Deep Causality and Counterfactuals for Scientific Explanation and Ethically Efficacious Economics and Social Sciences: How can the social sciences help make policies for advancing the common good?

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Deep Causality and Counterfactuals for Scientific Explanation and Ethically Efficacious Economics and Social Sciences: How can the social sciences help make policies for advancing the common good?

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“Felix, qui potuit rerum cognoscere causas” (Virgil 29 BC) (Lucky is he who has been able to understand the causes of things)

“More has been learned about causal inference in the last few decades than the sum total of everything that had been learned about it in all prior recorded history.” (Gary King)

“…the fundamental question at the core of a great deal of statistical inference is causal; do changes in one variable cause changes in another, and if so, how much change do they cause? In avoiding these questions, introductory treatments of statistical inference often fail even to discuss whether the parameters that are being estimated are the relevant quantities to assess when interest lies in cause and effects. “(Judea Pearl)

ABSTRACT

What does a causal explanation deliver in any science, but particularly in the social sciences? How are relatively deeper scientific explanations to be distinguished from superficial or shallower ones? Furthermore, what roles can counterfactual analysis play in social sciences and policy making? For a competent, morally motivated scientific policy maker, it is important to avoid inflicting harm and promote the common good. The purpose of this paper is to clarify how the idea of depth can play a role in finding the more "approximately true" explanation through causal comparisons and counterfactual conditionals that are scientifically salient in principle. In doing so, we must also be able to avoid inflicting harm and promote the common good. It is not an exhaustive treatment but rather focuses on a few aspects that may be the most critical in evaluating the explanatory strengths of a theory in the social sciences. It presents a general argument which is anti-Humean on the critical side and scientific realist on the positive and normative side. It also elucidates how explanations in political economy and other social sciences can be judged by the scientific realist criterion of causal depth by an extensive example from research in the political economy of development. In this case, an "intentional" and methodologically individualist neoclassical explanation is contrasted with a "structural" dual-dual approach as rival theories purporting to explain the same set of phenomena. Finally, avoiding harmful policies and aiding in making policies for advancing the common good are more likely if the methodological approach advocated here is adopted for responsible practice. Ultimately, following the methodology advanced here , it will be possible to drive further the tendencies towards the creation of an ethically efficacious economics(EEE) for ecologically sustainable humane policy making.

Keywords: Scientific Explanations, Social and Economic Explanations, Causal Depth, Critical Scientific Realism, Political Economy, Neoclassical Economics, Structuralism, Social Science Theories, Economic Models, Ethics and Economics, Counterfactuals and Causal Efficacy, Common Good. Economic Justice, Ethically Efficacious Economics(EEE)

1. Introduction: Causal Depth contra Humean Empiricism and Promoting the Common Good

How are deeper scientific explanations to be distinguished and policies for promoting common good including avoiding harm are to be promoted? The purpose of this note is to clarify how the idea of "causal depth" can play a role in finding the more "approximately true" explanation through causal comparisons and counterfactual causal reasoning. The ultimate social and economic policy purpose--- following the tradition set in motion among others by the *Nyaya* school in India and Aristotle's idea of human flourishing or eudaemonia in Europe--- is to help search for the common good that includes *inter alia* the avoidance of common harm as well.

I should emphasize the preliminary nature of this investigation. It is not an exhaustive treatment but rather focuses on a few aspects that may be the most critical in evaluating the explanatory strengths of a policy-relevant theory in the social sciences, in particular in economics. It presents a general argument which is anti-Humean on the critical side and scientific realist on the positive an d normative side. It also elucidates how explanations in political economy and other social sciences can be judged by the scientific realist criterion of causal depth by an extensive example from research in the political economy of development. In this case, an "intentional" and methodologically individualist neoclassical explanation is contrasted with a "structural" dual-dual approach as rival theories purporting to explain the same set of phenomena.

One of David Hume's great insights was to recognize that while events were observable, their putative underlying "causes" were not observable. What were observable such as spatial contiguity, temporal succession etc. turned out in his analysis not to be causes at all but the prejudices of our thinking. The incisiveness of Hume's empiricist analysis which found that there was no causality beyond the empirical regularities observed led Kant to declare that it was Hume who awakened him from his "dogmatic slumber".

Kant's awakening produced the classic " Critique of Pure Reason" where Kant attempted to rescue causality by arguing that by his transcendental deductions

causality along with universality, necessity etc. needed to be conceptualized as "categories of our mind". In the twentieth century, the logical positivists rejected the Kantian solution and embraced the Humean position albeit with typical flourishes of symbolic logic that was developing at an accelerated pace in the 1920s. Thus logical positivists such as Hempel or Carnap eschew causal language wherever possible. If cause is mentioned at all, it is to be understood as part of an empirical law or law-like statement. Hempel's deductive nomological model is the most rigorous and elegant example of this practice.

In contrast to the empiricist tradition, the scientific realists have always--- although not always equally clearly or forcefully--- emphasized causal explanations. In the 19th century, Darwin himself was an exponent of this view as a close study of his 1836-1844 notebooks reveal. Huxley was, as usual, much more forthright and pugnacious than Darwin. For example in Huxley(1894:Vol.1;158-9), one reads:

> any one who is acquainted with the history of science will admit, that its progress has, in all ages meant, and now, more than ever, means, the extension of the province of what we call matter and causation, and the concomitant gradual banishment from all regions of thought of what we call spirit and spontaneity.

