

Economic Dynamics

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Lecture 3: Extending the 'Three-Equation' Model

September 23, 2021

*Professor
ISM University, Lithuania*

*Professor
Virginia Western College, USA*



UNIVERSITETET I BERGEN

System Dynamics Group

Iryna's Vision



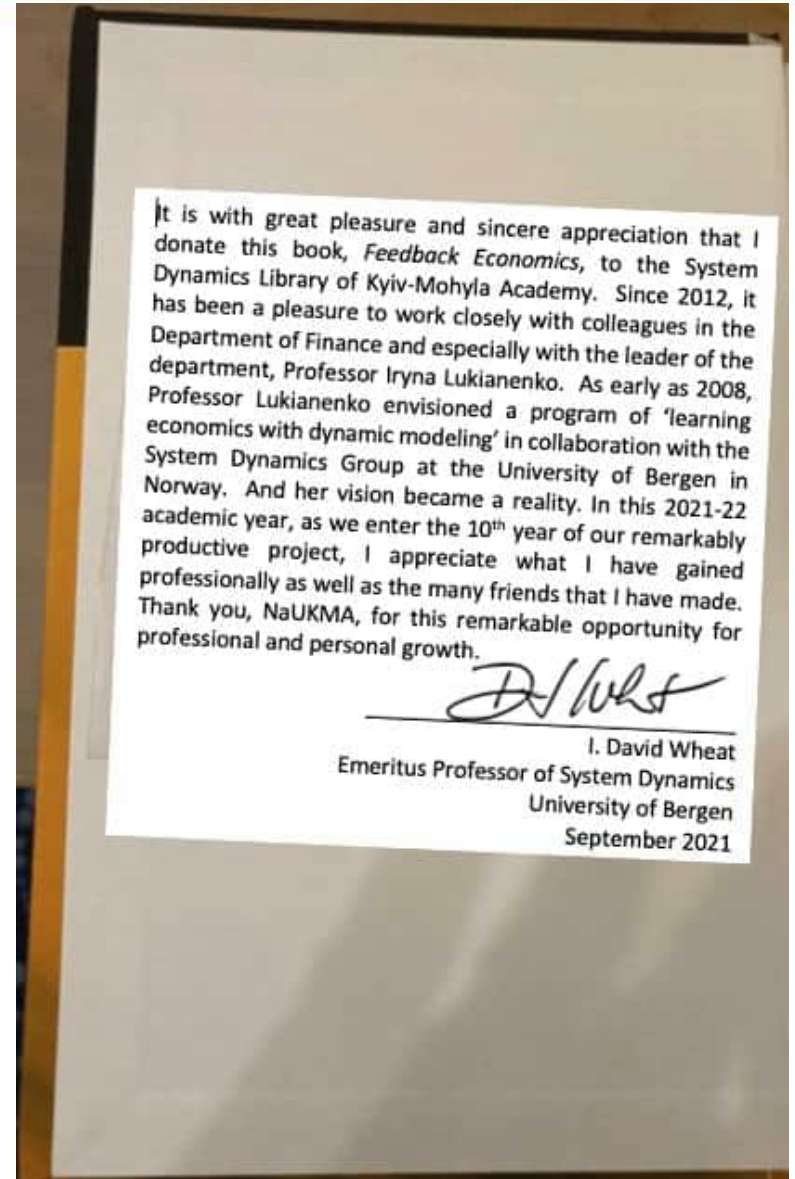
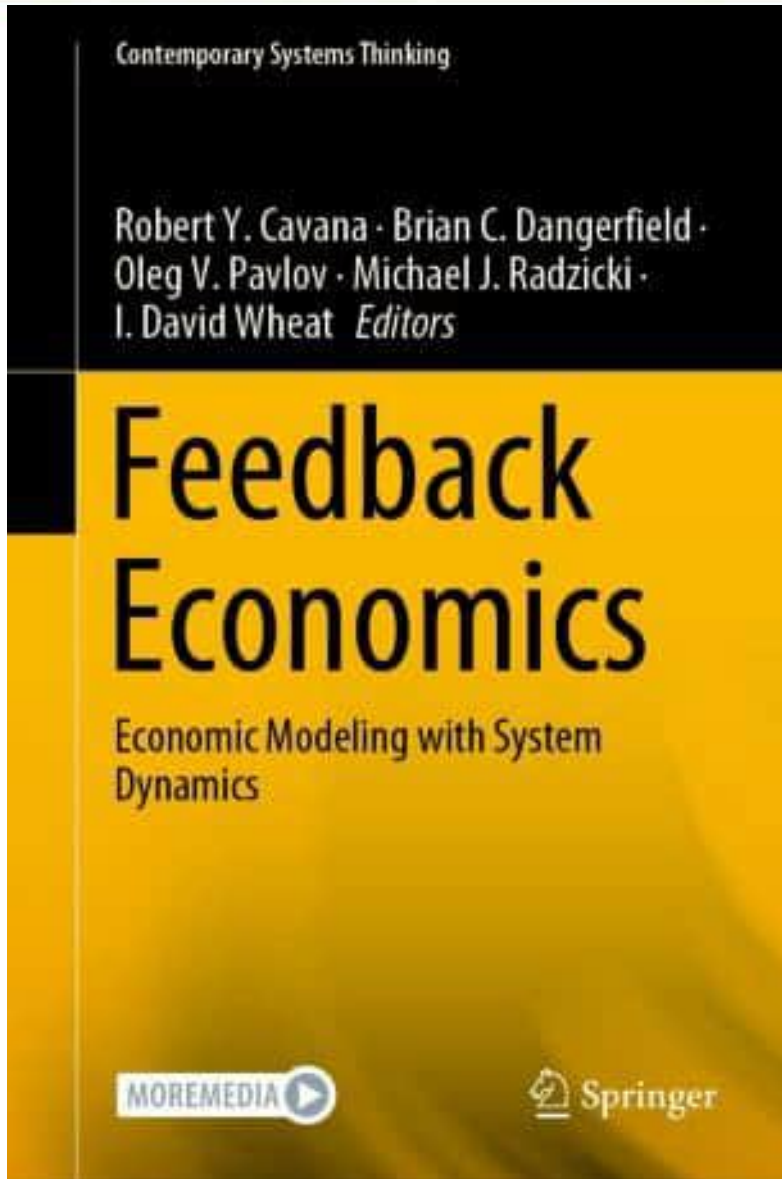
How old were you in 2008?

