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Economic progress as related sets of non-repeating eclipses

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Abstract: I use a seemingly simple analogy of lunar and solar eclipses and set theoretical language to characterize how objects (factors) and ideas (forces) have determined the course of economic progress. In the early Ages economic progress depended heavily on objects, i.e., objects eclipsed ideas. From the end of Classical Antiquity to the present, objects, ideas, and their interactions and intra-actions have driven economic progress. The future of economic progress would depend principally on ideas, not because objects would vanish, but because object productivity would increasingly depend on ideas. While the welfare implications of the full idea eclipse of objects are difficult to pin down, they are not inconceivable. One obvious outcome is that different regions and countries will continue to perform differently because ideas will remain unevenly distributed, and even when they are evenly distributed, they will not be equally productive in all places. Such a policy implication recommends more investment in ideas than in objects in order to close the gaps in economic progress across regions and countries.

Key phrases: Economic progress, object-idea eclipse, idea-object eclipse

JEL Codes: O10, O33, O47, N1

In his introduction to JB Bury's (1960[1932]) classic "*The Idea of Progress*," Charles A. Beard surmises that "the world is largely ruled by ideas, true and false (p. iv) [and that] ... among the ideas which have held sway in public and private affairs for the last two hundred years, none more significant or likely to exert more influence in the future than the concept of progress" (p. xi). The assertion was an excellent, nearly prophetic, foresight, such that the explanation of progress has been the principal preoccupation of all wise men and women, including economists. Three notable groups of economic theories of economic progress are discernible: classical growth theories, neoclassical growth theories, and new growth theories. These theories are too familiar to economists for review. Instead, I highlight W. Arthur Lewis (1965) and Paul M. Romer (1993) for showing modern economists that progress, variously measured, depends on "factors and forces" for Lewis, and "objects and ideas" for Romer. Amavilah (2005) has since concluded that factors and objects are the same thing, and forces and ideas are also the same thing.

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In this note I use a seemingly simple analogy to characterize how objects/factors and ideas/forces have determined the course of economic progress. I claim that economic progress can be explained easily as related sets of non-repeating *object-idea eclipses* and *idea-object eclipses*, not unlike lunar and solar eclipses (Figure 1). Such an approach enhances our understanding of the history, present, and future of economic progress. Below I demonstrate the claim.

1. The history: Object-driven economic progress

During the prehistoric ages (Mesolithic, Neolithic, Bronze, Iron, Classical Antiquity, Middle, and Early Modernity) objects were *the* determinants of economic progress. For instance, history convinced the Physiocrats of the importance of land above all else as their “*Tableau Economique*” emphasized. Mercantilists favored trade in land (e.g., gold, silver, etc.). Even classical economists, including Adam Smith, Thomas Malthus, David Ricardo, Karl Marx and many others, accepted labor as the principal source of value – the “labor theory of value” hypothesis. Thus,

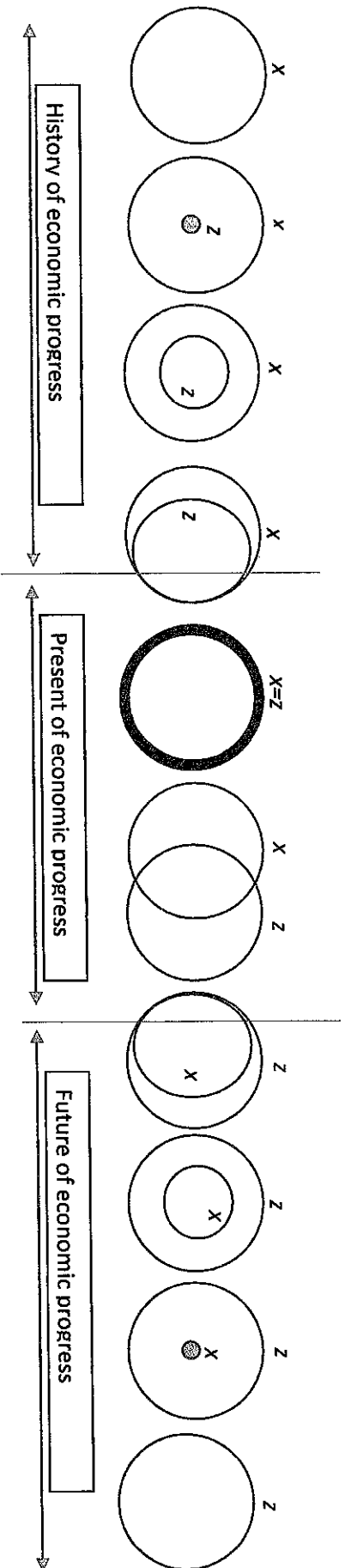
$$\dot{y}(t) = f[x(t) | \dot{z}(t)=0], f' > 0, f'' < 0, \quad (1)$$