Likewise, George Romanes, another 19th century realist and a friend of both Darwin and Huxley, writes of Darwinism that it

> seeks to bring the phenomena of organic nature into line with those of inorganic; and therefore to show that whatever view we may severally take as to the kind of causation which is energizing in the latter we must now extend to the former. . . .the theory of evolution by natural selection . . .endeavours to comprise all the facts of adaptation in organic nature under the same category of explanation as those which occur in inorganic nature – that is to say, under the category of physical, or ascertainable, causation. (Romanes, 1893:402)

What is significant in all these is that Darwin, as Dennet (1995) has most clearly pointed out, more than any other scientist before him articulates and exemplifies a

causal approach to scientific explanation by appealing to both non-observable and deep underlying causal processes. It is probably more helpful to study Darwin's notebooks than even the most articulate realist philosopher of science to see how a search for deep, non-mystical explanation can proceed in a complex, almost uncharted territory.[1] In this, there is a lot for social scientists to learn.

However, even if we grant that the notion of cause is not problematic---it actually is still controversial among the philosophers (See Sosa and Tooley (1993) and Salmon (1998)) although specification of causal mechanisms in terms of non-observable entities whose causal effects are in principle observable will be accepted by most scientists as a practical way to proceed[2]--- the question of how to choose from among a list of alternative causes still remains.

The purpose of this note is to clarify how the idea of "causal depth" can play a role in this endeavor. I will not try to be exhaustive but will rather focus on a few aspects that may be the most critical in evaluating the explanatory strengths of a theory. I will present an example from research in development economics where an "intentional" neoclassical explanation is contrasted with a "structural" dual-dual approach to the same set of phenomena.

Although the present approach is, at least in part, intended to draw attention to the revolutionary contributions of Darwin both to science and the philosophy of science, it is compatible with the contemporary developments including Boyd's (and Harman's) abductive defence of scientific realism as inference to the best explanation and Bhaskar's critical realism.[3] However, in contrast with both and consonant with Miller (1987), I focus attention on the need for drawing out the principles of the relevant realist philosophy of science from within the "topic-specific" practices of

[1]See Barrett et. als eds.(1987), Darwin(1859,1871,1883), Dewey(1910) Hodgson(2001, 2002, 2003, 2004, Knudsen (2004), Mayr (1964,1988,1992)

[2] There are some worries in physics about quantum causality and particularly non-locality after Bell's inequality was used by Aspect to show that non-locality did exist at the sub-atomic level. However, given the existence of "decoherence" at a larger scale level of our world, this may not be such a problem. For the social world there still remains the problem of mind-body identity vs. panpsychism and the role of consciousness and meaning that phenomenological and hermeneutic approaches emphasize. However, I believe that at the present state of our knowledge such issues are not resolvable, and we should be open-minded about alternative modes of explanations in the social sciences. Here, clearly the attention is restricted to the set of causal explanations that can be compared meaningfully.

[3] See Boyd(1973,1992),Harman(1965),Bhaskar(1975), Lawson(1997)

particular sciences. The purpose of this essay is not to establish this proposition deductively but rather to illustrate its plausibility by pinpointing the philosophical principles embodied in actual pieces of scientific work in a specific problem area. An important aspect of the approach presented here is to emphasize along with Judea Pearl and others the role of counterfactuals (Pearl 2009, Pearl and Mackenzie 2018), and use this to explore the prospects for achieving the common good in society. In this respect the current effort can be seen as a further exploration of extensions of Sen's capabilities approach in social contexts as in Sen (1992,1999, 2009), Nussbaum(1995,2000) and Khan(1998, 2016, 2017a,b,2018).

2. A (Partial) Characterization of Causal Depth and Some Exemplars

Causality is a category of our thought; It is also an ontological principle. Here we use a conception of causality not only as a mathematical function thatly expresses just the correlation between variables, but also as the "effective action" of the causes in reality. The Causality is therefore both an epistemological category and a property of reality that scientific procedures can uncover by systematic trial and error with the help of approximations in both theory and practice. Ontologically, Bunge (1959) argued early on among the post WW2 non-positivist philosophers of science that the cause is not only a category of relationship between ideas, but a category of connection and determination corresponding to a current feature of the factitious world (external and internal). Therefore, the causal link will also be an ontological category. Formal arguments using modal logic can be and have been constructed to support this position.

The essential idea of causal depth[4] as a selection criterion for explanations is that among the rival theoretical explanations for a given phenomenon, the deepest explanation---deepest compared to its rivals at the time--- is to be chosen provisionally as the "best"(" approximately true") explanation. As Miller (1987:88) puts it:

[4] See also Wilson(1994) and Wendt(1998,1999,2000,2001)

> Suppose a list of causes fits an appropriate standard causal pattern and accurately describes factors sufficient under the circumstances to bring about the effect in question. It may still fail to explain because those causes lack sufficient depth. Roughly speaking, a cause is too shallow to explain why something occurred if it is just one of the ways in which another cause, as intimately connected with the effect, produced the latter. In the slogan version of the causal theory of explanation, such causes are excluded by the requirement that "underlying" causes be described. Actually, "not underlain" would be the more accurate, but absolutely ugly term, since the question is whether one cause is undermined by another.
>
> More specifically, a cause, X, helping to bring about Y, is too shallow to explain why Y occurred if a cause, **Z,** of Y undermines X in one of two ways: (a) If X had not occurred, Y would have happened anyway; **Z** would have produced some causal substitute for X, bringing Y about in some other way. I will label the depth that X lacks, and Z may have here, "depth as necessity." (b) Z is a condition in which Y arose that caused Y, and caused it, in part, by causing X; Z is causally prior to X yet, also, too intimately related to Y to be bracketed as a remote cause. I will refer to this aspect or depth using the label "depth as priority."

In both depth as necessity and depth as priority the Darwinian example insists on a trans-empirical and scientific realist theoretical approach. Such an approach pays close attention to both contemporaneous and historical data but at the same time attempts to imagine in a creative manner various causal connections based on non-observable theoretical entities.

In the Humean or logical positivist way of explaining, the dogma is to stick with the "facts" or ---to use a somewhat refined philosophical language--- sense-data. However, as Quine, Putnam and many others have pointed out the Humean rejection of "metaphysics" is itself dogmatic and close-minded since it fails to acknowledge its own ontological commitments.

