CIRCULAR ECONOMY AS A VISION

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Abstract

When a complex economic system grows within a materially finite context and with the ignorance of negative external effects, a paradox of unmet needs along with underutilized, or wrongly utilized, potentials can only be explained by a system's fault lines. Also, cardinal context changes inspired by the fourth industrial revolution in the new millennium dawning exacerbated rewriting of existing rules. Planet Earth's system dynamics consists of three layers: economic layer, physical layer, and biosphere. The economy can't do what nature does, but to make the system dynamics sustainable, the economy can follow some principles based on which nature is functioning. A sustainable and inclusive economic system can only be based on the analogy with circular processes in the physical system and adaptive evolution in the biosphere. The new logic in macroeconomics and business economics has to promote the broader and systemic thinking about the economic system, synthesizing both micro and macro perspectives into a single point of view, the reversibility principle. Also, structural imbalances in the economy and existential ecological threats can't be managed exclusively by the market invisible hand. The solution needs visible and coordinative role of the state. Besides, the escape from structural recession can't come almost exclusively from inflation targeting policy tool, and should include the other side of the economic policy equation, structural side (or industrial policies). The aim of this paper is to investigate how to translate the forces of the new normal into a model of growth and specific policy platform to harness the new economy rules for sustainable and inclusive growth, both toward the people and nature. The prevailing idea is to get microeconomics and macroeconomics paradigms under the same roof.

Keywords:
Industry 4.0, circular economy, heterodox approach, industrial policies, automatic stabilizers

JEL classification: E61, O23, O25

Introduction

After more than two and a half centuries of industrialization and more than four decades long experiment with the neoliberalism, the climate change and income (and wealth) concentration are the most contingent factors for the future of the planet Earth.

The impact of global warming of 1.5 degrees above preindustrial level is the greatest challenge, perhaps. Income concentration is another indication of the neoliberal model of capitalism fault

lines. So, what happened in income distribution was a direct consequence of a sharp increase in the role of the financial sector. New social category is "plutonomy", related to those who have substantial wealth. Financial sector mentality influences investment expectations of plutocrats. In their portfolio, investment in capital markets instruments dominates. Besides, plutocrats prefer short-term gain instead of long-term growth. Instead of fighting climate crisis, massive funds are allocated in bizarre investments, like space tourism.

After Industry 4.0 has triggered transformation processes, the question is: what is the next step? Technology is always an enabler. But, vision, not technology, drives transformational processes. Circular economy is a promising vision. Like any vision, it is partly symbolic and partly real.

In the reference Đuričin and Vuksanović Herceg (2019a) we figured out that the key issue for microeconomics is the impact of connectivity on the behavior (or strategy), the value chain, and competitive dynamics. From the perspective of macroeconomics, a key issue is harmonization of the growth model and related economic policy platform.

In Industry 4.0, connected technologies are co-evolving in ways that bring massive combinatorial innovations on the market. Interplay of ICT, from one side, and physical and/or biological technologies, from the other side, drive research and innovation process beyond new frontiers. Also, cognitive technologies and data analytics minimize doubts about commercialization risk. To keep the technological progress, the merge of incumbents with innovative start-ups is almost inescapable. Lateral integration along the whole value chain ends with emergence of a super system business organization operating in exponential value chain (business platform or sphere) ecosystem. In short, convergence of business platforms functioning under the principle of reversibility is everywhere around us. It makes obsolete two basic microeconomics rules at once, the representative company and strategy of industry leader as a blueprint for followers.

As Industry 4.0 transforms spontaneously the paradigm in microeconomics, the assurance of a new paradigm in macroeconomics has never been more essential. In macroeconomics the shift in focus refers to how to turn combinatorial innovations into economic impact, with the vision to achieve sustainable and inclusive growth, both toward people and the nature. The previous is not a trivial endeavor, because the existing economic system is full of structural imbalances. Solving climate crisis and income inequality requires synchronization of the paradigm change in microeconomics with the paradigm change in macroeconomics.

All that has been said so far can be reread in more conceptual terms that the sustainable economic system can only be based on the circular processes analogy, as well as be a catalyst to those processes inside the economic system which support the dynamic equilibrium between the physical system and biosphere. By playing this role, the economic system could follow the reversibility constraint and assist the adaptive evolution.

