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EDITURA ASE

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Abstract: The notion of 'opportunity cost' has been neglected in economics. The reason is that any such measure of cost is invisible, unobservable, and untestable. Yet the so-called 'competitive ideal' in neoclassical theory is based on claims of decreasing returns and substitutional tradeoffs in production, consumption, and social relations, and therewith an exclusive focus on scarcity in economics. Within this view, collusion is suspect: it raises prices, reduces sales, and so harms social welfare. This is the baseline emphasis of neoclassical microeconomic theory. The opportunity costs of this framework involve a significant loss of perspective on actual economic phenomena, the potential value of which may far exceed that of orthodoxy. The unbounded character of economic effects suggests an analytical bound derived from our rational limits, since we cannot see the full range of outcomes stemming from our decisions: planning horizons so enter this scene. The paper describes the horizonal theory that would have emerged from the 1930s debates on cost had Hicks not walked away from increasing returns and had Hirshleifer not promoted a false 'rescue' endorsed by Alchian in 1968, declaring decreasing returns 'a general and universally valid law.'

Keywords: planning horizons, substitution, complementarities, competition, cooperation

Introduction

This paper is meant to address some rather uncomfortable implications of where neoclassical economics has failed us due to proponents' stubborn insistence on substitution assumptions across all realms. Where competitive frames – based on substitution assumptions – are imposed in complementary settings to which they do not apply, then this misapplication of models employed outside their relevant domains simply yields pathological outcomes in our social behavior and cultures. If so, the legacy of neoclassical theory in its enduring dominance as economic orthodoxy has wrought destructive effects that are invisible to that approach.

There is a long history here to be summarized at the end, but first we look at some seldom-acknowledged aspects of opportunity cost as an economic concept, after which we introduce some real-world characteristics not often noted or included in neoclassical analyses. Next, we expose some implications raised that are more effectively incorporated into economic analysis through a systems approach, or at least within a network conception. Additional implications of the fully interdependent domain of economic consequence involve an embrace of our rational limits and their role as an analytical boundary between anticipated effects and their ongoing repercussions. Each of these issues can then be expressed in terms of three essential elements of economic understanding: atoms (the realm of physical things); bits (or intangible goods); and wits (horizon effects), to show why substitution ought to be seen as a narrow special case in a world dominated by complementary economic connections. This discussion is followed by a historical look at diminishing returns and substitution assumptions, and how they have never been well-established for anything other than short-term production in which certain input factors can be treated as fixed. The paper ends by summarizing what has been said and by stating conclusions.

The notion of opportunity cost

The notion of opportunity cost generally appears in introductory textbooks of economics, defined as 'the value of the next-best foregone alternative to what one chose to do.' But when we proceed through the textbook to the actual estimation of costs – at least if our introductory text treads into any such close relation to real-world derivations – what we find is a different notion of cost derived from adding up prices for required input factors used to produce final goods, based on a claim that those input prices reflect true 'opportunity costs' when put to some other purpose. But that is not true opportunity cost. Let us consider why.

First, the impact of actual opportunity costs cannot be observed or measured empirically, as they comprise something we chose not to do. Consequently, the opportunity costs of whatever we actually chose inhere in the realm of what didn't happen and thus they remain invisible. But an accurate physical description of what we chose not to do is insufficient to assess opportunity cost; to properly evaluate the welfare effects of what we didn't pursue requires that we know what these unexplored options would feel like to wear, which is another daunting challenge.

The point is that any assessment of opportunity cost rests on theory; we project what these unfathomed options will look like and feel like to wear only in our imaginations, based on theories of how the world works.

So, opportunity costs arise from some model of how reality ought to respond to our actions. For example, in all our received doctrines, competition is viewed as efficient; the opportunity cost of any competitive system is collusion, which 'we all know' will restrict output through higher prices for greater profits. So, we advocate competition in every sphere of activity, based on a view that such is the best way to assure optimality in outcomes and social welfare results. We don't really question this claim, based on neoclassical theory and the assumptions on which it rests. There is no reason to doubt the claim within this cognitive framework; it is consistent with all we know, as an 'established Truth.'

So, opportunity costs are illusory; they reflect a theory of choice in which what we forego is only imagined and never experienced, in its real outcomes and normative value. But if opportunity costs are theoretically based, then we may need to consider a range of alternative frames and how they impact these costs, so as well our relative valuation of alternative options. If some other theoretical outlook carries quite different implications about the options we face, then perhaps we should revise our intentions in a different direction. But that, in turn, calls for a more openminded approach to theory choice than is found within neoclassical circles, where any diversion from orthodoxy is penalized or resisted as simply inadequate understanding instead of as an invitation to learn from multiple models in all their diversity (e.g., cf. Reder 1982, p. 19; also, Leontief 1982, p. 105). In this setting, which should be open and welcoming to new learning endeavors, dogma and rigid doctrine prevail at the expense of new thought. This is an important aspect of the opportunity cost of neoclassical economics, as further explored below.

The nature of real-world phenomena

The world as seen through a neoclassical lens is partial and thus partitionable, so composed of what are taken to be functionally independent parts that aggregate together into a larger composite entity whose macroeconomic effects stem from microeconomic components. The whole economic process seems to unfold much like a clock in its structural elements, as assembled into an operational whole. All pieces are reversible, and choices are made freely by individuals without attention to

temporal limits, others' intrusions, or any bounds in knowledge. All decisions in production, consumption or even social policy are assumed to be like those occurring in neighborhood stores, where all options are known and transparent and nothing is left to chance. We wander among the shelves, converting a limited budget to its highest value by choosing our very best options within what we can afford, guided by our rational incentive to be as well off as we can. Consumption is seen as an end in itself, while production decisions seek maximum profit. Our social policy choices are more complex, but they are treated as similar in the way they are represented. Choices are made for the best in all cases, where outcomes are judged as superior simply because they were chosen.

