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An Evolutionary Theory of Capabilities and Sustainability

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Version 1.0

Society is something that precedes the individual.

—Aristotle, *Politics*

1 Evolution, Development and Disequilibria

In nature, the evolution of a species refers to its adaptation over time to changes in its environment (including both nature and other species) in order to survive.

Most species (S), except humans, are less powerful than nature (N):

$$S < N \tag{1}$$

Evolution (ε) can thus be written as:

$$\varepsilon = \frac{\partial S}{\partial N} < 1 \tag{2}$$

This equation means that as a species changes its capabilities with respect to nature, it can never completely catch up with the latter. One species may overtake another and thus survive, but all species are inferior to nature.

Furthermore, since the imperative need is for the survival of the species (S) rather than of an individual specimen (i), the latter is considered inferior to the former. Nature is partial to the species over the individual, as expressed by Alfred Tennyson (quoted in Sen 2010): “So careful of the type she seems, so careless of the single life.”

In this sense, evolution in the natural world implies that species (S) are more powerful than individuals (i):

$$S > i \tag{3}$$

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Combining (3) and (1), we get:

$$N > S > i \quad (4)$$

1.1 Exosomatic Evolution

Homo Sapiens - a previously obscure mammal - broke out of this evolutionary trap due to its ability for imagining and communicating abstract ideas (Harari 2014). This ability was *endosomatic* - within the body. In turn, it allowed humans to develop two powerful *exosomatic* capabilities (Lotka 1945) - that is, outside their own bodies:

- Organization - thanks to their ability to imagine and communicate abstract concepts such as state, god, and empire, humans were able to operate in large groups (>150 individuals). This capability can be considered **Political power (P)**, affecting the way individuals (i) relate to their society (S).
- Production - using the abstractions of language, writing and mathematics, humans were able to create advanced tools and preserve the knowledge of such technological changes from generation to generation and from place to place. This capability can be considered **Economic power (E)**, affecting the way humans relate to nature (N).

P implied some people had increased power over others. Without abstract ideas such as God, State or Empire, individuals would only be able to recognize the people closest to them. Abstract thinking allows strangers to work together. Forms of social organization over time included tribes, city-states, empires, and – more recently (since the 17th century) – nation-states and corporations.

E helped people create tools which increased their power over nature. Some tools were used to enhance humans' productive powers - in agriculture, industry and science - while others were developed for destructive uses - in war and other violent behaviors.

In this way, humans acquired control of their own (exosomatic) evolution, and achieved a certain level of assured survival:

$$\varepsilon_h = \frac{\partial S_h}{\partial N} = 1 \quad (5)$$

The two exosomatic capabilities thus gave humans increased powers both over nature and over each other. With the agricultural revolution around 10,000 years ago, humans domesticated animals and land (also partly controlling the evolution of nature - animals and plant species - through selective breeding and seeding).

They also 'domesticated' other humans with the advent of slavery, which did not exist among hunters and gatherers but was now widespread across empires and city-states alike. These new trends meant that both nature and people were now increasingly the private and tradeable property of other people - that is, commodified.

However, at this stage, individual humans were still less powerful than humankind as a species:

$$i_h < S_h \quad (6)$$

So combined with (5) we get:

$$i_h < S_h = N \quad (7)$$

1.2 The Birth of Development

These powers eventually gave rise to new ideologies which overshadowed religions and other earlier belief-systems. The Renaissance (inspired by Aristotle, among others), the Scientific Revolution (e.g. the views of Francis Bacon) and the humanist turn put the rational individual human on a pedestal - above both society and nature.

Also in practice some societies started focusing on enhancing individual (endosomatic) capabilities, such as improved education and better health (Lutz 2009). The process of bringing individuals up to the social frontier (e.g. by educating more people rather than just the elite) is what we now call *development* (δ):

$$\delta_h = \frac{\partial i_h}{\partial S_h} = 1 \quad (8)$$

Unlike *evolutionary* changes - occurring at the level of the species over the long-run (many generations) - *developmental* changes affect the capabilities of individuals (or sub-populations) over the short-term, i.e. a human lifetime (Lotka 1945).

Development is never perfect, and indeed there are many remaining inequalities (UNDP 2019). But in principle, the process of development aims at equating the capabilities of individuals with those of society:

$$i_h = S_h \quad (9)$$

The key distinction here is between *evolution* - enhancing the species' capabilities - and *development* - bringing up individual capabilities up to the species capability frontier. Development can thus be thought of as inherently a process that reduces inequalities within a species (or a society), or between societies (countries) in the human world. It aims to flatten the gradient within society or humankind (and perhaps raise the floor), while evolution pushes up the human ceiling vis-a-vis nature.

Combining evolution and development we get, at this point in time:

$$i_h = S_h = N \quad (10)$$

The problem, however, is that we went too far.

Already in the 16th century, with the commercial and the scientific revolutions, humans started imagining that they are superior (rather than equal) to nature, as they are rational and nature is not, that is, imagining that $S_h > N$. But they didn't have the technical capabilities yet to do this in practice.

1.3 The Human Prometheus

For a while, the two exosomatic capabilities - Organization (P) and Production (E) - advanced in tandem, but the industrial revolution marked a sea change in the balance between them. For the first time, humans were able to control and mold *energy itself* (first steam and coal, later electricity and nuclear energy), thus not just utilizing nature's powers (as in the agricultural revolution) but actually surpassing them.

This had enormous consequences for technological change and productivity, accelerating their previously tepid rates of growth, as is well documented (e.g. Maddison 2003). However, this exponential increase in one exosomatic capability - production - had proceeded far ahead of the other - organization - leading, for the first time in history, to a disequilibrium between them:

$$E > P \tag{11}$$

This also meant that economic institutions (E) - based on private property - were now more powerful than political institutions (P) which represent social power. This inequality affected both society and nature negatively. As Klein (2015) put it, "Coal represented, in short, total domination, of both nature and other people".

First, much of the advanced technology (and thus economic power or 'capital') was owned by a minority, leading to a dramatic rise in inequality both between countries (Milanovic 2012) and within nations (by 1870, class-based disparities explained two-thirds of inequality in the world). This represented a threat to the social balance, as can be seen in violent upheavals such as the French, American and Russian revolutions (see section 2 below for more political consequences).

This *social imbalance* can be written as:

$$i_h > S_h \tag{12}$$

Second, humans' relationship with nature was also negatively affected. As nature is the ultimate public good, the commodification and privatization of nature have resulted in the deterioration of the physical preconditions for human existence. While humans are the most powerful species on earth, they are still part of the planet and their fate is thus intertwined with it. Along with mass extinctions of numerous species, the entire climate is now in peril due to the unbridled use of energy in the world economy, both in production and consumption. Rather than the fear of nuclear war (or in addition to it, see Chomsky 2019), we are now facing self-destruction by over-production (and consumption).