The double paradigm change as a trigger toward the circular economy is exactly what this paper intends to address. The structure of the paper follows the abovementioned. It proceeds in seven steps. After the introduction, the two following parts deal with the orthodox economic rules and their most dangerous consequences like climate crisis and income concentration. Part three discusses managed capitalism as an alternative to neoliberal capitalism. Part four focuses on the proactive role of Industry 4.0 in economic development. In part five, the paradigm change imperative is broken down into two sections, paradigm change in microeconomics and in

macroeconomics. Sixth part discusses the circular economy as a vision for future development. Part seven analyzes the heterodox economic policy platform with key explanatory details. The last part presents some concluding remarks and thoughts.

Anthropogenic climate crisis

In the new millennium dawning we are witnessing cardinal challenges. Climate crisis is probably the most important one.

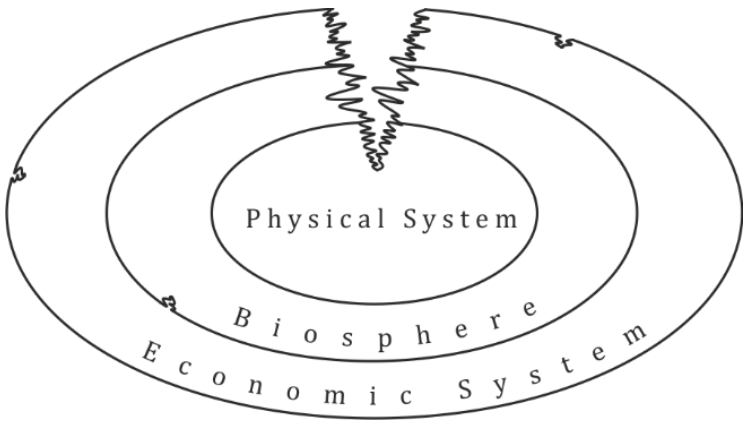
According to Forrester (1968), the world is system dynamics, namely a nexus of elements interconnected together by exchange relations (or flows). It includes three layers: the physical system, the biosphere, and the economic system.

The physical system is closed, but not an isolated layer. Functioning of the physical system is based on the conservation law. Matter and energy cannot be destroyed, they can be transformed. Energy exchange is possible, exchange of matter is negligible. In the transformation process, there is an amount of energy that can be transformed into disorder (or pollution). Typical manifestation of pollution is dispersed heat.

In the biosphere, the fundamental law of functioning is adaptive evolution. The economic system is man-made. Its viability, conventionally measured by GDP growth rate, is an indicator of harmony between stakeholders. In orthodox economic theory, the market is a primary coordination mechanism. Economic rules primarily related with the tax system and cost of capital are changeable and depend on the balance of interests.

The laws that govern the main processes in the physical system do not depend on economics school narrative and changing preferences of the most influential players. After almost two and a half centuries of industrialization, there are deep fractures between the layers (vertical) and inside the layers (horizontal) of system dynamics. Negative external effects are the result of exponential economic growth based on industrialization. Fractures in the economic system and disorder, particularly dispersed heat, have penetrated deeper into the structure of system dynamics threatening sustainability of the planet as a whole (Figure 1).

Figure 1: System dynamics disorder



In 2017 anthropogenic carbon injection was about 400 Gt per year. Attribution studies based on global climate models identified the role of anthropogenic forces as a primary driver of global warming in the last century. Robustness of the previous results confirms recent modeling of global warming based on artificial intelligence (Pasini, Racca, Amendola, Cartocci, and Cassardo, 2017).

Framing the decarbonization challenge requires halving gross anthropogenic carbon-dioxide emissions every decade. Almost all sectors of the economy need a transformation path. Energy, agriculture, manufacturing, transport, construction, and finance are critical. Road map for radical decreasing of anthropogenic emissions could help promotion of nonlinear disruptive technological breakthroughs toward the circular economy. Circular economy could be economically viable if it triggers new industrialization.

Income concentration: proof of neoliberal capitalism misconceptions

Besides the growing consciousness about climate crisis, another negative consequence of the neoliberal model of capitalism is income (and wealth) concentration.

The term neoliberalism has been used to explain the trend in economics that followed the displacement of Keynesianism during the 1970s with greater role of the market. The phrase Washington Consensus (Williamson, 1993) is a brand name of related policy platform and minimal reform package which Washington-based institutions suggested to troubled economies from Latin America during the 1980s and economies in transition from Eastern and Central Europe during the 1990s. Reconsidering this policy platform is still in progress, including initiators of this concept.