In some formulations, the Humean "refusal" of ontology can indeed become self-refuting in the same way that relativism is self-refuting. A causal approach as Darwin in particular uses it will sift through a number of rivals to settle upon the most plausible---one could loosely use the language of verifications here as well---

alternative in light of the data. Darwin's own example involving bats is particularly elegant.

> I have carefully searched the oldest voyages, but have not finished my search; as yet, I have not found a single instance, free from doubt, of a terrestrial mammal (excluding domesticated animals kept by the natives) inhabiting an island situated above 300 miles from a continent or great continental island; and many islands situated at a much less distance are equally barren. . . . Though terrestrial mammals do not occur on oceanic islands, aerial mammals do occur on almost every island. New Zealand possesses two bats found nowhere else in the world: Norfolk Island, the Viti Archipelago, the Bonin Islands, the Caroline and Marianne Archipelagoes, and Mauritius, all possess their peculiar bats. Why, it may be asked, has the supposed creative force produced bats but no other mammals on remote islands? On my view this question can be easily answered: for no terrestrial mammal can be transported across a wide space of sea, but bats can fly across. [More specifically, bat transport occurs to provide a basis for speciation through natural selection, but occurs so infrequently that variants on remote islands are not overwhelmed by migrants from the more competitive mainland.][5]

It is important to emphasize here that Darwin is engaging in a particularly significant type of causal comparison in this example. As Miller points out:

> Here as throughout the book, Darwin is comparing his favored hypothesis of speciation through natural selection not with the mere supposition of its falsehood but with rival hypotheses about the factors at work in the phenomena. The existence of islands with terrain hospitable to terrestrial mammals lacking such endemic species is important because the main rival is the hypothesis, dominant among the best-informed secular-minded scientists of the time, that species are created, without ancestors, by a force that makes them well-adapted to their environments. Also, Darwin makes his argument on the basis of principles he shares with the other side, for

[5] Quoted from *The Origin of* Species in Miller(1987) p. 164; See also Darwin(1871,1883)

> example, the shared principle that offspring are like their parents but subject to small variations, not the tendentiously anti-creationist, though plausible principle that a complex organism must be the offspring of another. Finally, Darwin is not claiming to have a complete explanation of the phenomena in question, although he certainly thinks that the complete answer would entail the approximate truth of his natural-selection hypothesis. Elsewhere, he makes it clear both that the mechanisms of heredity and variation are mysterious to him and that there is no
> way of predicting how an observed advantage will affect the actual course of speciation. The issue for him is whether the best available account of the data, however vague or incomplete, entails the superiority of the natural selection hypothesis over its current rivals.[6]

This type of argumentation is also common in physics when the contest among rival theories demands causally explicit comparisons. An example is Newton's contrast of the causal mechanisms in his celestial mechanics with rival accounts such as Cartesian vortex theories and Tycho Brahe's system.

His discussion of comets in his summary pamphlet, " The System of the World", makes this clear. Indeed, comets are most appropriate for the purpose of causal comparison in this context. All the rival theories in this example share the principles of geometric optics. By using these non-controversial shared principles Newton could derive important features of the orbits of comets.

Once these orbits are derived mathematically, it then can be argued that the Ptolemaic celestial spheres found in Brahe's descriptive geocentric theory can not really exist. For if they did, then surely comets would collide against them. Likewise, the Cartesian vortices can not be the agents that move the planets and other celestial bodies. Newton observes that comets follow a dynamic trajectory through all parts of the sky which is inconsistent with the dynamics resulting from a vortex.

[6] Miller (1987) pp.164-65.

One could easily multiply such examples from the mature sciences. I hope the above examples demonstrate the need for taking rival theories seriously and for establishing alternative causal mechanisms which can be examined by using techniques of observation and logical procedures which are accepted as fair by all sides. It should also be noted that this is not simply a plea for mainstream theorists to take seriously the causal mechanisms postulated by the non-mainstream theories. The argument is symmetric. In fact, there are grounds for stressing that the challengers to the mainstream theories need to spell out the causal mechanisms of both their own alternative theories and the rival mainstream theories as well as the shared principles among these alternatives. Much dogmatism in social sciences can be avoided if rival theorists were to make explicit the causal mechanisms and the grounds for what would comprise a fair causal comparison among rival theories.

It needs to be emphasized that even after clarifying shared principles, there will generally be substantive areas of disagreement among contending theories. However, in this instance at least, the discussion of substantive disagreements and their possible resolution can proceed without talking at cross-purposes. There are more difficult cases where the framework principles themselves are in dispute. For such cases, it is necessary to develop a detailed theory of confirmation that would rely on topic-specific rules within a field or sub-field of inquiry rather than some global a priori or deductivist general rule (for example, the failed logical positivist attempt to offer such global rules of confirmation for all sciences).

While such a theory of confirmation for economics, political economy or the social sciences in general is yet to be fully developed, the approach defended here would call for a consideration of specific debates in substantive areas in order to develop such specific principles of confirmation. In particular, the demands for causal depth in specific theories would have to play a critical role in developing these topic-specific principles.

I now turn from the biological and physical sciences to a topic-specific example in political economy of development. In recent years the neoclassical optimizing agent approach to institutions has gained prominence. The claim by its proponents (see Ray 1997, for a particularly lucid and rigorous presentation of the strongest version of the

neoclassical approach) is that these intentional explanations involving the decision making problem of the representative agent are to be preferred to more structural models which do not seem to have "microfoundations". The mathematics of optimization gives it additional credibility. Yet, what are the claims of the more structural "dualistic" models of development inspired by classical political economy?

