Money and Macroeconomic Dynamics

Accounting System Dynamics Approach

Edition 3.1

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Preface

My Off-Road Journey for A Better World

Futures Studies

In early 1980's, I was told by one of the graduate colleagues at the University of California, Berkeley, that if I continue the research involving Marx and Keynes in addition to neoclassical theory, I would never get a good job offer in the United States. He was right. It was a time for Reganomics which has eventually evolved to the era of globalization in 1990's. Paying little attention to his thoughtful suggestion, I pursued my Ph.D. thesis on the subject "Beyond Walras, Keynes and Marx - Synthesis in Economic Theory Toward a New Social Design", which, alas, became a start of my off-road journey. Main part of the thesis was luckily published with the same title [78], yet it has been left unnoticed among main stream economists.

When I started teaching at the Dept. of Economics, University of Hawaii at Manoa, I almost lost my energy to continue the research on neoclassical mathematical theory for academic survival, because the theory seemed to be totally detached from the economic reality. It was in those discouraged days when my introduction to the futures studies and Prof. Jim Dator, then secretary general of the World Futures Studies Federation, took place by chance in Hawaii in 1987. Upon arrival to Japan next year, I immediately joined the Federation, and became very active on futures studies for more than ten years since then.

Among the activities of futures studies I have been involved, a major one was the organization of futures seminar series in Awaji Island, Japan, with an objective to establish a future-oriented higher institution dubbed the Network University of the Green World (http://www.muratopia.org/ NUGW). The seminars had been held for seven years from 1993 through 1999, then suspended due to the lack of fund. In the book based on the first seminar in 1993, I have proclaimed that

> Thus, what has been missing in industrial-age scientific research, and hence in the academic curricula of present-day higher institutions, is a study of interrelated wholeness and interdependences [81, p.200].

In order to fill the missing niche, I have tried, with a help by the seminar participants, including Novel laureate Jerome Karle, to establish a new wholistic

field of study dubbed FOCAS, meaning Future-Oriented Complexity and Adaptive Studies, in vain. Yet, my conviction on the need for such futures studies for higher education continued to remain as worth being upheld. Faced with the threat of our survival due to climate changes and environmental disasters, future-oriented studies of interrelated wholeness and interdependence is, I believe, more urgently needed for solving these complex problems, since solutions offered by fragmented professionals at the current higher institutions might be the causes of another problems as Asian wisdom connotes. For our survival and sustainability, we need future-oriented higher education which provides wholistic visions and solutions to the present complex problems caused by fragmented science and technology of the present-day higher education. This conviction became a fruit of reward for me at the cost of abandoning neoclassical economic research in a traditional academic stream.

System Dynamics

Throughout the future-oriented activities later on, I was luckily led to the systems view, specifically a method called system dynamics, by chance. It seemed to me a totally new field of study that makes a heavy use of computer simulation for analyzing dynamic behaviors of system structures in physics, chemistry, engineering, environmental studies, business and economics, and public policies, to name a few, in a uniform fashion. In short, its methodology can uniformly cover many fragmented fields of studies, and in this sense it seemed for me to be able to share a similar interdisciplinary vision with future-oriented studies. After many years' frustration on the futures studies, I've jumped in the fieled by attending its international conference in Istanbul, Turkey, in 1997. Since then I have been continually attending the system dynamics conferences up to the the present day.

It didn't take much time to realize that, due to its interdisciplinary nature, system dynamics is also facing a similar difficulty in finding an academic position as a discipline in the current extremely fragmented higher educational system, as future-oriented studies have been suffering similarly. In other words, system dynamics and futures studies can have no comfortable places in the current universities. The only difference is the use of computer in the former, and the use of our brain in the latter.

Hence, it seemed to me that future-oriented studies and system dynamics constitute two major fields of future's higher education, using our brain on the one hand and computer on the other hand for a study of interrelated wholeness and interdependence in order to attain human and environmental sustainability. In fact, it has been repeatedly argued at the international conferences whether system dynamics is merely a tool or discipline. For me it seemed to be not to the point and accordingly a fruitless argument.

On the contrary, the following description by Prof. Jay Forrester, a founder of system dynamics, on the nature of system dynamics looked to me to the point.

> Such transfer of insights from one setting to another will help to break down the barriers between disciplines. It means that learning in one field becomes applicable to other fields. There is now a promise of reversing the trend of the last century that has been moving away from the "Renaissance man" toward fragmented specialization. We can now work toward an integrated, systemic, educational process that is more efficient, more appropriate toward a world of increasing complexity, and more compatible with a unity in life [19].

