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Opportunity cost: beginning, evolution and a much-needed clarification

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Abstract

Having found discrepancies in the definitions of opportunity cost in a few textbooks, I started disinterring its beginning and evolution. The journey, for over two years now, has resulted in this paper. It works along two related lines: i. It makes significant corrections and some additions to received knowledge regarding the beginning and evolution of the concept of opportunity cost. Frederick von Wieser is normally credited with having birthed the concept. The scholars who I credit with shaping and slowly building the concept are Cantillon, von Thünen, Ricardo, Mill, Patten, Macvane, Green, and Davenport, among others in the foundational phases. Further, the LSE scholars have worked extensively on the applicability issues surrounding the concept. Even in the past two decades, scholars have conducted surveys to gauge the level of understanding of the opportunity cost concept among economists, and proposed clarifications. ii. Based on the edifice of opportunity cost so constructed, I propose a schema for calculating it in a way that imbues it with conceptual rigor.

Keywords: opportunity cost; pedagogy; evolution; economic thought

JEL Classification: A2; B19

Opportunity cost: beginning, evolution and a much-needed clarification[1]

Sheetal Bharat[2]

"*[T]hings are thus*
because other things were so,
and that things having been as they were,
things could not now be otherwise than they are"

--- Davenport 1894, p561

I. Introduction and outline

The concept of opportunity cost is high up in the list of the most important concepts in the field of economics, together with scarcity and incentives, which are both related as well. It is a shame therefore that Buchanan found it necessary to say that "[a]lmost all professional economists, old and new, can provide a rough working definition of opportunity cost that is tolerably acceptable [sic] for pedagogic purposes. But very few economists, new or old, have been consistent" (1973 p14, in Buchanan & Thirlby 1973). This stinging indictment is as correct now as it was when he wrote it. The concept comes with a wide range of definitions and explanations in texts, classrooms and scholarly works, but a full understanding of what it includes, and the range of contexts where it can be gainfully employed is largely missing. Microeconomics texts are inconsistent with the definition of opportunity cost, and unclear on its relationship with explicit, implicit and economic costs. Teachers in undergraduate classrooms may provide genuinely meaningful examples of opportunity cost calculations but are unable to relate it with other topics taught in the course. The notable exceptions to this rule are when the teacher is explaining the concepts of zero economic profits in perfectly competitive markets, and comparative advantage in international trade.

[1] This paper was presented at the INET-YSI Virtual Plenary, History of Economic Thought Working Group, on 13th November 2020. I thank the participants for their comments. I thank Dr Alex Thomas and Dr Ajit Sinha for their suggestions on the draft. I am thankful for research assistance from Ms Tess Kurian, Ms Namitha V, and Ms Dhanusha Prabhu. This work is dedicated to the first batch of students to graduate from the Bengaluru Dr B R Ambedkar School of Economics University, who also motivated this research question.
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Being a concept that is introduced to to-be economists and other scholars and professionals rather early in their economics education, this lack of consistency is worrying. My search for clarity led me to want to dig into the early thought that gave birth to, and later debates that caused the evolution of the concept. Frederik von Wieser is credited with having proposed this concept[3] (Robbins 1934 p22, in Buchanan & Thirlby 1973, Bradley 1981 p33, Boettke and Leeson 2003, Parkin 2016, p14); but a study of his works (1888, 1891, 1892, 1927) to look for the first formal definition of opportunity costs was unsuccessful. It is also admitted that the concept, though proposed by him, was popularized among English speaking scholars by David Green, Philip Wicksteed, Herbert Davenport, Frank Knight and Hubert Hendersen (Robbins 1934 p22, footnote 3, in Buchanan & Thirlby 1973). These works lead to other contemporary works where value-related discussions were slowly but decisively giving shape to the concept. Frequent references to earlier classical scholars revealed to me that the true birth of the concept of opportunity cost does not lie in the works of von Wieser (1888).

The London School of Economics Essays on Cost[4] (Buchanan & Thirlby 1973) further sharpened the definition by stressing the critical angle of subjectivity. That said, by the own admission of one of the editors of the volume, those works, written by various scholars associated with the London School of Economics and Political Science over four decades, did not have a great influence on the way the concept of opportunity cost was to be employed (p12). In addition, after that publication, and all the way till 2005, there has been no theoretical work on understanding opportunity costs for several decades, though problems with its use have been many.

Ferraro and Taylor (2005), in a paper that brings the concept of opportunity cost back into focus, share the results of their survey meant to assess the understanding of the concept of opportunity cost among economics professionals at the Allied Social Sciences Association conference in the United States. They are disturbed by their findings: the correct answer to their opportunity cost question was chosen, among four alternatives, by the smallest proportion of the respondents. Further, the distribution of responses among the alternatives might as well have been uniform, so indicating that there was no consistent pattern in the incorrect answers chosen.

[3] I thank Prof Ajit Sinha for making this suggestion to me – it helped me get started with this disinterment.
[4] I thank Prof Uskali Mäki for suggesting this vital resource to me at the 43rd Annual Economics and Business History Society Conference at the University of Jyvaskyla, Finland, from 30th May to 2nd June 2018, where I presented a preliminary draft of this paper.

These, to me, were adequate motivating factors for wanting to study the beginning and evolution of the concept of opportunity cost and propose clarity. Based on this search, and based on a clear listing out of the features that make the concept, I go on to propose a schema that explains the various dimensions that can be, and often consciously or sub-consciously *are* considered in any decision-making process – whether economics or non-economics related. This framework then puts into perspective some definitions that appear in texts. I believe this framework will bring clarity to classroom discussions and bring to the fore the immense potential that this concept has in explaining human decisions – the *raison d'être* of economics.

II. Pedagogy as motivation

Having indicated the centrality of the concept of opportunity cost in the discipline of economics, I now motivate this area of research citing the inadequacy with which it is discussed in a wide range of undergraduate economics textbooks.

A study of the definitions of a concept as foundational as opportunity cost in undergraduate textbooks causes confusion – not a good sign for any discipline. All 15 textbooks consulted agree with the basic definition of opportunity cost: value of the next best alternative, or the amount of one good given up for acquiring another, or value of the best alternative foregone. Some of them give a graphical description by clarifying that opportunity cost can be measured as the slope of the budget line, or slope of the production possibility frontier (Varian 1995; McEachern & Kaur 2016; Stiglitz & Walsh 2006; Nicholson & Snyder 2012; Case, Fair & Oster 2014). Fewer of them specify that opportunity cost is a subjective concept, and only exists in the mind of the decision-maker, only at the time of decision-making (Buchanan 1991, McEachern & Kaur 2016, Stiglitz & Walsh 2006, Gwartney *et al* 2014). One classic and popular text does not mention opportunity costs at all (Koutsoyiannis 2017).

The disagreement, though, comes in an important respect: the relation of opportunity cost with economic, implicit and explicit costs. Within this discussion, there seems to be consensus on the equation: economic cost = explicit costs + implicit costs. As long as the concept of opportunity cost is not brought into the lexicon, there is consensus. Some authors equate opportunity cost with economic cost (McConnell, Brue & Flynn 2009), some equate it

with implicit cost only (Hirschey *at al* 1996, Gwartney *et al* 2014), some equate it with both economic and implicit cost (Besanko *et al* 2005, Tandon 2015), and still others say that all costs are opportunity costs (Pindyck & Rubinfeld 2013, McEachern & Kaur 2016).

It is instructive at this point to consider an example from some of the most popular undergraduate economics textbooks currently in use. Gregory Mankiw's *Principles of Microeconomics* (2017) and Samuelson and Nordhaus' *Economics* (2017) offer similar examples. Mankiw, in an attempt to calculate opportunity cost of going to college, adds up the tuition fee that a person pays if they go to college, with the earnings they would have if they had taken up a job instead. This suggestion seems flawed because it adds up the numbers associated with two events that cannot possibly occur together – the decision under consideration and the alternative: the fact, and the counterfactual. This paper is an attempt to find a conceptually rigorous alternative to this peculiar but common practice.

III. History of thought on opportunity cost

As with any foundational concept in any discipline, opportunity cost has a long and interesting history, which does not seem to have adequately come out in the literature. The economics scholarship commonly attributes the foundation of the concept of opportunity cost to the Austrian school, specifically, to Frederik von Wieser (1888)[5]. While it is certainly true that von Wieser made contributions towards its construction, the works of scholars who wrote before and after him are too important to not receive notice. This section charts the evolution of the concept of opportunity cost from its first tentative and hesitant appearance in written work in the eighteenth century, on through the various versions in debates it has engendered through the nineteenth century, and finally to the applicability discussions in the twentieth. Even these past two decades in the twenty-first century have seen revisionary proposals that continue to challenge scholars and add nuance to our understanding of opportunity costs.