The most advanced and therefore the most appropriate candidate for causal comparison with the neoclassical model is what can be called a “dual-dual” model (Svejnar and Thorbecke 1980, 1982, Khan 1982a, b, 1985, 1994, 1997, 2004a, b, 2006; Khan 2008a;Khan and Thorbecke 1988, 1989; Thorbecke, 1992, 1994; Thorbecke and Santiago, 1984; Thorbecke and Morrisson. 1989). This corresponds to the characteristics of a developing economy with not only the traditional and modern sectors but also a kind of dualism within each of these sectors in terms of formal/informal dichotomy. More specifically, the process of development for economies moving from the least developed status to a higher level of development may modify the traditional sector further in the direction of a more market-based modern sector while the formal/informal dichotomy is accentuated within both the sectors. This is one of the most important moves theoretically which is consistent with the stylized facts to be explained in the course of economic development without introducing *ad hoc* assumptions. In fact, the dual-dual theory reveals that even within the category of the least developed economies the theoretical possibility of the uneven development of the formal and informal sectors both in the urban and the rural areas can exist. In recent years, it has indeed been empirically confirmed as well.

Thus, in this theoretical framework, the coexistence and distribution of modern and informal type of activities in both rural and urban areas are taken as basic structural features of the economy in question. The structural dual-dual approach integrates poverty analysis with rural-urban movements in an economy wide setting by endogenizing both migration[7] and intra-group income distributions and the nominal poverty line. Following this line of work leads to the social scientists' being able to assess policy repercussions on both poverty specific to particular socioeconomic groups and on overall national poverty.

[7] Within an overall trend towards rapid urbanization there can be migration in both directions. This can have important implications for poverty reduction policies, as Khan (2006) shows for South Asia.

To elaborate a bit further, the starting point is the dual economy models of Lewis (1954) and Fei and Ranis (1964)[8].The roots of Lewis' seminal work are in the classical political economy. These pioneering efforts, however, could not or did not take into account the co-presence of dualism within each sector of the two sector models of the dual economy. Erik Thorbecke first raised this issue in 1979 during the course of a National Science Foundation interdisciplinary project on technology and development and Svejnar and Thorbecke (1980, 1982) was the first published work on a prototype of dual-dual technology classification scheme. Khan (1982a, b) and Khan (1985) were applications of this scheme to the energy and textiles sectors in South Korea. Khan (1983) raised the issue of linking technological dualism to poverty theoretically, following an early observation of Pyatt and Thorbecke (1976). Khan and Thorbecke (1988, 1989) were further applications of technological dualism to Indonesia. Khan (1999) explores the connections between rural-urban dualism and migration and poverty in South Africa. Khan (2006) explores both rural-urban and reverse migration in a dual-dual model for South Asia.

In the current formulation, a rural/urban dichotomy is combined with traditional/modern technological dualism, leading to a fourfold classificatory scheme.[9] The four broadly defined sectors in this scheme are:

1. *Subsistence agriculture* with traditional labor-intensive technologies, family farms and food crops for domestic consumption;
2. *Large-scale agriculture* producing mostly export crops using capital-intensive technology.
3. *Urban informal* sector defined in an operational manner;
4. *Modern sector* with industry and services in the urban areas.

Poverty analysis in this dual-dual approach can be integrated with migration and various shocks that are important features of the urbanization process in developing countries. Thus, in addition to explaining the standard "development scenario", the

[8] See Khan (1997) chs. 2 and 3 for a historical survey and a specific intertemporal dualistic model which is used to analyze the conflict between employment and output.
[9] See Svejnar-Thorbecke (1980, 1982) and Khan (1983) for early developments. See also Khan (1997, 2006) and Stifel-Thorbecke (2003).

dual-dual model explains additional features of development--- particularly the uneven nature of this process in a number of dimensions--- which the neoclassical approach can not. The fact is that while individual agents may or may not optimize, the causally deeper political economy approach can explain a number of observable phenomena that the neoclassical theory can not explain and this is in addition to explaining the same range of phenomena. Furthermore, in the neoclassical version, the observable market segmentation, subcontracting, surplus labor in agriculture and disguised unemployment in developing economies etc. are derived from the optimizing agent setting only by introducing *ad hoc* assumptions about information, implicit prices, discount rates etc.[10] The equations of the model below show that the so-called micro-foundations at the household and firm levels can also be incorporated in the formalization of this theory. In addition, the formal/informal and rural/urban structural features are also modeled appropriately.

It can be shown mathematically(Khan2008, 2018) that the dual-dual structural theory-based model has greater causal depth than the standard neoclassical optimizing model since the households and firms can optimize here but within a deeper socio-economic structure. In addition to the standard *explananda* common to the concerns of the two rival models, these structural features allow the social scientist to explain other phenomena such as poverty, migration and their interactions among other things.

An important general lesson about causal depth can also be drawn from this example. If scientific realism is even approximately true then pinpointing the ontologically real features in an approximate fashion will likely lead to further discoveries. The history of the mature sciences corroborates this view. It turns out that in social sciences, too, causally deeper theories can lead to deeper insights as well as further discoveries. This is another reason to reject the Humean straitjacket. But more importantly, it is also a good reason to reject dogmatic, *a prioristic* formulas for doing science even when

[10] This is not to claim that it is never legitimate to modify a theory from its original version. In fact, this is the norm in any progressively productive mature science such as physics, chemistry, biology etc. But the modifications must have both empirical justification through further testing and be theoretically coherent, and not just *ad hoc* "saving the phenomena". In Lakatos's terms, both neoclassical and non-neoclassical research programs can become degenerating if ad hoc assumptions are not put this rigorous checking requirement for justification. As McCloskey has argued the neoclassical habit of using "consistent with" after using such ad hoc assumptions in a formal model does not justify the neoclassical theory.

they carry the attractive label of scientific realism, as they sometimes do. The moral is to follow what creative scientists do in any field but to do it with an awareness of the epistemological and ontological assumptions of rival theories.