The problem with this conception is that it dodges the real-world complexities of a totally interdependent universe in which all we do ripples enduring effects outward onto everything else forever. In this world, treating our impacts as independent misrepresents the reality of the outcomes set in motion by the decisions we make. Every one of us interacts with and thus is wholly embedded in a social and ecological context; to ignore what we like to call 'externalities' – treating them as special cases standing outside our regular frames – simply works to blind us to all larger implications.

We inhabit a world irreversible in time and complexly interactive in its scope of effects; to sidestep these specific connections will leave us unable to consider realistic outcomes of our decisions, with their unbounded spread of impacts whose full extent we can never anticipate. These are realities that demand a systems approach or network conception of social and economic behavior. To characterize our world as inherently separable and decomposable involves a dangerous misunderstanding of how things actually work, and thus an opportunity cost arising from confusion about our results, both in their depiction and normative value.

Substitution and complementarity in network conceptions

Systems theories have long been resisted within orthodox circles, due to reasons unclear to anyone with an eye to realistic conclusions. Ecologists understand the problem; one of their basic conditions is that the ecological system is interactive and unpredictable in its spreading effects. The problem is that any economy operates in the same way, despite how most economists model it as if its elements were independent from the rest of its parts. There are important phenomena neglected

due to a bias against the unbounded interdependence of the whole system as a dynamic process.

One informative way to look at whole systems that may be more tractable is to consider a transportation network as a proxy for a fully interdependent system. Within a transportation network we find both parallel and end-to-end linkages, which can be characterized as substitutes and complements, where relations are 'either/or' and 'both/neither' in their respective usage. Within this system, traffic moves across the network in complex configurations: one agent's substitutes are another's complements, depending on direction of travel and how complex tradeoffs are faced. The important point is that two types of interdependence are involved in this situation, not one: substitution is inextricably tangled up with complementarity, yielding two alternative forms of institutions suggesting efficiency.

Substitution calls for competition as efficient, while complementarity advocates cooperation (collusion) as efficient. However, if any network captures substitutional and complementary interrelations in a composite tangle that cannot be decomposed in obvious ways, then we face a dilemma of institutional choice. In neoclassical economics, this problem is adroitly avoided through assumptions of substitution, such as within the 'industry' concept where the institutional answer is packaged into how the question is framed: 'industries' are defined as populations of substitute products. But that answer has obscured the interplay of actual interdependencies in any real economy as a dynamic, complexly interactive framework of social behavior and ecological impacts. The network conception – which works as a proxy for a complex system – identifies and incorporates two types of interdependence, not one: substitution and complementarity or, in a systems language of feedback control loops and time delays, negative vs. positive feedbacks as balancing vs. reinforcing influences on effects. Substitutional (negative) feedbacks suggest that neoclassical assumptions of independence are legitimate, because 'externalities' – as they ripple outward from their immediate source – also attenuate to insignificance. As Krupp (1982, p. 390) put it: 'Axioms of independence … lead directly to the laws of substitution… Independence means that the behavior of the elementary unit can be described without reference to the behavior of other units.' But with complementary (positive) feedbacks, the opposite holds true since 'externalities' – as they emanate outward – amplify as they spread, meaning that they cannot be ignored; indeed, they are an essential part of the process to which we attend in our theories. To the extent that complementarity is important or has an impact on our

systems analysis, we must adopt and embrace a holistic conception of how any economy operates or functions. As Gunnar Myrdal (1978, pp. 772-74) put it:

> There is no one basic factor; everything causes everything else. This implies interdependence within the whole social process. And there is generally no equilibrium in sight. One important aspect of this process is that most often, although not always, changes which are reactions to a more primary change tend to move in the same direction. … This is why circular causation may have *cumulative effects*. Through feedback regularly causing more primary changes to have repercussions *in the same direction*, the results for good or ill may, after some time, be quite out of proportion to an initial change impulse… (original emphasis)

The role of rational limits in any interdependent domain

The problem with any acceptance of a fully interdependent system where every action instigates effects spreading outward forever on everything – at least as an operating assumption more realistic than independence – is that if real outcomes are wholly unbounded, how might we conceptualize such phenomena within the epistemological limits of our rational anticipation? Here our rational limits constitute the analytical boundary [1] of our understanding. Let us call this the horizonal limit of our range of knowledge, within a concept of 'planning horizons' which capture our accurate expectations of the results of actions taken. In other words, every decision we make contains an H* reflecting how far ahead in time and around us in social and ecological space we are able to project correctly all the expected outcomes. The full extent of our planning horizon in any specific context is thus defined by surprise, in those moments or realms where real outcomes diverge from what we expected. We will address this notion further.

Herbert Simon (esp. 1982-97) introduced us to 'bounded rationality' and its economic importance, although an unboundedly rational *homo economicus* still holds sway in neoclassical theory. In this sense, the planning horizon can be considered a formalization of Simon's key concept, while 'horizon effects' (an ordinal shift of planning horizons, which can be private or social, as such changes occur in concert, called 'interhorizonal complementarity') suggest an entire range of phenomena unfold to understanding outside of the neoclassical lens. One might consider the time dimension of any such shift as treating 'run length' as a variable, but the point here is really that a longer time-horizon is achieved through a broader understanding of phenomena in all dimensions of experience. If so, the more

encompassing notion is the planning horizon, which spreads across time and space (both social and ecological) as an ordinal index of 'conscience' in our behavior. This horizonal theory unfolds into an ethical economics.

What is the impact of planning horizons and horizon effects? The first place to look is at pricing decisions: the setting of prices for profit maximization in neoclassical theory is readily characterized by $P^* = M^* \times E^*$. Then the impact of horizon effects on prices can be shown because longer horizons shall lead to reductions in both M^* and E^* and thus in P^* as well. [2] But that analysis solely addresses an individual price setter, and so ignores the interrelationships among price setters in a larger economic context. How might we frame that issue?

