A neo-Schumpeterian perspective on the analytical macroeconomic framework: The expanded reproduction system

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Abstract

This study aims to introduce a new analytical macroeconomic framework, the expanded reproduction system, that combines the accumulated wisdom of several contemporary economic models while also compensating for their shortcomings. This new framework may be used to study macroeconomic phenomena from both the supply and demand side over a number of different time intervals. Furthermore, as we account for both new product and productivity innovations, we are able to account for both qualitative and quantitative developments within the economy.

Keywords Schumpeterian Economics, New Classical Synthesis, Macroeconomics, Economic Policy

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1. Introduction

In 2003, during his presidential address at the annual meeting of the American Economic Association, Robert Lucas announced that "the central problem of depression-prevention has been solved, for all practical purposes." Mishkin (2007) went further by asking the ambitious question: "Will monetary policy become more of a science?" Behind these confident pronouncements regarding current macroeconomics and macroeconomic policy, there was a new classical synthesis (NCS), which was represented by the dynamic stochastic general equilibrium (DSGE) model. The NCS perspective began with the application of a rational expectation assumption to the field of macroeconomics and was developed by Lucas (1972, 1976), Sargent (1976), and Kydland and Prescott (1982). After ending the conflict between the real business cycle perspective and the new Keynesian paradigm (i.e., the two competing macroeconomic frameworks), the NCS perspective dominated macroeconomic theory for three decades. (Fagiolo and Roventini 2012; Galí and Gertler 2007; Woodford 2003)

In their work, Lucas (1972, 1976), Sargent (1976), and Kydland and Prescott (1982) endeavored to explain the dynamic behavior of macro phenomena using an intertemporal, competitive, rational-expectation equilibrium model, which was inspired by the contemporary economic growth model (Wickens 2012). One of the reasons for this approach's prolonged dominance in the field of modern macroeconomics is that it is firmly grounded in microeconomic theory (Chari and Kehoe 2006). The efforts to establish microfoundations to macroeconomics based on the idea that individual agents' decisions underpin macroeconomic behavior have also accompanied the development of the new classical revolution. Finally, the critical assumption of "rational expectation," has made intertemporal analysis possible within macroeconomics, which, in turn, ensures that the microfoundations of the general equilibrium models are tractable (Colander 2006).

Alongside the NCS, which embraces new classical and new Keynesian economics, there is another stream of modern macroeconomics, termed the new growth theory, that explains the economy's growth path in a more realistic manner than the Solow framework,

which assumed exogenous, given technological progress (Romer 1986; Lucas 1988). Although the new growth theory deals more with long-term subjects and focuses on the source of technological progress (which is the engine of growth), it still shares many similarities with the NCS, such as an equilibrium framework and a microfoundation approach. In particular, the new growth theory and the NCS use the same analytical template, which is one of the reasons why their results are so easily reproduced.

The NCS was not formulated in an ivory tower. Chari and Kehoe (2006) showed that macroeconomic theory has played a significant role in shaping policy in the U.S. and several other countries. Following Lucas' critique (1976), a consensus has emerged that monetary policy should target low nominal interest rates and low inflation rates, that tax rates on labor and consumption should be constant over time, that taxation on capital income should be almost zero, and that returns on debt and asset taxes should be manipulated to mitigate the adverse effects of shocks. These widely accepted policy objectives have been strongly influenced by the NCS in macroeconomics (Chari and Kehoe 2006).

However, the bankruptcy of Lehman Brothers in 2008 and the European debt crisis thereafter, proved that current macroeconomic theories could neither predict a crisis nor offer solutions. As Krugman (2009, 2011) argued, current macroeconomics could not even help policy makers to find a means of returning to a steady growth path. In this respect, the crisis can be regarded as a natural experiment that tested economic theory and found it wanting, because the crisis was caused, in part, by fundamental problems with the underlying general equilibrium theory and its assumptions. Thus, it can be said that an "economic crisis is a crisis for economic theory" (Kirman 2010). Indeed, many scholars have stated that the basic assumptions in the DSGE model hinder the study of current economic phenomena and that alternative macroeconomic theories are needed. (Colander 2006; Colander et al. 2009; Krugman 2009; Krugman 2011; Stiglitz 2011)