The works of the mysterious Richard Cantillon inspired physiocratic and classical scholars in many of the fundamental aspects of economics analysis. Thornton (2007, Cantillon 2010) proposes conceivably and surprisingly for the first time that Cantillon was the first scholar to ever write about the opportunity cost concept, though the name Cantillon

[5] Though Potter and Sanders (2012, p249, footnote 1) claim that it is "commonly" attributed to John Stuart Mill.

gave it was *intrinsic value*[6]. Cantillon's work dates to 1733 (though published under a pseudonym, posthumously, in 1755) – a century and a half before any of von Wieser's works. That said, there have been questions raised on the validity of Thornton's translation. Groenewegen (2012) and Menegatti (2016) cast doubts on the quality of the translations and the technical interpretations by Thornton (2007).

Nonetheless, a more unassuming translation (Essay on the Nature of Commerce, n.d.) conveys the idea. In Chapter 7 of Cantillon's *Essai*, Cantillon discusses the pay that a handicraftsman would expect to receive if he went for an apprenticeship to train in the handicrafts: conceptually comparable to Mankiw's example of a student considering college. The point Cantillon probably makes here is that the handicraftsman, at the end of his training, must earn more than the husbandman "in proportion to the time lost in learning the trade". This suggestion comes because he points out that the boy, from a reasonably young age starts helping the father in the fields. Since the father would lose the services of the son at home and on the farm, there must be a compensation in terms of higher wages – a consideration of alternative use of time seems to be influencing the handicraftsman's expected pay.

von Thunen, about a century later, seems to have also suggested something along the lines of opportunity cost considerations when choosing between silviculture and dairy farming (von Thunen 2009). He considers the lost revenues from dairy farming if the land was given over to silviculture, and so justifies the importation of timber (p112).

It is obvious that these suggestions were tenuous and still far from the modern definition of opportunity costs. What is required, feasible and achieved in this paper is a sequential build-up of the concept of opportunity cost from these vague early suggestions to the full modern conception.

Tens of scholars in the late eighteenth and early nineteenth centuries were grappling with England's biggest socio-political problem of class interests and political control – the Corn Laws. In their search for an explanation for high rents and high grain prices, they employed the opportunity cost concept.

The explanation: it was not high rents that caused grain prices to be high (and so for the industrialises to be unhappy with the landlords, but in fact, the direction of influence was opposite. An increase in the demand for grain caused an increase in prices. The increase in the price of grain made it feasible for poorer quality land to be brought into cultivation –

[6] Cantillon's original work is in French. The English translation by Saucier (Cantillon 2010) uses this term.

indeed, the increase in demand *necessitated* the bringing of more land under cultivation. That this new land was of poorer quality meant that it required more labour and capital than better-quality land to produce the same amount of grain. This higher expense reduced the profits the poorer-quality lands enjoyed. But under free competition, it should not be possible for adjacent plots of land catering to the same market to afford different rates of profit – arbitrage will naturally bring about an equilibrium. Ricardo suggests, in the natural-laws language of his age: "rent immediately commences" (1817, p55). As poorer-quality lands are brought into cultivation, rent accrues on land of better quality – thus adding an element to their costs and bringing profits down in line with the new land. If any current tenant is unwilling to pay the new rent, the owner will have no trouble finding someone else to work the land. Rent will rise to the point that makes any new tenant indifferent between the two options of (i) cultivating the new poorer-quality land, and (ii) paying a rent to cultivate the better-quality land. This explanation is drawn equally from Anderson (1777), Ricardo (1817, p54) and Mill (1865, p257).

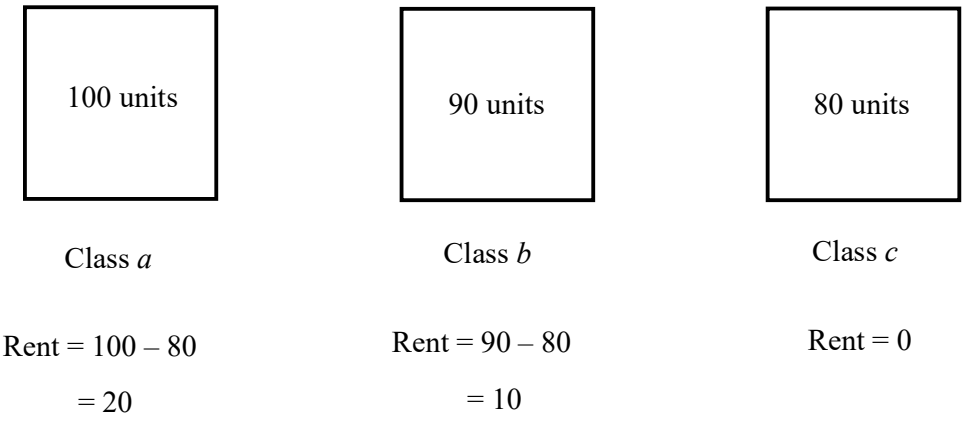
Now to bring the discussion quickly back to opportunity costs – where are the opportunity costs in the above discussion of rents? The calculation of the new rent accruing to better-quality land is based on the next best alternative available.

> When, in the progress of society, land of the second degree of fertility is taken into cultivation, rent immediately commences on that of the first quality, and the amount of that rent will depend on *the difference in the quality of these two portions of land* (Ricardo 1817, p54; emphasis added).

The suggestion is that cost does not simply depend on the intrinsic qualities of the tract of land itself or the monetary expenses incurred in working it, but its relative productivity compared with the least productive tract in use. In Ricardo's illustration (p55) tract numbers 1, 2 and 3 produce 100-, 90- and 80-units worth of grains respectively, net of what is required to sustain labour. If only number 1 is in use, then all the produce of 100 units belongs to the owner-cultivator. If the demand for grain increases enough for tract 2 to be brought into cultivation, then the value of tract 1 increases, because it is more productive. The rent will manifest such that the second cultivator will be indifferent between (i) cultivating tract 2 without paying any rent, and (ii) cultivating tract 1 and paying a rent of 10 units to the owner. While the profit on the two tracts of land are equalised, the rent collected by the owner of tract 1 is greater because it is more fertile than tract 2. It has certain "original

and indestructible powers" (p50) which tract 2 does not, and which warrant rent. The amount of this rent is determined by the difference between the produce of each plot of land and the produce of the least productive plot of land in cultivation employing an equal amount of labour and capital (p59). The least productive plot of land in cultivation does not enjoy any rent, because it is not scarce; it does not possess any advantages compared with any other resources currently in use. There is no opportunity lost in using it.

Illustration 1: Ricardo's example (1817, p55)



A further clarification Ricardo provides of the fact that the least productive plot of land in use decides the rent on all other plots follows (p59):

> "The exchangeable value of all commodities, whether they be manufactured, or the produce of the mines, or the produce of land, is always regulated, not by the less quantity of labour that will suffice for their production under circumstances highly favourable, and exclusively enjoyed by those who have peculiar facilities of production; but by the greater quantity of labour necessarily bestowed on their production by those who have no such facilities; by those who continue to produce them under the most unfavourable circumstances; meaning---by the

> most unfavourable circumstances, the most unfavourable under which the quantity of produce required renders it necessary to carry on the production."

This elaborate extract brings into focus the comparison between the productivity of the tract of land under consideration and the least productive tract of land in use – the alternative that decides the magnitude of rent. This notion of a comparison with an alternative was not something that was accepted as a method of understanding the level of rent that applies to a tract of land. It was not applied to other aspects of economic analysis.

The international economist is well aware that Ricardo's idea of comparative advantage, in all modern texts, employs opportunity costs as an explanatory tool. How then can it be suggested, as it seems above, that Ricardo only dimly illuminated the idea of opportunity cost? Bernhofen (2005) suggests, mostly accurately, that Ricardo based his illustration of comparative advantage on the labour theory of value. He used labour time to assign value to the alternative goods a country could produce. It was Haberler, over a century later, that reformulated Ricardo's theory of comparative advantage using opportunity costs, thus dissociating it from the discredited labour theory of value, and "laid the conceptual foundation for modern trade theory" (Bernhofen 2005, p1). As Haberler himself said, his reformulation of Ricardo's theory of comparative advantage permits it to retain its "analytical value and all conclusions drawn from it are preserved" (p1).