This *environmental imbalance* can be written as:

$$S_h > N \tag{13}$$

Combined, we get:

$$i_h > S_h > N \tag{14}$$

So, ironically, while the two exosomatic capabilities made humans the first and only species to be able to *control* the course of its own evolution (for example, many mammals cannot swim or fly, but humans built boats and later airplanes to allow themselves to do just that), the *disequilibrium* between the two also means that humans are the first species that can *end* its own evolution and even existence by destroying itself, either directly by a global war or indirectly by global warming.

2 Partial Responses to Disequilibrium

Even before the industrial revolution was in full swing, both nature and humans have been commodified, as can be seen in the production function of neoclassical economics:

$$Y = f(K, L) \tag{15}$$

where L stands for human labor and K (somewhat confusingly) conflates both produced capital and nature (but leaves out energy, see Keen 2019). This *Great Commodification* has placed economic over political institutions, private over public interests. It was not met silently, with both political and intellectual reactions to this encroachment of E into P.

2.1 The Polity Strikes Back

Societies everywhere rebelled against the increased dominance of private interests – in the hands of aristocrats, royalty, corporations or a combination thereof – over the well-being of the rest of society, usually living in abject poverty. The French Revolution which began in 1789 dethroned the monarchy and weakened the aristocracy and clergy, declaring liberty, equality and fraternity as the rights of man. Initially, the attempt to establish a republic floundered, leading to dictatorship and even empire, although later it inspired democracy not only in France but around the world.

The American Revolution which began in 1785 is normally cast as a struggle between patriotic American colonists and the British monarchy, but it was also clearly a rebellion against the discriminatory economic policies of the British East India Company (one of the earliest multinational corporations). With the help of the British government, the Company was forcing the colonies to import manufactured goods from England and export raw materials back, thus preventing their industrialization (Hamilton 1791). These policies were not unlike those taken by advanced countries in recent decades to ‘kick away the ladder’ for developing countries (Chang 2002).

The Russian Revolution of 1917 was another effort to overthrow a particularly regressive regime where the opulence of the aristocracy was in sharp contrast to the misery of most people, many of them still living in serfdom. Instead of a workers’ democracy, however, the emerging Soviet Union was a dictatorship, not of the proletariat as envisioned by Marx but of the ruling (and only) communist party. Likewise, nationalist fascism in Italy and Germany presented itself as the liberator of workers exploited by rich globalized elites, only to replace the weak democracies in place at the time with a totalitarian state (though unlike communism, fascist regimes worked together with and were supported by big corporations).

As Polanyi (1944) famously described, these were reactions of societies threatened by the encroachment of economic forces and private interests on political institutions and the public good.

However, in their attempt to defend themselves (and strengthen P vis-à-vis E) against the commodification of 'fictitious commodities' – people, nature and (as explored elsewhere, e.g. Assa 2016) money – some of these societies went to the other extreme, and the changes they made came at the expense of individual freedoms. Instead of $E > P$, they ended up with:

$$P > E \tag{16}$$

And instead of $i_h > S_h$, totalitarian states have:

$$S_h > i_h \tag{17}$$

In a way, this reaction to the dominance of the economic over the political was an attempt to turn back the clock to before the industrial revolution. The recent return of populist and xenophobic parties in many developed countries as a response to globalization, the Great Recession and austerity policies is a similar overshooting of the pendulum. However, living under the absolute control of the state is not acceptable to most humans anymore (precisely *because* we control our own exosomatic evolution).

In a way, this oscillation of power from society to individual and back, or from the economy to the polity and back, are reminiscent of the predator-prey dynamics long familiar to biologists. For example, the Lotka-Volterra system of differential equations describes the interaction of two species, such as wolves (predators) and sheep (prey):

$$\frac{dx}{dt} = \alpha x - \beta xy \tag{18}$$

$$\frac{dy}{dt} = \delta xy - \gamma y \tag{19}$$

where x is the number of prey, y is the number of predators, $\frac{dx}{dt}$ and $\frac{dy}{dt}$ are the instantaneous growth rates of the two populations, and t is time. The positive parameters $\alpha, \beta, \gamma, \delta$ represent the interactions of the two species (Lotka 1925, Volterra 1926).

A variation of this model introduces grass (representing the environment) for the sheep to eat (Wilensky and Reisman 2006). This model implies that an equilibrium in this environment depends on a balance-of-power between predator and prey. If the wolves are too powerful and eat all the sheep, they will starve to death. Likewise if the sheep multiply too fast, they'll eat all the grass (before it has a chance to regenerate) and die.

This model can be used as an allegory, where the sheep are individuals, the wolves are society, and grass is the environment. If society (the wolf) is too weak, individuals (the sheep) multiply out of control and destroy the natural environment they depend on (grass). As a result both species and nature suffer. On the other hand, if society (wolf) is too strong (as in totalitarian states), it destroys all the individuals (sheep) and then starves by itself.

2.2 Liquidating Democracy

Some political reactions to the disequilibrium were more balanced, including the struggle for workers' rights as represented by labor unions, as well as the increasing demand for universal suffrage. Even some non-democratic regimes - such as the first German Reich - recognized the importance of placating the masses and enacted welfare systems to provide health, retirement and education systems (starting with the Bismarck model in 1833). These various equalizing trends peaked in the post World-War II social-democratic welfare states of the industrialized countries, where big government, big unions and big corporations balanced private and public interests for about 30 years.

This period - a brief return to $E = P$ - is often referred to as the Golden Age of capitalism (*Les Trente Glorieuses* in French), as it combined high economic growth rates (not equaled since then in OECD countries), low inequality, and relatively low environmental impacts¹. This period also witnessed most of the decolonization of territories previously ruled by the West, and an increase in the importance of multilateral institutions.

However, private interests (economic power) struck back. Starting with the collapse of the Bretton-Woods system of fixed exchange rates, capital flows across borders increased, and leading politicians in countries like the US and UK initiated massive liberalization, deregulation and privatization programs. Both inequalities as well as environmental degradation increased, although *average* standards of living in the industrial world were still improving. This changed following major shocks such as the collapse of the Soviet Union (which saw dramatic decreases in life expectancy, gender parity in education and income) and the Great Recession (which saw declining life expectancy for some population groups in OECD countries, see Case and Deaton 2020). The policy space of nation-states as well as of multilateral organizations shrank, while the power of multinational corporations has never been greater.

In a way, globalization (of trade and investment but especially of finance) was a way for private interests to strike back such that global economic institutions - E_g (e.g. the WTO) - were more powerful than many national polities - P_n (Slobodian 2018). Thus in today's globalized world we have:

$$E_g > P_n \tag{20}$$

2.3 Intellectual Solutions at the Margin

The fall of the Berlin Wall in 1989 and the collapse of the Soviet Union two years later evoked at least two different reactions. On the one hand, some saw this moment as the end of history (Fukuyama 1992), and the start of a new liberal world order based on capitalism and democracy. Deregulation, privatization and financialization proceeded with increased vigor, not just in the rich world but - through the power of international financial institutions - also forced on developing countries as part of the Washington Consensus.