Many studies have analyzed the failings of modern macroeconomics. First, they point out that the rational expectations assumption is a critical flaw in the model. Colander et al. (2009) stated that the assumption of rational expectations implies that "individuals and the

economists have a complete understanding of the economic mechanisms governing the world" and that there is no room for imperfect information or adaptive adjustment. Hendry and Mizon (2014) also showed that the DSGE framework could fail if there were extrinsic unpredictability, which would make it impossible to accurately calculate either conditional or unconditional probabilities in advance; in fact, Knightian unmeasurable uncertainty is dominant in the real world (Knight 1921). In addition, the microfoundations are flawed in that the aggregate behavior is not compatible with that of a rational individual who maximizes their profit and utility. In other words, without considering the interaction between agents, analyzing each individual does not guarantee tractable aggregate behavior (Kirman 2010). However, the assumption of a representative agent hinders the intrinsic analysis of this interaction among agents (Colander 2006; Colander et al. 2009).

In addition, even though the new growth theory was not directly responsible for the crisis, it still fails to adequately explain modern capitalism and misinforms growth policies. First, it tends to "divide up the source of growth" and simplify economic growth in term of a continuing equilibrium, despite powerful evidence of continuing disequilibrium. Furthermore, it ignores the institutional complexities of modern capitalism, including the importance of government policies (Nelson 2000). Most importantly, it cannot capture the qualitative development of the economy.

Just as a physicist first investigates a frictionless system as a benchmark of the real system, mainstream economists have spent the last three decades developing modern economic models as their benchmark model. However, because the field in which microfoundations were developed is technically sophisticated, researchers often only consider technical issues. Furthermore, students have been prevented from seeing the overall macroeconomic picture because their studies are divorced from the real economy (Colander 2006).

The history of macroeconomic thought shows a dialectic development whose principle is the thesis-antithesis-synthesis paradigm. Thus, even though the economic crisis proved the NCS to be flawed, and the new growth theory could not capture the nature of

capitalistic economic growth, it does not mean that we must completely discard these theories. Instead, we have an opportunity to create a new framework that addresses the old models' flaws while embracing new ideas.

This paper argues that the NCS has two central legacies; an analytical framework rooted in microeconomics, and the idea that there should be a consensus on the proposed theory's basic framework, which can be an analytical template. No paper explains this basic analytical structure; however, most of the analytical framework of the macroeconomic model and the new growth theory, as depicted in Figure 1, consists of descriptions of the economic environment, which includes assumptions about the demand side's preferences, the production technology, and the market and information structures. The framework also calculates the equilibrium states under competition (taking into account market clearing conditions), the evaluation of Pareto optimality, and the derivation of policy implications. These macroeconomic theories are deeply steeped in microeconomics, and although they have many failings when it comes to describing the real world economy, they seem to comprehensively cover the entirety of the economy.

(insert Figure 1 here)

There are alternative macroeconomic theories to the NCS, but the new models cover different macroeconomic behaviors and different subject levels. Consequently, now is the time to integrate these alternatives and the analytical framework of the NCS into a new, comprehensive framework, which is this paper's main objective.

The rest of this paper proceeds as follows: In section 2, we investigate the analytical basis of the NCS and the new growth theory and compare them to the evolutionary/neo-Schumpeterian alternatives. Section 3 provides a new macroeconomic framework, the expanded reproduction system, and Section 4 presents this framework's policy implications. In Section 5, we present our concluding remarks.

2. The macroeconomic analytical template of the NCS and the new growth theory versus that of evolutionary/neo-Schumpeterian economics

The neoclassical growth model, which inspired the DSGE model, was originally put forward by Solow (1956) and Swan (1956). This closed, aggregative model was extended during the 1960s by Cass (1966) and Koopmans (1963), who created the Ramsey–Cass–Koopmans (RCK) model and the neoclassical growth model (Barro 2008; Spear and Young 2014). Some have described the Cass–Koopmans approach as a general equilibrium version of the Solow–Swan model (Durlauf and Quah 1999; Spear and Young 2014), and as such, we believe that it is appropriate to begin our study with an examination of its analytical framework.