Neoliberal model of growth is founded on the following ideas. First, well-being is the first derivative of egoism. Second, economic agents are rational and with constant preferences. Third, market is efficient and self-regulating. Fourth, state ownership is inefficient.

In related policy platform there are "1+2 targets": inflation (low and stable), full employment, and sustainable growth. In such line of reasoning, the main policy tool is inflation targeting, almost exclusively based on monetary measures.

Moving on to a simplified explanation of previous assumptions, neoliberals come to conclusion that when the economy is fully liberalized, deregulated, and privatized, the price stability is going to be a prerequisite for full employment and sustainable growth, followed by internal (fiscal) and external (current account and capital) balances. In this line of reasoning, policy makers, guided with the aim to provide price stability, rely on simple solutions like using monetary policy to control inflation and holding fiscal balance and external balances in check. By doing that, they are leaving to the market to do the rest in accordance with resource allocation as well as factor's prices and factor's income levels. So long as inflation is low and stable, the steady decline in the level of output is highly unexpectable. Namely, the best thing economic policy can do to maintain output gap is to control inflation (Blanchard, Dell'Ariccia, and Mauro, 2010).

It is not controversial that the economic growth measured by GDP generates the increase of the living standard. But there is no symmetry between the living standard and well-being. In the reference (Fehder, Porter, and Stern, 2019: 355), the authors eloquently demonstrate that GDP growth is not sufficient for improvement in the foundations of human well-being and overall welfare. Moreover, because a significant part of generated income will necessarily be used to govern the system with increasing complexity in a sustainable manner as well as compensate negative external effects of the industrialization.

Relevance of the previous set of propositions is hard to prove empirically for certain reasons. Besides intensively discussed reasons like market efficiency (both static and dynamic), one of them is that the output gap is not directly observable. Many times temporary factors have caused inflation to run in low and stable mode, not signalizing structural imbalances and a need for policy interventions. Also, premises about economic agents as rational, selfish and with constant preferences collided with reality. Behavioral economics argued that economic agents are neither fully rational nor completely selfish, and that their preferences are not stable. Sometimes risk appetite dominates risk aversion in terms that the response on gains is stronger than response on corresponding losses contrary to conventional premise about risk-return relationship (Kahneman, 2011: 283). This situation leads to irrational exuberance. In this case, common welfare could not be the first derivative of egoism.

Last but not least, this line of reasoning is based on implicit assumption that the supply of free goods is practically infinite and that negative external effects are negligible. Assuming that there are no limits in natural capital, externalities can safely be disregarded. As a consequence, there is no need to regulate negative external effects and market imperfections. Market forces coordinate activities and motivate the effort better than any other alternative choice ("less government is better government"). If we put into the equation finiteness of natural resources and pollution, we see that in the absence of any action based on negative feedbacks, including those triggered from the market, the growth can't regularly reach sustainable rate. In the finite physical world anticipated positive impact of competition on negative external effects can't be provided by the invisible hand of the market.

In the last stage of discussion of the inclusivity argument vis-à-vis neoliberal model of growth, a delicate topic has appeared, income (and wealth) concentration (Milanovic, 2016). According to Alvaredo, Chancel, Piketty, Saez, and Zucman (2018), top 1 percent of the world captured 27 percent of total growth, and bottom 50 percent captures 12 percent of total growth. Without any doubt, neoliberal model of capitalism favors a few. Income distribution looks like a champagne glass. Risk of contagion is growing when downward spiral of inequality and low growth impacts social cohesion.

Managed capitalism vs. free market capitalism

Neoliberal narrative leaves many questions unanswered. Expectations and reality collided because the real economic system is neither efficient nor self-stabilizing. It may implode, there may be hysteresis. One important unanswered question of the orthodox policy platform is whether stable inflation is healthy by itself and, particularly, good for maintenance of the low output gap in case of some imperfections and structural changes. It is particularly important for economies with output gap (Blanchard, Cerutti, and Summers, 2015: 25).