On the other hand, resistance to certain side-effects of the dominant economic paradigm arose (originally) from the global South (Fukuda-Parr and Muchhala 2020). Both the capabilities approach to human development and the environmental sustainability movement attempted to min-

¹On the links between inequality, capabilities and climate change see Chapter 6 of UNDP 2019.

imize the worse externalities of an economically centered world system. As we'll see in section 3, however, both implicitly accept the fundamental disequilibrium - $E > P$ - and merely address its symptoms, either social or environmental.

2.3.1 Development as Freedom

The Human Development (HD) or capabilities approach emphasizes the enhancement of (individual) human freedoms as opposed to narrow economic growth. It asks *Growth of What?* and answers - capabilities. This was a way to get humans out of the production function, to decommodify them, and make their freedoms an end in themselves (as well as the means for their own development, through agency).

In a way, this was the culmination of the liberal principle of individual sanctity which operated towards decommodifying humans, starting in 1833 with the abolition of slavery in the British empire (followed by the U.S. in 1865). In this historical trend, the philosophy of human development championed by Amartya Sen and Martha Nussbaum was an important step of intellectually freeing humans from their economic shackles.

However, it is critical to locate Sen's work in the context of his training in welfare economics and social choice theory, which focus on *individual* rights, conditions and choices. In articulating the capabilities approach, Sen (1980) argued that the purpose of human development (as opposed to narrow economic growth) should be the enhancement of human freedoms to choose the life valued by people, rather than maximizing commodity production (or income). This shift from a focus on commodities owned by individuals to what functionings and capabilities individuals can derive from these commodities was indeed significant, as it implied optimizing choices rather than maximizing utility as in standard microeconomic theory.

But economic theory also includes a *macroeconomic concept* - public goods - normally defined as being both non-excludable and non-rivalrous². Typical public goods are national defense or a common language, but also the environment. Climate in particular is considered a global public good as it is available across borders and also affected by activities around the world. Some natural resources (e.g. water reserves or fish stocks) are common goods rather than pure public goods, since they are rivalrous (they can be exhausted by overuse) although still non-excludable (Mas-Colell, Whinston and Green 1995).

It is this concept of a public good that is missing from the capabilities approach. The paradigm shift at the micro level from commodities to capabilities has not been mirrored by a macro-level equivalent. Given that nature is the ultimate public good, this gap can help explain HD's weakness in terms of environmental sustainability³.

Using our terminology from above, HD can be defined as *counter-evolutionary development*:

$$\delta_{HD} : \left(\frac{\partial i_h}{\partial S_h} = 1 \right) \cap \left(\frac{\partial S_h}{\partial N} > 1 \right) \quad (21)$$

²Meaning people cannot be excluded from using them and do not have to pay for them, as well as that one person's use of the public good does not decrease its availability for others.

³Although many attempts have been made, e.g. Anand and Sen (1994, 2000), Sen (2009, 2013), Nussbaum (2001, 2006), Khoday (2018), Peeters et. al. (2015), Martins (2013).

since the second term goes against the definition of evolution (equations 2 and 5 above), where the capabilities of a species with respect to nature increase *less than or up to* to those of nature).

Another way to look at this is to say that HD emphasizes development over evolution:

$$HD = \delta > \varepsilon \quad (22)$$

2.3.2 Development as Conservation

The Sustainable Development (SD) paradigm⁴, stretching back to the Club of Rome and the Brundtland Commission, likewise starts from the commodity-individual-economy nexus, but takes a different path. It seeks to protect nature from the most harmful effects of the modern economy. In a way it reacts to the functional (transmission or conversion) part of the production function - the ‘f’ in $Y = f(L, K)$ - but without taking nature (embedded in K) out of the production function. So while people (at least as individuals) have been de-commodified in the human development approach, Nature was not as lucky in SD.

SD asks *Growth How?* and answers, sustainably. That is, it keeps the aim of development as economic growth, but focuses on a more environmentally friendly way to achieve it. Many of the proposed mechanisms in the SD paradigm explicitly rely on market solutions for environmental problems, and some ignore the social aspects of sustainable development, focusing on ‘greening the economy’ (Klein 2015). Sustainability scientists themselves acknowledge that current Earth System models are based on a social narrative focused on macroeconomic optimization (Donges et. al. 2017).

Furthermore, SD builds on the definition of sustainability from the Brundtland commission - meeting the needs of people today without compromising the needs of people tomorrow. However, this definition suffers from at least two problems:

- It is anthropocentric - nature here is seen just instrumentally, as a means towards meeting people’s needs
- Focusing on *intergenerational* equity ignores problems of the present (e.g. climate change, coronavirus)

Sustainable development (SD) - narrowly defined - can thus be thought of as *counter-social evolution*:

$$\varepsilon_{SD} : (\frac{\partial S_{he}}{\partial N} = 1) \cap (\frac{\partial i_{he}}{\partial S_{he}} > 1) \quad (23)$$

As with HD, SD’s partiality can be seen in the relationship it implies between evolution and development, only with the opposite sign:

$$SD = \varepsilon > \delta \quad (24)$$

⁴The term Sustainable Development is used here in its narrowest meaning - conservation - rather than the broader sense embodied in the SDGs, for example.

2.3.3 Mind the Gap

Not surprisingly, there is at present no clear conceptual link between HD and SD (although many empirical attempts have been made to integrate sustainability in the HDI (Hickel 2020, Biggeri and Mauro 2018, Pineda 2012, Neumayer 2012, Lutz et. al. 2018). This means that, at least implicitly, there is an apparent *People-Planet dichotomy*.

Due to this missing link between HD and SD, the two approaches imply a (spurious) trilemma:

- HD combines economic well-being (standard of living) with capabilities, but has not yet integrated nature successfully.
- SD combines economic well-being and natural well-being, but does not focus on human freedoms.

In a way, this is because at a practical level, both HD and SD are operationalized as ‘per capita income growth plus’, where SD adjusts the means (green production) while HD adjusts the goal (human freedoms). But both focus on the individual, implicitly accepting Margaret Thatcher’s dictum that ‘there is no such thing as society’. This leads to perverse results, not only ‘dirty’ HD (as in many OECD and emerging economies) but also human-blind environmental policies (e.g. as exemplified by the Jillets Jeunes protests in France following proposals for carbon taxes, see more below).

Just as the political responses to disequilibrium described in section 2.1 failed because national politics have been encased by global economic institutions, so the intellectual responses described in this section - HD and SD - have not inspired sufficient action, as they are both modifications of mainstream (marginalist) economic thinking - abstracting from the big picture and from deep political analysis. They attempt to fix symptoms at the margin, ignoring systemic power and institutional imbalances.