The RCK model fits well within the macroeconomic-theory template, which is summarized in Figure 1. This model assumes that there is no uncertainty in the economy and that all of the firms and households act as a representative household and firm would. The households have constant relative risk aversion (CRRA) utility functions (which guarantees that the growth path will be balanced), while the firms' production functions factor in capital, labor, and labor augmenting technology. The firms maximize their profits subject to cost constraints and the households maximize their lifetime utilities subject to their budget constraint. Under these conditions, one can observe the dynamics of the economy as it moves toward equilibrium and compare the welfares of a representative household under both social planners' regimes and perfect competition. In addition, one may also study the potential impacts of various policies by adjusting the parameters and calculating new equilibrium points (Romer 2011).

This optimal growth theory analytical framework, which began with the RCK model, has since provided the basic frame of analysis for all of the neoclassical economic models, including the DSGE model. In addition, this neoclassical-macroeconomic template is highly useful in that it may be used to study various topics, including finance, business cycles,

unemployment, and economic growth. Even after the crisis, this template was used to analyze its causes by Martin and Philippon (2014).

However, as we previously mentioned, the DSGE model failed to prevent the crisis or provide adequate recommendations to remedy its repercussions, and as such, an alternative macroeconomic framework is needed. There have already been efforts to build such a realistically grounded framework, especially in neo-Schumpeterian economics.

Although there is no explicit consensus on this analytical framework, after the publication of Nelson and Winter's seminal work (1982), subsequent pieces, such as Conlisk (1989), Metcalfe (1989), Verspagen (1993), Silverberg and Lehnert (1993), Chiaromonte and Dosi (1993), Dosi et al. (1994), and Silverberg and Verspagen (1995b), adhered to a similar set of basic evolutionary economic principles First, these models assumed that there was heterogeneity among the population (i.e., heterogeneity in firms, countries, or techniques). Next, they featured a mechanism that would generate novelty in the population and a selection mechanism among novelties. Finally, the economic interpretation of the models were offered (Silverberg and Verspagen 1995a). However, the template that these models shared tended to only deal with firm and industry dynamics while focusing on innovation without considering the underlying system (which determines the creation of novelty).

Hanusch and Pyka (2007) pointed out that although neo-Schumpeterian economics has helped to broaden our understanding of dynamic economic phenomena, it has heretofore focused exclusively on the real economy (such as industry). They further added that a more comprehensive and systematic framework would be required to capture the complex phenomena of economic development. Consequently, they suggested that such a framework would need to address industry (which, as mentioned above, has already been well covered), finance, and the public sector, and that the co-evolution of these factors should be considered as well.

Institutions (including political and organizational domains), which permeate the real economy and co-evolve with it, have also been widely studied. Aoki (2001) delved into institutional diversity and the complexity of economies in order to understand the formal and

informal rules governing the interaction between people in each domain. He tried to understand "the ways in which the agents revise their beliefs in a coordinated manner" by examining the changes in institutions. His study, in fact, explored the macro dynamics of society through institutions, which permeate the economy. In a similar manner, Ostrom and Basurto (2011) introduced an ontological framework, or analytical template, for studying institutional change. Though Nelson (2006), Schmid (2004), North (2005), and Ostrom (2005) used slightly varying definitions of the term "institutions," they all argued that institutions are comprehensive determinants of macroeconomic dynamics that should be studied along with the market's workings.

On the other hand, there is research on the framework that regards knowledge and the development of knowledge as a "process of coordination and change in generic rules in an open, self-organizing economic system (Dopfer et al. 2004; Dopfer and Potts 2007)." These studies endeavored to go beyond the generic level when analyzing the evolution of economic systems, focusing on knowledge itself and offering a new, micro-meso-macro framework. They argued that knowledge originates, is adopted, and retained at the micro level, and that, at the meso level, this knowledge triggers certain population dynamics, which, in turn, spark regime changes at the macro level. They added that the government should not attempt to control either the price or production of goods. Blind and Pyka (2014) also tried to develop the Dopfer–Pott framework so as to provide an analytical template by offering an "operational method for identifying and testing hypotheses that relate to rules." These studies investigated macro dynamics by tracking the generation of novelty from the micro level to its diffusion into society under certain institutions. Furthermore, they were able to develop a framework that examined more than just the market. However, these bottom-up methods can be supplemented by top-down methods, as shown in Figure 2.