where $\dot{y}(t)$ is some measure of economic progress such as the growth of real per capita GDP, t is the general time referring to both calendar time (terms) and economic time (runs), the dot represents the rate of change of the variable over which it sits, f'' implies diminishing returns to $x(t)$. Since $\dot{z}(t) = 0$, or at least $\dot{z}(t)$ is a constant, (1) is a very simple process in which technological change is either absent, insignificant, or unappreciated. Indeed, until Marx and Engels (1967[1848]) acknowledged the importance of technology, (1) was an accurate depiction of the production technique.¹

As a determinant of $\dot{y}(t)$, $\dot{z}(t)$ emerged slowly over the ages. The figure below shows $z(t)$ appearing first as a tiny dot, and increasing in size (importance) over time. Using European history as an illustrative example, one can date the emergence and increasing importance of ideas to the Middle Ages; i.e., the idea-dot appeared in the Middle Ages and grew rapidly during the Renaissance (High Middle Ages). Ideas were then systemized and systematized into transferable (socially inheritable) knowledge during the Age of Reason, or Age of Enlightenment. Historians of ideas like Robert Nisbet (1980) as well as economic historians like Schumpeter (1954), Hicks (1969), and Rima (1978) tell us that rapid growth of scientific ideas (along with occasional idea revolutions) occurred during these

¹I am here referring to Chapter 1 on “Bourgeois and Proletarians,” pp. 79-94, in which technological improvements were the only things that stood between the survival of capitalism and the emergence of a proletariat dictatorship.

Figure 1 -- Economic Progress Eclipses: Objects to Ideas*



Reading from left to right:

- Objects are the only source of economic progress ($x \cap z = \emptyset \Rightarrow x$ and z are disjoint)
- Ideas emerge, but objects dominate overwhelmingly ($z \subset x \Rightarrow \{m: m \in x, z = 0\}$)
- Ideas grow, but they far less important than objects ($z \subset x \Rightarrow \{m: m \in x, z > 0\}$)
- In some cases objects and ideas are equally responsible; sometimes not ($z \subseteq x \Rightarrow \{m: m \in x, m \in z\}$)
- Object- idea mutual eclipse ($x = z \Rightarrow \{m: m \in x \cap z \text{ and } m \in x \cup z\}$)
- Ideas and objects intersect ($z \cap x \Rightarrow \{m: m \in x, \text{ and } m \in z\}$)
- In some cases ideas and objects are equally responsible; sometimes not ($z \subseteq x \Rightarrow \{m: m \in z, m \in x\}$)
- Ideas overwhelm objects ($x \subset z \Rightarrow \{m: m \in z, x = 0\}$)
- Objects disappearing, but still there ($x \subset z \Rightarrow \{m: m \in z, x = 0\}$)
- Ideas are the only source of economic progress ($(z \cap x = \emptyset \Rightarrow z$ and x are disjoint))

*Since I am only using set theoretical language rather set theory, the terms inclusion and union, the eclipses they refer to, may be read as embodied (biased) and disembodied (neutral) progress.

ages. Such growth reaffirmed earthly life as apparent from printing, paintings, mathematics, governance, and all sorts of self-actualizations. Many famous European philosopher-scientists grazed these epochs: da Vinci, Michelangelo, Bacon, Descartes, Locke, Spinoza, Voltaire, Hume, Kant, Newton, to mention a few in no particular order.

The proliferation of ideas weakened first, and then uncoupled, the State-Church alliance which existed for many years prior. Absolute religions, especially Christian religions, reformed and the “reformation” allowed space for the development of ideas like capitalism, and so necessarily the Marxist antithesis of capitalism. As a matter of fact, although ideas have had a significant influence on economic progress all over the world as far back as 500AD, it was the combined effect of a secular State and a reformed Church that made England the epicenter of the Industrial Revolution (Elton, 1963).