3. Causal Depth, Counterfactuals and Common Good---Poverty Reduction in the Counterfactuals via the Dual-Dual Structural Model as an Exemplar

"Had Cleopatra's nose been shorter, the whole face of the world would have changed." So speculated Blaise Pascal in 1669. This is an example of a counterfactual thought. Leaving aside the truth value of Pascal's speculation, the method of counterfactuals in history has been known at least since Thucydides's famous history. Khan and Yang(2018) also show that his history also contains germs of the idea of what scientific realists today call "causal depth". Putting the idea of counterfactuals together with the scientific realist concept of causal depth helps us explore different states of the socio-economic world in causally salient ways. In fact, the realist interpretation of randomized controlled trials is precisely that of specifying counterfactuals in a precise enough manner in order to draw conclusions by realizing alternate ---factual and counterfactual---states of the world in specific trials. Structural models follow the same logic. In fact, the famous papers by Simon on causal ordering can be interpreted in this way.[11] The important work by Rubin[12] follows a similar logic of the (realist) counterfactual experimental specification.

As an example of avoiding harm and pursuing the common good of capabilities enhancement by reducing poverty within the dual-dual model can be mentioned. The neoliberal model claims deductively that since "free markets" lead to the most efficient and *Pareto optimal state* of the economy, there is no logical case for increasing well-being via interventionist poverty reduction policies. The counterfactuals pursued in causally deeper structural dual-dual model show at least two common good related results empirically(Khan 2006).

First, the free trade argument that tariff reduction is sufficient for poverty reduction turns out to be largely wrong. Even under the most favorable counterfactual

[11] See Simon(1952,1953). Also see Simon and Rescher(1966).
[12] See in particular, Rubin(2004,2005)

conditions, the results do not carry through below 20 percent tariff. Furthermore, even in the quantitatively effective range, the actual quantitative poverty reduction is miniscule. Even within that "achievement", we find that urban poor groups actually fare worse than before. Thus a nuanced scenario analysis requires a possibility for posing detailed counterfactual conditionals in a critical scientific realist manner.

Second, the structural model shows that counterfactual experiments involving structural changes such as asset redistribution can lead to a vastly more favorable situation for the poor and an unambiguous improvement in well-being. From an ethical point of view, such an outcome can be defended either through the Rawlsian difference principle, or better yet through the Sen-Nnussbaum-Khan social capabilities theory.

Furthermore, we should consider the question of causal mechanisms in light of causal depth. Neoclassical theory postulates mechanisms that are mathematically consistent with optimizing agents' calculus. However, causal mechanisms require more depth than just the consistency with the optimizing calculus. Among other things there must be concrete causal pathways---diagrammable according to graph theory ---showing the elementary paths, causal loops and multiple pathways that are all causally salient.[13]

Therefore, causal depth and realist counterfactual thought experiments are not mere scientific arcana. In reality, these are tools of causal analysis for crucial experiments for policy formulations for avoiding the harm that unreflective neoliberalism can inflict, and indeed has inflicted on the most vulnerable groups. More broadly and positively, the approach defended here can lead to advancement of common socio-economic good. [14]

[13] The realist approach to causality requires more than just mechanisms connecting events.Connecting events is the approach taken by Peter Hedström and his coauthors.See Hedström, P., & Swedberg(1998a,b), R. For a realist account and a critique of see Hedström group's approach to mechanisms, see Archer(1995,1996,2012,2014).

[14] A good example of normative analysis of this type is Miller(2010) on global justice. Another is the book by Alan Gilbert on Democratic Individuality, Gilbert(1990).

4.**Conclusions:**

In this short note I have tried to defend a partial but useful characterization of causal depth and counterfactuals from a critical scientific realist methodological perspective. I have shown that this view is close to the view implicit in the practice of great scientists such as Darwin and Newton[15]. In contrast to Hume and Humeans, scientific realism can advocate such a practice through careful comparisons of relevant theories (see also Clarke 2007)in a specific area of research. Such causal comparisons are necessary for judging if the theory in question really does explain the phenomena it purports to explain more deeply than the other contenders. In addition, a "causally deep" theory will generally lead to further insights that are genuinely novel. The formal presentation of the structural dual-dual model makes this particularly clear vis-à-vis its neoclassical rival.

What is also important is the role of realist counterfactuals. Such realist counterfactual experiments and comparisons can help avoid inflicting serious harm. Equally important, such experiments can lead to a better policy formulation for advancing the common good. Indeed, this is where our argument meets the earlier socially oriented progressive economic thinkers since the 1930s such as Keynes, Myrdal, Kalecki and Tinbergen among others.

However, it is necessary to sound a note of caution here. Indeed, if one is not careful, there is a danger of making scientific realism as a philosophy of science---even when it claims to be critical-- as *a prioristic* and dogmatic as logical empiricism. The antidote to such danger is to cultivate a conscious habit of comparing alternative theories according to specific criteria for causal depth and morally defensible propositions(in a sense that is similar to but not identical with Boyd's moral "realism" analogous to scientific realism) among other things. Such comparisons are never

[15] One could also make the case for both relativity theory and quantum mechanics. But the arguments involve more advanced mathematical reasoning and particularly for quantum mechanics, more subtle reasoning for answering the objections of the Copenhagen school and its later followers.

complete or final which is really another way of looking at science and ethics as open-ended social processes.[16]

[16] Here I am getting close to my colleague George DeMartino's(2019) wonderful quote from the Polish poet Wislawa Szymborska whom I had the honor of meeting when I was in high school, many years before she won her well-deserved Nobel prize. In her lovely poem (later a song)*"Nothing Twice"* we read the following lines:

> *Nothing can ever happen twice*
> *In consequence, the sorry fact is*
> *that we arrive here improvised*
> *and leave without the chance to practice."*