(insert Figure 2 here)

There is a general consensus that an alternative framework should have certain characteristics. First, as Schumpeter (1911) stated, the economy is rarely in equilibrium but rather develops endogenously, and the framework should reflect that. Second, the framework should cover the entire economy including the production side, the demand side, the workings of the market, and its characteristics, just as the NCS framework does (Backhouse 2010). Additionally, it should also embrace the elements that evolutionary economics, complexity economics, and, broadly speaking, neo-Schumpeterian economics have studied. Lastly, it should take a systematic perspective and include other domains like finance and the public sector (Hanusch and Pyka 2007).

In addition to the aforementioned characteristics, the macroeconomic framework of industrial capitalism presented in this study can be maintained in order to model sustained economic development. In other words, our framework can be used normatively for economic development policies.

3. The expanded reproduction system: the normative/analytical basis of macroeconomics and the growth model

This study endeavors to create a long-run, macroeconomic, analytical framework for studying the development of capitalism. We, of course, agree with Verspagen's (2006) idea of "economics development as an historical process of structural change," but it is also true that as long as industrial capitalism has been sustained, there has been an underlying, basic framework or template, which we call the "expansive reproduction system" (Kim and Heshmati 2013).

(insert Figure 3 here)

The new macroeconomic framework that we propose in this paper is the expanded reproduction system (ERS) of industrial capitalism. This framework has four stages, which are similar to those of the DSGE model: the demand expansion stage, the supply expansion

stage, the capital accumulation stage, and the market adjustment stage. Economic circulation is created by the flow of capital and value between these components, which is just as important as the components themselves (this is illustrated in Figure 3 as the progression from A to F).

As briefly exploring elements and flow among them of the ERS, first, economic profit increases effective demand (B). Simultaneously, profits may be invested into innovative endeavors, which increase productivity, this, in turn, can increase demand (D–C). This paper focuses on the effects of developing innovative new products. These new products create new demand and eventually a new sector (D–A). This cyclical flow within the macroeconomy enables qualitative and quantitative development after the market adjustment stage (E–F). We will explain each of steps in details momentarily.

In the ERS, the most important steps in terms of macroeconomic development is flow from D to A, which new technologies encourage to create new goods and eventually to emerge new demand and new sector. According to Schumpeter (1911), a halt to this circulation indicates that the economy is not growing and that there are no "new combinations" (i.e., innovations which trigger economic development). Conversely, if the economy is growing, we may attribute the improvement to new products, new sectors, and new demand. In other words, technological innovation that yields new goods and new sectors stimulates the economy to expand both quantitatively and qualitatively. As Saviotti and Frenken (2008) and Saviotti and Pyka (2013) pointed out, innovation that improves productivity is not the only form of innovation, and if one considers the development that occurred after the First Industrial Revolution, it is clear that the creation of new products and the emergence of new sectors has allowed society to move "from necessity to the imaginary world." The modern consumer, in fact, enjoys a variety of goods that people in the late eighteenth century could never have imagined. This vast expansion in goods and services constitutes a major qualitative development within the economy, and as such, it should be regarded as highly significant (Grossman and Helpman 1991; Romer 1987,1990; Saviotti and Frenken 2008; Saviotti and Pyka 2008, 2013; Stokey 1988, 1991). The innovation step, therefore, should be

treated as a major source of economic development or the engine of macroeconomic evolution, and thus, should be included as a central feature in the new macroeconomic framework.