In an 'industry' setting, we just characterize firms as interacting with substitutes, but any such dodge only looks at one side of the two-sided coin of interdependence in a network context or a systems setting. We can consider the net interdependence of any one member in any group of price setters thus. Here the one firm (or product) on which we are focused operates within a surrounding group of firms producing substitutes and complements for that firm's product. But those producing complements have very different preferences with respect to that firm's price than those selling substitutes. Substitute producers seek a higher price at that firm as that will shift sales to their substitute products, while purveyors of complementary goods want a lower price from that firm. Consequently, looking at the difference between own-profit P^* and joint-profit P' maximizing prices for any member's product yields an index S_I of the net interdependence of all firms in any group with respect to one member or product, where: $P' = P^* + S_I$. This will give us a way to measure and think about the relationship between an agent and any group, beyond the 'industry' concept.

What we are framing is an indeterminate balance of substitution and complementarity within any composite group with respect to one member thereof. The question turns to how that balance of interdependence is affected by a shift in planning horizons or 'horizon effects.' This question has a general answer: horizonal growth (private or social, as they both move together) renders a shift in the balance of interrelations away from substitution and in favor of complementarity, if we assume that planning horizons move in concert through 'interhorizonal complementarity.' The difference of own from joint profit maximizing prices in this context is stated by S_I, as an index of net substitution within that relationship. If so,

then $S_I > 0$ means that group is dominated by producers of substitute goods; $S_I < 0$ means other members are mostly complementary and thus seek a lower price. The point being made here is that longer horizons reduce S_I and may shift it from positive (substitution) to negative (complementarity). The derivation of this relationship is shown in a footnote below. [3] The intuitive argument is that the successful extension of people's horizonal range (either private or social) shifts their relations away from conflicts toward concerts of interest, so will lead to greater alignment of personal goals with social concerns. If so, horizon effects will matter.

The argument above means that longer and more extended planning horizons shall lend to reductions of conflict and greater consilience in society. But how do we engineer our social incentives to foster horizonal growth, as a means to more efficient production as well as to more robust conscience inculcated into our social culture? That is the question of our age, one that has never been posed within neoclassical theory because substitution assumptions have blocked the reason for any such query: this is an important part of the opportunity costs of this stolid doctrine. It has a one-sided view of interdependence, ignoring complementarity, at a high cost to our understanding. Furthermore, the proper answer to how we encourage horizonal growth will contravene some much-favored doctrines.

In large part, longer and broader horizons are encouraged and fostered through learning activity and educational achievement; the better we understand the world – the closer the fit of our models to the realities to which we lack any direct epistemological access – the greater will be our range of awareness about the ongoing impact of our current decisions, and so the more control we will have over how we influence others and the environment that we inhabit and pass along to our children. The longer and broader our planning horizons, the better off we (along with everyone else) will be. So how do we encourage such learning and educational effort? In some ways, the potential gains are obvious and self-directed, thus internalized to private action. The better we understand the world, the more effective we are.

But what is the nature of educational and informational effort? Even neoclassical economists treat knowledge as a 'public good' – thus as a special exception to our rivalrous substitution assumptions – and that is because when information is traded, nothing is lost to the giver to offset the benefit to receivers, and generally such transactions are not uni- but multi-directional and productive – new information that neither possessed is spawned during the process – so all

interactions involving intangible goods suffer no scarcity limits such as apply to material goods. So maybe a start to the answer might be to focus on this difference.

Atoms, bits, and wits: the dominance of complementarity

The whole purview of economics can be split into three domains: atoms, bits, and wits (Jennings 2015b, 2016). The realm of atoms (material goods) is an orthodox setting in which production is subject to decreasing returns so firms stay small and competitive. Along with decreasing returns (with its upturning unit cost curves) comes substitution assumptions and a focus on rivalrous situations such as with the 'industry' concept. Input factors are also related by substitution assumptions in neoclassical theory, with no room for complementarity in the production process. [4] But decreasing returns is not the whole story, except for short-run phenomena in which costs may rise due to short-term constraints on factor variability. For all long-run analyses, though, increasing returns (falling costs) are the rule, for all sorts of reasons including the nature of physical space (such as the ratio of a pipe's volume to its circumference as size increases), the fact that a replication of all inputs with scale (for constant costs) should be the worst one might do, since larger scale will allow reorganization for lower unit costs. This claim of increasing returns is supported both theoretically and by ample empirical evidence. If firms – by expanding – reduce unit costs, then there are positive feedbacks in this system and growth may be self-sustaining while leading to consolidation. No competitive outcomes or stable equilibria will ensue, which argument will be addressed in the next section.

So short-run atoms serve as a realm of substitutional tradeoffs, since decreasing returns apply on this scene. But long-run atoms – assuming increasing returns for all long-run phenomena – are realms of positive feedback and thus of complementarity, as Nicholas Kaldor (1975, pp. 347-48) explained (deriving his claim from a long-run Keynesian model): 'the essential complementarity between different factors of production … or different types of activities … is far more important for an understanding of the laws of change and development of the economy than the substitution aspect.' But Kaldor didn't develop the institutional implications of this important conclusion. Complementarity also implies the efficiency of cooperation, something he may have hesitated to stress in an age of socialist threats. Furthermore, this is a realm where competition

must fail and produce counterproductive results and pathological social behavior. These opportunity costs are important; they corrupt the essential conclusions of neoclassical theory, implicating competition as a source of many unheralded ills.