2008: NaUKMA group visited Bergen

2012: The vision became reality

2021: Many others have benefited, including you.

Book for SD Library in the Department of Finance



Dedication



It is with great pleasure and sincere appreciation that I donate this book, *Feedback Economics*, to the System Dynamics Library of Kyiv-Mohyla Academy. Since 2012, it has been a pleasure to work closely with colleagues in the Department of Finance and especially with the leader of the department, Professor Iryna Lukianenko. As early as 2008, Professor Lukianenko envisioned a program of 'learning economics with dynamic modeling' in collaboration with the System Dynamics Group at the University of Bergen in Norway. And her vision became a reality. In this 2021-22 academic year, as we enter the 10th year of our remarkably productive project, I appreciate what I have gained professionally as well as the many friends that I have made. Thank you, NaUKMA, for this remarkable opportunity for professional and personal growth.

A handwritten signature in black ink, appearing to read 'D. Wheat'.

I. David Wheat
Emeritus Professor of System Dynamics
University of Bergen
September 2021

Lectures: Thursdays, 16:30-17:30



Sep 16	Introduction to Dynamic Modeling	
Sep 23	Simplified 'Three-Equation Model'	
Sep 30	Extending and analyzing the 'Three-Equation' Model	
Oct 7	Add Firms, Households, and Government to the Model	
Oct 14	Test & Analyze the Model	
Oct 18-27	— autumn break —	
Oct 28	Add Banking Sector to the Model	
Nov 4	Add Central Bank to the Model	
Nov 11	Add Foreign Sector to the Model	
Nov 18	Test & Analyze the Model	
Nov 19- Dec 16	Study for Final Exam	