There is also an adequately clear reflection of an appreciation of opportunity costs in Ricardo's chapter *On Foreign Trade*. It is true that he uses the lens of the labour theory of value – the dominant thinking of his age, but he uses it to suggest what alternative product the labour and other factors of production can produce. "[T]he value of all foreign goods is measured by the quantity of the produce of our land and labour, which is given in exchange for them" (1817, p146). When predicting the pattern of trade and specialisation, he says "it would be advantageous to [Portugal] rather to employ her capital in the production of wine, for which she would obtain more cloth from England, than she could produce by diverting a portion of her capital from the cultivation of vines to the manufacture of cloth" (p150). Here, the focus is on the alternative that can be produced – the heart of the idea of opportunity cost, rather than on the resources employed. A further substantiation of Ricardo's contribution to the concept of opportunity cost in his comparative advantage model will follow a little later in this chronology.

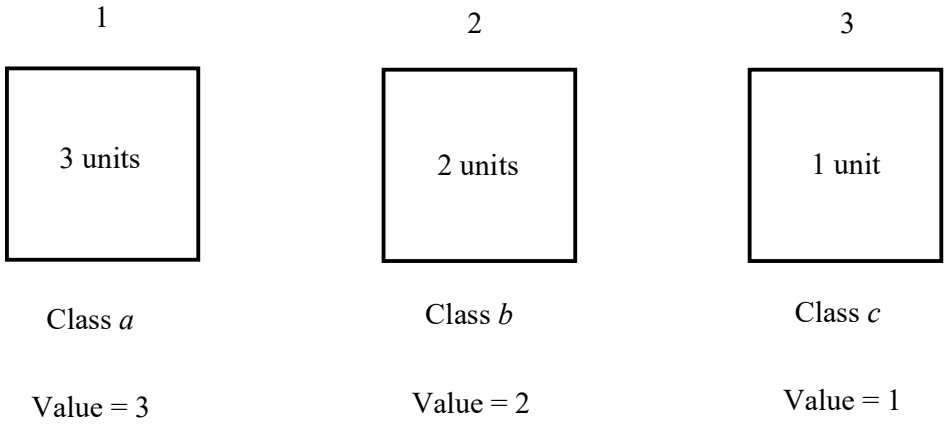
von Wieser built on top of what Ricardo had proposed. In a statement that almost appears a paraphrasing of Ricardo's explanation for exchange value presented above, von Wieser says that "[p]roduction goods which are capable of being employed in several ways receive their value … from the value of the least of their products, the production of which is economically permissible." (1888, p171).

The appearance of similarity between von Wieser's and Ricardo's examples hides a minor difference. A little clarity will help unentangle their respective contributions to the construction of the opportunity cost concept.

Ricardo's example is already illustrated. A comparable explanation of von Wieser's (p171) example follows:

> "Assume that, in a productive stock of the class *a*, the item put to the most insignificant use gives a product of [3], every item in the stock will have the value of [3]; every item of the class *b* has the value of 2, if the marginal productive contribution of the class be 2, and every item of the class *c* has the value of [1], if the marginal productive contribution amounts to [1].[7]"

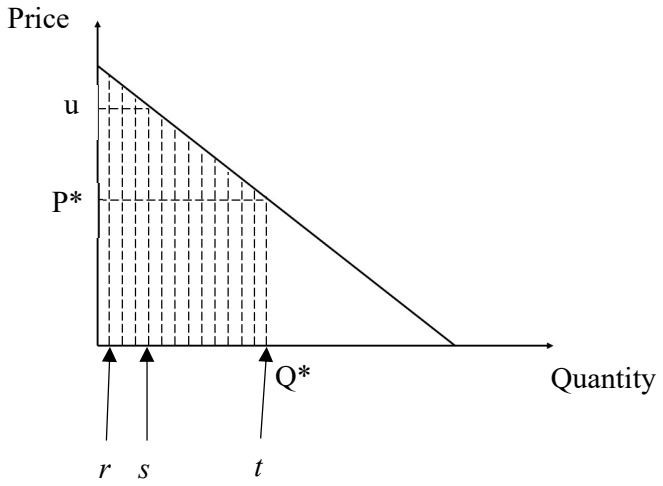
Illustration 2: von Wieser's example



[7] von Wieser makes a strange decision to label what appears to be the worst quality of the productive resource as Class *a*, and the best as Class *c*. I have taken the liberty of switching them around, partly to avoid cognitive dissonance, and partly to facilitate comparison with Ricardo's example.

von Wieser says here that the value of all tracts of land belonging to the same quality class will be the same; and this value will be determined by the least productive use to which a tract of land in that quality class is put. This is in mild contrast with Ricardo's example, where he showed that tracts of land of differing qualities earn differential rent determined by the least productive tract of land in use. It is easy to see that these are both hinting towards the same general idea, though von Wieser's example affords a slight generalisation that Ricardo's does not.

Illustration 3: A marginal willingness to pay-explanation for value of a resource



von Wieser's position can also be explained using the marginal willingness to pay-interpretation of the demand curve. The idea is that there is enough of the Class *a* resource available to serve only the first say, 20, purposes arranged in decreasing order of earnings potential. These available 20 units of the Class *a* resource will be employed by the highest bidders. The highest bidding buyers are most likely to be the buyers who expect the greatest return from their employment of this resource. In *Illustration 3*, the units of the Class *a* resource are on the x-axis, and the prices that different actors are willing to pay for them are on the y-axis. The y-axis can also be said to measure the expected earnings from use of this resource, because that is what dictates willingness to pay. Given that there are only Q* units of the resource available for sale at the price P*, they are all purchased by users who expect

to earn the most. The last unit of the available resource is purchased by a user who expects to earn P* from their use of the resource in project *t*. Project *t* is the least productive use of the Class *a* resource, and this is what dictates what all other users pay for it also. "This value attaches equally to all similar articles … of a productive stock, even to those which are actually employed in more remunerative ways" (p171). There are other uses to which this resource could be put, but they earn less for the user than P*, and so these users are pushed out of the market. von Wieser offers another similar example of this comparison in his 1927 work (p101) employing bridges and the iron used to construct them.

Davenport (1894, p568) gives another explanation for *Illustration 3*:

> [I]f price falls, the marginal producer will cease production, but it remains to ask why this producer ceases production when price falls. The fact is commonly not that market conditions afford him no remuneration in this line of production, but that *greater remunerations are possible elsewhere*. [emphasis added]

The markets discussed in the two examples are different, but the logic remains. In von Wieser's context, this quote can be understood to mean that if the price of this Class *a* resource was to rise, then some of the current participants in this market would exit it. They would find that their resources can be better employed elsewhere. Davenport's example brings the above discussion nearer the opportunity cost concept though only in the context of the marginal participants in the market. von Wieser's argument is that the value of the resource for all the users of it is dictated by the least productive use of it that is feasible. It is as if saying that instead of using my unit of this resource for project *s*, if I had used it for project *t*, I would have earned P* only, and not *u*. So P* is the opportunity cost of me taking up the project *s* – it is the earnings I might have received had I undertaken the alternative project, *t*. This alternative earnings potential holds for all uses of the resource that are part of this market.

A question may well be asked: why should all the participants in this market choose that specific marginal project *t* to compare their chosen projects with? Why can the user employing the resource for project *r*, not consider project *s* as the alternative? Here von Wieser appears inconsistent. In different parts of his tome, his choice of words suggests different answers to this question. Variously, he suggests that:

- the basis for evaluating costs due to a resource should be the least productive use to which it can be put (1888, p171);
- or that "the value of *all "cognate" products*, without exception, is incorporated" (p174, emphasis added);
- or that the "productive process … costs exactly as much as the value which the material and labor required would have produced if rationally applied" (1892, Sec. 6);
- or the almost confusing claim that "[c]osts *are production goods* when these are devoted to one individual employment, and, on account of *their capacity of being otherwise employed*, take the shape of outlay, expenditure" (1888, p174, emphasis added).

Without delving into the task of deciphering this last statement, or achieving harmony among the four, it may yet be said that von Wieser brought to light an important way of looking at all variety of costs.