As a poet, I am the first to agree with her insight and deep humility about our human condition. However, in science although the demarcation problem is impossible to solve once and for all---despite the efforts by Kant and neo-Kantians, the logical positivists, Popper and scientific realists---- there is the question of relative degree of truth, that is relevant and possible to answer non-dogmatically as I have tried to do here. I am not sure that Barthes's quest for a postmodern *Mathesis singularis* can ever be fulfilled in the sciences including human sciences though I myself keep trying. Perhaps, the ever-alert doubting self that treats all "science" as provisional and in a pragmatic way with a deep and compassionate ethical concern for all is the least harmful of approaches. I feel humble enough to accept this position with the challenge of an eternal quest for provisional knowledge in a Non-Faustian way---as in Tennyson's great poem, Ulysses--- and also accept concrete ethical responsibility for every one of my acts existentially---including the acts of thinking, speaking and writing. This position also is open to what I would now call an appropriately humble hermeneutics cum dialectics(Khan 2008b) towards which I think the deeper interpretations of Hegel,Husserl, Heidegger and Gadamer point. On dialectics, see also, Haider Khan, Dialectical Logic: Ontology and Consciousness**,** lecture given on June 26, 2014. https://www.youtube.com/watch?v=1i3neXi-5d4

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Appendix: A Brief Exposition of the Dual-Dual Model Equations

A. Formal Representation of Dual-Dual Model---the model at a glance

For the interested reader, the formal representation of the dual-dual model with Constant Elasticity of Substitution (CES) Production Functions is given below. The readers interested in following the equations in detail are referred to the section 4

of Part B , “Notation and symbol explanation” below, which describes the model in greater depth.

Production and Labor Market

$$X_{fc} = A_{fc}\left[\beta_K^{fc}\overline{K}_{fc}^{\frac{\mu_{fc}-1}{\mu_{fc}}} + \beta_{LS}^{fc}LS_{fc}^{\frac{\mu_{fc}-1}{\mu_{fc}}}\beta_{LU}^{fc}LU_{fc}^{\frac{\mu_{fc}-1}{\mu_{fc}}}\right]^{\frac{\mu_{fc}}{\mu_{fc}-1}} \quad .....(1)-(2)$$

$$X_{ic} = A_{ic}\left[\beta_K^{ic}\overline{K}_{ic}^{\frac{\mu_{ic}-1}{\mu_{ic}}} + \beta_{LU}^{ic}LU_{ic}^{\frac{\mu_{ic}-1}{\mu_{ic}}}\right]^{\frac{\mu_{ic}}{\mu_{ic}-1}} \quad .....(3)-(4)$$

$$i_{ic} = \frac{P_{ic}X_{ic}}{LU_{ic}} .....(5)-(6)$$

$$wu_{ex} = \frac{P_{ex}\beta_{LU}^{ex}X_{ex}}{LU_{ex}} .....(7)$$

$$wu_{ex} = i_{food}(1+\delta) .....(8)$$

$$i_{srvc} = \frac{P_{im}\beta_{LU}^{im}X_{im}}{LU_{im}} .....(9)$$

$$w_{im} = i_{srvc} + \gamma\frac{\Pi}{LU_{im}} .....(10)$$

$$\Pi = P_{im}X_{im} - i_{srvc}LU_{im} - ws_{im}LS_{im} .....(11)$$

$$wu_{ex} = (1-\frac{hLU_{im}}{LU_{srvc}+LU_{im}})wu_{srvc} + (\frac{hLU_{im}}{LU_{srvc}+LU_{im}})wu_{im} .....(12)$$

$$ws_{fc} = \frac{P_{fc}\beta_{LS}^{fc}X_{fc}}{LS_{fc}} .....(13)-(14)$$

$$ws_{im} = \left[\frac{1-\beta_{LU}^{im}}{(1-\theta)\beta_{LU}^{im}+\theta(1-\beta_{LU}^{im})}\right]^{1/1-\theta} ws_{ex} .....(15)$$

Disposable income and savings

$$I_{rih} = i_{food} LU_{food} \text{.....(16)}$$

$$I_{ruh} = wu_{ex} LU_{ex} \text{.....(17)}$$

$$I_{rsh} = ws_{ex} LS_{ex} \text{.....(18)}$$

$$I_{rlh} = P_{ex} X_{ex} - ws_{ex} LS_{ex} - wu_{ex} LU_{ex} - S_{ex} \text{.....(19)}$$

$$I_{uih} = i_{srvc} LU_{srvc} \text{.....(20)}$$

$$I_{uuh} = ws_{im} LU_{im} \text{.....(21)}$$

$$I_{ush} = ws_{im} LS_{im} \text{.....(22)}$$

$$I_{ukh} = P_{im} X_{im} - ws_{im} LS_{im} - wu_{im} LU_{im} - S_{im} \text{.....(23)}$$

$$I_{bch} = tM \text{.....(24)}$$

$$S_{fc} = \lambda_{fc} [P_{fc} X_{fc} - ws_{fc} LS_{fc} - wu_{fc} LU_{fc}] \text{.....(25)} - (26)$$

Demand

$$C_c^h = \frac{\alpha_c^h I_h}{P_c} \text{.....(27)} - (49)$$

Foreign Trade

$$M = \sum_h C_{im}^h + \frac{S_{im}}{P_{im}} - X_{im} \text{.....(50)}$$

$$EX = X_{ex} - \frac{S_{ex}}{P_{ex}} \text{.....(51)}$$

Equilibrium Conditions

$$\sum_c LU_c = LU \text{.....(52)}$$

$$\sum_{fc} LS_{fc} = LS \text{.....(53)}$$

$$X_{ic} = \sum_h C_{ic}^h \text{.....(54)} - (55)$$

$$P_{im} \equiv 1 + t \text{.....(56)}$$

$$P_{ex} \equiv 1 \text{.....(57)}$$

B. A More Detailed Exposition:

The production sectors are specified as CES with the choice of nonunitary[17] elasticities of substitution for the two formal sector commodities in equations 1 and 2. The informal sector commodities also have CES specifications. All commodities are produced under capital constraints. Thus, capital, K, in each sector has an upper bound denoted by a bar above K. The assumption that capital stock is fixed in each sector may be relaxed, but it is in fact, a fairly standard assumption for developing economies.