lab dates to be announced, by **Alina Novik** and **Marianna Olskevych**

Assignments due before next lab



1. Play the new Game and do Tasks 2 & 3.

<https://exchange.iseesystems.com/public/david-wheat/setmp/index.html#page1>

2. Why do inflation & unemployment tend to move in opposite directions?

3. Be prepared to discuss your assignments.

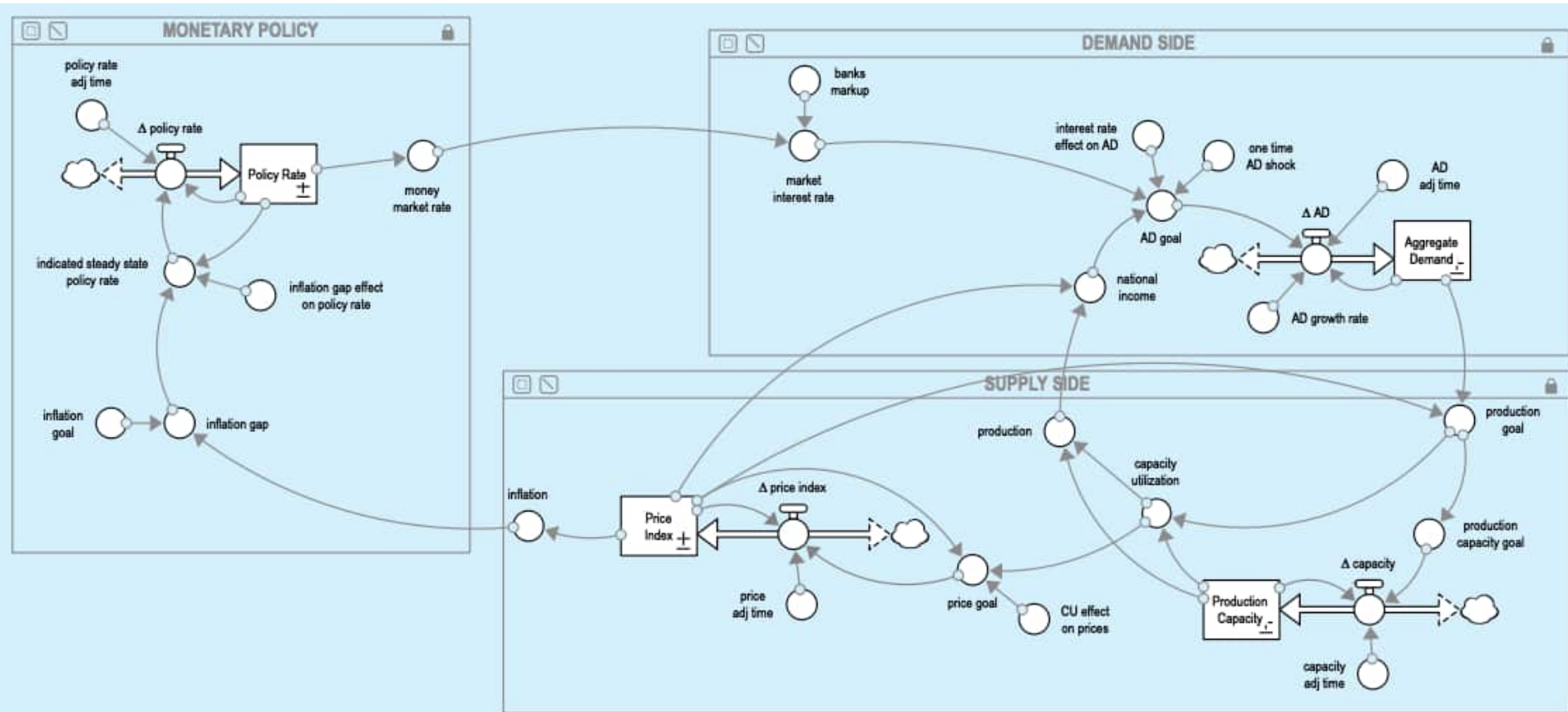
4. Practice with *Stella*.

Send all written assignments to Alina (NaUKMA), Marianna (LNU), and me
novikaj@ukma.edu.ua olisk@ukr.net david.wheat@uib.no

