The Green-MKS system: A base line environmental macro-dynamic model

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In three different moments during his Distinguished Lecture at the Eastern Economic Association, Samuelson (1983) referred to Karl Marx, John M. Keynes, and Joseph Schumpeter as "heroes", "giants", and "prodigious workers" of the economic profession. Perhaps more than anybody else, they contributed to the understanding of the inherent instability of capitalist economies and the essential relationship between cycles and growth (Vercelli, 1984). Marx died in 1883, the year Keynes and Schumpeter were born. One hundred years or so later, Goodwin (1986) presented his last fundamental contribution: The MKS System. Despite obvious differences and apparent incompatibilities between the three of them, Goodwin viewed their theories as being somehow complementary to each other.

Peter Flaschel dedicated his entire academic career to developing a macrodynamic framework for studying modern economies from a disequilibrium perspective. A fruitful collaboration with scholars from different parts of the world resulted in a series of papers and books (e.g. Chiarella and Flaschel, 2000; Chiarella et al., 2005; Asada et al., 2011; Flaschel et al., 2018) to which some refer to as the "Bielefeld School". He shared Goodwin's understanding that growth and cycle are indissolubly fused and the MKS system as a natural extension of the original growth-cycle model (Goodwin, 1967). From Marx, we have the correspondence between profits, income distribution, and accumulation. From Keynes, the principle of effective demand. Finally, Schumpeter presents innovation as the driving force of capitalism. Elements for a synthesis between these three authors can be found in Flaschel (2009). The problem at hand is how to conceptualise the evolutionary aspect of capitalism. A baseline macro model was published a few years later, where the Marxian reserve army mechanism provides global stability while Keynesian demand and Schumpeterian process innovations work as destabilising forces (see Flaschel, 2015; for recent developments, see Chiarella et al., 2021, pp. 271-410).

However, it must be noted that this literature remains silent to one of the main challenges of our generation: climate change. There is a fundamental contradiction between the economy's current structure and the need to tackle global warming. Sustainable development seems a critical piece currently missing in the MKS framework. Our purpose in this paper is to extend the growth-cycle model in Flaschel (2015) to consider the feedback effects between the macroeconomy and the environment. In particular, we formalise into the model a mechanism that explains how people with different environmental attitudes influence each other and contribute to the design of environmental policies (as in Dávila-Fernández and Sordi, 2020; Cafferata et al., 2021). For this purpose, we rely on a continuous-time version of the discrete choice approach (Brock and Hommes, 1997; for a review, see Franke and Westerhoff, 2017). The resulting 4-dimension Green-MKS system admits endogenous persistent and bounded fluctuations, representing the interaction between attitudes towards climate policies and growth-cycle dynamics.

We differentiate between three types of agents. On the one hand, we have those that are unsure that man-made climate change is occurring, and unenthusiastic about acting. On the other hand, there are people who strongly believe global warming requires immediate action. The last group consists of individuals without a clear position or that are unable to influence the public debate. Conditional to the level of interaction between players, society chooses the stringency of environmental regulation. Such

a choice will influence the adopted production technology. The economy is fundamentally demand-led, but innovation and income distribution are affected by the agents' choices. A certain level of economic activity generates an amount of Green House Gas (GHG) emissions that endogenously feedbacks in the attitudes towards climate policies. The model is compatible with two stable equilibrium points. One with the majority of the population supporting environmental action and another in which the majority of agents oppose strong regulation. To the best of our knowledge, our Green-MKS system is the first to use the discrete-choice approach to show it is possible to control for multi-stability and obtain a unique green equilibrium point with higher growth and employment rates. Such a result has important policy implications that open avenues for future research.

References

Asada, T., Chiarella, C., Flaschel, P., Mouakil, T., Proaño, C., Semmler, W. (2011) Stock-flow interactions, disequilibrium macroeconomics and the role of economic policy. Journal of Economic Surveys 25(3), 569-599.

Brock, W., Hommes, C. (1997) A rational route to randomness. Econometrica 65, 1058-1095

Cafferata, A., Dávila-Fernández, M., Sordi, S. (2021) Seeing what can(not) be seen: Confirmation bias, employment dynamics and climate change. Journal of Economic Behavior & Organization 189, 567-586.

Chiarella, C., Flaschel, P. (2000) The Dynamics of Keynesian Monetary Growth: Macrofoundations. Cambridge: Cambridge University Press.

Chiarella, C., Flaschel, P., Franke, R. (2005) Foundations for a Disequilibrium Theory of the Business Cycle. Cambridge: Cambridge University Press.

Chiarella, C., Flaschel, P., Franke, R., Araújo, R., Charpe, M., Proaño, C., Szczutkowsi, A. (2021) Unbalanced Growth from a Balanced Perspective. Cheltenham: Edward Elgar.

Dávila-Fernández, M., Sordi, S. (2020) Attitudes towards climate policies in a macrodynamic model of the economy. Ecological Economics 169, 106319.

Flaschel, P. (2009) The Macrodynamics of Capitalism: Elements for a Synthesis of Marx, Keynes and Schumpeter. Second Edition. Berlin: Springer-Verlag.

Flaschel, P. (2015) Goodwin's MKS system: A baseline macro model. Cambridge Journal of Economics 39, 1591-1605.

Flaschel, P., Charpe, M., Galanis, G., Proaño, C., Veneziani, R. (2018) Macroeconomic and stock market interactions with endogenous aggregate sentiment dynamics. Journal of Economic Dynamics & Control 91, 237-256.

Franke, R., Westerhoff, F. (2017) Taking stock: A rigorous modelling of animal spirits in macroeconomics. Journal of Economic Surveys 31(5), 1152-1182.

Goodwin, R. (1967) A growth cycle. In C. Feinstein (ed.) Socialism, Capitalism and Economic Growth, 54-58. Cambridge: Cambridge University Press.

Goodwin, R. (1986) The M-K-S system: the functioning and evolution of capitalism. In H.-P. Wagener, J.W. Drucker (eds.) The Economic Law of Motion of Modern Society. A Marx-Keynes-Schumpeter Centennial. Cambridge: Cambridge University Press.

Samuelson, P. (1983) Marx, Keynes and Schumpeter. Eastern Economic Journal 9(3), 166-179.

Vercelli, A. (1984) Fluctuations and growth: Keynes, Schumpeter, Marx and the structural instability of capitalism. In R. Goodwin, M. Kruger, A. Vercelli (eds.) Nonlinear Models of Fluctuating Growth. An International Symposium, Siena, Italy, March 24-27, 1983. Berlin: Springer-Verlag.