The preceding is familiar and well-trod territory for experts far more competent in these things than I am. My only point is that along the *r-evolutionary* path one comes upon *partial* and *full eclipses of ideas by objects*. A partial eclipse of z by x would be

$$\dot{y}(t) = f[\dot{x}(t), \dot{z}(t) | \dot{z}(t) \neq 0 \in \dot{x}(t)]. \quad (2)$$

Unlike (1), (2) represents the dominance of objects, and not the absence of ideas, in economic progress. During the partial object eclipse of ideas many wars for objects were waged, whether objects were slaves, land, or some other stuff. The brave foot soldier was the hero, for whoever brought home the most loot was “king,” so to speaking. However, as soon as it became clear that ideas enhanced the productivity of objects, to continue the war analogy, the general in charge of the battle plans, strategy, organization, and coordination proved equally, if not more valuable than the foot soldier, even if the general himself was away from the battlefield. Entered to stay the role of ideas in economic progress.

2. The present: Object-idea-driven economic progress

Although the distinction between objects (factors) and ideas (forces) is crucial to economic progress, both Lewis and Romer have neglected to stress object-idea interactions as well as object-object and idea-idea intra-actions (cf. Amavilah, 2005, 2014a). If they did, (2) could be restated as

$$\dot{y} = f[\dot{x}, \dot{z}, \dot{\tau}], \quad \dot{\tau} = \int_t^{\infty} [\dot{x} \dot{z}] dt = \int_t^{\infty} [\dot{x} \cap \dot{z}] dt, \quad (3)$$

representing a *mutual, but partial, object-idea eclipse*.² Hence, ideas and the technology (knowledge) to which they gave birth, became prominent in the Middle Ages with the emergence of science and the scientific approach to things.³ According to Beard's understanding of Bury technology has no end goal of its own; it begins r-evolutions as evidenced by the Industrial Revolution. Thus, "... the effects of technology upon the social evolution ... are not confronted by accomplished work alone, but also by a swiftly advancing method for subduing material things" (p. xxii). This is the case because "technology by its intrinsic nature transcends all social forms, the whole heritage of acquired institutions and habits, ... [and] it cannot be monopolized by any nation, class, period, government or people" (p. xxiii). Hence,

Until people prefer hunger rather than plenty, disease rather than health, technology will continue to be dynamic. At all events it has behind it man's insatiable curiosity which leads him to search the heavens with telescopes, dive to the bottom of the sea, and explore atomic worlds. Curiosity would have to die out in human nature before technology could become stagnant, stopping the progress of science and industry. ... Thus technology reinforces the social, as distinguished from the individual, aspects of historical evolution (pp. xxiv- xxv).

Progress is progressive (dynamic); it continues into a *mutually full eclipse* and this time it is not possible to tell whether objects eclipse ideas, or idea eclipse objects. In set theoretic language,

$$\dot{y} = f[2\dot{x} | \dot{x} = \dot{z}]. \quad (4)$$

The separation of the scientific from the unscientific and debilitating myths as well the accumulation of technology (knowledge) it enabled, cleared the stage for yet another set, one in which ideas begin to dominate objects – *partial or full eclipses of objects by ideas*. As an illustration of a partial eclipse of objects by ideas, we get the equivalent of (2) above as,

$$\dot{y} = f[\dot{z}, \dot{x} | \dot{z} \neq 0 \in \dot{z}]. \quad (5)$$

In essence (5) is not brand new. Following the Parente-Prescott (1994) framework, which has a theoretical basis in Hayek (1937, 1945, 1974) and many others and an empirical justification in Mincer (1958, 1981), also among many, Amavilah (2014ac) concluded that factor intra-actions and interactions are fundamental to human knowledge defined as technology plus human capital. Human knowledge affects economic progress directly as well as indirectly through its effects on other factors

²Note that if $\dot{t} = f(\dot{x}, \dot{z}, t)$, the $\dot{t} = \int_t^{\infty} [\dot{x}\dot{z}]dt$ is really triple integration over x , z , and over t for both x and z .