The most important aspect of the concept of opportunity cost is that it requires comparison with an alternative: cost is not intrinsic to a decision or task but is derived from that which is given up – the alternative. Ricardo employed this idea for the purpose of ascertaining the value of land – rent, and his calculations were based on varying qualities of the soil[8]. von Wieser employed it more widely – to ascertain the value of any productive resource. In von Wieser's own words (1927, p85):

> If we examine Ricardo's theory of rent again, we shall see that he correctly recognized in the special case of land and the cost of its cultivation the marks of the specific position [varying quality] and computation of costs. The significance of the contrast, however, is not exhausted in the theory of ground rent; it extends to all fields of the computation of value and the determination of prices.

Silas Macvane is sharp in his criticism of von Wieser's idea that the value of a thing depends on alternatives foregone – "[t]hat way of looking at cost seems to me to verge on the fanciful" (Macvane 1893a, p22). "When you try to grasp [cost], to attach it to a real

[8] As suggested earlier, Ricardo's idea of comparative advantage also used opportunity costs, and this angle is further explained by Patten – discussed below.

commodity, and to measure it as a definite tangible quantity, it eludes you, and retires to the region of the might-have-beens" (1893a, p269).

Macvane has a pointed justification for his critique too (1893b, p267):

> If we enquire as to the cost of coats, we are referred for answer to the value of wool for making blankets, carpets, etc. If we enquire as to the cost of blankets, we are in turn to think of the value of wool for making coats, carpets, etc. But what of the cost of coats, carpets, *and* blankets, and all other articles made of wool? If we must use the value of the rest to express the cost of each, how are we to express the cost of the whole group?

This critique from Macvane derives from his view of cost as something that ought to be seen as a social construct, rather than something a business person must grapple with. He was certain that cost, properly considered, must be seen as the total exertion by society, and this was the "economic or scientific view" (1893b, p14). von Wieser's conception of cost was, he believed closer to the entrepreneur's narrow view: he was clearly attempting to ascertain the cost of a resource in the process of production. This concern that Macvane has is addressed by Green just the following year, but a full understanding of the process of evolution of the concept of opportunity cost warrants a brief postponement in that discussion.

Macvane firmly adhered to the Classical labour theory of value: only he added to it the element of time. The process of production, in this age, had become complex enough that the fruits of labour in most enterprises could not be expected to be reaped immediately. Labour and waiting, he believed, were the only two factors that were to be considered as adding to cost: "[n]othing more is needed" (1893a, p18-19).

Simon Patten, whose intellectual leanings in this debate are distinctly Austrian, was able to bring some clarity to von Wieser's slightly confused ideas regarding the frame of reference in opportunity cost calculations. He also made clear that Ricardo's explication of comparative advantage was not the special case that the scholarship had understood it to be[9],

[9] It is counterintuitive and has generated considerable debate ever since it was published, even though Ricardo, in 1817, was far from being the first to propose the idea. As Bernhofen and Brown (2018, p230) point out, Henry Martyn, in 1701, was the first to propose, in contradiction to the dominant mercantilist thinking of the age, that imports rather than exports could contribute to national wealth. Smith (1776), Torrens (1808) and Ricardo (1817) later elaborated on Martyn's idea. Jacob Viner, in 1937 (p440), gave this idea the name, the eighteenth-century rule.

but just another instance of Patten's own interpretation of opportunity cost (though this term was not yet in use).

Patten proposes two main conceptual tools[10] – 'interference in consumption' and 'effective utility'. Interference in consumption is what a producer faces when deciding to put down her resources towards production. Instead of using her time to work on production, she could have spent the time consuming some goods she owns, or enjoy leisure time. The act of production is to be carried out in the face of an availabile opportunity for consumption. This, Patten terms as interference in consumption: he also calls it sacrifice (Patten 1893b, p36 onwards), which brings this concept quite near opportunity cost. As an example of the subjectivity of the interference in consumption-component of cost of production, he presents the picture of a wealthy individual who has resources in plenty. This person would face a high interference in consumption, if she were to participate in any productive activity. A person who has nothing to lose faces no interference in consumption. For this reason, he also calls it an "index of prosperity" (p46).

This concept of interference in consumption, says Patten (pp43-44), fully explains Ricardo's special result regarding comparative advantage.

> "The well-known doctrine of Ricardo makes international trade an exception to the general law that value depends upon cost of production. … Foreign trade, however, is no exception … . The apparent exception is due to the fact that, in foreign trade, cost is used [mistakenly] in the sense of disagreeable exertion [alone], while in domestic commerce it is made to include both the cost due to disagreeable exertion and the sacrifice due to interference in consumption."

Using the idea of interference in consumption, Patten is able to view the idea of comparative advantage through the lens of opportunity costs. This completes the promised validation of the claim that Ricardo plays an important role in the construction of the concept of opportunity cost.

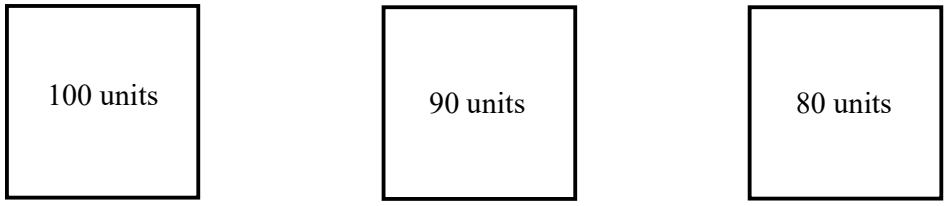
Turning now to the second conceptual tool employed by Patten – effective utility. Patten credits John Bates Clark (1887, p78) with having proposed the notion of effective utility, but Patten presents it significantly clearer. He distinguishes between positive and

[10] Two are chosen here to focus on the issue at hand, among a wide range of concepts.

effective utilities[11]: positive utility is the subjective estimate of the total enjoyment from consumption of a good, whereas effective utility is the difference between the enjoyment of one good and another available alternative. The following example shows that opportunity cost, as used in calculating land rent in Ricardo's example is in fact the negative of Patten's effective utility.

Ricardo's example is carried forward in *Illustration 4*, by calculating the opportunity cost of using each tract of land. The opportunity cost of using tract 1 equals the 80 units that might have been earned by working tract 3, the least productive plot in use. The opportunity cost then is what might have been earned minus what is currently being earned. Since tract 1 is the most fertile, the net opportunity cost is negative.

Illustration 4: Ricardo's example revisited



Class *a*	Class *b*	Class *c*
Revenue = 100	Revenue = 90	Revenue = 80
OC of using 1 = 80*	OC of using 2 = 80*	OC of using 3 = 80*
Net OC = 80 – 100 = – 20	Net OC = 80 – 90 = – 10	Net OC = 80 – 80 = 0

* The opportunity cost in each case is 80 units because that is the produce of the least productive tract of land currently in use.

[11] Where Clark distinguished between absolute and effective utilities.

Now Patten's effective utility is the difference between the gains from two alternatives. So the effective utility from tract 1 would be 100 – 80 = 20, that for tract 2 would be 10, and for tract 3, it would be 0. It is clear that effective utility is the negative form of opportunity cost. This also addresses the problem that von Wieser left in his various works regarding the appropriate frame of reference in opportunity cost calculations: the comparison needs to be made with only one available alternative; not several, not all possible alternatives.

An additional contribution from Patten is that he slightly widened the uses to which his effective utility (by extension, opportunity cost) concept may be put. He uses it in the context of labour, not as a factor of production, but as a supply side decision-making problem: a worker who has several options available will be able to demand higher wages, because there is a greater chance that some of those options are well-paying, and so her effective utility from her best option might be high. A worker with limited skills and so limited employment opportunities will probably have relatively few, and low paying options, thus reducing her effective utility from her best option (Patten 1893b, p58).

Since the range of circumstances in which this concept could be productively employed had been increased, the frame of reference needs to be clarified afresh. Ricardo and von Wieser seem to have suggested that the comparison should be with the least productive resource in their context of calculating the value of a factor of production. Since Patten has expanded the range of situations where the concept of opportunity cost can be applied, it needs to be stated now that the frame of reference is the next-best alternative that the relevant decision-maker has. This suggestion is based on Patten's example; Patten does not himself use the term next-best alternative. This is now a penultimate step in the direction of the modern conception of opportunity costs.

Green, I believe, completes the construction of the edifice. Not unimportantly, he is the first scholar to use the term opportunity cost – in his 1894 paper titled *Pain-Cost and Opportunity-Cost*.