It is a useless effort to search for an appropriate academic citizenship at the current fragmented higher education. In this sense, it seems to be a right choice to introduce the visions and methods of system dynamics to the K-12 education where academic fragmentation does not yet break down into the learning process. The reader may visit a creative learning Web site for its successful introduction at http://clexchange.org.

I felt I have finally been led to a right truck, after more than a decade-long off-road journey, toward a better world. If I had stayed at the economics profession, I would have never encountered system dynamics as most economists are currently still unaware of it. What I have learned from system dynamics is the importance of system design.

My continuing off-road journey got refurbished with this spirit of system design. In the falls of 1998 and 1999, I had a chance to visit MIT where I was introduced systems thinking and system dynamics for the first time as if I was a first-hand learning student by Prof. John Sterman and his doctorate students as well as Prof. Jay Forrester and his undergraduate team of Road Map project (educational self-learning system dynamics program through Web). This became my off-road journey of no return from system dynamics in my profession.

Accounting System Dynamics

Instead of being forced to stay in the economics profession, I was luckily given a chance to teach system dynamics at two management schools in Japan; first at the Osaka Sangyo University in Osaka, then Doshisha Business School in Kyoto. System dynamics obtained its first citizenship in this way as academic subject to be taught in the fragmented higher educational system in Japan.

Eventually, as a faculty member of management and business schools, I strongly felt it necessary to cover accounting system in my system dynamics class. Yet, my search for SD-based accounting system turned out to be unsuccessful, giving me an incentive to develop a SD method of modeling financial statements and accounting system from a scratch. I started working on the SD-based accounting system in the summer of 2001 when I was spending relatively a quiet time on a daily rehabilitation exercise in order to recover from the physical operation on my shoulder in June of the same year. This retreat environment provided me with an opportunity to read books on accounting intensively. My readings mainly consisted of the introductory books such as [29], [38], [43], [68] and [69], since my knowledge of accounting was limited in those

days[1]. Through such readings, I have been convinced that system dynamics approach is very effective not only for understanding the accounting system, but modeling many types of business activities. This conviction fruitfully resulted in my presentation on the principle of accounting system dynamics at the 21st international conference of the System Dynamics Society in New York in 2003 [83], which became a turning point in my off-road journey.

Rekindled in Berkeley, California

In the same summer of 2003, I was luckily offered an 8 months' sabbatical leave, and came back to Berkeley in almost 18 years since I left in 1986, this time as a visiting scholar at the Haas School of Business, not the Economics Department. My old friend, Nobie Yagi, from Berkeley days kindly provided his second house on his site for my family's stay, which gave me a good opportunity to talk with him almost daily. He received Ph.D. in finance and options trading from Berkeley around the same time as I did.

Conversation with him, together with my research environment at the business school rekindled my interest in economics, specifically macroeconomics and finance again. Even so, in those days I have already taken an off-road journey away from main stream economics, and decided to investigate it from my off-road side way. Specifically, I resolved to start reconstructing macroeconomic theories on the basis of the principle of accounting system dynamics which was completed in the same summer.

Since then, being led by the inner logic of accounting system dynamics and macroeconomics, I have spent almost my entire off-road journey on a step-by-step construction of macroeconomic models, which turned into a series of presentation of papers such as [85], [86], [87] and [88]. This series of macroeconomic modeling was completed in 2008 as [89] with a follow-up analytical refinement method of price adjustment mechanism in [90] next year.

An Oasis in Wellington, New Zealand

Second good luck visited me on my off-road journey as two months' short sabbatical leave in 2009 at the Victoria Management School, Victoria University of Wellington, New Zealand. Prof. Robert Y. Cavana, a well-known leading scholar in system dynamics, kindly hosted my visit. This good luck enabled me to review the above paper series uniformly for the publication of this book. Almost daily conversation with him over lunch, as well as a lovely research environment in Wellington, encouraged me to keep working on the draft. Without this stopover in New Zealand as an oasis in my off-road journey, the draft would not have been completed.

[1] In addition to these books, a paper dealing with corporate financial statements [2] was published in 2002. However, current research for modeling financial statements is independently carried out here with a heuristic objective in mind.

National Model

I was a late comer to the research community of system dynamics. While my step-by-step macroeconomic modeling was advancing, some researchers have kindly suggested at the conferences that I should review the research papers on the National Model project that was led by Prof. Jay Forrester with several Ph.D. students at MIT.