The success of the free market capitalism was based on the manufacturing-led export growth model (Stiglitz, 2018). This model had intention to be universally applicable, the way for catching up. The industrialization of developing economy was based predominantly on imported technology. However, the technology transfer doesn't lead to sustainable macro balances. Macro deficits (current account and capital balance) increase debt, reduce the speed of growth and developing economy enters in the indebtedness spiral. To escape middle-income trap, developing economy must reduce the impact of foreign borrowing. This is not possible without annulment of the trigger of borrowing, technology purchase from abroad.

The search for a solution has inspired some reformers from East Asia during the early 1960s and other economics luminaries later on, for example (Rodrik, 2004), for the growth model change toward the internal technology development. Technology development as a result of industrial policies is a way of making sustainable competitive advantage of tradable sector as a prerequisite for annulment of fiscal and macro deficits (Đuričin, 2017: 19-24). So, it was the seed of the concept of "pro-growth state", platform based on the industrial policy centric model of growth and related economic policy platform, sometimes called "heterodox". By doing this, architects of the system implicitly advise transition, or correction, from neoliberal capitalism to managed capitalism (Rajan, 2010).

Industry 4.0 as an enabler

In the evolution of the industrial revolution there are four stages (Đuričin and Vuksanović Herceg, 2018: 40). In the first two stages, capital has replaced labor. In the last two, information has replaced capital. In Industry 4.0, connectivity has become the ultimate free good, instead of land, water, and air.

In Industry 3.0, connectivity between information and communication technologies led to zero marginal costs. So, indirect effect of such technology change is ephemeralization[1]. With exception of computers, servers, fiber-optic networks which are built from material objects, the elements from the periodic table of elements are going to be *passe*, as well as workforce from real economy. Due to ephemeralization, information intensive service economy is featured by bubbles, growing disinflation pressure and fiscal imbalance.

Another type of the combinatorial innovations is the hallmark of Industry 4.0. In the new environment competitors continually experiment, without a prevailing idea, with virtual-physical (and/or biological) amalgams. The new type of combinatorial innovations enables the shift from embedded to cyber-physical (and/or biological) systems.

In Industry 4.0, ephemeralization is not an issue anymore. The last wave of industrial revolution drives the economy toward greater reuse of elements. Almost every entry of the periodic table is being used in some kind of combinatorial innovations. Fast growing industries are a typical example of phenomenon that combinatorial innovations exemplify complexification. Innovative amalgams have made business ecosystem more virtual, but they also increase the capability and sophistication in use of material objects in resource saving production.

[1] Ability of new technology to do more and more with less and less, until an extreme situation, to do everything with nothing.

The strong reason not to trust the invisible hand of the market is related with the use of natural elements for combinatorial innovations. Following conventional theory premises, shortages of elements should be corrected by price increase, discouraging the consumption and/or encouraging development of substitutes. Insight in the commodity market long-term trends showed just the opposite. Regarding some rare elements, market forces frequently respond slowly. For example, it takes from 10 to 20 years to bring a new mine into commercial exploitation. Without coordination policies imposed on a global level, market forces could push production of some metals and fossil fuels to the economies that do the minimum to protect environment.

Industry 4.0 will drive the global economy toward greater role of demand for natural resources. The reversibility principle could favor the elements which are most adaptable. Carbon could be the element of choice. Instead of minimizing carbon output, the new model of growth should find the ways to maximize carbon inputs. Also, in energy sector hydrogen is the most promising element.

Double paradigm change

Every science, no matter how serious it is, follows its paradigm as a set of rules with the power to explain behavior of the system under consideration.

All that has been said so far leads to the conclusion that the economic system functioning under neoliberal rules can implode, particularly when deregulation in capital markets prevails, which was the primary cause of the Great Recession of 2008. Moreover, any unconventional rules ("too-big-to-fail") and policy measures (particularly quantitative easing and negative interest rate policy) did not contain answers to the structural problems erupted with the last crises. So, dynamic efficiency of the system depends on structural measures beyond inflation targeting. What is, also, clear is that social cohesion based on reasonable concentration of income and wealth as well as regulation of negative external effects are a public good.