Though Ricardo and von Wieser did mention that in the case of scarce resources, costs must be computed in a certain way, Green makes scarcity the starting point of his discussion (Green 1884, p220). "The day is short, life itself is short, one's powers are limited, and one's possessions are seldom as large as he would like" (p223). He believes that most situations that are to be studied by the economist involve scarcity of resources; and in an

environment of scarcity the pain or disagreeable exertion involved in production cannot possibly matter in ascertaining value. This had long been a point of contention between the Austrian and Classical scholars.

Green cites the example of a scientist who is to deliver a lecture. If her remuneration was to be determined by the pain involved in delivering the lecture, then it is possible that she might receive nothing at all, because it might have been a pleasure for her to prepare for and deliver the lecture. Based on this, and several other examples that we can see around us, it is adequately clear that remuneration does not depend on the pain involved in labour. If we take now an example of a sweeper or drain cleaner, it is more realistic to imagine that the remuneration to low skilled workers must be determined by the other ways in which they might have chosen to spend their time. These tasks are common, and several such opportunities may be available. The remuneration that the sweeper can demand will depend on the earnings she expects in other employment opportunities that she has access to. "[M]ore fruitful opportunities in other directions" (p219) may be used to bargain for better remuneration in the employment under consideration. The scientist, similarly, may be in a position to demand remuneration on the basis of the next best use of her lecture time, whatever it may be.

> By devoting our efforts to any one task, we necessarily give up the opportunity of doing certain other things which would yield us some return; and it is, in general, for this sacrifice of opportunity that we insist upon being paid rather than for any pain which may be involved in the work performed (p222).

This quote finally completes the construction of the concept of opportunity costs. These very explanations continued to be elaborated on by Davenport (1894, 1902 and 1908), Fetter (1915), Knight (1928), Wicksteed (1933) and Stigler (1941) – which shows that the main work of (re)construction was complete by 1894.

Green also proposes applying this clearly defined concept to a wider range of applications, which Patten, before him, had just begun to attempt.

> Not only time and strength, but commodities, capital, and many of the free gifts of nature, such as mineral deposits and the use of fruitful land, must be economized if we are to act reasonably. Before devoting any one of these resources to a particular use, we must

> consider the other uses from which it will be withheld by our action; and the most advantageous opportunity which we deliberately forego constitutes a sacrifice for which we must expect at least an equivalent return (p224).

Note here that Green extends the scope of analysis to even "free gifts of nature", possibly with the understanding that unrestricted use will lead, at some point, for these resources to become scarce, and so not free anymore. This is a very forward-looking idea for someone the late nineteenth century.

Green even responds, convincingly it may be added, to Macvane's critique of von Wieser's suggestion of using alternatives to assess value[12]. Regarding Macvane's comment that von Wieser's proposal relegates costs "to the region of might-have-beens", Green assures the reader that "such is the very nature of costs … . These opportunity-sacrifices must always have the unreal character of might-have-beens, but they come near enough to existence to have the controlling influence over objective exchange values" (p224). With this statement, again, Green hits at the very heart of the idea of opportunity cost by pointing out that even though it requires an account of the counter-factual, a seemingly tough task for the average thinker, it nonetheless is an exercise that is engaged in subconsciously by every decision-maker in every circumstance, to the best of their knowledge and ability. This is obvious from the range of disciplines in which researchers have employed this concept in the last half century[13].

Green, it turns out, was not alone in arriving at this complete picture of the workings of the black box that is human decision-making. Davenport (1894, p563), parallelly, makes a bold and powerful claim which is indeed borne out in research and observation:

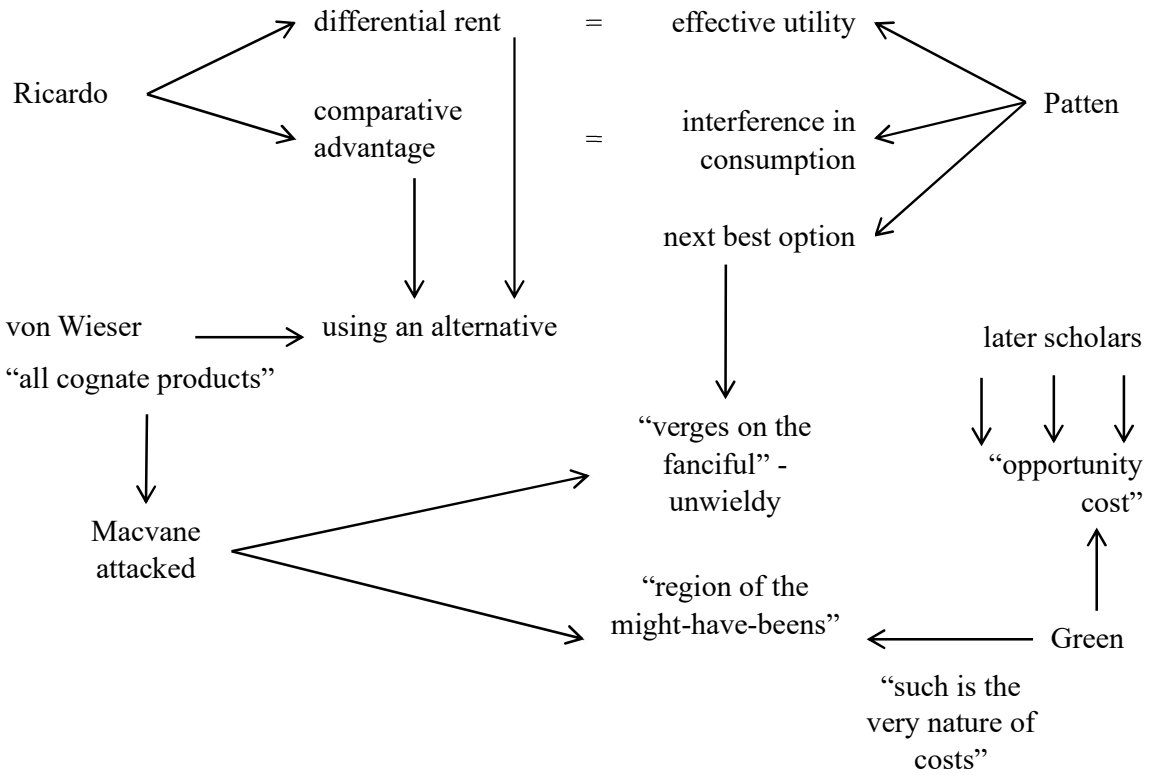
[12] Macvane's other comment, regarding the aggregation problem of the opportunity cost concept does not receive as convincing an answer. Green claims (1894, p228) that Patten (1893a) discusses this issue in depth, but I am unable to locate this explanation. Green says that at the national level there are no lost opportunities. I am unconvinced: even at the level of the entire country, when all productive resources, and all possible economic activities are considered, the availability of productive resources still falls short of what would be needed for all possible economic activities. At the level of the entire country, each decision that is made must still choose between alternatives and give up some of them. Just because one individual has given up activity, there is nothing that guarantees that someone else will choose it. Someone else sure may, in which case, it will drop out of the national level opportunity cost calculation; but this is not necessary.

[13] It has been employed in papers about storage of resources in plant tissues (Chapin et al 1990), biodiversity conservation (Norton-Griffiths & Southey 1995), allocation of mental processes (Kurzban et al, 2013), use of US Senate floor time as political capital (Kelly & Pevehouse 2015), study of forest management to reduce deforestation (Plumb et al 2012), aside from the many economics contexts.

> Economic activity, whether of the pleasurable or the painful sort, may be stated in terms of sacrifice. … The economic problem can accordingly be stated as the minimizing of sacrifice. This formula includes not only all the phenomena commonly regarded as belonging to economic science, but also many classes of phenomena not ordinarily so regarded … . The underlying law of economics is thus found to be identical with the primary law of metaphysics, physics, and sociology, viz., that *force follows the line of least resistance*. [emphasis added]

This completes the construction of the concept of opportunity cost by tens of scholars over at least a century and a half. By the very end of the nineteenth century a sequential build-up over extended discussions among scholars brought out the elements at play in decision-making.

Illustration 5: Evolution of the concept of opportunity cost



This concept came to be broadly accepted in the early years of the twentieth century, together with the increasing Austrian influence on mainstream economic thinking. Nowhere is this influence more apparent than in the *LSE Essays on Cost* (Buchanan & Thirlby eds. 1973), which is a collection of essays written through the middle half of the twentieth century.

The methodological individualism of the Austrian school of economic thought shines through the volume as every contribution stresses the subjectivity of opportunity costs.