Unfortunately, the national model itself was not available and its related papers were scattered around. Under such situation, my survey managed to cover the following papers [15], [16], [17], [18], [20], [21], [22], [23], [24], [25], [26], [27], [32], [36], [61], [62]. Yet, the review of these papers only gave me an impression as if I were, with my eyes closed, touching various parts of an elephant without knowing what the elephant looks like. During the 23rd international conference of System Dynamics Society in New York, July, 2005, in which I presented a SD-based Keynesian model, I have strongly felt that my research cannot advance without understanding a whole picture of National Model, because my modeling approach, I feared, might have been already taken by the National Model project team.

Without losing time, in September of the same year, I visited Prof. Jay Forrester in his office at MIT. We spent almost two hours on discussing about his National Model. He told me that the national model is still going on, and I may have no chance to take a look at it until it's completed. Even so, the conversation turned out to be very fruitful to me, out of which I got convinced that my modeling approach on the basis of accounting system dynamics is quite different from his modeling method. This conviction gave me an energy to continue my off-road journey in my own way. At the same time, I truly hoped that the national model would be completed in the near future.

In the spring of 2007, I was invited to review the Ph.D. dissertation by David Wheat at the University of Bergen, Norway, whose title is "The Feedback Method: - A System Dynamics Approach to Teaching Macroeconomics [75]". His model, written by Stella software, seemed to me to be a simple version of the National Model. In this sense it became the first complete macroeconomic model ever presented to the public, and his effort should be congratulated. In the following year, at the 26th international conference of System Dynamics Society, Athens, Greece, I have presented a complete macroeconomic model, written by Vensim, on the basis of accounting system dynamics [89].

US Congressional Briefing

After a completion of my macroeconomic model in 2009, I was taking a rest in a foggy day at a vista point on my off-road journey. Financial crisis triggered by the bankruptcy of Lehman Brothers in 2008, followed by a series of government debt crises in the US and EU, blew away thick fog and all of a sudden a lofty peak of better world I've been searching for emerged in front of me. It was a peak of new macroeconomic system of public money. When I looked back the trail I followed so far, it turned out to be a macroeconomic system of debt

money.

A glimpse of this new peak of hope drove me again into writing papers [91] and [92] toward a better world. On the next day of the presentation of my paper [92] at the 29th International Conference of the System Dynamics Society in Washington DC, that is, on July 26, 2011, I was invited by the Congressman Dennis Kucinich to present the findings of my macroeconomic simulations on the workings of public money system at the US Congressional Briefing. This unexpected invitation recharged my driving energies toward a steeper trail on my off-road journey.

The peak of the better world is a green and sustainable world. It will be described in the last chapters of 12, 13, 14 and 15 (Part IV). Coincidentally this turned out to be the reinvigorated world of MuRatopian economy I've vehemently pursued in my dissertation in 1980's as a new social design.

Beyond

While working on my dissertation on "Beyond Walras, Keynes and Marx", I was once visited by a daydream that an academic torch of economic thoughts has been handed over from Karl Marx to John M. Keynes and from Keynes to me. It occured unexpectedly when I happened to realize the fact that Keynes was born in the year 1883 when Marx passed away, and I was born in the year 1946 when Keynes passed away. Since then I've been enslaved by a sense of scientific mission, though the reader may laugh at its mirage, that I should carry on and go beyond their economic thoughts for a better world.

Modern macroeconomic foundation was laid by the Keyne's esteemed book: The General Theory of Employment, Interest and Money published in 1936. When I encountered the title for the first time as a young student of economics, I got puzzled and confused by the order of "employment, interest and money". Nowadays, students may have no such puzzles because almost all macroeconomic textbooks start with the analysis of GDP that determines the level of employment, followed by the aggregate demand that constitutes GDP such as consumption and investment. Then interest and money supply are introduced as a determinat of investment. Under the Keynesian analytical framework, money has been all the time treated as an adjunct to the macroeconomic system; that is, money has been regarded as an exogenous entity, not as an endogenous one. This may be the reason why employment comes first, followed by interest and money comes last in the title of the book.

On the contrary, the title of this book, though it deals with similar subjects as Keynes, starts with the analysis of money and interest, followed by macroeconomic dynamics. The book is founded on the method of Accounting System Dynamics. Accounting system has been the most rigorous method in social science, while system dynamics has been the robust foundation of dynamic analysis (that is, differential equations) in natural science since Newton. In this sense, this methodology could be said to provide the most robust tool for analyzing the structure of macroeconomic behaviors. This analytical method that is being applied to the macroeconomic analysis has revealed that *money matters by all*

means or *money is all the time endogenous* as the reader may be convinced by going through the book. In other words, without money comprehensive macroeconomic models are first of all unable to be constructed. Money continues to sit in the center of all macroeconomic behaviors. This is why the title of this book becomes "Money and Macroeconomic Dynamics" In the Keynesian sense, the title of the book may be called "The General Theory of Money, Interest and Employment. The torch of Keynes' General Theory is now to be carried over in a thoroughly reversed order!

