true value of the good since there is no other available measure of its worth. Smith was willing to countenance the value of a good as an objective but practically unmeasurable reality. This enabled a cautious skepticism about the accuracy of market prices, since whether they truly represent a good's real value is a question plagued by the irresolvable uncertainty of measurement error. While this particular uncertainty was exorcised by marginal utility analysis in the name of scientific integrity, the cost of cutting that aporetic tension could be as large as it is unquantifiable.

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