> Cost is not something which is objectively discoverable … ; it is something which existed in the mind of the decision-maker before the flow began, and something which may quite likely have been but vaguely apprehended. … The available alternatives cannot be said to exist unless the person making the decision is aware of them. (Thirlby 1946, p139)

In his substantiation of the subjectivist notion of opportunity cost, Thirlby adds another reason: since the alternative that has been given up in any instance of decision-making time does not occur, it can never be observed. Its value, which is the opportunity cost, can never be understood by any individual other than the decision-maker at the moment of decision-making (p182). Opportunity cost is a matter of opinion and judgement, not of accounting and knowledge (pp140, 178).

Buchanan (1973, p14), Coase (1938, p109), and Thirlby (1946, p160, in Buchanan & Thirlby eds. 1973) point out that opportunity cost is essentially an *ex ante* concept that is meant to assist in decision-making. As soon as the decision is made, the cost is immediately incurred. All flows of resources in accordance with that decision do not indicate costs anymore, but only flows of resources "under standing orders" (Thirlby 1946, p174, in Buchanan & Thirlby eds. 1973). This is in contrast with the practice of cost accounting, which is essentially an *ex poste* exercise, recording nominal expenses already incurred. Coase firmly claims (1938, p113; Edwards 1937, p81, in Buchanan & Thirlby eds. 1973), for this very reason, that modern cost accounting practices cannot possibly yield opportunity costs; the practice of cost accounting is not meant to consider the future revenues that may be earned through alternative use of available resources.

Coase (1938, p103, in Buchanan & Thirlby eds. 1973) also points out that it may not always be possible to represent opportunity cost in monetary terms because "courses of

action may have advantages and disadvantages which are not monetary in character, because of the existence of uncertainty and also because of differences in the point of time at which payments are made and receipts obtained". That said, Robbins asserts that opportunity costs cannot be measured in terms of the quantity of a good, the production of which is given up when the production of another good is decided upon. It must be understood in terms of the *value* of that quantity of goods to the decision-maker (Robbins 1934, pp25-6, in Buchanan & Thirlby eds. 1973), which, again, is essentially subjective.

While the works of the earlier thinkers brought to light a theoretical explanation of the decision-making process of the human brain, these later scholars, who carried forward the theories to the world of applicability, seem to be throwing a wrench in the works. Buchanan protests (1973, p13, in Buchanan & Thirlby eds. 1973) the absence of a full appreciation of the subjective opportunity cost concept in economics textbooks. Specifically, he points out that Coase's (Austrian and so subjectivist) critique of Pigou's (objective) notion of marginal social cost, though widely appreciated and applied, has not influenced the academic discussions adequately:

> the standard chapters on cost in … textbooks remain as if [a] fundamental critique [of the Pigouvian conception of social cost] in the Coase paper had never been published. … One reason perhaps lies in the fact that the critique of orthodoxy is too fundamental. … How can we write the elementary textbooks and teach the elementary course if we cannot draw the standard cost curves?" (pp12-13).

That the textbook discussion of opportunity costs is inadequate is already shown, but it is yet to be accepted that this inadequacy leads to others.

The absence of a deep enough discussion of the subjectivist notion of opportunity cost has resulted in the unhindered development and deployment of the profit maximisation rule, which, the LSE scholars point out cannot possibly be adhered to: the desired equality between marginal revenue and marginal cost (Thirlby 1952, p205; 1960, p280, Wiseman 1953, p238, in Buchanan & Thirlby eds. 1973). Given that costs are highly subjective, ephemeral, and may not be represented in monetary terms, how is one to ascertain if the rule is satisfied? A further reason reflecting the removed-from-reality nature of the rule is that the decision-maker may only be one administrative entity in a business operation that is made of several departments, each with their own decision-makers. It is improbable that the rule,

even if it were satisfied at the level of one department will also be satisfied at the level of the entire enterprise.

This is not to suggest that the marginal revenue-marginal cost rule has no base in logic and no place in application. The logic of the rule is unencumbered by criticism. Decisions in several businesses and other human endeavours seem to play out *as if* the rule were being followed. In cases where inefficiency or impropriety are apparent, the justification is easily given by pointing out a violation of this rule. The criticism comes in the area of applicability and whether the rule can be employed *ex ante* to guarantee efficient decision-making.

While the LSE scholars have highlighted the limitations of mainstream cost theory, their proposals were not easy to heed for researchers who are looking for quantifiability, which has come to occupy an increasingly central position in twentieth and twenty-first century economics scholarship.

This need for quantifiability has led to opportunity cost being measured in terms of interest forgone in several research papers, and it has been left as a vague presence in several others. The range of meanings given to the term would have been an embarrassment to the discipline of economics, had the LSE scholars not emphasised the subjective nature of opportunity cost. That said, these same applications may still be a cause for concern due to the narrowness of definition.

Three papers in the last two decades, starting with Ferraro and Taylor (2005), bring an understanding of the concept of opportunity cost into question. Based on the broad range of answers chosen to what appears to be a straight-forward opportunity cost question, the authors are despondent in their conclusion that unless the fundamentals of the discipline are taught with thoroughness in the classroom and discussed adequately in textbooks, the system of education will continue to churn out scholars and practitioners unable to carry out simple analyses and make meaningful contributions to public life.

Potter and Sanders (2012) and Parkin (2016) point out that the results of the 2005 survey are not such as to warrant concern at all for two reasons: the question may not have been structured as well as needed, for the purpose at hand; and the concept of opportunity cost really is ambiguous. Potter and Sanders embark on a tour justifying each of the four answer options, and so absolving respondents of all blame. Their point about the concept of opportunity cost is that it may be represented as a net measure or a gross measure, either of which can be considered correct. Given that the end purpose of any exercise assessing

opportunity cost is to arrive at a decision, using either type of opportunity cost measure does not matter, as long as the corresponding benefit calculation is consistent (*Table 1*, p251).

The *net* measure of opportunity cost

= Benefit that may be derived from the next best alternative available

- any expense involved in choosing that next best alternative

The *gross* measure of opportunity cost

= Benefit that may be derived from the next best alternative available

+ any expense involved in choosing the best/preferred option

Parkin, while agreeing with the basic position of Potter and Sanders regarding opportunity cost ambiguity, disagrees with the reason. His explanation, though less thorough mathematically, is more refined conceptually. He shows evidence from twentieth century scholarship to claim that *two definitions* of opportunity cost are in fact current (p12): one that uses a *quantity* of goods forgone measure, and the other that uses a *value* of goods forgone measure. This is a nuance that Potter and Sanders missed, and they deal only with the value measure of opportunity cost and the multiple ways in which it can be described. Parkin, while not going into the accounting of opportunity costs, concludes that the quantity measure of opportunity cost is better and more direct because it is easier to work with.

These three relatively recent papers on the subject show the continued relevance of research in the history of economic thought, specifically because the definition is contested.

IV. Schema for ascertaining opportunity costs

I believe this sequential build-up of the concept of opportunity cost has left us with an adequately full sense of how we should be thinking about it today. It is by now clear that opportunity cost is just the name that economics gives to a process that is employed most naturally and almost subconsciously in the minds of decision-makers. In any case, it is

certainly not a completely new way to make efficient decisions; just a much-needed elaboration of a rather natural human process. What follows then is exactly that: a complete picture of what opportunity cost is composed of. This will enable a comparison with and evaluation of the way in which it has been used in economics textbooks.

Firstly, an important aspect must yet be clarified. So many undergraduate economics textbooks use the terms implicit costs, explicit costs, economics costs, accounting costs, opportunity costs, and, what is worse, their relations with each other vary markedly. It is therefore easiest to start on a clean slate.

There are two ways to look at the cost of any activity or decision (even if the decision is to not act or the act is to not decide): (i) direct cost that is to be measured in real terms: in terms of the resources expended; and (ii) the opportunity cost that is to be measured as the alternative uses that may be made of those expended resources (or the subjective values of those alternative uses), had they not been expended on the activity under consideration.