In the informal sectors each worker receives her average revenue product. Rural small holders may work on common land and these rural farming households may share the total income equally among all the family members. Urban informal workers supply all their labor at the prevailing wage rate. Thus leisure is not an argument in their objective function. This may be defended as an extreme assumption when people are at the margins of subsistence. Equations 5 and 6 show the informal sectors' income determination.

The total income per unit includes logically the returns also to non-labor assets for those who own land or capital. Hence, the relevant measure of income is total income per unit from all sources.

The profit maximizing rural large landholders ensure that under competitive conditions wages for unskilled workers in the export sector are equal to the marginal revenue product of the unskilled labor they have to hire. Equation 7 reflects this condition. Equation 8 shows the equilibrium allocation of unskilled labor in the rural informal sector. In equilibrium, the rural sector wage rate is below the wage rate in the formal sector by a fixed factor. This reflects the assumption that there are transactions costs in working in the rural formal sector that is captured by this mark up.[18]

Turning now to the import sector, for unskilled workers in the urban area the

[17] The Stifel-Thorbecke model uses Cobb-Douglas production functions with elasticities of substitution restricted to a value of 1.

[18] Alternatively, one could also postulate that there is an 'insider' market wage equilibrium in the formal sector, and those unskilled workers lucky enough (or more likely, because they know someone already working in the formal sector) to get a job in the formal sector can enjoy this wage premium. This is not a hypothesis the authors consider, but the data will be consistent with this hypothesis as well.

assumption here is that they get the income per unit of labor in the urban services sector (shown in equation 9) plus a share of the profits as given in equation 10. The profit determination itself is shown in equation 11.

The Harris-Todaro model features regarding rural-urban migration are captured in equation 12. Here, in equilibrium, rural wage must equal the expected wage in the urban sector. In equation 12, the probability of getting a job in the import sector is given by the share of the urban uneducated labor force in that particular sector multiplied by a scale parameter, *h*.

Skilled workers are employed only in the formal sectors. Their wages are determined in equations 13 and 14 by their marginal revenue products. We now turn to the determination of incomes for the households.

1. Household Income Determination

There are nine types of households. Two in the rural area are landowning households--- large and small. There are also urban capitalists and bureaucrats. The other five are households where the main source of income is from labor.

The rural informal households which are really rural small holders receive their total revenue from production as shown in equation 16. Rural unskilled and skilled households receive their wage incomes as shown in equations 17 and 18 respectively. Equation 19 gives the incomes of the rural large land holders.

Equations 20- 24 show the incomes of the urban households. The working class households receive wage income and the capitalists the profit incomes, in general. The bureaucratic households capture part of the rents from imports by colluding with the rent seekers.[19] The formal sector employers (rural large land owners and urban capitalists) are the only savers in the model. They each save a constant fraction of their nominal incomes.

Household demand functions are captured by maximization of Cobb-Douglas utility functions subject to their income constraints. There are 23 such equations (equations 27-49) because the four rural household groups have access to only food and importables. This gives us eight equations. Each of the urban groups has access to

[19] Salaries are excluded in equation 24. The reasoning is that these are invariant to exogenous shocks.

three commodities--- food, importables and urban services. This gives another 15 equations. The prices for the three commodities can be used to define an overall deflator.

2. Foreign Trade

Imports in this model are the difference between domestic demand and production of import competing sector. Exports can be supplied at the prevailing price up to any quantity under the small country assumption. Thus exports are equal to total output less the savings in the form of exportables of the rural large landholders. Equations 50 and 51 show the import and export demand functions respectively.

3. Equilibrium conditions for the model as a whole and Causal Depth

There are two sets of equilibrium conditions in the model. First, the labor market equilibrium conditions are given by equations 52 and 53. There is disguised unemployment, as discussed before, but no formal involuntary unemployment. The second set of equilibrium conditions given by equations 50 and 51 is that the domestic demand for the informal sector goods and services is matched by domestic supply. Prices in the formal sectors are set by the world market prices. The export price is normalized to one. The import price is equal to 1+t, where t is the tariff rate. Exchange rate is held fixed during the particular modelling period. It is clear that the current account balance must be exogenous. This balance is equal to foreign savings which are assumed to be zero here. Hence current account balance is assumed to be zero.[20] This completes the description of the formal model. It is clear that this model has greater causal depth than the standard neoclassical optimizing model since the households and firms can optimize here but within a deeper socio-economic structure. In addition to the standard *explananda* common to the concerns of the two rival models, these structural features allow the social scientist to explain other phenomena such as poverty, migration and their interactions among other things.

[20] Implicitly, this amounts to claiming for a reforming economy that the stabilization policies indeed succeed in restoring the external balance.