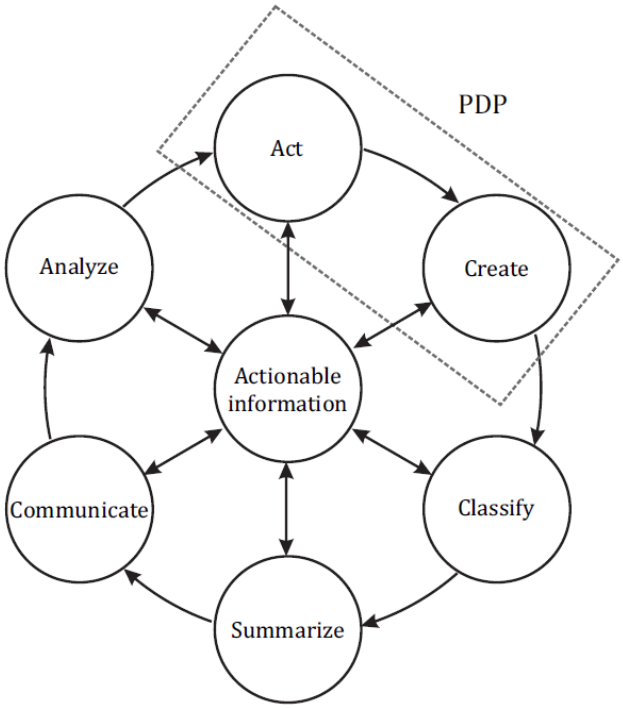
It is time to expect an inflection point according to the conceptual platform because there is the reason and opportunity for that. The new normal triggers double paradigm changes in microeconomics and macroeconomics. Both changes are founded on the simple principle of reversibility.

Due to universal connectivity, the possible interconnections (or flows) grow with the square of the number of interested parties (or nodes). The complexity of business ecosystem grows faster than ecosystem itself. Namely, the number of transactional data grows faster than the number of actionable information. So, noise will grow faster than the signal, and in fact, the former easily drowns the latter.

The last wave of industrial revolution begins in the manufacturing stage of the value chain. In this stage products and/or services created by drawing physical information into digital realm also communicate to each other with the aim to drive further activities in the value chain, both downward and backward. Output of manufacturing plays the role of a medium which executes physical-to-digital-to-physical loop (or PDP loop).

Ingenuity of the mentioned concept can be found in its simplicity, serial transformation of transaction data into actionable information along the value chain activities, or the Information Value Loop (see Figure 2).

Figure 2: The Information Value Loop



Note: The figure is partially modified in accordance with Raynor and Cotteleer, 2015: 53

To the opposite of expectations, the empirical studies indicate that majority of the investment that companies make to follow the Industry 4.0 principles are often below expectations regarding value creation (Kagermann, 2015). Namely, productivity has not kept pace with potentials of combinatorial innovations.

The alignment of micro and macro perspectives refers to the question: how to turn combinatorial innovations into economic impact, with the vision to achieve sustainable and inclusive growth, both toward people and the nature? Achieving this requires synchronization of the paradigm change in microeconomics with the paradigm change in macroeconomics. The previous synchronization needs some adjustments in macro management, particularly in the model of growth and the economic policy platform, by following the same principle of reversibility.

When it comes to economic policy platform, we must replace the narrow view of macroeconomic stability, artificially reduced to inflation (low and stable) and related narrow policy tool of inflation targeting as almost exclusive choice. Policy makers can't navigate a complex, multidimensional space of financial, natural, physical, and human capital with a simple economic tool based on price control. They can't manage what they do not measure. We must be aware of the limits of monetary policy for keeping the growth sustainable, and open the space for structural policies.

What we really need to formulate in the new macro management paradigm is to convince ourselves of, at least, five economic rules with the real transformative power. First, the "visible hand of the state" is legitimate and complementary institutional choice with the invisible hand of the market. Second, the state has a role to play in shaping economic development by using industrial policies. In fulfilling this mission, the state has to concentrate on tradable sectors as well as on infrastructure activities, particularly related to the short list of technological priorities. The new energy mix based on expansion of renewables is crucial for climate change. Also, transformative power of new investments is related with learning by doing spillovers. The good system of life-long education, combined with learning by doing and learning by learning in technological and institutional spillovers, could create new jobs and enhance development. Third, it has to be recognized that a short-term budget balance should not be a fetish. Public investments combined with fiscal stimuli are critical to avoid the stagnation trap and for search to solutions for climate crisis. In connecting different forms of capital there is a double axis. Vertical axis expresses mobilization of different forms of capital to provide major shifts, particularly in technology development and education. The horizontal axis represents inclusion of economic agents in technological breakthroughs spin-offs via market mechanism. Fourth, plurality of ownership forms has advantage over exclusive focus on private ownership, because well-managed collaboration between economic players enables corrections of negative effects of competition in some sectors (network technologies and sectors with high positive external effects).