Additionally, the creation of new goods, new demand, and the emergence of new sectors is highly important as it is the only solution to demand saturation. In the early days of macroeconomics, D. H. Robertson (who helped found the field of Keynesian macroeconomics) worried that a saturation of demand for existing goods and services could cause an economic recession and cited the Great Depression as an example of this effect. In his General Theory, Keynes also worried about how the consumer's decreasing marginal utility for existing goods and services was reducing effective demand. However, even though these economists had already noticed that a lack of new products was restricting demand (and thereby that new goods could stimulate the lagging economy), they focused more on increasing effective demand through government expenditure because they regarded the creation of new desire as morally wrong (Yoshikawa 2009).

It should be noted that, up until this point, there has been little interest within the field of macroeconomics in finding a model that might solve the demand saturation problem. As Aoki and Yoshikawa (2002) mentioned, the endogenous growth theories that are based on research and development (R&D) expenditures have only dealt with innovations that raise productivity, which is not entirely appropriate for dealing with demand saturation. Indeed, it is generally accepted within the field of macroeconomics (especially with regard to growth theories) that innovation is meant to refer to improvements in productivity. The early economic growth theories, such as the RCK model by Ramsey (1928), Solow (1956), Cass (1966), and Koopmans (1963), assumed that final goods were homogenous and could only account for quantitative growth and not qualitative development. More recent growth theories are similarly limited in their exclusive consideration of technological innovation (Arrow 1962; Lucas, 1988; Romer 1990). In addition, even though they apply the concept of creative destruction to intermediate goods in their model, Aghion and Howitt (1992) address only

innovation in intermediate goods with regard to homogenous final goods in their Schumpeterian growth theory.

Moreover, many macro-level studies in the field of neo-Schumpeterian economics assume homogenous final goods in their models. Marengo and Valente (2010) criticized the formal growth theory in the field of evolutionary economics for focusing too narrowly on productivity-increasing process innovations (as Nelson and Winter (1982) did in their seminal work), even though the driving force behind capitalism is the creation of new goods.

As we have already argued, without the creation of new goods and the emergence of new sectors, there will be an imbalance between rising productivity and saturated demand, which will cause the economy to inevitably face a bottleneck that will retard development and growth (Saviotti and Pyka 2013). Consequently, we must deal with capitalism's demand saturation problem by developing a new macroeconomic framework, the ERS. We believe that the ERS may be used to expand upon Metcalfe (2001) and Metcalfe et al.'s (2006) research on the process by which new technology creates new demand.

Nonetheless, although the creation of new goods (and resulting increased demand and new sectors) is a critical factor in understanding macroeconomic phenomena, this does not mean that productivity-increasing process innovations are not important as well. These two types of innovation (good and productivity innovation) should both be included in the new macroeconomic framework because of their complementary relationship. Pasinetti (1983) stated that an increase in productivity must be considered along with an increase in demand because it would compensate for an increase in consumers' demand. Saviotti and Pyka (2008) argued that, through classical competition, such productivity innovations could be in charge of growing efficiency, as driving force behind quantitative expansion. Furthermore, this form of innovation has been widely studied within the field of macroeconomics and has the support of many scholars, going as far back as Adam Smith. As such, our proposed framework addresses productivity innovation with flow C.

Our macroeconomic framework includes ideas on the financial market, which are shown as flow D in Figure 3. Hanusch and Pyka (2007) regarded the financial market as one

of the normative pillars in the neo-Schumpeterian perspective's capitalistic economy because, as Schumpeter (1911) argued, the relationship between the banker and the entrepreneur is critical for innovation. A financial market is significant at the macroeconomic level because it drives economic development and growth by catalyzing capital accumulation and technological innovation (Levine 1997). Moreover, because financial development promotes technological development and vice versa, Minsky (1988) emphasized coevolution between technology and finance. Therefore, in order to understand the greater modern economy, it is first necessary to understand the relationship between the financial sector and innovation, which is captured by flow D in our framework.

When considering the financial market in terms of innovation, our framework focuses on the direction of flow that capital ore resource are heading to rather than the types of finance (though some research exists on which type of finance is better for innovation). In our framework, we assure that the flow of resources is present in the ERS and accumulated capital is not allowed to leak out of the system. We borrow Perez's (2003) terminology in which the capital provided by the financial market is termed productive capital rather than financial capital.[1] According to our framework, the financial market for productive capital is beneficial for the ERS' effective circulation (and is related to flow D), while the intermediaries that provide financial capital boost leaking resources.