Both HD and SD accept the $E > P$ disequilibrium. Thus no progress can be made on climate change (or social imbalances) until equilibrium is restored.

3 Society: The Missing Link

Both HD and SD present a view of development which is broader and richer than the narrow view of economic growth they set out to build on. Each one, however, deals with only part of the disequilibrium $i_h > S_h > N$, where society - S_h - is the missing link between the individual - i_h - and nature - N .

HD focuses on the enhancing the capabilities of individuals and aims to make $i_h = S_h$, for example by ensuring that all people have the highest levels of health and education possible under current conditions. HD thus involves an increase in individual capabilities and freedoms, but does not account for how people *relate* to each other (trust, social cohesion, inequality)⁵.

SD focuses on stabilizing the system (nature, including the planet, humans and other species) - aiming to make $i_h = N$, for example by using carbon pricing to ensure that the economy’s

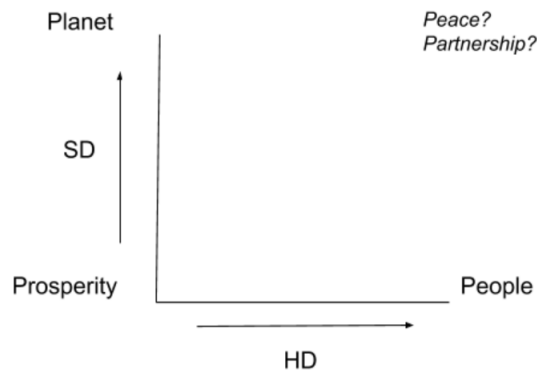
⁵Although IHDI partly addressed that.

externalities are taken into account. SD thus seeks improvements in the environmental system's functioning regardless of how it affects society - implicitly assuming that i directly interacts with N.

In reality, however, *people's interactions with nature are mediated by society and its institutions*. SD ignores S_h and attempts to go directly from i to N, **and fails**, since the problem is $i_h > S_h > N$. HD also does not have a convincing link to nature due to its focus on individual capabilities and functionings, whereas only social and institutional functionings can mitigate climate change on a sufficient scale.

Put another way, both HD and SD are missing part of the problem as they are non-political, both aiming to minimize the economy's worst externalities. HD wants to change the *purpose* of the economy (E) from producing commodities to enhancing capabilities, while SD aims to change the *method* of E from treating nature as an unbound source of inputs to one that is resource-constrained. **Both ignore P.**

In terms of SDGs, both HD and SD react to the narrow economic focus on Prosperity (the point of origin in the diagram below). HD goes towards People, while SD goes towards Planet.



Neither approach reaches the top-right corner, which represents the social and political element, involving how people interact with each other (both as individuals and through institutions).

3.1 A Systems Approach

How can society - the missing link between an economy focused on individuals, and nature as a public good - be integrated into this conceptual framework?

A good place to start is the idea of complex systems, which is well-known in the natural sciences but has been a rather late comer to the social sciences (Farmer and Foley 2009). Complex systems consist of heterogenous agents interacting in different ways, and it is this *interaction* which gives rise to emergent phenomena - aggregate results at the level of the system that cannot be predicted from or reduced to the behavior of individual agents.

Even in the natural sciences, however, many Earth System models have not dynamically analyzed the complex interactions between the human world - including agency and socio-economic networks - and the planetary one. Many such models develop complexity on the ecological side but

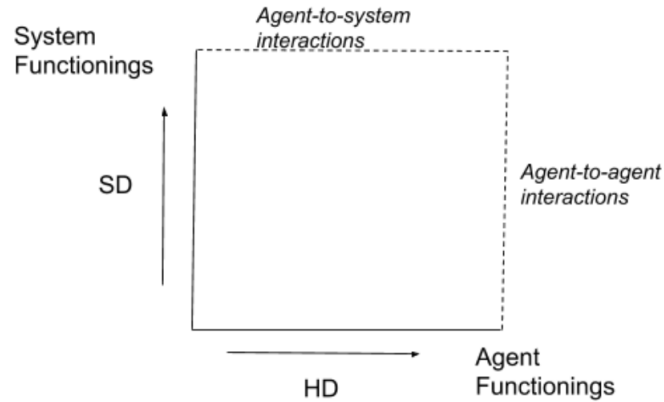
model the human side as a simple macroeconomic optimization exercise (Donges et. al. 2017).

But the human world is also a complex network, with interactions between people occurring through networks such institutions, trade, information, politics and infrastructure (ibid.). Thus a systems approach would be very useful to analyzing the shortcomings of the two intellectual responses discussed above, and proposing a link between them.

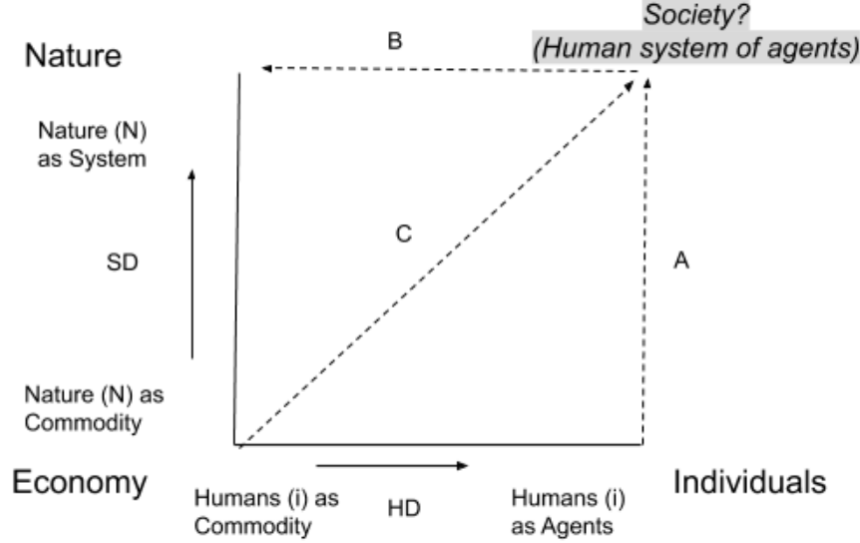
Complex systems are often simulated using agent-based models (ABM) and consist of four main elements:

- The properties of individual agents (agent functionings)
- The properties of the system (system functionings)
- The behavior of agents (agent-to-agent interactions)
- The *emergent* behavior of the system (agent-to-system interactions)

HD and SD focus on the first two, respectively, ignoring the other two.



They both start from the production function where both humans and nature are commodities, and set out to free them. HD transforms humans (i) from commodities to agents (who have capabilities), while SD transforms nature (N) from a commodity in the economic system to the system itself.