Moreover, it lights up the macroeconomic systems analyzed in Part II and III of the book as a *debt money* system in which Walras, Keynes and Marx used to live and we are living today, while it illuminates the macroeconomic systems designed in Part IV as a *public money* system in which we'll live in the near future as a sustainable world beyond the current debt money system.

Let me stop my off-road journey at this point. It is my hope that the reader will continue this off-road journey to the summit, so that, as travelers and hikers increase, it eventually becomes a main road journey for a better and green world.

With many thanks to those who guided me and offered a cordial help during my off-road journey, on my birthday:

June 24, 2013

Awaji Island, Japan

Acknowledgments

First of all, I would like to give my cordial thanks to those who have helped me during my off-road journey: Jim Dator, Matthias Ruth, Jay Forrester, John Sterman, Nobie Yagi, Robert Y. Cavana, David Wheat, Andrew Ford, Dennis Kucinich.

I have started using this draft as a main reference in my MBA classrooms since 2009. Feedback comments and suggestions from my students, Hisashi Deguchi, Hiroyuki Hori and Nobuo Nishi, turned out to be very helpful to improve the draft, for which I do express my acknowledgments. Prof. Yutaka Takahashi has read the draft and given me some valuable comments, to whom I am very grateful.

Meanwhile, I have taken opportunities to offer the SD workshops at the 28th International Conference of the System Dynamics Society, in Seoul, Korea, July 29, 2010, at the 29th Conference in Washington DC, USA, July 28, 2011, and at the 30th Conference in St. Gallen, Switzerland, July 26, 2012, under the theme: An Introduction to Macroeconomic Modeling – Accounting System Dynamics Approach. Many SD researchers and students from the conferences have participated in the workshops and gave me very valuable suggestions and comments on my analytical method of macroeconomic modeling, convinced me simultaneously that it's on the right track, for which I truly thank them all.

Additionally I was given invaluable opportunities to present the contents in Part IV: Macroeconomic Systems of Public Money at the 6th, 7th and 8th Annual AMI (American Monetary Institute) Monetary Conferences in Chicago, USA, in 2010, 2011, and 2012. I truly thank Stephen Zarlenga, the director of AMI, and Jamie Walton, the AMI researcher, for providing these opportunities, and conferences participants, specifically Joe Bongiovanni, for their worthy comments and suggestions. These turned out to be very prolific for deepening my analyses.

Finally, I do warmheartedly appreciate the patience of my families; Naomi, Dychi and Yokay for my relinquishing fun time with them on holidays due to my off-road journey.

Gassho!

A Quick Tour of the Off-Road Journey

Some Figures in this book may be too small to identify the details. Under the circumstances, the reader is recommended to refer to the attached M&MD CD Book which includes all figures used in this book. These figures are also freely downloaded, for the convenience of the reader, from the author's Web site at *www.muratopia.org*. The reader is also encouraged to confirm our simulation results by running the companion models simultaneously that are included in the same CD Book. Additionally, the reader may enjoy running simulations according to his or her own interest in macroeconomic behaviors. In this case, this book could be partially used as User's Guide for macroeconomic simulations.

Let us now begin with a quick tour of the author's off-road journey. The reader is recommended to follow chapter by chapter except the section 3.6, Accounting System Dynamics in Action, in order to fully comprehend the macroeconomic model-building structures, because most models built in the book are constructed step by step by following the previous models. Your feedbacks are mostly appreciated by the author through his email at kaoru3@muratopia.org.

Part I Accounting System Dynamics

Chapter 1 introduces the author's way of understanding system dynamics from a dynamics viewpoint. Those who have its background may still find some useful features of system dynamics.

Chapter 2 compares general equilibrium price adjustment mechanism of demand and supply with off-equilibrium adjustment mechanism that is made possible by the system dynamics method of incorporating inventory. This off-equilibrium approach becomes a point of departure of our macroeconomic analysis from the neoclassical equilibrium analysis.

Chapter 3 combines the principles of system dynamics with those of accounting system. The unified principle is called the Principle of Accounting System Dynamics, which constitutes one of the most robust foundations for the analysis of macroeconomic dynamics.