When it comes to impact of the paradigm shift in macro management on the real world, there is bad news and good news. Bad news is that the blind spot of denial and negligence of neoliberal economics fault lines still prevails. Good news is that alternative conceptual platforms on the global level have already been discussed (Rodrik, 2004; Stiglitz, Lin, and Monga, 2013; Mazzucato et al., 2015; Stiglitz, 2018). Also, there is a growing interest for discussion of implementation specifics of the new conceptual platform for economies in transitionism (Đuričin and Vuksanović, 2014).

Circular economy as a necessity

Regardless of global warming presenting an existential challenge to the planet, inertia of investments in fossil fuels still exists because there is no adequate regulation of negative external effects. In 2017, world financial assets approached USD 250 trillion. But, total energy investment was USD 1.8 trillion (World Energy Investment, 2018: 11), only. Investment in fossil fuel production, including new environmentally unfriendly technologies like fracking, dominates with more than one half. Consequently, global carbon gas emission keeps growing and there is neither a market nor effective regulatory body in any economy in the world to stop this.[2] If nonlinear acceleration of pollution continues toward the tipping point, climate crisis will be reaching an end-game scenario (Steffen et al., 2018).

Until natural resources are processed in cycles in a linear industrial (and energy) production process under the impact of the orthodox economic rules or by biogeochemical processes, the environment will continue to deteriorate. The construct "circular economy" as an alternative is used to describe a closed system of interactions between the economy and the environment

[2] According to International Energy Agency, the energy-related carbon gas emission grew by 1.4 percent in 2017, reaching historic heights of 32.5 Gt.

based on new economic rules. The general effect of the reversibility rule is a resource and energy circulated economy.

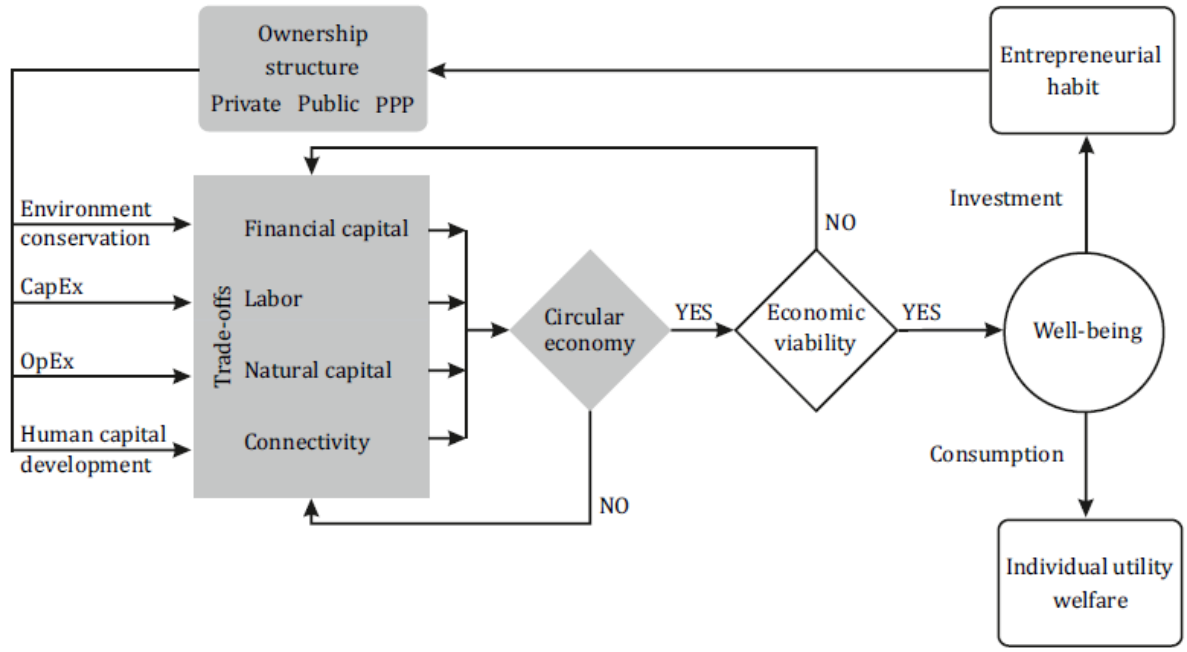
What all meanings of the circular economy generally have in common is the reversibility principle (or cyclical closed loop). According to Murray, Skene, and Haynes (2017: 371), this term has a linguistic and descriptive meaning. Linguistically, it is an antonym of a linear economy as conversion of resources from the physical system and biosphere into waste and pollution through industrial production. Descriptive meaning relates with the concept of "cycle". Actually, there are two cycles: the biogeochemical and reversal of already produced industrial products.