The first missing element, as the diagram above shows, is a right-hand vertical arrow (A) leading from individuals and their capabilities to society and its functionings, based on the interactions between agents or individuals and the rules for these interactions (i.e. institutions à la Douglass North 1990).

This missing link in turn is why we do not have a top arrow from right to left (B), since only social and political responses to nature can be effective. In other words, individual interactions of people with nature (through private institutions such as markets) can never be sufficient to address challenges such as climate change or multidimensional inequalities.

The upper-right corner is not just where 'society' is, but also the other end of the diagonal (C). Its south-west corner represents $E > P$, whereas by the time we get to the northeast corner, we have $E = P$. That is, balance between economic and political institutions (or the two exosomatic capabilities they represent - production and organization).

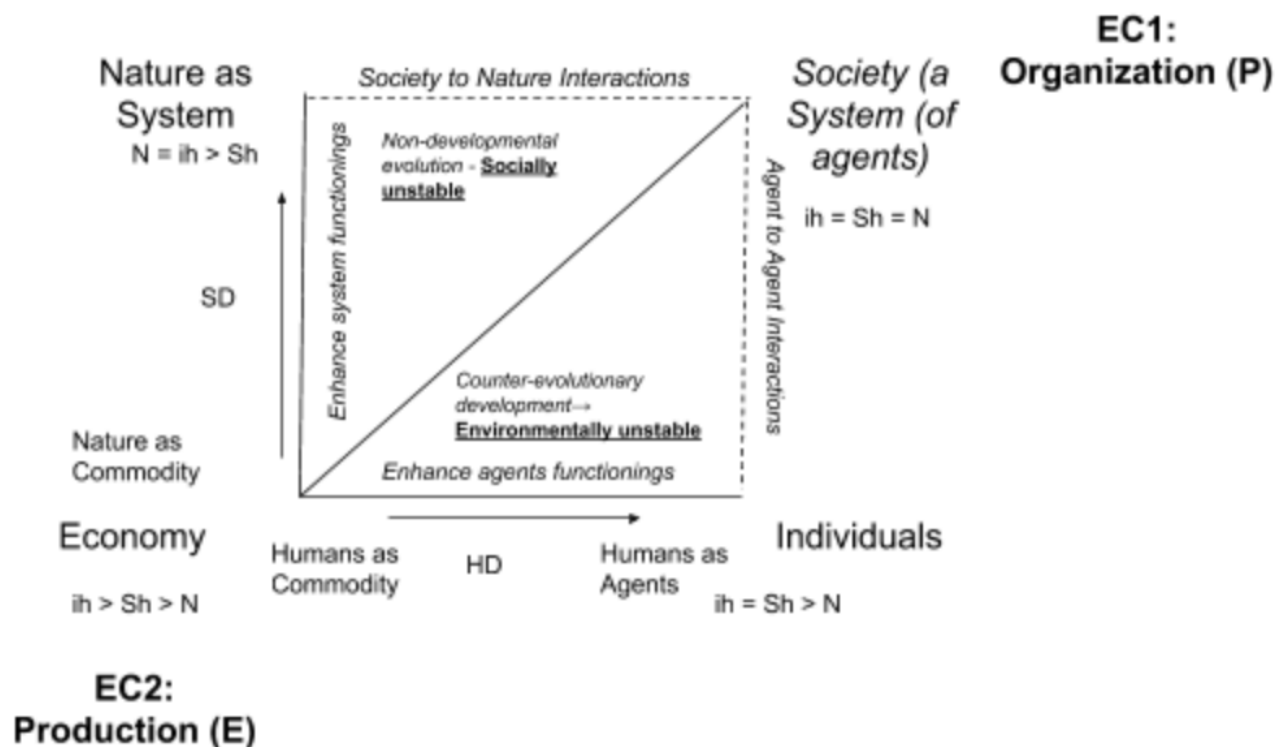
The need to go beyond individual capabilities and beyond economic solutions when facing social or environmental problems can be seen very vividly in the current global response to the coronavirus. Market forces alone could not have directed the enormous resources needed for procuring the necessary medical supplies or economic stimuli, and in fact are in many cases *opposed* to the lockdowns and social distancing necessary to save lives. Likewise, letting individuals freely choose when and how to practice social distancing would be self-defeating - only a collective coordinated effort can work since the virus can easily spread from one person to another.

This current and practical response to a major threat demonstrates that collective action on other fronts - e.g. climate change, global poverty and conflict - is not just possible but even straightforward as long as the public interest S_h is put on par with the private i_h (and political institutions are in balance with economic ones, $E = P$).

The next section proposes an intellectual framework to think about how such a balance could be made the new normal, rather than just evoked in times of crisis (pandemic or war, for example).

3.2 Evolutionary Development and Social Evolution

As we saw in the previous section, HD and SD cover only two of the four sides in the complex systems square. HD focuses on enhancing agent capabilities, while SD aims to improve system functionings. As the diagram below shows, this gives rise to both *non-developmental evolution* in the top triangle and to *counter-evolutionary development* in the bottom triangle.



Non-developmental evolution (SD) is socially unstable, and therefore *politically non-feasible*. The French government learned this lesson first-hand in October 2018, when it attempted to impose a tax on diesel and petrol as part of its green transition. The policy sparked massive protests as it did not take into account the (regressive) distributional impacts of the environmental measure on society.

This is not an isolated case, and there is sometimes also a link between anti-environmental sentiment (and even climate denial) and nationalism, at least in developed countries (Klein 2015). In developing countries there is a different dilemma, since in addition to issues of equity, raising the average standard of living is still a main policy goal, and environmental measures are sometimes perceived as anti-growth.

Counter-evolutionary development (HD), on the other hand, is environmentally unstable, and - left unchecked - will lead us to a point of no return.

The solution is a balance between development and evolution (as seen in the diagonal in the figure above):

$$\varepsilon_h = \delta_h \quad (25)$$

which means:

$$\frac{\partial i_h}{\partial S_h} = \frac{\partial S_h}{\partial N} \quad (26)$$

This implies adding the two missing arrows:

- *Social evolution* – agent-to-agent interactions (right side arrow going up) in response to the social imbalance $i_h > S_h$
- *Evolutionary development* - society-to-nature interactions (top-right corner going left) in response to the environmental imbalance $i_h > N$

While there are conceivably many ways to address these imbalances, a key obstacle to progress on these two fronts is the private, for-profit ownership of two strategic sectors in most economies today - finance and energy. As discussed below, private finance exacerbates social imbalances - thus *blocking social evolution* - while private ownership of energy production and distribution are at the root of the environmental imbalances today - *blocking evolutionary development*.

In terms of sequencing, the social imbalance ($i_h > S_h$) would have to be addressed *first*, since society is the link between individual humans and nature ($i_h > N$). Nature does not have agency in the same sense that people do (individually or collectively)⁶.