Flow B represents the relationship between income and demand, which has been a significant issue in Keynesian economics. Indeed, Keynesian ideas are the crucial building blocks of modern economic thought on this subject, but with respect to the ERS, they are part

[1] According to Perez (2003), the economic agents that use the capital determine its identity, although both types of capital are the same on the balance sheet. The owner of financial capital aims to accumulate wealth in the form of money and to expand this wealth by trading information and making suitable contracts with banks, brokers, and other intermediaries. Productive capital, on the other hand, is determined by the purpose and motivation of economic agent, who creates new value by producing goods and services. The goal of productive capital is to facilitate production, and the aim is to expand funds and maximize profit by investing in innovative activities.

of the entire economic system. This step can also be related to the issues of redistribution or inequality in terms of increasing effective demand. While it is true that inequality and demand have been well studied in mainstream economics, neo-Schumpeterian economics has been likely to explore the supply side of the issue. Consequently, more research is needed on the demand-side, because, as Pasinetti (1983) stated, it is impossible to evaluate relevant technical progress without considering the evolution of demand.

In our macro framework, the market adjustment stage corresponds to the concept market equilibrium, which is a core element of the DSGE model. Saviotti and Pyka (2013) pointed out that studies on neo-Schumpeterian economics tend to underestimate the role of the market, while the DSGE approach tends to exaggerate it. However, it is still important that the market be accounted for as it provides order to the economy. Furthermore, Metcalfe et al. (2006) argued that the market process' coordination function is significant in determining the relationship between innovation, investment, demand, and the structural transformation of the economy. They added that a market mechanism allows the economy to evolve and harmonizes the development of each economic behavior. Based on this argument, we developed our concept of market adjustment to be more like Witt and Brenner's (2008) flow equilibrium; by definition, "a flow equilibrium results if influx and outflow in a flow system over a given period of time are balanced in such a way that a constant relation between the system's capacity and its throughput is stabilized (steady flow)" (Witt and Brenner 2008).

In addition, our macro framework differs still further from the DSGE model in that it is designed to consider the intrinsic dynamic changes in the economy. If the circulation is sound and smooth, after one complete cycle (in which qualitatively and quantitatively expanded demand and supply achieve flow equilibrium), the economy should not be the same as before. This means that the economy is neither heading toward a steady state nor following a "constrained circular flow" (to borrow Schumpeter's expression), but is, instead, transferring to a different and higher track of circulation. Therefore, capitalism will continue

to grow both quantitatively and qualitatively as long as the ERS continues its virtuous cycle. Figure 4 depicts the spiral dynamics of economic development under the ERS.

(insert Figure 4 here)

This development process is wholly endogenous, and cannot be interpreted as a result of external impacts when there are no constraints to hinder the natural flow of resources. If the circulation of capital and value are not tampered with but allowed to circulate freely, the economy will, by its inherent nature, promote continuous technological innovation and expand both quantitatively and qualitatively. Spontaneous economic development is, therefore, inevitable. Consequently, just as Schumpeter (1911) endeavored to do, we present a theory of economic change, which proposes "a source of energy within the economic system which would of itself disrupt any equilibrium that might be attained," and offers a process "which does not merely rely on external factors propelling the economic system from one equilibrium to another."

Thus, we argue that industrial capitalism (as described by the ERS) accelerates naturally in terms of development and growth, expanding faster and faster over time, because the speed of technological progress and the rate of capital accumulation increase over time. Consequently, we may conclude that, in order to explain impediments to economic development and recessions, we must determine where bottlenecks may occur in the circulation process..