*Use this format for file names:
LastNameFirstName YYMMDD e.g., HarrisEmmylou 210916

zip all files before emailing

Model Divided into Sectors

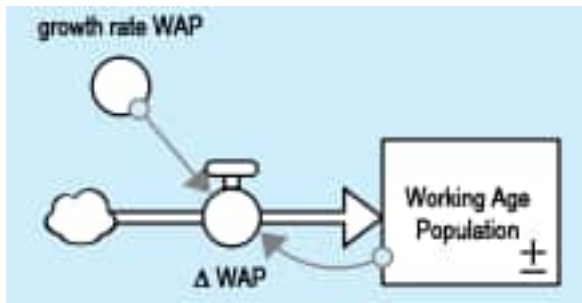
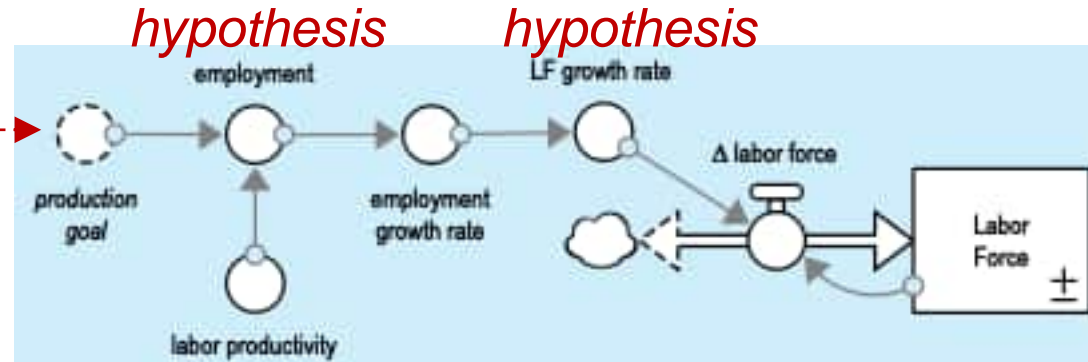
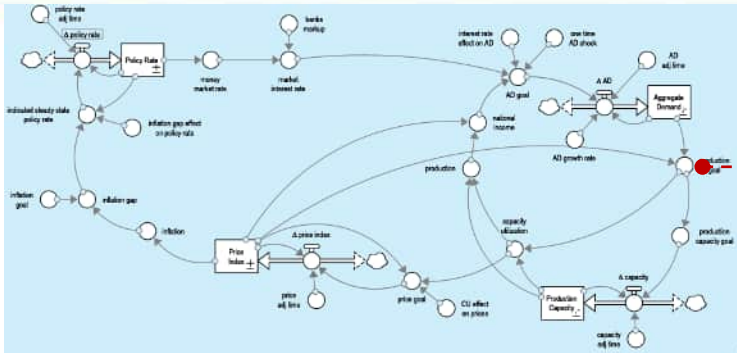


Tracing Dynamics with 'Causal Lens' Tool



Open Stella and open last week's model

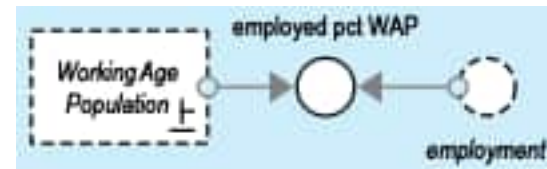
Adding Employment Structure



$$100 * (\text{Labor Force} - \text{employment}) / \text{Labor Force}$$



$$100 * \text{Labor Force} / \text{Working Age Population}$$



$$100 * \text{employment} / \text{Working Age Population}$$

Simulation Game, **New Version**



- *You will play the role of central bank leader.*
- *You now have **two** policy goals:*
 - ***low & stable inflation***
 - ***low & stable unemployment***
- *You will*
 - *review the economic conditions after each quarter and*
 - *decide what the policy rate should be during the next quarter.*
- *In Task 1, you will have about 5 minutes to play the game.*
(in the homework assignment, you can work in groups of 2-3 and take as much time as you need to 'do your best.')

INSTRUCTIONS:

You are the leader of a central bank in the future, and you have a **dual** mandate for monetary policy:

- (1) low & stable inflation (near 2%). (2) low and stable unemployment rate (as low as possible with stable inflation).

After the simulation begins in 2025, the unemployment rate is high (but falling) and inflation is low (but rising). In the first task (1), there are no shocks after the simulation begins. Other tasks are more challenging.

Click 'PLAY' to run the simulation. Each quarter, you will review the economic conditions and decide whether to change the Policy Rate. You have three options: raise it, lower it, or no change. After you decide, click 'PLAY' again. Repeat until the simulation ends.

Do each task several times, and take screenshots. Email your best results to Marianna, Alina, and David.

In the email,

- (1) write your name (or names, if you are part of a team),
(2) explain the strategy you used in the game.