³This relationship between ideas and knowledge is based on Amavilah's (2009, pp. 977-978) interpretation of Bertrand Russel (1948, 1956) and Thomas Sowell (1996).

and forces of economic progress. For instance, Grier's (2005) study of Sub-Saharan African countries show that physical and human capital have large and positive marginal effects on each other. Grier (2002) also found that in Latin American countries human capitalized people assimilate new knowledge better than uncapitalized people. Similarly Graca, Jafarey and Philippopoulos (1995) indicate that physical and human capital are endogenous to economic progress, with human capital influencing total factor productivity – a result that confirms Arrow's (1969) insight that “knowledge arises from deliberate seeking, but it also arises from observations incidental on other activities [such] fact production and investment may lead to increases in productivity without any identifiable allocation of resource to that end , [and that] ... deliberate ... expenditures on [knowledge] are actual steps in the [output] production process” (p. 30).

Even more interesting was the implication that the effects of human capital on the economic activity were larger at higher levels of economic progress than at lower levels. This outcome is consistent with the interpretation that lower levels of development depend more on objects than higher levels of development. It is also in line with Theo Eicher's (1996) study which concluded that new technologies are skill-intensive, while unskilled labor is more comfortable with old technologies. Eicher's conclusion compares favorably with Lucas and Moll's (2014) innovative model in which an economy uses its old technology to continue to produce old goods and services while simultaneously it searches for new technologies that would enhance the productivity of old, or the production of new, goods and services.

3. The future: Idea-driven economic progress

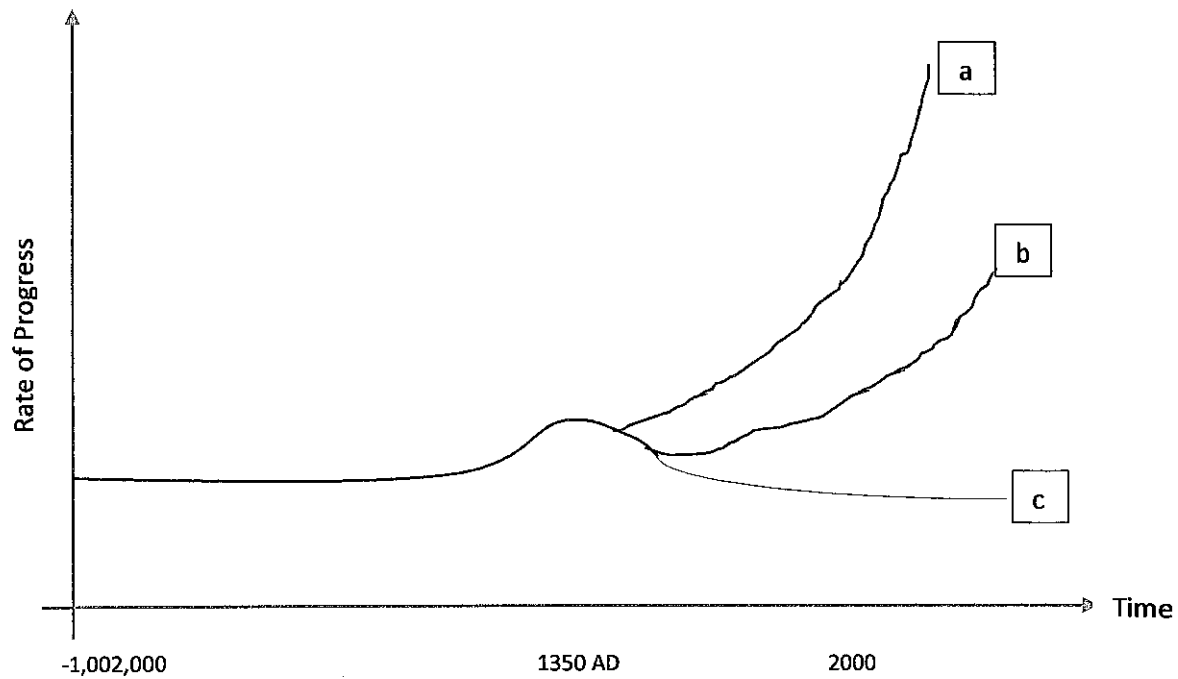
From both Figures 1 and 2 it is clear that in the future economic progress depends on ideas, not because objects are not there, but because object productivity relies on ideas so much that without ideas economic progress stops. In other words,

$$\dot{y} = f[\dot{z}, \dot{x} | \dot{x} \approx 0 \in \dot{z}]. \quad (6)$$

Judging from the present state of things, (6) is not unrealistic. In fact, it is predicted by DeLong's (1998) “Estimates of World GDP from the Million BC to the Present,” and the extension of DeLong by Max Roser (2014) backward to 1,002,000 BC and forward to 2014. Figure 2 below is my analytical interpretation of different epochs of economic progress. The figure shows that for much of human history, economic progress was low because it was based on objects. As ideas started to germinate after 500 AD, the rate of progress picked up, but the increase was dampened by events like the Black Death c. 1350, believed to have resulted from poor health and hygiene, which themselves were outcomes of wide spread poverty.⁴ The Death reduced the population and incidentally tended