But what about bits? As noted above, information exchanges – those of any intangible goods – are not framed as rivalrous, but as complementary interactions: the information we exchange in a conversation, for example, is not lost by anyone and the process will likely unearth new knowledge. So, the realm of bits is not one of scarcity but rather is one of complementarity and abundance models, implying a case for cooperative frames.

If so, then any rivalrous structures set into place through our institutions shall lead us into a dangerously myopic culture by impeding informational learning, acquisition, and transmission, which in turn will shorten horizons in a manner we will address next. We see the impact of wrong system designs in the pathological symptoms of higher-order need deprivation in Maslow's (1954, 1968) sense of that term. Signs of organizational stress have been detailed by Chris Argyris (1971, pp. 262-63, 268-69) as showing up in the form of 'frustration, failure, short time perspective and conflict' that lead to behaviors marked by 'competition, rivalry, … hostility and … a focus toward the parts rather than the whole.' Douglas McGregor (1960, pp. 310-11) added symptoms of frustrated 'social and egoistic needs,' such as 'passivity, or … hostility, or … refusal to accept responsibility' as well as materialism and a preoccupation with money. These symptoms quite truly surround us in our social culture.

What is all this saying to us? One way to examine the pattern is through a horizonal lens since the realm of wits should be included in our revised economics. Planning horizons (horizon effects) supply a new relation of interdependence in the form of 'interhorizonal complementarity,' because the balance of substitution and complementarity in any situation is sensitive to horizon effects: horizonal growth will shift our interdependencies away from substitutional conflicts to complementary alignment. This occurs through an increase of conscience, or – inversely – with an ethical loss when horizons shrink. Indeed, learning itself is a complementary process encouraged through cooperation and diverted by competition. This suggests that the neoclassical adulation of competition is having extremely harmful effects on our social

relations. Much of what Argyris and McGregor describe is seen in our cultural patterns.

So why have neoclassical economists so long ignored increasing returns and complementarity in our relations? The interconnectedness of all things out there in reality is undeniable, so why do economists stubbornly cling to models based on independence assumptions that cannot truly be justified? There is a long and important story behind this unfortunate tragedy, which will only be sketched here.

A historical look at diminishing returns and substitution assumptions

The problem started with Alfred Marshall's (1890) synthesis of economic theory, that put him in a position of dominance over the field for many years until his death in 1924. John Clapham (1922) wrote an article called 'On empty economic boxes' that sparked 17 years of ferocious debate on what is meant by decreasing vs. increasing returns. By the late 1920s, Alfred C. Pigou (1927, pp. 193, 197; 1928, pp. 252-53, 256) – the heir to Marshall's chair – in two influential papers on cost and supply dismissed decreasing returns as 'impossible' in economics and declared that 'supply price cannot … increase with increases of output. …Only the laws of constant or decreasing supply price … are admissible.' These statements led to papers exploring the implications of increasing returns, showing that there was no equilibrium possible under these conditions, and that our analyses should be dynamic and not static in nature.

A well-known paper by Allyn A. Young [5] (1928, pp. 230-33, 238) that focused on increasing returns supported disequilibrium: '…the counterforces which are continually defeating the forces which make for economic equilibrium are more pervasive and more deeply rooted than we commonly realize. … Thus change … propagates itself in a cumulative way.' He added that industry 'ought to be seen as an interrelated whole' in the analysis of economic growth. This breakdown of Marshall's approach was speeded by a 1930 Symposium on 'Increasing returns and the representative firm' with Gerald Shove (1930, p. 116) finding 'that the economies of large-scale industry are … positive and of considerable magnitude.' During the early 1930s, Joan Robinson (1932, 1933) and Edward H. Chamberlin (1927, 1933) simultaneously came out with theories of 'imperfect' and

'monopolistic' competition, respectively, giving increasing returns (falling costs) more general attention.

Nicholas Kaldor (1934) found that '*long-period static equilibrium and perfect competition are incompatible assumptions*' and that 'the existing … economic system … is … adapted to … dynamic change and imperfect foresight…' (original emphasis). Austin Robinson (1934, pp. 256-57) developed this view, where firm sizes stem from a tradeoff between scale economies and managerial limits, supporting Marshall's framing of economics as a biological 'study of the adaptation of economic organizations to their environments.' And John Maynard Keynes (1936) also published his *General Theory*, starting another related debate on macroeconomic phenomena and the process of cumulative change. The salient theme underlying the economic cost debate was that increasing returns and declining costs, once accepted as true, were incompatible with efficiency, equilibrium, and a competitive analysis, so causing some vexingly insurmountable problems for the orthodox analytical frame.

The political implications should be noted as well [6]. Oskar Lange (1938, p. 54) voiced them most clearly:

> …The actual capitalist system is not one of perfect competition; it is one where oligopoly and monopolistic competition prevail. This adds a much more powerful argument to the economist's case for socialism. The wastes of monopolistic competition have received so much attention in recent theoretical literature that there is no need to repeat the argument here. The capitalist system is far removed from the model of a competitive economy as elaborated by economic theory. … Only a socialist economy can fully satisfy the claim made by many economists with regard to the achievements of free competition.

So, these lofty economic conceptions seemed driven in part by political arguments about the optimal organization of social institutions, whether by markets or through command. A strong (but totally incorrect) 'excess capacity' argument was made tying increasing returns to inefficiency yielding socialist claims by people like Lange that a centralized setting of prices served better to mimic competitive firms than the free market did. [7] Thus the economic case for increasing returns supported a socialist cause according to its advocates, setting the stage for an Age of Denial in economics stimulated in 1939 by 'The Hicksian Getaway.'