3.2.1 Democratizing Finance

As we saw in section 2.2, a balance between private and public interests (and the economic and political institutions which represent them) *did* exist for a brief period in developed countries after World War II. This social-democracy, as it was called, was obliterated in the 1970s by unleashing finance – which had already wrought economic and political disaster in the 1920s and 1930s – both internally (Krippner 2011) and abroad, in developing countries through the IFIs and global economic rules (Slobodian 2018).

But why finance? The answer is that, after World War II, the balance-of-power between economic and political forces rested on governments' ability to control *industrial* corporations, as these had physical presence in their countries and could thus be taxed, regulated and generally kept under control. It also included strong unions in a tri-partite corporatist system, still visible in a few countries today (e.g. Germany, Japan, Sweden).

By contrast, financial capital is intangible. It can move across borders with lightning speed (once capital controls are abolished), it is hard to regulate, tax or even see, and can much more easily move from a heavily regulated country to a tax haven. Globalized finance thus forces countries into a race to the bottom (UNDP 2019) where most do not dare impose capital controls, taxes

⁶Though India, China and several Andean countries have 'given' nature agency in their constitutions (Khoday 2018, Waldmueller and Rodríguez 2018) .

or other regulations. Even developed countries can lose their credit rating if the bond-markets are not pleased (as has happened to the U.S. in 2011). Finance also helped break the power of unions by leveraging the threat of capital flight in order to deregulate (both labor and environmental laws), lower taxes, privatize and make workers more precarious.

As a result, social evolution is far from perfect in most of today's societies. High and/or rising inequalities, widespread poverty, unemployment, high private debt and slow growth in both developed and emerging countries are just some of problems. The literature on financialization has clearly shown how the enormous increase in the financial sector's power in recent decades is statistically linked to all of these (e.g. Epstein 2005, Assa 2012, Palley 2013, Stockhammer 2013).

The power of modern finance comes from its alchemy-like ability to create money out of thin air. Once the prerogative of kings (as evident in the etymology of the term 'seigniorage'), since the end of the gold standard in 1973, private banks could create money endogenously by extending credit, which increases both their assets (the loans) and liabilities (the borrowers' newly created deposits) simultaneously (Werner 2014).

This enormous power can be used to help firms and countries build their productive capacities, but also to buy real-estate, financial assets and other speculative activities (Schumpeter 1939). This *functional differentiation of credit* is reminiscent of Aristotle's distinction between Oikonomia (οικονομία) - referring to the management of a household's resources and needs (from which we get the term 'economy') - and Chrematistics (χρηματιστική) - making money for its own sake (Leshem 2016, Cendejas Bueno 2017).

While economic textbooks assume that the former use is the most common, in recent years the latter has accounted for up to 80 percent of new credit created in advanced countries (Hudson and Bezemer 2012). Using finance mostly for private gain in speculative activities has led to many crises, including the Japanese bubble of the 1990s (Werner 2014) and global meltdown of 2008.

The power of financial institutions - both national and global - also constitutes a threat to political democracy. While many organizations - private corporations and non-for-profit organizations - attempt to lobby governments and shape policies and laws to their benefit - the ability of banks to *create* money gives them a much bigger arsenal with which to influence politics. Especially when campaign finance rules are lax or even *encourage* such behavior (such as the 2010 Supreme Court decision in the U.S. which allows corporations unlimited and anonymous campaign contributions), financial power in essence *deflates* electoral power and renders democracy merely nominal. It is thus the epitome of $E > P$, and specifically of $i_h > S_h$.

Is the alternative then to nationalize the banks? State-owned banks in developing countries often perform worse than privately-owned banks in terms of profitability, capital ratio, risks and costs (Micco, Panizza, and Yanez 2007, Cornett et. al. 2010), primarily due to their political considerations. This even applies to the 'big four' banks in China, a country that has championed the model of state-led capitalism in recent decades (Lin and Zhang 2009).

A more balanced approach is offered by the German model, which allows for both stability and competition in the banking sector. Fully 70 percent of banks in Germany are based, controlled and owned locally. Cooperative-banks or credit unions (*Volksbanken*) account for 27 percent of German banks, and are usually small, charge lower fees as a percentage of profits, and share the benefits

of both banking and seigniorage (money creation through loans) with their community. Another 43 percent of banks in Germany consist of municipal savings banks (*Sparkassen*). These are small, municipally-owned institutions which recycle their profits to support the tax revenues of local city councils (thus enabling lower taxes than what would be possible with private banks). Both forms of local banks are non-for-profit (Werner 2010).

Some additional advantages of local (non-profit) banking include favoring local firms (since information asymmetries are lower in a smaller geographical area), local allocation of new money, more sustainable banking practices (avoiding lending to speculative activities), enhanced competition between a large number of small banks, and lower overall inequality in society.

Another advantage of local, non-for-profit banks over profit-seeking multinational banks is that the latter are far more capable of using their leverage to influence politics and even the electoral process in their favor. The former would be a much more natural component of any campaign finance reform aiming to get money out of politics (and thus leading to $E = P$ at both the national and global levels). This would help ensure that global economic institutions (such as the WTO) are not stronger than national polities (or international political treaties like the Paris Agreement), i.e. to get to $P_n = E_g$.

In a way, this middle-ground between private banks and state banks - democratizing finance rather than nationalizing it - echoes the views of Rajan (2019) on the community as the third pillar, going beyond the market-state dichotomy which oscillates between free-market fundamentalism and a populist or nationalist backlash as described in section 2.1 above. In fact, ‘society’ as different from ‘state’ is very much a community-based, local concept. The balance $E=P$ is meant to leave space for civil society to thrive, in the spectrum between the two 400-year-old institutions - the corporation and the nation-state.

3.2.2 Socializing Energy

If private finance is the obstacle to social evolution, the private ownership of energy production and distribution is the obstacle to evolutionary development.

The industrial revolution started with the harnessing of energy. It is perhaps not a coincidence that Adam Smith published *The Wealth of Nations* in the same year – 1776 – that James Watt created the first commercially-viable steam engine (Daly and Farley 2011). New technologies relying on huge amount of fossil energy enabled the production of consumer (and later capital) goods on an unprecedented scale (Klein 2015).

That is also when the human economy’s negative impacts on nature began. Local communities immediately noticed the polluting effects of coal-fired factories on the air and, in turn, on the health of workers and miners, although international concern with environmental degradation had to wait until the second half of the 20th century.

Unlike the Luddites, most people today would not want to turn back the wheel of progress and give up our industrially-convenient way of life. But it is also clear that something must change soon, or else the planet – and humans among all its species – would be irreversibly damaged.