4. Policy making applications of the ERS

In the mid-twentieth century, a division of labor arose in the academic community regarding macroeconomic policy prescriptions. One school held to the long-term approach, which used economic growth theory to depict economic trends, while the other focused on short-term economic fluctuations around the trend, which were related to the business cycle

(Dosi et al. 2010). In addition to these two approaches, the more intermediate-term Kondratieff cycle, or technological cycle, was also widely studied (Maddison 1991; Rosenberg and Frischtak 1983). These different approaches developed independently and pose different policy-related questions.

These various approaches with their different time scales have focused on separate parts of the economy: the business-cycle approach is mainly interested in aggregate demand, (and is, therefore, roughly similar to the Keynesian perspective), while the other side, which emphasizes growth, focuses on innovation by delving into the supply side. The interest in the supply side with respect to endogenous technological progress, for instance, cannot be found in the NCS, although it tries to refine the interaction between the fundamental dynamics of technology and high-frequency, demand-related, non-fundamental shocks (Dosi, Fagiolo, and Roventini 2010). In addition, although new growth theory mainly deals with supply-side innovations, it cannot embrace the demand side of the economy. Additionally, there has been a movement within neo-Schumpeterian economics to address not just the supply side, but the demand side as well (however, it would be more like the role of demand in innovation) (Witt 2001). Recently, comprehensive pieces have been published that tried to reconcile the Schumpeterian and the Keynesian perspectives (Dosi, Fagiolo, and Roventini 2010). However, these pieces generally ignored the qualitative changes that are driven by the creation of new goods and the eventual emergence of new sectors. Thus, we can see that there is yet no comprehensive framework for policy making that considers different time spans while capturing the supply side, the demand side, and the economy's other elements.

The ERS, however, is a unified approach that includes varying time spans, the Keynesian perspective, and the Schumpeterian perspective. The most critical and distinctive feature of our framework is its aims and implications for macroeconomic policy (including monetary, fiscal, and innovation policies); it prescribes a smooth circulation of the ERS without bottlenecks.

From our point of view, the policy implications that are afforded by other macroeconomic frameworks are reasonable, but they offer only partial solutions to the

problem of bottlenecks, which are further biased by the historical circumstances under which they were developed. For instance, the Keynesian approach first appeared as a response to the Great Depression and consequently focused on ways to enlarge effective demand. According to economic history, demand was saturated after the Second Industrial Revolution, which encouraged mass production; therefore, it was inevitable that a study would be done on how to increase demand. In other words, because the Great Depression era suffered from an impediment to flow B in Figure 3, the Keynesian approach provided a tailored solution, that while effective, was only appropriate for corresponding demand-side crises.

The business cycle, the technological-regime cycle, and long-term trend approaches also depend on where a bottleneck occurs in the ERS. For instance, when a bottleneck of short duration arises, such as problems with demand, interest rates, or unemployment, we can say that there is a problem related to the business cycle. Additionally, when a delay in the creation of new goods prolongs the saturation of demand, an intermediate-term bottleneck develops, which means that a technological paradigm shift or enlargement of the adjustment gap is needed in order to solve the problem; these issues are inherently linked to the technological or Kondratieff cycle (Dosi 1982; Saviotti and Pyka 2008; Perez 2003).

As long as the ERS structure is sound and resources or capital are not leaked from circulation, then the economy will grow both qualitatively and quantitatively. However, if the system's capital or resource flows are drained (i.e., the ERS is damaged), then the economy will lose its engine of growth and cease developing. Therefore, we can conclude that macroeconomic policy should strive to maintain the industrial ERS.

5. Conclusion

The 2008 economic crisis showed that the DSGE model, which is the mainstream macroeconomic framework, cannot provide an appropriate solution to the world's economic woes. Consequently, an innovative macroeconomic framework that utilizes prior models' accumulated wisdom while overcoming their shortcomings is needed.

Furthermore, the current alternatives to the DSGE model do not deal with the economy as a whole. Thus, this paper suggests a more comprehensive macroeconomic framework, the ERS of the industrial capitalism, which can be a template for macroeconomic analysis. In the system, not only are the individual elements treated as important, but so are the flow of resources and capital among them. In this framework, the most significant flow is that of capital from accumulated capital to new goods, to new demand, and eventually to new sectors because this step drives the qualitative development of the economy and, more importantly, solves the problem of demand saturation. However, the framework also embraces all of the significant economic elements in industrial capitalism and the capital and resource flows between them.