John R. Hicks, a young British economist, barged onto this scene with a book called *Value and Capital* (1939, pp. 82-85), in which he walked away from the issue, declaring boldly, with impressive honesty, that:

> a general abandonment of … perfect competition … must have very destructive consequences for economic theory. Under monopoly the stability conditions become indeterminate; and the basis on which economic laws can be constructed is therefore shorn away. … It is, I believe, only possible to save anything from this wreck – and it must be remembered that the threatened wreckage is that of the greater part of general equilibrium theory – if we can assume that the markets confronting most of the firms with which we shall be dealing do not differ very greatly from perfectly competitive markets [by supposing] … marginal costs do generally increase with output at the point of equilibrium (diminishing marginal costs being rare)…

Then, with a directness too often absent today in economics, Hicks justified his 'get-away':

> At least, this get-away seems well worth trying. We must be aware, however, that we are taking a dangerous step, and probably limiting to a serious extent the problems with which our subsequent analysis will be fitted to deal. Personally, however, I doubt if most of the problems we shall have to exclude for this reason are capable of much useful analysis by the methods of economic theory.

Period. End of section. The next starts with a sigh of relief for removing this annoyance so one can get to the work at hand: 'Let us, then, return to the case of perfect competition…' Thus, Hicks dismissed the doubt that he himself had raised about diminishing returns as a limiting and 'dangerous step' for the ensuing analysis.

This was the end of discussion, tragically, due to the onset of World War Two. After the war, Paul Samuelson (1947) founded his Ph.D. dissertation on the Hicksian frame, and shortly thereafter Arrow and Debreu (1954) extended their general equilibrium theory on Samuelsonian grounds. So would established doctrine emerge out of these shared assumptions and methods, supported by Friedman's (1953) unduly influential case against realism in economic constructions. So would orthodox economics enter an Age of Denial about increasing returns from which it has yet to fully emerge. There was a brief moment during the 1960s when this emergence started, though it was all too soon derailed by 'The Hirshleifer Rescue.' The issue revolved around the role of time and learning in economics, and how this should be handled.

Armen Alchian (1959) started discussion on a way to incorporate time into the theory of cost. Concepts of time had played a large role in the 1930s debates, and many other papers suggested how time might be incorporated into theories of dynamic cost, including: Frank H. Knight (1921, pp. 186-87, 214-15); George Stigler (1939, pp. 305-8, 310-12, 318-21); and John M. Clark (1940, pp. 241-43, 246-50; 1955, p. 459). Julius Margolis (1960, pp. 531-32) addressed 'sequential decision making under ignorance' where 'actions taken today alter tomorrow's information and thereby tomorrow's decisions,' so the firm must be concerned not only with profit but also with learning effects. On this frame, Margolis traced the relation of prices to planning horizons in what I encountered as a surprising insight of broad significance, though his discussant (Farrell 1960, pp. 560-64) totally missed the point, calling Margolis' claim a minor refinement of perfect competition theories.

Alchian's 1959 article offered nine propositions on cost in its relation to time. Alchian's propositions stated that the equity cost of production turns on how production runs structure volumes of output through time: more rapid output rates (X) for a given volume (V_o) increase its cost, whereas more time (m, T) reduces its total and marginal costs of production. The key to Alchian's explanation is that a faster X for a given V_o means shortening m (time) by speeding up production. Curiously, Alchian's model was seen as a threat to orthodox statics, in its suggestion that increasing returns would derive from augmenting V (given X_o) by lengthening m. Thus, Hirshleifer (1962, pp. 235-38, 246) took up the challenge with the explicit intention of 'rescuing the orthodox cost function' by showing

> that marginal cost eventually begins to rise with proportionate expansion of [rate and volume of output]. … Happily, it can be shown that this property does indeed follow from the Alchian postulates (with a weak addition), so that we can justify the accepted shape of the marginal cost curve in the orthodox theory…

This argument then was picked up by Walter Y. Oi (1967, pp. 590, 594) in a paper on 'progress functions.' Oi considered two writings: the Hicksian model of *Value and Capital* (1939) and the Alchian (1959) propositions as recast by Hirshleifer (1962). On this basis, Oi argued that learning and technical change could be ignored in neoclassical theory, as already contained in the Hicksian framework – confirmed by Alchian and Hirshleifer – as intertemporal production functions.

Because 'the neoclassical concept of factor substitution is … obliterated by turning to progress functions,' Oi (1967, p. 594) rejected this approach:

> In order to deduce these propositions, Alchian and Hirshleifer both appeal to learning, experience and economies which derive from not having to rush production plans. Notice, however, that if these writers had adopted a Hicksian intertemporal production function and [my] two theorems … all nine propositions are seen to be logical consequences of my modified dynamic theory of production. … To sum up, a dynamic theory of production along the lines of Hicks provides us with an essentially neoclassical explanation for progress functions. … To attribute productivity gains to technical progress or learning is, I feel, to rob neoclassical theory of its just due.

Consequently, any explicit treatment of learning phenomena or planning horizons in economics is not needed; these processes are already embedded in the Hicksian frame. Planning horizons and other such concepts simply are redundant; the neoclassical theory of perfect competition already incorporates such issues. Then, in an essay on 'Cost' for the *International Encyclopedia of the Social Sciences*, even Armen Alchian (1968, pp. 319-20) endorsed the Hirshleifer argument as solidly established truth:

> A general and universally valid law is that for every volume of output there exists an output rate beyond which the marginal cost with respect to rate always increases. This is commonly called the law of diminishing marginal returns with respect to output. … Average cost per unit … can be decreasing for small outputs. But as larger outputs are considered, the average cost will, beyond some output rate, begin to rise persistently and with increasing rapidity…

Alchian's statement describes precisely what Hirshleifer claimed to have proven about production technology. Yet this finding conflicts with Pigou and other 1930s arguments for increasing returns before the appearance of 'The Hicksian Getaway.' In 1968 – a mere 40 years after Pigou's second paper – following Alchian's declaration above, economists simply were relieved to have solved the imbroglio over increasing returns. 'The Hirshleifer Rescue' of equilibrium models showed decisively that static cost curves should turn upward (for rising volume and output rates on a fixed horizon), thus relieving economists from any further heed to the anomalous impact of either increasing returns, learning, growth, or technical change on the costs of production. Ralph Turvey (1969, pp. 285-88) offered a summary of this series of papers, concluding his argument thus:

> This review of a number of contributions to cost theory makes it clear that the definition of marginal cost as the first derivative of cost with regard to output is too simple to be useful. Both cost and output have time dimensions, and both may be subject to uncertainty. …A cost analysis which is to be useful in decision-making needs to be historical dynamics, not comparative statics.