As mentioned in section 2.3 above, many of the efforts under the banner of ‘sustainability’ involve market-based solutions, often vigorously supported by major energy companies. These include familiar policies such as carbon taxes, as well as talk of ‘green innovation’ by private for-profit firms. There is also much praise for private-public partnerships in the energy sector, although these are usually skewed towards the ‘private’ part of the partnership (Aronoff 2016).

One problem is that private firms have a fiduciary obligation to their shareholders to maximize profits over any other goal. Thus they often put consumers and/or the environment second to financial returns. For example, in 2016 one of the largest private providers of solar energy in the U.S. raised the monthly fees it charges solar-panel owners by 40 percent, and also reduced the amount of energy people could sell back to the grid (if they weren’t using it). When the state government raised objections, the firm moved to another state, laying off 550 local employees (ibid).

Just as in finance, however, there is a middle-ground between state-run and privately owned energy supply and distribution. One common approach to energy democracy is municipalization, where local rather than national governments buy out private utility firms and manage them for the public. This approach allows much more ambitious transitions to clean energy than with privately-centered firms, and it is also more accountable to citizens. One example is Barcelona’s mayor announcing that its power supply will be municipalized and use 100 percent renewable energy by 2016.

Another option is to set-up Rural Electric Cooperatives (RECs) by having residents of a town apply collectively for state loans to fund the construction of powerlines and other infrastructure. The U.S. government provided initial funding for such RECs during the New Deal, and these were later entirely funded, owned and operated by the residents themselves. By 2016 the U.S. had 900 RECs with 42 million customers (12 percent of the country’s consumer base). This model allows for setting affordable rates, but has a built-in bias against low-income residents who cannot qualify for a loan. Furthermore, some towns are more conservative than others when it comes to switching to renewable energy.

A third model is, like in finance, made in Germany. Built on bottom-up citizen pressure for 30 years, the country’s energy transition (*Energiewende*) to renewables finally took off in 2011. Social movements enabled national policies for replacing private fossil-fuels monopolies with community-owned energy cooperatives, also creating nearly half a million new jobs. The impact on sustainability is considerable, since on certain days (though not on average), 100 percent of all power consumed in Germany is from renewable energy, and by 2050 the country is expected to get 80 percent of its total energy use from renewables.

Perhaps it is not a coincidence that Germany is leading in both local-banking and in community-based renewable energy production. As mentioned in the beginning of this section, the social imbalance $i_h > S_h$ (which is exacerbated by financialization) often blocks collective efforts to rectify the environmental balance $i_h > N$, through its influence of the political process and even citizen perceptions. Germany, which had experienced fascism, communism and social democracy in the past century, has apparently hit the sweet spot of $E = P$, implying $i_h = S_h = N$ ⁷.

⁷This is not to say that Germany or any other country is perfect. In fact in the Euro Zone, Germany is often criticized for putting E over P in its insistence on austerity in indebted countries. For a discussion of how a country can be assessed on its external actions, see the *Good Country Index* in Anholt (2020).

4 Conclusions and Implications for Measurement

The theoretical discussion in section one examined the long-term trajectory of two exosomatic capabilities - organization and production - that have enabled humans to harness and even surpass some of nature's powers. Section two described some of the reactions – both political and intellectual - to these disequilibria, and pointed out their shortcomings and the resulting gap. Section three proposed a conceptual and policy link between HD and SD using a system approach, where agent-to-agent and agent-to-system interactions need to be added.

The gap between HD and SD, however, goes beyond their different ontologies and policy-recommendations. It also involves an epistemic debate on what constitutes a good measure of progress. Thus we have to consider what the empirical implications of social evolution and evolutionary development might be.

First, we look at how statistics - originally 'data on the state' - have been 'privatized' and made to serve E rather than P . Then we look at the need to go beyond the 'Beyond GDP' paradigm, which amounts to the greening of or humanizing of headline economic indicators such as GDP. Since the fundamental problem is the $E > P$ disequilibrium, we must **bring back P** into our measurements, which is what the last sub-section does. Rather than propose a specific indicator or index, however, the discussion below provides heuristics for translating the conceptual and policy links above into the empirical realm.

4.1 The Privatization of Statistics

Statistics and probability have been studied as early as the 8th century in the Arab World. The modern concept of statistics, however, dates back to the 17th century. Perhaps not by coincidence, the earliest statistical publication in Europe – an essay on mortality rates by John Graunt in 1663 (Studenski 1958) - appeared shortly after the Peace of Westphalia (1648) which saw the birth of the nation-state (Assa 2015). The link to the state is also evident in the etymology of the word 'Statistics', referring to the science of the state - *Statistik* in German - first used in 1740 by Gotfried Achenwall (Willcox 1938).

Economic statistics arrived shortly after vital statistics, with William Petty's *Political Arithmetick* in 1690, as a tool to compare the power (economic and military) of England with that of France and the Netherlands, as well as argue for certain policies and taxes. Measuring the wealth of nations (by individuals) was thus an exercise in *numerical rhetoric* until the 20th century, when the task was taken up by national governments and made objective (at least on its surface, see Assa 2018, 2019).

Even in the 20th century, however, statistics were used for political purposes. The U.S. conditioned the provision of Marshall Plan aid to Western Europe after World War II on the adoption of the western System of National Accounts (SNA), while the U.S.S.R. imposed on its satellites the use of socialist alternative – the Material Product System. Ironically, the latter was not based on Marx's criterion of including only activities producing surplus value, but rather on Adam Smith's narrow production concept (i.e. excluding all services).

After the fall of the Soviet Union, a statistical 'end of history' of sorts arrived. As the formerly socialist countries began adopting the western SNA, the international standard was drastically re-

vised in 1993 (and again in 2008). The production boundary – separating what is included in GDP from what is excluded – has been pushed far beyond its origin, nearly crumbling like the Berlin Wall did four years earlier. Banks’ own equity, income from derivatives, military production, as well as research and development expenditures (all previously either excluded or treated as intermediate consumption) were now part of GDP. This had the convenient effect of giving rich countries a statistical edge over poorer countries (Assa and Kvangraven 2018).

But it also made financial profits a huge part of growth accounting (Assa 2015, 2016), and provided implicit incentives for countries to follow the Anglo-Saxon model of economic development, as it rewarded privatization, securitization, and real-estate or financial bubbles. For example, the fees generated by underwriting sub-primate mortgages show up in GDP, but the risk - in the form of higher private leverage - does not. The SNA revision also gave the appearance of convergence in some cases based on real-estate bubbles which now inflated GDP. For example, using the SNA 68 instead of the SNA 93, Greece might never have been admitted to the Euro zone since its deficit under the old measure was higher than the 3 percent allowed by the Maastricht Treaty (Assa and Kvangraven 2018).