Finally, the ERS approach provides a good policy making benchmark, which is whether a policy encourages the smooth circulation of the ERS without causing bottlenecks.

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Figure 1 The macroeconomic analytical template of NCS

1.Economic environment (Fundamentals)
- preference
- production technology/endowment
- market structure and government
- information structure

2.Equilibrium (mostly competitive equilibrium)
- optimization
- market clearing conditions

3. Pareto optimality and policy implication

Figure 2 The alternative analytical framework and its potential uses

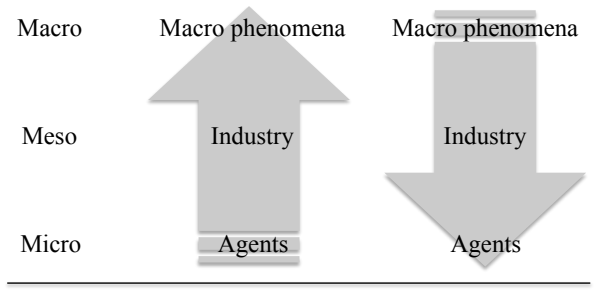

Figure 3 The expanded reproduction system

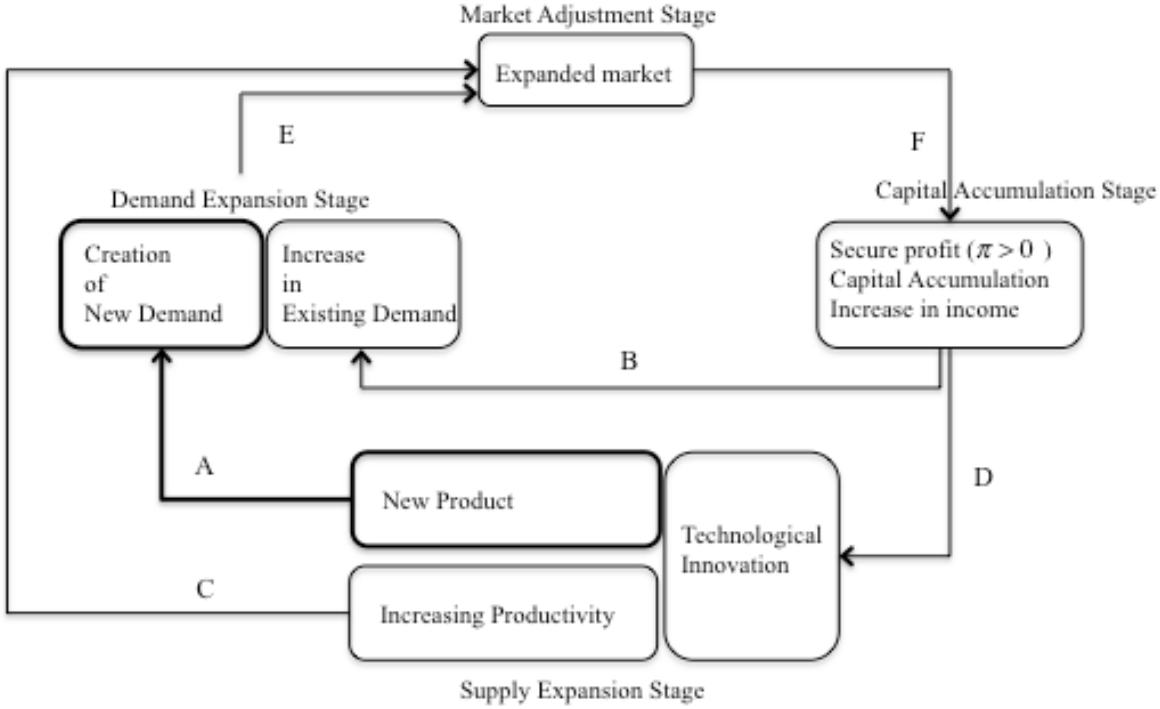

Figure 4 The spiral dynamics of economic development