The circular economy concept promotes industrial symbiosis, in which business organizations exchange each other's waste resources within exponential value chain with the aim to reduce (or delay) waste and pollution. Last but not least, this is the process of reduction of displacement of industrial products through better manufacturing. In short, the circular economy is a 3R process (reduce, reuse and recycle).

To replace the old paradigm, we need to develop a multi-pronged growth model which promotes the circular economy concept. This model should entail proliferation of combinatorial innovations based on deeper insights into well-being as well as energy and natural resources conservation.

Figure 3 is a flow diagram expressing how things are developing in the circular economy. Each development trajectory has a filter based on internationally recognized standards of environmental conservation. This filter proceeds as an economic viability filter. To preserve the global ecosystem, each national economy has collateral impact on others. The model has capacity to improve human well-being and overall welfare well beyond GDP. Regarding the specific set of preferences, well-being should be divided into individual utility welfare and investment as manifestations of entrepreneurial habit. In the new model there is no *ex ante* preference toward the ownership structure of innovative start-ups. Private, public and private-public-partnership compete with each other.

Figure 3: Circular economy model of growth



Source: Đuričin and Vuksanović Herceg, 2019b: 110

Proposed model is particularly important for developing economies. To catch up with the developed world, the developing economy primarily has to close the gap in knowledge, through robust investments in research and innovation, technology development, as well as in education. That also means concentration on a short list of tradable sectors, with the aim of new industrialization and infrastructure development.

Interestingly enough, the new model has already played an important role, even in the developed economies. According to UNCTAD's survey (2018), since the Great Recession of 2008, 101 economies across developed and the developing world, accounting for more than 90 percent of global GDP, have adopted industrial policies.

Heterodox policy platform as a tool

Industrial policies are in the center of the new economic policy platform. Automatic stabilizers help in harmonization of industrial policies (horizontal and vertical) with core policies (monetary and fiscal). The automatic stabilizer is an example of applicability of the reversibility principle in macro management. The fiscal automatic stabilizer is a very old idea, actually very Keynesian idea, of countercyclical measure defined as the intertemporal reallocation of fiscal burden with the aim to reduce the negative economic consequences in bad times by using surpluses from the good times.

There are three reasons behind this policy instrument. First, with the increase of the share of state-owned sector in output creation, which is a leading trend, automatic stabilizers will play a greater role (Blanchard et al., 2010: 6). Second, pro-development measures, particularly industrial policies, mean more reliance on policy measures to prevent excessive build-up of debt and contain inflationary consequence of fiscal stimulus. Third, when in the short run the concern is output growth, weaker private demand (domestic or foreign) should call for slower fiscal consolidation. To achieve long run expectations, this argument has led policy makers to

shift from conventional targets to structural targets (Blanchard, Dell'Ariccia, and Mauro, 2013: 16).

Along with the fiscal automatic stabilizers, there is significant progress in other automatic stabilizers from other core policy areas. A neutral interest rate and stable and competitive FX rate play the role of key monetary automatic stabilizers.

Conclusion

The intention in this article is to help policy makers navigate toward a circular economy future. Micro and macro management should be under the same roof when an economic system intends to be sustainable and inclusive. In the new normal, one of the most important rules of functioning on a micro and micro economic level is the reversibility principle.

The circular economy model of growth and related policy platform, called heterodox, should reorient the economic system toward purpose-driven business models with the aim to reconcile private value with public good. The new model of growth should enable a flow of resources, whether it be financial, human or planetary, based on the core principle of reversibility. In such a model, economic policies are designed to be not only stabilizing, but also regenerative, abundant to all, and mutually beneficial.

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