The list of these resources that should form the basis of cost analysis comes from a common appreciation of what resources people have at their disposal that are scarce: money, time, owned goods and energy (Hornik 1996, Hamilton *et al* 2018, Williams *et al* 2016, 1993 Dollahite & Rommel, Rettig 1993, Winterhalder 1983). These four dimensions of direct costs are outlined with some examples:

i. When a person decides to purchase a good, she must spend money on the purchase. This is the first and most obvious element in direct costs. This will be measured in units of currency.

ii. She will probably also spend some time researching on the best brand to purchase and the best mode of purchase – online, local shop, mall, *etc*. The time element will also enter into the analysis as time that will be spent on the activity if this particular decision is made: the time she will spend reading this book that she is considering buying, or the time she will spend driving this car she is considering buying, or the time she will spend constructing this home, once she purchases the land, *etc*. The time cost of an activity will be measured in terms of hours or days or years, as the case may be.

iii. In deciding on a course of action, some goods already in the ownership of the decision-maker may be used up. Since these are scarce resources that may cease

to exist or cease to be useful any more or wear out with use, they must count as a direct cost of the course of action. In deciding to cook dinner at home, instead of eating out, all the ingredients that will be used in the preparation must count as direct costs. If a machine owned by the decision-maker is being considered to be used for production of a commodity, then that machine will no longer be available for production of other commodities, and, in addition, will begin to wear out. These costs cannot be measured in any specific unit, but must be acknowledged nonetheless. An observation to be made here is that goods owned by the decision-maker must be put to some use at some point: they cannot be hoarded, unused. So considering them as a direct cost of undertaking a course of action may seem like giving in to the sunk cost fallacy. This would not be entirely accurate. If the owned good may be used in multiple ways, it must be considered as one of the direct costs of a course of action. A sunk cost is indicative of zero opportunity cost, at least along this one dimension.

iv. Some activities warrant a great deal of energy, like walking to the store, working on a research paper, or caring for a child. The energy under question may be physical, emotional, intellectual, or cognitive. In any case, this cost is difficult or impossible to measure cardinally. Yet, for the purpose of comparison across courses of action, an ordinal ranking may be possible.

Note that the above are all things in the context of which the English language uses words like *spend* or *use*, or even *waste*, if the decision has been a poor one.

These are direct costs which are *not* what this entire paper till now has been about. This paper is about opportunity costs – that is, the opportunities our decisions cause us to lose. That element is to be built on top of those mentioned in the above list, and - this is important to acknowledge - cannot be ascertained unless the direct costs are listed and measured (or at least ranked). In what alternative way could the decision-maker use her money, time, owned goods, and energies? This category of costs is opportunity costs. Direct costs are our *scarce resources we spend* towards an activity. Opportunity costs are the *opportunities we lose* because of an expenditure of our resources on the activity under consideration. These are two alternative views of cost: while they may be considered parallelly, they may not be summed.

The following table presents a schema for evaluating direct and opportunity costs in any circumstance under consideration, given some identifiable alternative.

Table 1: A proposed schema for identifying /measuring costs

Activity under consideration	Activity A	
Next best alternative	Activity B or inactivity	
Dimension:	**Direct costs:**	**Opportunity costs:**
Money	Measured in units of currency	Alternative uses of the money
Time	Measured in any unit measuring time	Alternative uses of the time
Owned goods	No specific unit of measurement; just a count of the goods used	Alternative uses of the owned goods
Energy	No unit of measurement, though ranked alternatives may be useful	Alternative uses of the energy
Conclusion	A similar calculation must be made for activity B (may be with activity A as the alternative). If the total value to me of the elements in the opportunity cost column is less in this table than in the activity B table, then I should choose activity A. Since scarcity of money, time, owned goods and energies is assumed, these values will all be non-negative.	

Note: The two darkened cells are the ones that textbooks seem to generally consider – a discussion on this issue follows.

There are two observations to be made at this point, that will conceptually align this schema with earlier scholarship.

The first observation is regarding the evaluation that the LSE scholars had placed on the opportunity cost concept as a tool for one individual to check the efficiency of a decision made by another. They had said that it could not be done, given the subjectivity involved. This schema, I believe, may help create consensus by providing a format for documenting that very subjective thought process before arriving at a decision. Of course, it still is true

that the subjective value attached to some elements in the opportunity cost column may still give cause for disagreement.

A second observation is regarding the two methods of accounting for opportunity costs that Potter and Sanders (2012) proposed. It is not difficult to align the present schema with their terminology of net and gross measures of opportunity cost. The information required to ascertain the *net* opportunity cost – any direct expense associated with the alternative – is not available in this table, but could be ascertained by comparing this table with another such table prepared for activity B, considering activity A as the alternative. The difference between the opportunity cost column elements in the activity A table and the direct costs elements in the activity B table would be what Potter and Sanders refer to as the net measure of opportunity cost[14]. Even if we were not immediately interested in this concept of net opportunity cost, this second table may anyway be needed to arrive at a decision based on a comparison of opportunity costs.

The concept of gross opportunity cost needs a small explanation before matching with the present schema. Potter and Sanders propose the adding of the would-be benefit from the alternative use of the resource with the expense involved in the chosen alternative. This would be akin to adding the contents of the two boxes highlighted in *Table 1*, if we assume that the would-be benefit is the opportunity cost of time. They, in addition, assume that money and time are the only scarce resources, and all costs are measured in currency. These assumptions are not valid: this point is discussed further below.

A few examples are considered the appendix to illustrate ways in which this schema might be populated and how the final decision might be arrived at.

One anticipated critique of this schema, together with the elaboration in the appendix is that the scarce resources mentioned – money, time, owned goods and energy – or some subset of them may be used as a package and so it is superfluous to mention them separately. For instance, in the case of buying a plot of land (*Table A2*), it is the same alternative activity or set of alternative activities that define the opportunity cost of both time and energy. The alternative activity of buying an automobile would involve all dimensions. In other circumstances, it is easy to list activities that simultaneously account for the use of

[14] This process (of carrying out a mathematical operation between the elements in an opportunity cost column and those in a direct cost column) is not directly useful in the current schema. Technically, it is not incorrect to do this because the comparisons will be between aspects of the same activity, B. It is mentioned here to show a consistency with earlier works.

money, time and emotional energy, or of money and goods, or of any other combination of dimensions. Far from taking away from the validity of the above analysis, these instances strengthen the necessity of identifying alternative activities independently under each of these four dimensions, properly and explicitly permitting repetition. Leaving out any one of these from the schema presented here for identifying costs would indicate that that dimension need never be considered under any circumstance, and that would make the analysis incomplete in at least some circumstance.

The research on opportunity cost neglect may also appear to take away from the legitimacy of the proposed schema (Moche *et al* 2020). Several behavioural experiments have established that decision-makers tend to ignore some opportunity costs of their decisions. This is not entirely accurate. Opportunity cost is defined as an essentially subjective phenomenon that takes place in the mind of the decision-maker at the moment of decision-making. At that moment, whatever alternatives come to the mind of the decision-maker are considered. If a particular way of framing a question modifies the set of alternatives that are within the range of consciousness of the decision-maker, this does not indicate that her previous decision was incorrect or that she has neglected opportunity costs (Robbins 1934, pp25-6, in Buchanan & Thirlby eds. 1973).

V. A discussion

With this schema at hand, I now carry out a sample evaluation of one popular undergraduate economics textbook, the one written by Gregory Mankiw of Harvard University, and then proceed to clarify some terms and concepts noted in sections I and II.

Mankiw (2017, pp5-6) adds up the direct money cost of going to college – tuition, and living expenses in excess of what they would have been otherwise – with the opportunity cost of the decision-maker's time – earnings foregone from employment (also on p141 in another example involving a painter, Samuelson & Nordhaus 2017, p174 do exactly this as well, as do Ferraro and Taylor 2005 and several other scholars). The reason he probably feels justified in making this addition, is that both are measured in terms of money. Yet, the schema proposed here shows that there is a fundamental problem with adding a direct cost in terms of one dimension, and the opportunity cost in terms of another. In an analysis of costs,

one may either consider all direct costs as a package, or all opportunity costs together. To mix them in any combination at all is to fundamentally confuse the subject.

Another justification for Mankiw's curious addition is that he might consider that one type of cost serves as a proxy for another. If the direct cost of money serves as the proxy for the opportunity cost of money, or if the opportunity cost of time serves as a proxy for the direct cost of time, then it may be considered okay to sum them up. This explanation, though, is a stretch, and any evidence for it is hard to come by in the text.

Accountants are roundly criticised for failing to consider anything but the direct money cost of an action – the first box. And then the undergraduate economics text goes ahead and mentions the opportunity cost of time as a factor that an astute and forward-looking economist must add to the work of the narrow-minded and backward-looking accountant (Samuelson & Nordhaus 2017, p175). The economist, though, most often, has not been astute enough to distinguish between the direct cost measured in terms of as many of the four scarce resources as is relevant, and the opportunity cost of using them.