[Click here for information about the Tasks](#)

Select your Task:

- 1 2 3

Set the Policy Rate:

2

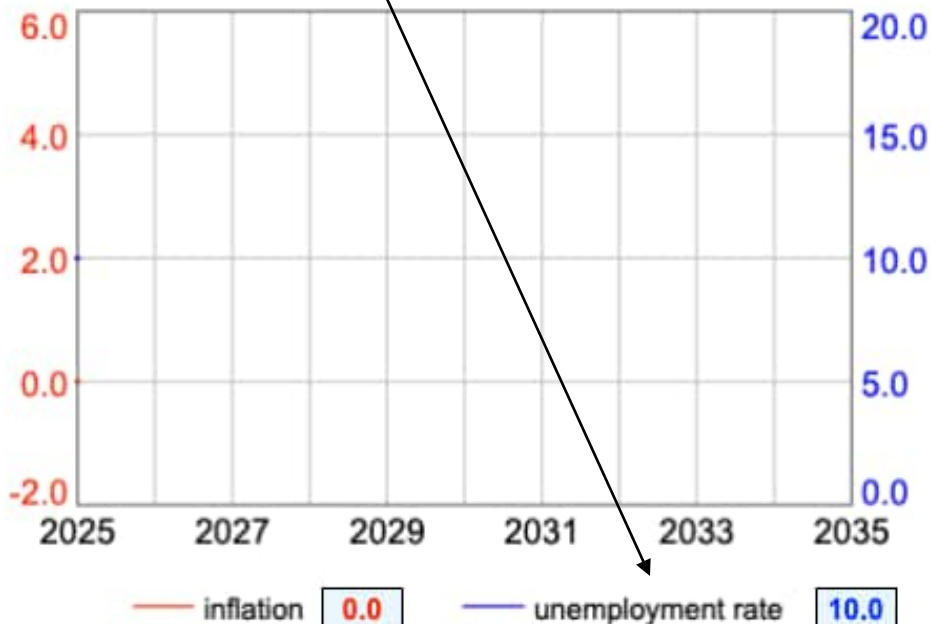
PLAY

re-set

Key Indicators

GDP growth %

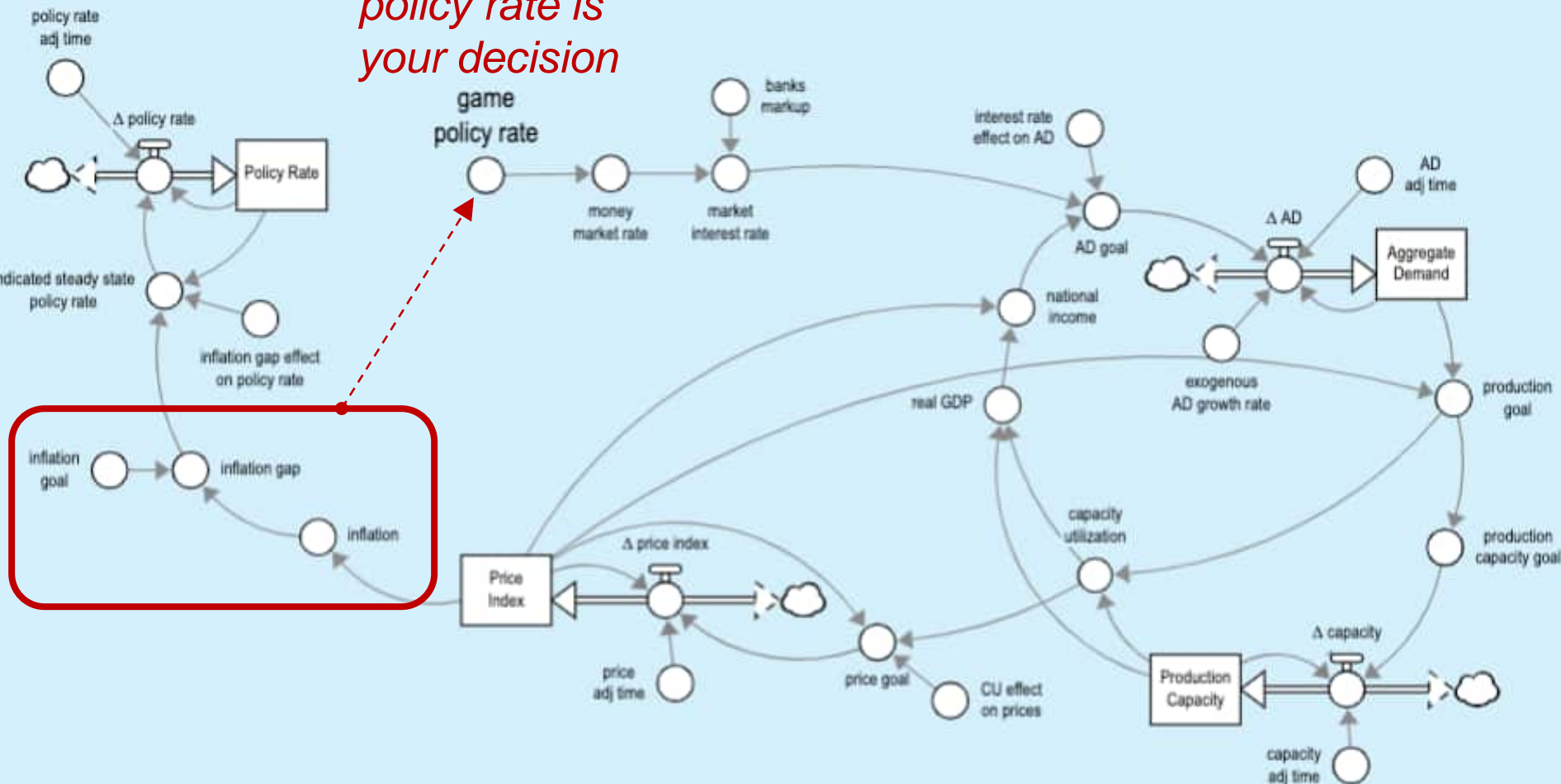
capacity utilization



Model Structure behind Simulation Game



*policy rate is
your decision*



Online Simulation Game



<https://exchange.iseesystems.com/public/david-wheat/setmp/index.html#page1>



I. David Wheat

Professor of System Dynamics, University of Bergen, Norway
Adjunct Professor of Economics, Virginia Western Community College, U.S.A.
Professor, Monetary Policy, ISM University of Management & Economics, Lithuania
Professor, Economic Dynamics, National University of Kyiv-Mohyla Academy, Ukraine

Professor Wheat studies economic systems. His research specialty is simulation modeling of European economies, including Ukraine, Lithuania, Latvia, and the Euro Area.

He teaches monetary policy and economic dynamics to graduate students in Lithuania and Ukraine. He also teaches macroeconomics to undergraduates in the United States. In Norway, after teaching the system dynamics modeling process for many years, he continues to offer courses in macroeconomic dynamics and policy design & implementation. His projects include collaboration with Ukrainian economists to build dynamic modeling capacity at national universities in Kyiv and Lviv, creation of a system dynamics version of the central bank's monetary policy model and building an economic development policy model for Ukrainian government ministries. He also worked with economists at Lithuania's central bank to develop a multi-industry system dynamics model of price dynamics in Europe.

For more than twenty years, his system dynamics-based *MacroLab* model has been used by macroeconomics students in the United States. That model is available online, and students can use it without special software. He is currently writing a textbook to supplement student use of *MacroLab*. His latest economics journal article is *Teaching Endogenous Money with Systems Thinking and Simulation Tools*, and the most recent conference paper was *MacroLab20: A Framework for Comparative Macroeconomics* (with M. Oliskevych and A. Novik). He is co-editor of *Feedback Dynamics*, published by Springer in July 2021, including a chapter co-authored with Oliskevych and Novik: 'Get Started with Macro Modeling.'

Wheat is past-president of the economics chapter of the International System Dynamics Society. He served as Associate Editor of the *System Dynamics Review* and on the Advisory Board of the *International Journal of Pluralism and Economics Education*. He has given more than thirty international guest lectures. For three decades, he was president of Wheat Resources Inc, a consulting firm serving business and government clients. His current firm, Praktika LLC, specializes in coaching others to build useful models (<https://www.usefulmodels.net>). He received his PhD at the University of Bergen, his master's degree in public policy at Harvard University, and his bachelor's degree in government and mathematics at Texas Tech University. During the 1970s, he served at the White House as staff assistant to the President of the United States.