The ultimate outcome of this series of papers was that 'The Hicksian Getaway' and 'The Hirshleifer Rescue' achieved the status of General Laws. As a result, economists simply accepted neoclassical theory: everyone knew (and taught or learned) that average and marginal cost turned upward, for high enough volumes and output rates. Thus, economists paid no further regard to increasing returns. But the interregnum didn't last long: the early 1970s saw a revival of ferocious attacks on American neoclassical theory, mostly by European economists including: Martin Shubik (1970, pp. 405, 413-14); Janos Kornai (1971); E.H. Phelps Brown (1972); and Nicholas Kaldor (1972, p. 1240; 1975, pp. 347-48). Kaldor endorsed increasing returns and tied it to generalized complementarity, calling for 'a major act of demolition' of orthodox economics as a means to 'make any real progress.'

After receiving a Nobel Prize in 1972 for his work on *Value and Capital*, Hicks (1977, pp. v-vii) said he accepted this honor 'with mixed feelings' as it was 'work which I myself … have outgrown':

> What I now think of *Value and Capital* is the following. The 'static' part … opened up … exciting [vistas]; so it was difficult when writing not to exaggerate their importance. Thus it was that … I so preposterously exaggerated the importance of the perfect competition assumption, declaring that its abandonment would involve the 'wreckage … of the greater part of economic theory.' … In spite of all that has since happened to that particular piece of theory – the further elaborations at the hands of Samuelson, of Debreu and of so many others… – the time came when I felt that I had done with it. But what I really regretted was that it had played so large a part as it did in the … 'dynamic' part of *Value and Capital*. … Where I … went wrong was in my attempt to represent … equilibrium … [by treating decisions simultaneously with their effects], so that an equilibrium could be reached. That however was nonsense. … It was this device, this indefensible trick, which ruined the 'dynamic' part of *Value and Capital*. It was this that led it back in a static, and so in a neoclassical, direction. Since then … I have endeavoured to avoid the relapse into statics [and] to keep my thinking more securely in time, concerning myself with processes…

So here we have Hicks, suggesting that the whole case for 'The Hicksian Getaway' was regrettable 'nonsense' based on an 'indefensible trick, which ruined the 'dynamic' part of *Value and Capital*.' If Oi's reconfirmation of the orthodox story is founded on 'the 'dynamic' part of *Value and Capital*,' where does this leave 'The Hirshleifer Rescue' and the case for excluding technical change, expectations and learning from economics? Hicks simply asserted decreasing returns against twenty years of debates supporting increasing returns, almost forty years later retracting this ploy. Yet 'The Hirshleifer Rescue' has not been disproved or reversed. During my own dissertation research in 1978 (Jennings 1985; also cf. 2015a), I encountered 'The Hirshleifer Rescue' as the only technical argument that I could find for decreasing returns, so I examined the claim very closely. Here is what I discovered.

The whole question of how we do economics stands on the outcome of the case for increasing returns. But the Age of Denial persists on this subject, exemplified by Mitchell Waldrop's (1992, p. 18) reporting of the reaction by UC-Berkeley economics professors to former student Brian Arthur's academic research on increasing returns:

> So there they had all been, sitting down to sandwiches at the faculty club. Tom Rothenberg, one of his former professors, had asked the inevitable question: 'So, Brian, what are you working on these days?' Arthur had given him the two-word answer just to get started: 'Increasing returns.' And the economics department chairman, Al Fishlow, …stared at him with a kind of deadpan look.
>
> 'But – we know increasing returns don't exist.'
>
> 'Besides,' jumped in Rothenberg with a grin, 'if they did, we'd have to outlaw them!'
>
> And then they'd laughed. Not unkindly. It was just an insider's joke. Arthur knew it was a joke. It was trivial. Yet that one sound had somehow shattered his whole bubble of anticipation. He'd sat there, struck speechless. Here were two of the economists he respected most, and they just – couldn't listen. …

The entire justification for the accepted approach – the competitive frame based on decreasing returns, substitution, and scarcity models – stands fully on 'The Hirshleifer Rescue.' Understanding – and debunking – this argument discredits all equilibrium models as simply irrelevant (just as Kaldor opined) as explanations for anything other than notably transient short-term phenomena. All long-run economic analyses cannot avoid increasing returns.

One important source of the problem is one of framing conceptual issues. As Arrow (1982, pp. 5-7) explained:

> A fundamental element of rationality, so elementary that we hardly notice it, is … its extensionality. … It is an axiom [of rationality] that [a] change in description leaves the decision unaltered. The cognitive psychologists deny that choice is in fact extensional; the framing of the question affects the answer.

The problem with Hirshleifer's argument is that he framed the issue in terms of a relationship based on flows combined with stocks (namely rate and volume of output), rather than making time explicit as Alchian had. This suppression of time in the Alchian-Hirshleifer model obscures its role. With the functional form of cost transformed to J = J(V,m,T), the impact of time on cost is readily seen (Jennings 2015a). So why was this specious argument not disproved a long time ago? My doctoral thesis (Jennings 1985, pp. 99-101), after reviewing a much more complex and comprehensive version of this disproof, finished the argument with a lament about how impactful this error has been (cf. Jennings 2015a, p. 28).