4.2 Beyond the Greening of Indicators

Many attempts have been since the 1990s made to find alternatives to GDP, not just based on these political biases but also since it does not capture human or ecological well-being. One example, based in the HD capabilities approach, is the Human Development Index. It averages three dimensions of human functionings – health, education and standard of living. It is thus broader and more informative than GDP, but it still looks at how individuals perform, on average (IHDI also looks at distribution). It thus has no information on the $E > P$ disequilibrium at the root of both our social and environmental imbalances, and, as a result, cannot fully inform policies to address them.

Just as the HDI sought to ‘humanize’ the dominant measure of GDP, other indicators seek to ‘green’ it. There are too many to mention, but some key examples include the Gross National Well-Being Index (GNWI), Gross Happiness Index, Sustainable Development Goals Index (SDGI), Social Progress Index, Happy Planet Index, Sustainable Development Index ($SDI = HDI / \text{ecological overshoot}$), and Adjusted Net Savings (Chibber 2020).

While all of these are useful in their own ways, most do not have a clear conceptual or theoretical foundation (as the HDI does). Some attempt to capture several indicators in a given domain (e.g. happiness), while others attempt to capture everything (e.g. the SDG Index) and therefore provide a negligible amount of information on each component. None addresses the power disequilibria discussed above.

Another problem with ‘greening’ socioeconomic indicators like GDP or HDI is that environmental and geographical phenomena have different scope, units and time dimensions than social or economic variables. Many of these processes occur on a planetary (or at least regional) scale, and are therefore difficult to allocate to administrative units such as countries.

4.3 Measuring the Balance of Power

Moving beyond this ‘ecosystem of indicators’ requires resisting the temptation to just add whatever one cherishes to either GDP or HDI (or SDGI). A clear theory is required to give any new measure a solid conceptual foundation. Obviously, the theory in this paper is not the only one, but nonetheless the following is an attempt to translate the evolutionary theory of capabilities and sustainability presented above into three heuristics for measurement.

First, many indices such as HDI measure people’s *endosomatic* capabilities – health, education, happiness etc. The analysis above has shown however, that *exosomatic* capabilities allowed humans to break the evolutionary trap and reach dominance on the planet. Since the disequilibrium of the two main exosomatic capabilities E and P is key to the social and environmental imbalances, a measure flowing directly from this theory **must account for *exosomatic* capabilities** - organization and production (or politics and economics, finance and energy etc.) at the level of the human species, *not* the individual.

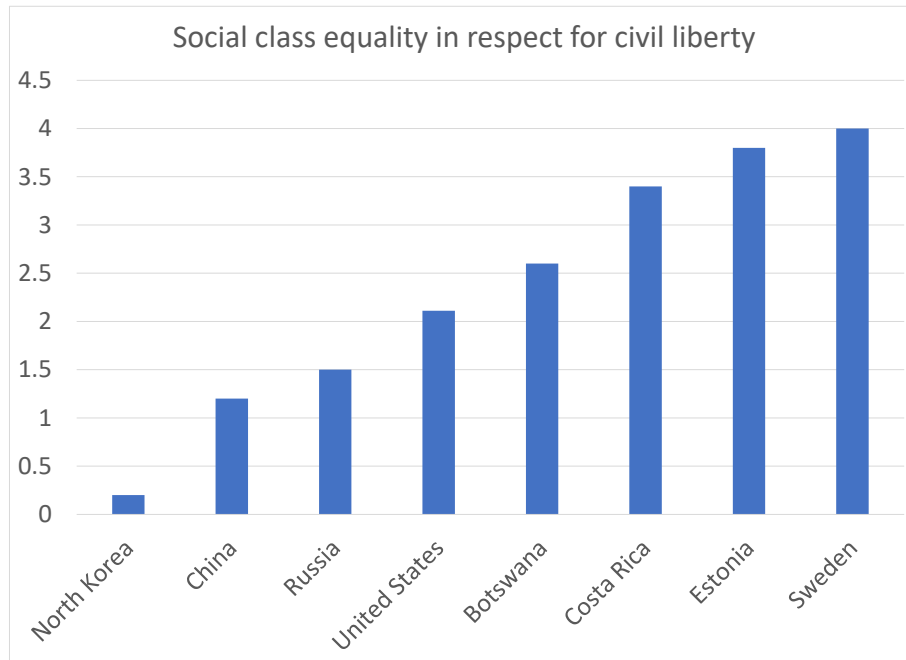
Second, as the disequilibrium between E and P relates to *institutional power*, tracing the balance between economics institutions (such as firms and consumers) and political ones (such as government, unions etc.) is key. Thus, a desirable property of a new measure is looking not just at absolute levels of some concept (e.g. size of the economy, quality of governance) but **present a *relative* assessment of the two domains**. Some example include comparing private vs. public expenditure on healthcare (from WHO), the ratio of investment in energy with private participation (World Bank), the extent of state ownership of the economy (V-Dem database), or the proportion of private to public debt in a country (Bank of International Settlements).

Third, a new measure should **be symmetrical with regards to the *direction* of the disequilibrium**. That is, a country with $E > P$ (e.g. a neoliberal regime) should be discounted just like a country with $P > E$ (e.g. a totalitarian regime). In the context of this paper, an interesting indicator to consider is *Social class equality in respect for civil liberty* (V-Dem database). This indicator measures how far civil liberties – access to justice, property rights, freedom from forced labor and freedom of labor – extend across the socioeconomic spectrum. It is thus a good proxy for how close P gets to E.

The indicator ranges from 0 (poor people have far less civil liberties than the rich) to 4 (poor and rich people have civil liberties to the same extent (Pemstein et. al. 2019)). While the methodological robustness of this measure can be disputed, it is available for 179 countries from 1789 (the French Revolution) until 2019.

This indicator can serve as an example of how the three heuristic above work in practice. First, class and civil liberties are exosomatic - they do not pertain to any person’s body but rather to their relative standing in society. Second, they are relative concepts. And third, this indicator penalizes countries with either $P > E$ or $E > P$, that is, it is symmetrical.

As the graph below shows, both authoritarian states - such as North Korea, China and Russia – and a very neoliberal country – the United States – are in the bottom half of the distribution (2019 data).



This ordering of countries would not make sense using any absolute indicator. The per capita income of the US is higher than most of the countries; income inequality is highest in Botswana and Costa Rica; and China is growing faster than Russia. It is rather the *relative* balance of political and economic dimensions (civil liberties and class, respectively) - E vs. P - that is captured by this indicator. The bottom three countries have $P > E$, while the U.S. has $E > P$. Botswana, Costa Rica and Estonia are approaching the $P = E$ balance asymptotically, and Sweden actually achieves it.

Fully developing a statistical measure to account for the concepts discussed above is clearly outside the scope of this paper. It is hoped, however, that this essay has provided some of the necessary groundwork for such a project. As Anholt (2020) observes:

“A good index doesn’t simply measure important things well: it changes the frame of debate about what it’s measuring, provokes new discussions on those topics at all levels of society, and provides new language with which to do so.”

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