Part II Macroeconomic Systems of Debt Money

Chapter 4 sets off macroeconomic analyses of debt money system through chapter 9. This chapter investigates a simple capitalist market economy consisting of traditional budget equations by applying the principle of accounting system dynamics. The economy is constructed on the framework of monetary flow such that the so-called Say's law holds; that is, a well-known Goodwin Growth Cycle model.

Chapter 5 explores the nature of money and its creation through a fractional reserve banking under current debt money system. Functional-money creation processes under both flow and stock approaches are comparatively

investigated step by step from the case of the gold standard to the case of loan to banks, then loan to government.

Chapter 6 expands the analysis of money to interest and examines the equity distribution between non-financial sector and banks. It is then applied to the monetary Goodwin model to find out if this integrated monetary economy with interest triggers business cycles into economic recessions.

Chapter 7 discusses a typical Keynesian macroeconomic model of aggregate demand where Say's law no longer holds by applying system dynamics adjustment process. Then, a Keynesian IS-LM equilibrium model is explored within the framework of monetary circulation among producers, consumers, government and banks.

Chapter 8 integrates real part and monetary part of macroeconomic activities analyzed in the previous chapter by distinguishing nominal and real units of macroeconomic variables such as nominal vs real interest rates and nominal vs real GDP.

Chapter 9 incorporates population dynamics and labor market with the introduction of Cobb-Douglas production function. This chapter completes our comprehensive macroeconomic analysis under the debt money system. It reveals an inescapable accumulation of government debt even under an ideal equilibrium path in the real sector.

Part III Open Macroeconomic Systems of Debt Money

Chapter 10 sets off macroeconomic analyses of open debt money systems through chapter 11. This chapter explores a dynamic determination of foreign exchange rate in an open macro economy in which goods and services are freely traded and financial capital flows efficiently for higher returns.

Chapter 11 expands the comprehensive macroeconomic model in chapter 9 to the open macroeconomies on the basis of the framework developed in the previous chapter. It provides a complete generic macroeconomic model of open macroeconomies as a closed system of debt money.

Part IV Macroeconomic Systems of Public Money

Chapter 12 sets off our macroeconomic analyses of public money systems through chapter 15. This chapter discusses how the government debt crisis is structurally built in the current macroeconomic system of debt money. Then it demonstrates how the government debt can be liquidated under an alternative macroeconomic system of public money, proposed by the American Monetary Act, by revisiting the integrated macroeconomic model developed in chapter 8.

Chapter 13 analyzes the workings of a public money system under the most comprehensive open macroeconomies developed in chapter 11. Then it is demonstrated that under the public money system government debt can be liquidated without triggering recession, unemployment and inflation both in domestic and foreign economies.

Chapter 14 explores monetary and financial stability under the public money system in comparison with the current debt money system by constructing a simplified macroeconomic model with a stock approach of credit creation presented in chapter 5.

Chapter 15 searches for a better design of our macroeconomic system for our sustainable futures. First, it examines the public money system in comparison with the current debt money system. Then, the MuRatopian economy that was introduced in 1988 is revisited as a complementary system. Finally, the integrated system of these two is proposed as the best design of macroeconomic system for our sustainable futures.

Chapter 16 proposes a transition process from the debt money system to the public money system by constructing a simple macroeconomic model based on the accounting system dynamics. The model briefly handles main features of the debt money system, in 8 steps, that cause "booms and depressions", debt accumulation and failures of recent quantitative easing financial policy. It then offers a transition process to the public money system in 6 steps.

Postscript

Due to the budgetary constraint[2], the author was unable to get an editorial help in English. Accordingly, the reader would be kindly asked to accept the author's apologies for some clumsy writings that still remain in this book.

[2]This was caused by the sudden termination of the author's academic position, in March 2013, at the Graduate School of Business, Doshisha University, Kyoto, due to the use of system dynamics in his MBA lecture of Business Economics. Concerned researchers of system dynamics and economics overseas sent letters of petition to the president and dean of the university to stop the violation of academic freedom in vain.

Edition Notes

Edition 1.1 Figure 3.10 is revised. Minor type errors in Preface, Chapters 1, 9 and 15 are corrected.

Edition 2.0 Chapter 16 is newly added. Figure 11.6 is revised. Minor type errors are corrected.

Edition 3.0 Chapter 5 is fully revised with money creation models of both flow and stock approaches. Terminologies such as "money supply" and "monetary base" in the Chapter are replaced with "money stock" and "base money", respectively.

Edition 3.1 Chapter 3 is partly revised with revised definitions of Asset Management Ratios.

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