⁴A typical example of the saying that, “The people are sick because they are poor, [and] they poor because they are sick.” I have seen this statement in an interview of Tim Parsons, Director of Public Affairs for the Johns Hopkins Bloomberg School of Public Health (http://malaria.jhsph.edu/news/world_malaria_day2009.html). I am certain that statement is not original to Parsons; it is more likely due to Dr. Albert Schweitzer than anyone else – but I am quessing.

Figure 2 – Rates of Economic Progress form 1,002,000 BC Onwards*



- -1,002,000 BC – 1350 AD: Object-driven history of economic progress according to DeLong (1998) and Roser (2015).
- 11350 AD – 2000 AD: Object-idea-driven present of economic progress according to Lewis (1965) and Romer (1993).
- 2000 – onwards: Idea-driven future of economic progress.
- [a] – [c] = range of future possibilities.

Source: Theoretical interpretation of DeLong (1998) and Roser (2014)

to raise the standard of living of the improvised survivors but at the same time labor declined. Consequently landlords leased land to peasants without relinquishing property rights. According to GR Elton (1963) at the time “land alone bestowed social prestige” (p. 269), and without that prestige soon peasant uprisings happened all over Europe. Other notable “economic problems” ensued, chief among them : the Medici Bank debacle, the Memmingen Articles, the Draft of a Poor Law, the Enclosures and Inflation, and Export and Imports issues. All these would have put economic progress on a declining asymptote (dash Line c in Figure 2) were it not for the rise of ideas such as The Industrial Revolution, the “discovery” and colonization of the Americas and the establishment of en route stations like the Cape of Good Hope in South Africa.

Both De Long and Roser tell us that GDP and per capita GDP in 1990 international dollars doubled every year from the 1500s to the 1800s, and increased by 12-folds in the last 200 years after the 1800s. As De Long says, “a large proportion of our high standard of living today derives not just from our ability to more cheaply and productively manufacture the commodities of 1800, but new types of commodities, some of which do a better job of meeting needs that we knew we had back in 1800, and some of which needs that were unimagined back in 1800” (p. 4). My claim here is that idea-object interactions, object-object and idea-idea intra-actions made possible Roser’s backward L-shaped path of economic progress.

Conceptually, economic progress stemming from a full idea eclipse of objects followed the path indicated by Line a. Line b represents a situation in which mutual eclipse of ideas and objects, while Line a represents what would have happened had economic progress continued to depend on objects. Since ideas, just like objects are, will never be evenly distributed, one can expect different regions of the world to be located some place in the a-c area of Figure 2. In that perhaps Dani Rodrik (2013) is correct that the future looks gloom for the developing countries. If he is, it is probably because of these countries will continue their dependence on objects.

4. Concluding remarks

Max Roser asked the following questions: “Why didn’t economic growth [progress] happen before? Why were our ancestors kept in poverty for millennia after millennia?” The answers to these questions do not only lie in individual countries as Roser stated, but more fundamentally in that (a) in the past over-reliance on objects held economic progress back; (b) interactions and intra-actions explain the present state of economic progress; and (c) the future of economic progress belongs to ideas. But are ideas subject to diminishing marginal returns?⁵ The answer is “No”, especially not if Bury is correct that technology is a function of human curiosity, and that human curiosity ends only when humans have given up on living, and so that they “prefer hunger rather than plenty” (cf. Amavilah, 2014b, Lewis, 1965). What is reasonable to say is that ideas are subject to significant uncertainty in the short- to the medium- terms, however, that may be the only for the lack of an analytical framework for assessing the welfare implications of idea-driven economic progress. The

⁵A scenic will probably say, “People do not ideas.” To that I would say people would eat whatever people in Heaven and on Earth, and earthlinkings are lucky because the people will live foreevr.

needed framework here is one that models the welfare economics of renewable public goods and services (ideas) subject to uncertainty in the short- to medium-terms and simultaneous consumption and production externalities in the long-run. Developing such a model would be a fruitful research endeavor with obvious policy implications, I think.

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