4. Notation and symbol explanation

Production and Labor Market

$$X_{fc} = A_{fc}\left[\beta_K^{fc}\overline{K}_{fc}^{\frac{\mu_{fc}-1}{\mu_{fc}}} + \beta_{LS}^{fc}LS_{fc}^{\frac{\mu_{fc}-1}{\mu_{fc}}}\beta_{LU}^{fc}LU_{fc}^{\frac{\mu_{fc}-1}{\mu_{fc}}}\right]^{\frac{\mu_{fc}}{\mu_{fc}-1}} \quad \text{.....(1)-(2)}$$

Eqn 1-2: output of formal sector [superscript/subscript; fc=formal sector commodities]

X=output in formal sector; A=Technology coefficient; K=Fixed capital; β=share of input in output; LS= skilled labor; LU=unskilled labor; μ=elasticity of substitution;

$$X_{ic} = A_{ic}\left[\beta_K^{ic}\overline{K}_{ic}^{\frac{\mu_{ic}-1}{\mu_{ic}}} + \beta_{LU}^{ic}LU_{ic}^{\frac{\mu_{ic}-1}{\mu_{ic}}}\right]^{\frac{\mu_{ic}}{\mu_{ic}-1}} \quad \text{.....(3)-(4)}$$

Eqn 3-4: output in informal sector [superscript/subscript; ic=informal sector commodities]

X=output in formal sector; A=Technology coefficient; K=Fixed capital; β=share of input in output; LS= skilled labor; LU=unskilled labor; μ=elasticity of substitution;

$$i_{ic} = \frac{P_{ic}X_{ic}}{LU_{ic}} \text{.....(5)-(6)}$$

i_{ic}=income in informal sector (wage in informal sector is determined)

$$wu_{ex} = \frac{P_{ex}\beta_{LU}^{ex}X_{ex}}{LU_{ex}} \text{.....(7)}$$

wu_{ex}= unskilled labor wage in export sector [subscript ex is used for export sector representation]; β=share of input in output

$$wu_{ex} = i_{food}(1+\delta) \text{.....(8)}$$

δ= Transaction costs of work in rural formal sector (export) instead of working in food sector (for unskilled labor) ; i_{food}=income in food sector

$$i_{srvc} = \frac{P_{im}\beta_{LU}^{im} X_{im}}{LU_{im}} \text{.....(9)}$$

i_{srvc}=income in service sector of unskilled workers

$$w_{im} = i_{srvc} + \gamma \frac{\Pi}{LU_{im}} \text{.....(10)}$$

w_{im}= wages in import competing industry; γ=profit share ratio for unskilled labor in import competing sector; Π=profits;

$$\Pi = P_{im} X_{im} - i_{srvc} LU_{im} - ws_{im} LS_{im} \text{.....(11)}$$

Π=profits of capitalists; ws_{im}=skilled labor wage;

$$wu_{ex} = (1 - \frac{hLU_{im}}{LU_{srvc} + LU_{im}}) wu_{srvc} + (\frac{hLU_{im}}{LU_{srvc} + LU_{im}}) wu_{im} \text{.....(12)}$$

h= scale parameter

$$ws_{fc} = \frac{P_{fc}\beta_{LS}^{fc} X_{fc}}{LS_{fc}} \text{.....(13)} - \text{(14)}$$

ws_{fc}= skilled wage in formal sector

$$ws_{im} = \left[\frac{1 - \beta_{LU}^{im}}{(1-\theta)\beta_{LU}^{im} + \theta(1 - \beta_{LU}^{im})} \right]^{1/1-\theta} ws_{ex} \text{.....(15)}$$

ws_{im}= skilled wage in import competing sector; θ= relative risk aversion of skilled workers

Disposable income and savings

$$I_{rih} = i_{food} LU_{food} \text{.....(16)}$$

I_{rih}= disposable income of rural informal household

$$I_{ruh} = wu_{ex} LU_{ex} \text{.....(17)}$$

I_{ruh}= disposable income of rural unskilled household

$$I_{rsh} = ws_{ex} LS_{ex} \text{.....(18)}$$

I_{rsh}= disposable income of rural skilled household

$$I_{rlh} = P_{ex}X_{ex} - ws_{ex}LS_{ex} - wu_{ex}LU_{ex} - S_{ex} \text{.....(19)}$$

I_{rlh}= disposable income of rural large landholders household

$$I_{uih} = i_{srvc}LU_{srvc} \text{.....(20)}$$

I_{uih}= disposable income of urban informal household

$$I_{uuh} = ws_{im}LU_{im} \text{.....(21)}$$

I_{uuh}= disposable income of rural unskilled household

$$I_{ush} = ws_{im}LS_{im} \text{.....(22)}$$

I_{ush}= disposable income of urban unskilled household

$$I_{ukh} = P_{im}X_{im} - ws_{im}LS_{im} - wu_{im}LU_{im} - S_{im} \text{.....(23)}$$

I_{ukh}= disposable income of urban capitalist household

$$I_{bch} = tM \text{.....(24)}$$

I_{bch}= disposable income of bureaucrat household

$$S_{fc} = \lambda_{fc}[P_{fc}X_{fc} - ws_{fc}LS_{fc} - wu_{fc}LU_{fc}] \text{.....(25)} - (26)$$

S=savings of formal sector employers (urban capitalists and rural large landholders)

Demand

$$C_c^h = \frac{\alpha_c^h I_h}{P_c} \text{.....(27)} - (49)$$

α=budget share of commodities; I=household income; C=consumption of commodities by households; P=price of commidites;

Foreign Trade

$$M = \sum_h C_{im}^h + \frac{S_{im}}{P_{im}} - X_{im} \text{.....(50)}$$

M=import; C= demand for imported commodities; S=savings of capitalists; P=price of imported commodities; X=output in import competing sector;

$$EX = X_{ex} - \frac{S_{ex}}{P_{ex}} \text{.....(51)}$$

EX=export; X=output in export sector; S=savings of rural capitalists (large landholders); P=price of export commodities;

Equilibrium Conditions

$$\sum_c LU_c = LU \text{.....(52)}$$

$$\sum_{fc} LS_{fc} = LS \text{.....(53)}$$

$$X_{ic} = \sum_h C_{ic}^h \text{.....(54)} - \text{(55)}$$

$$P_{im} \equiv 1 + t \text{.....(56)}$$

P=price of imports; t= tariff rate

$$P_{ex} \equiv 1 \text{.....(57)}$$

P=price of exports