The opportunity costs of neoclassical economics: summary and implications

The 1930s were a formative time in economics, when a post-Marshallian synthesis started due to Clapham's (1922) seminal paper. Marshall died in 1924, and shortly thereafter Pigou (1927, 1928), his protégée, set the stage for the 1930s debates by endorsing increasing returns as a universal truth. The ensuing exchanges show a time of ferment among economists, as a wide range of issues were raised and discussed throughout the discipline. Some have quoted Words-worth (1805) on what those years were like for economists: 'Bliss was it in that dawn to be alive / But to be young was very heaven…' The field was open to new ideas, searching for resolution of fundamental lacunae in a flowering process of learning and growth. The brief review reported above identifies only a few of the many insights sown at that time.

Microeconomics emerged from Marshall, looking for resolution. Assumptions were raised, debated in their ramifications, and then accepted or rejected diversely in ongoing exchanges sweeping through many aspects of microeconomics. Setting acceptable limits and defining the boundaries of the

field truly absorbed the attention of economists through these years, at least until 1939 and the brutal onset of World War Two. It is sad that the interruption occurred at that very moment; it ended discussion and drew attention away from what had been learned. The issues surrounding increasing returns and its spreading impact faded from view. Once the war was over economists sought to move ahead, trying to get beyond the irresolution of that turbulent time.

'The Hicksian Getaway' offered an opportunity to escape from these unresolved dilemmas: Samuelson (1947) placed his *Foundations of Economic Analysis* on this frame, then Arrow, Debreu and others simply followed his lead into equilibrium models showing purportedly how competitive markets work, if under restrictive conditions. A great many honors were bestowed upon economists for advances in equilibrium theory and static conceptions set thereon. The opportunity cost of this selective focal attention takes the expressive form of frustration with the economic questions and answers usually posed. Many economists have voiced similar views to those cited here.

But opportunity costs stay unseen, as the worth of what we forego. One can never return to opportunities spurned through choice; these are Roads Not Taken, to be forever lost. The new theoretical insights that might have flowed from more realistic constructions stay unknown. The 'alternative fields' of institutional, ecological, social and cultural economics have flourished, depicting how work could have proceeded under increasing returns suppositions. Additional books by Schultz (1993) and Arthur (1994) and some edited volumes (cf. Buchanan and Yoon 1994; Heal 1999) suggest a revival of academic concern over increasing returns, but its full methodological and horizonal implications remain undeveloped. My papers on horizonal theory limn the opportunity costs.

The impact of 'The Hicksian Getaway' and 'The Hirshleifer Rescue' was to imbue rigid dogma with a false scientific credential, at the expense of openminded debates such as occurred in the 1930s. The fragmentation of economics as a formerly integral discipline is one result. The reason is a direct consequence of competitive frames, standing on substitution assumptions, scarcity and decreasing returns, so therewith independence assumptions.

Increasing returns should change all that. Instead of embracing complementarity, increasing returns and network models, static constructions still litter the field. Instead of addressing chaotic complexity in all its unfolding

cumulation, narrow equilibrium models and partial analyses steer economics away from pressing concerns. Instead of forcing economists to admit that choice is not determinate, the positivist definition of 'science' says testability by prediction is the only acceptable justification for inferential claims. Instead of framing conscious awareness into all models of human decision, many economists still abstract away from bounded attention into rational expectations, perfect knowledge and complete information. Such suppositions state the conditions under which our results apply: any unrealism in assumptions will limit the applicability of findings so derived. Realistic conceptions matter, in contrast to what Friedman (1953) contended.

The real world in which we live is one of increasing returns save for short-term phenomena. So any economic construction built on decreasing returns should not be used to guide decisions, since it will squander resources somehow. We need to fit our analyses to the prevailing conditions at hand to rely securely on the outcomes so wrought. Otherwise, we run a risk of 'knowing not what we do.' Several examples have been described.

If education is suffused with complementary interdependencies, substitution does not apply: incentives structured on a competitive frame must fail in this setting. Cooperation is the efficient institutional form in the presence of positive feedbacks such as suggested by complementarity. If embracing increasing returns will make 'complementarity … far more important' than substitution in economics (cf. Kaldor 1975, p. 348), so will the case for competition collapse in favor of cooperation as the optimal organizational form for human society.

This shows a core reason for the failures suggested here: rivalry in academics is simply counterproductive in the presence of dominating complementarities in this sector. The failure reaches from theory into behavior and our institutional frames. The opportunity costs of what we do remain unseen, except through a theoretical lens. Suppositions – set apart from the facts – shall lead us astray. In an academic community organized in a cooperative frame, new ideas and diversity would be welcomed and not shunned. The impact of competition on our learning activity has been disastrous, shutting off advances in knowledge.

All this is so, even without any mention of planning horizons (H*). As one of the aims of this paper is to point the way to a novel approach, it is appropriate to address some 'horizonal' implications. As noted above, with marginal cost

defined as M(Q,H) – where $M_H < 0$, and where $M_Q > 0$ *only for short horizons* which, extending, open the cost curve until $M_Q < 0$ – the case for increasing returns and complementarity is thereby strengthened. But there is another aspect of horizonal interdependence that reinforces the case against substitution in favor of complementarity for which we use the term 'interhorizonal complementarity.'

Your planning horizons interact directly with mine. Horizon effects spread contagiously across social space. If so, when I become more intelligent and predictable in my decisions, you can plan better too: I thus stabilize (as a disturbance term) in the causal projections on which you base all your actions. Equally, if I 'lose my cool' and confidence in what I know – or if my decision environment grows less certain – a shrinkage of my planning horizons will likely influence you. Horizons shift together, radiating outward to others. Such phenomena – with respect to the interpersonal linkage of horizon effects – show 'interhorizonal complementarity,' and they appear in many arenas unexplored by economists. These are but a few indications of many new research opportunities stemming from horizon effects. The whole field is unexplored and open to scientific inquiry.