This leads into an exercise in unentangling the several terms used in cost discussions in textbooks – explicit, implicit, economic, accounting, and opportunity costs: a ghastly excess.

Explicit costs are most akin to the concept of direct costs that I have employed in section IV, but there is an important difference. Explicit costs, in common parlance, are strictly meant to be measured in units of currency alone. Direct costs, as I use the term, are necessarily to be measured in terms of the dimension under consideration. Depending on the scholar, it may be that explicit cost is what figures in the very first box in the proposed schema, which is also the same as accounting cost. But if one looks at the meaning of the term 'explicit', it is possible to argue that it best describes what I have, in fact, referred to as direct costs.

Implicit costs are trickier to understand. As the Oxford dictionary definition suggests, these costs are not obvious, though the costs are essentially linked with the activity or decision under scrutiny. They involve the counter-factual, like opportunity costs. In fact, several textbook authors consider opportunity costs and implicit costs to be identical. Given the dictionary meaning of the term implicit, it is clearly akin to the term opportunity cost as defined in the schema. The point here is that this cost is not obvious but needs to be discerned after considering a counter factual.

These discussions have now yielded a problem. Standard economics textbooks say that economic costs = explicit costs + implicit costs. If explicit costs are like what I call direct costs, and if implicit costs are like what I call opportunity costs, then this implies that economic costs are a sum of direct and opportunity costs. This is clearly incorrect, because the schema shows that direct and opportunity costs are *alternative* ways of perceiving costs: they are substitute measures of cost. They may be studied parallelly but may not be summed. This conflict manifests because explicit and implicit costs take incomplete views of the cost scenario. Explicit costs only consider direct money costs. Implicit costs, most often, only consider the opportunity cost of money or time. Whether the implicit cost refers to an opportunity cost of money or time, it is in any case added to the explicit cost to arrive at a complete sum. The explanation for this is the error scholars make in assuming that all costs measured in units of currency may be summed.

In conclusion, direct costs and opportunity costs are justified in claiming full capability in handling cost theory. Even accounting costs are just a subset of direct costs – those measured in terms of money. A full analysis, though, requires the consideration of all scarce resources at the disposal of the decision-maker, and the opportunity costs associated with each.

The schema presented in this paper opens itself to two levels of subjectivity. The first comes in because of the alternatives that happen to be within the range of view of the decision-maker at the point of decision-making time. Framing effects may alter the decision, and this is something that this explanation of cost theory permits. The second comes in because the values attached to the same set of elements in the opportunity cost column may vary by personality type or time of day. Neither of these two is a reason for embarrassment. The process of human decision-making *is* complex. This paper sheds light on exactly how it might be happening, and how it may be employed with benefit in complex scenarios.

Policymaking can be an area where this schema can be employed in a way that respects the democratic process by maintaining an open analysis of all direct and opportunity costs. If the use of the concept of opportunity cost in academia is cleaned up, the rest will follow.

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Appendix:

Table A1: Purchasing a smart phone

Activity under consideration	Purchasing brand A mobile phone	
Next best alternative	Purchasing brand B mobile phone	
Dimension:	**Direct costs:**	**Opportunity costs:**
Money	15,000 (price of brand A) – 12,000 (price of brand B) = 3,000 units of currency	Fungibility of money makes it difficult to precisely identify an alternative use of 3,000 units of currency. It will be whatever the marginal use at the hypothetical, alternative point of decision-making time happens to be.
Time	I will be spending just as much time with brand A phone, as I would have with brand B. No time cost involved here.	NA
Owned goods	NA	NA
Energy	The physical energy used is negligible. Purchase of brand A phone, may better assist my intellectual efforts because of a better processor.	NA
Conclusion	If the total value to me of the elements in this opportunity cost column is less than the total value to me of the elements in the opportunity cost column in the table prepared for brand B phone, then I should choose A.	

Table A2: Purchasing land

Activity under consideration	Purchasing a plot of land to construct a home on	
Next best alternative	Continuing with a rented accommodation	
Dimension:	**Direct costs:**	**Opportunity costs:**
Money	The interest to be paid on loan + cost of construction of the home – rent paid for the apartment (all measured for the same duration) = x units	Given that money is fungible, the exact alternative use of the money is difficult to ascertain, but it would be the marginal activities undertaken through various points in the next few years.
Time	2 hours per day for 2 months to finalise on a plot + 1 hour per day for 2 years of planning and constructing a home = ~ 820 hours spread over two years	The opportunity cost of 820 hours spread over two years could be routinely spending more time with family, contributing more to work, or several of the marginal activities that the person may want to undertake.
Owned goods	Almost all owned goods would find a new home, but they will not get consumed. So, NA.	NA
Energy	There will be a good deal of all kinds of energy spent in the process of purchasing a plot of land and building a home.	Alternative use for any unused physical energy could be home work, following a fitness regimen, or any other marginal use of physical energy. Freed up emotional energies may be lavished on relations, or a career.
Conclusion	If the value to me of the elements I am giving up by buying a plot of land is less than if I continued with a rented accommodation, I should buy the plot of land.	

Table A3: Attending college

Activity under consideration	Enrolling for a postgraduate degree	
Next best alternative	Entering the labour market	
Dimensions:	**Direct costs:**	**Opportunity costs:**
Money	200,000 / year in tuition + 10,000 / year for living expenses (in excess of what I would have spent had I entered the labour market) * 2 years = 420,000 units of currency	420,000 units of currency would have earned 8% interest: 33,600 units of currency (assumed simple interest)
Time	Most of my waking hours for 2 years	If I had entered the labour market with most of my waking hours, I would have earned 360,000 units of currency / year * 2 years = 720,000 units of currency (It is possible to suggest that this money might have earned an interest, but it might also have been spent in other ways).
Owned goods	NA	NA
Energy	Studying for a postgraduate degree would undoubtedly demand a high investment of intellectual and cognitive energies, but whether or not these would be greater or less than those required for the employment alternative, would depend on the nature of that employment.	If in fact the energies used in the college degree were greater than in the employment, then alternative use of those energies would be listed here.

Conclusion	There are two observations to be made: (i) is the same as in the earlier examples: if the total value to me of the elements listed in the opportunity cost column is less than in any other case, then I should go to college; and (ii) is more nuanced, leading from the fact that this table is about costs, which are more obviously short-term. The benefits of education are expected in the long-term. A more wholesome approach will be achieved by bringing into consideration the net present value of the long-term benefits.

Table A4: Participating in a protest march

Activity under consideration	Participating in a protest march about issue A	
Next best alternative	Staying home	
Dimensions:	**Direct costs:**	**Opportunity costs:**
Money	500 units of currency for creating posters	The alternative use of the money would be the marginal activity that would have been undertaken.
Time	Tentatively 6 hours on one day. In case of arrest or other complications, uncertain.	The alternative use of 6 hours could be sleeping, working, blogging, or any other marginal activity.
Owned goods	While participation in the protest march itself may not cost me in terms of my possessions, depending on the political nature of issue A, my rights over some or all my possessions may be at stake.	If indeed my ownership of some or all my possessions is at stake, then this cell will be heavy in content.

Energy	The physical energy that will be used in sloganeering, marching, *etc*. Emotions, in addition, would be a primary reason for participating in a protest march.	Alternative use for any unused physical energy could be home work, professional work, or any other marginal use of physical energy. If the person does not participate in a protest march, their emotional energies already invested in politics may be used in blogging, or other political activism, or they may just withdraw and conserve their energies.
Conclusion	If the total value to me of the elements in the opportunity cost column is less than in other cases, I should participate in the protest march.	

Table A5: Government selling coal mining rights

Activity under consideration	Government considering auctioning coal mining rights	
Next best alternative	Invest on renewable sources	
Dimension:	**Direct costs:**	**Opportunity costs:**
Money	Money would be earned, not spent	NA
Time	There is no difference in the time spent on planning the sale or investment on renewables. So NA.	NA
Owned goods	The area of the mines would be lost. If we may consider clean air as a good possessed by the government and the people, then that is likely to spoil in quality if the coal is mined and burned.	If the government did not auction off the coal mines, it might have retained the land for any other use that does not involve the extraction of coal.

Energy	This is to be seen as a personal quality. So, NA	NA
Conclusion	The only consideration here is that the government could own the mine themselves and use it as they deem fit, and so prevent it from being used irresponsibly from the climate perspective. If they value this opportunity less, they will sell the mine. This is where public pressure may have an impact on how the government assigns value to the climate.	

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