Substitution, decreasing returns – 'The Hicksian Getaway' and 'The Hirshleifer Rescue' – offer reasons why new approaches have not yet emerged. An economics standing on increasing returns will differ in many ways still undiscovered. There is work to be done to repair the damage of false suppositions and to revise our 'habits of thought' (Veblen 1898) along with our many unconscious assumptions. So once again, by instigating conversation among economists – with an open mind and a thirst to learn and thus to increase understanding – could there be another formative moment in economics to come? One can only hope…

The issue of what an unexplored economics of complementarity would be is hard to imagine from our current cultural context. Within such a sphere, helping you is really helping myself – with our interests and needs aligned – so we will look out for each other rather than just satisfying ourselves. There is no inherent boundary between your aspirations and mine. We would work and belong together in a mutually supportive frame of economic relations within a cooperative system. We would develop together a passion for learning about how

our world truly works, and also decide on encompassing plans stretching as far as sight will reach.

So, this is the opportunity cost of a myopic culture of conflict and denial – of cascading ecological and ethical losses – set in place through an Age of Denial legislated by orthodox theory in neoclassical economics. Our very planet is in deep peril, because of a dangerous shortsightedness stemming from competition based on substitution and decreasing returns suppositions, stemming from our refusal to deal with increasing returns, complementarity and a strong economic case for cooperation. From my perspective, we are enduring catastrophic consequences spilling out of frameworks simply unfit to their applications. Shall we awake and change? The urgency cannot be overstated. There is nothing more important than this. When the opportunity costs of whatever we do exceed its worth to us, there emerges an urgent need to change direction and revisit our choices. Is that time not here?

Endnotes

[1] Cf. Nicholas Georgescu-Roegen (1970, pp. 2-3; 1971, pp. 213-14), who declared that: 'No analytical boundary, no analytical process.'

[2] A formal derivation of these claims is found in endnote #2 of Jennings (2012, p. 27). Margolis (1960, pp. 531-32) stated the relation of planning horizons to pricing quite properly thus, even though his focus was far narrower than my own:

> … The greater the uncertainty … the shorter will be the planning horizon and the greater will be the … costs… The implications … are that the greater the ignorance of the market the higher will be the estimate of the costs and the more inelastic the estimate of demand. What price should a firm charge if it has hopes of later expanding its market? The higher the price the greater the expected short-run profits and the greater the sacrifice of expected information about the mass market. The lower the price the more information it gains about the future market possibilities.

[3] For the basic formula $P' = P^* + S_I$, the relation $dS_I/dH_j^* < 0$ is justified as follows: S_I is a combinatorial of profit effects within group I, where $S_I \equiv \Omega s_i$ for $s_i \equiv (\theta_i/\theta_j) \bullet (M_i^* - P_i^*) \bullet [\varepsilon_{ij}^* \div (\varepsilon_j^* + 1)]$. As H_j^* rises, P_j^* falls, increasing

Q_j^*. This, in turn, directly augments sales of complements and reduces substitutes' sales in the group. But here we examine a different type of interhorizonal interdependence, through mutually reinforcing contagion effects of H_j^* on neighboring $H_{i \neq j}^*$s in educational (learning) systems. First, a horizonal lengthening of H_j^* ought to reduce θ_i/θ_j as Q_j^* is more responsive to H_j^* than are other $Q_{i \neq j}^*$s. The magnitude of the markup declines, as any horizonal lengthening in the group reduces all markup terms ($E^* > 1$), while raising own-elasticity $| \varepsilon_j^* < -1 |$, making the denominator of the term $[\varepsilon_{ij}^* \div (\varepsilon_j^* + 1)]$ increasingly negative also. The impact of a horizonal shift on static cross-elasticities (ε_{ij}^*s) is the key to the puzzle: longer planning horizons enhance sales throughout the group, pushing ε_{ij}^*s from substitution toward complementarity: $d\varepsilon_{ij}^*/dH_j^* < 0$. This implies that $dS_I/dH_j^* < 0$, that horizonal lengthening alters our relations away from substitution and toward complementarity, away from conflict toward a concert of interests in society. A similar derivation for the same conclusion, based a formula like that above, with the sign of S_I reversed (using $P^* = P' + S_I$) is found in Jennings (2012, endnotes 8 and 11 on p. 30).

[4] For a look at the difference between George J. Stigler's assertion of substitute factors and Richard R. Nelson's exploration of factor complementarity, cf. Jennings (2015a, endnote #5 on pp. 37-38). Another aspect of this issue was addressed by George B. Richardson: Cf. Peter Earl's (1983, p. 29) discussion of 'The Richardson Problem'; also cf. Richardson (1960, esp. chs. 3-4; 1972), along with Harald B. Malmgren (1961, 1968); Richardson (1959, pp. 233-34) explained the problem thus:

> *A situation of general profit potential can be tapped by one entrepreneur only if similar action is not intended by too many others… In general, a producer will need to know both that the production of <u>complements</u> (such as raw materials) will be adequate and that the production of <u>substitutes</u> will not be in excess. For the sake of brevity, however, we shall ignore the existence of complementarity…*

[5] Interestingly and non-coincidentally, Allyn Young was also Edward H. Chamberlin's Ph.D. thesis adviser.

[6] Also cf. Mises (1920), Lange (1934, 1936), Lerner (1934, 1939, 1977) and responses by Hayek (1935, 1940).

[7] A detailed discussion of the flaws in this 'excess capacity' argument can be found in Jennings (2015a, endnote #3 on pp. 36-37).

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The author declares that there is no conflict of interest.

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