

# Empirical and Normative Macroeconomic Theory and Monetary/Fiscal Policy in the Twenty-First Century: The Case of Minsky

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## Abstract

In this second case study about the progress in macroeconomic theory of markets, we try to contribute toward moving the economic discipline beyond its earlier history of divisive schools of economics—moving ahead on a consensus that: (1) Keynes advanced macro-economic theory to include an economic policy concern about employment, (2) Lasik included a concern about inequity, (3) Hayek included a concern about democracy. Now, we add that: (4) Minsky demonstrated that financial markets were inherently unstable and needed proper regulation. Hyman Minsky was a major economist bridging the twentieth and twenty-first centuries, but he did not become famous (an economic “star”) until the 2008 U.S. financial crisis. Minsky argued that financial markets are inherently unstable. In fact, the 2008 financial crisis was a dramatic market instability. Minsky’s prediction about “the instability”; of financial markets was in contradiction to the traditional economic assumption that free markets are always perfect. Furthermore, Minsky emphasized the importance of economic models in empirically validating theory, especially in depicting institutional operations (such as shadow banking). In Minsky’s terms, we show how to construct macroeconomic models that accurately depict reality—illustrating this by modeling the 2008 Global Financial Crisis.

## Keywords

Microeconomic Theory, Market Instability, Minsky, Economic Models

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## 1. Introduction

In a previous paper, we reviewed the case study of the history of economy theory in the twentieth century—focusing upon the long-running theoretical and policy

disputes among three of the most famous economists: John Maynard Keynes, Harold Laski, and Friedrich Hayek. (Betz, 2024: pp. 819-842) We then analyzed this history to learn about the scientific methodology for grounding theory as valid either as a normative or empirical explanation.

*Therein, we emphasized that the more practice (or policy) is based upon scientific knowledge, the more likely prescription by a consultant will be effective toward attaining a client's purpose. Thus, the importance of social science theory to societal policy is to draw inferences from past events that can be useful to policies for controlling future events.*

Now, to further understand how to differentiate economic theory as normative (what should be) or as empirical (what is), we continue our review of the history of the interaction between macro-economic theory and fiscal policy—continue it into the twenty-first century. Then, the work of a fourth “star” economist, Hyman Minsky, began to be recognized more widely by the economics discipline. Minsky did not become famous (an economic “star”) until the 2008 U.S. financial crisis. Also, we will analyze this crisis by modeling it using an approach that Minsky advocated—describing the institutional connections in macroeconomic events.

It was after this crisis that the economic community began more widely to read how Minsky had predicted that liberal free-markets of financial markets were not stable but inherently unstable. L. Randall Wray wrote: “Why does the work of Hyman P. Minsky matter? Because he saw the 2008 Global Financial Crisis coming. Indeed, when the crisis first hit, many of those familiar with his work (and even some who knew little about it) proclaimed it a “Minsky crisis”. That alone should spark interest in his work.” (Wray, 2016)

In the 2008 Financial Crisis, the U.S. Federal Reserve (Central Bank) reacted in a Minsky way to salvage the economy from a deep recession due to the crisis. L. Randall Wray wrote: Fed Chairman Benjamin Bernanke put together a “Big Bank” rescue package of \$29 trillion (yes, you read that correctly!) to save the world’s banking system. As a result, we saw very few runs on banks and remarkably few bank failures, given that this was by far the worst financial crisis since the Great Depression (when President Roosevelt had to declare a bank “holiday” to stop runs, with only half of all the banks allowed to reopen). Minsky would have given such policy advice. (Wray, 2016)

Why had many economists not anticipated the possibility of financial meltdowns, such as occurred in 2008? L. Randall Wray wrote: “What passed for ‘macroeconomics’, on the eve of the global financial collapse, had little to do with reality. The world modeled by mainstream economics bore no relation to our economy. It was based on rational expectations in which everyone bets right, at least within a random error, and maximizes anything and everything while living in a world without financial institutions. There are no bubbles, no speculation, no crashes, and no crises in these models. And everyone always pays all debts due on time.” (Wray, 2016)

Traditional normative economic theory had held that all liberal free markets were perfect and stable. L. Randall Wray wrote: “Back in 1929, the most famous American economist, Irving Fisher, announced that the stock market had achieved a ‘permanent plateau’, having banished the possibility of a market crash. In the late 1960s, Keynesian economists, such as Paul Samuelson, announced that policy makers had learned how to ‘fine-tune’ the economy so that neither inflation nor recession would ever again rear their ugly heads. In the mid-1990s, Chairman Greenspan argued that the ‘new economy’ reflected that the era of ‘the Great Moderation’ had arrived so that recessions would be mild and financial fluctuations attenuated. In every case, there was ample evidence to support the belief that the economy and financial markets were more stable, that the ‘good times’ would continue indefinitely, and that economists had finally gotten it right. In every case, the prognostications were completely wrong... In every case, Minsky was vindicated. (For financial markets), Minsky had asserted that” (Apparent) stability is destabilizing. “What appears initially to be contradictory or perhaps ironic was actually tremendously insightful.” (Wray, 2016)

After 2008, many mainstream economists began reviewing Minsky’s earlier work. L. Randall Wray wrote: “When the crisis hit, prominent economists discovered Minsky. The most famous U.S. Keynesian, Paul Krugman, even devoted a number of his New York Times columns to Minsky’s work... Krugman went on to give three lectures at the London School of Economics (LSE), the third of which he titled ‘The Night They Reread Minsky.’ During his talk, he claimed: ‘I was into Minsky before Minsky was cool,’ and he gave Minsky credit for recognizing the growing fragility of the economy long before it finally collapsed into the Great Financial Crisis... Similarly, speaking at the annual ‘Minsky Conference’ on April 12, 2009, Janet Yellen (who would later replace Chairman Bernanke as the head of the Fed) commented: It’s a great pleasure to speak to this distinguished group at a conference named for Hyman P. Minsky... My talk today is titled ‘A Minsky Meltdown: Lessons for Central Bankers.’ I won’t dwell on the irony of that. Suffice it to say that, with the financial world in turmoil, Minsky’s work has become required reading. It is getting the recognition it richly deserves.” (Wray, 2016)

However, Traditional economists’ recognition of the importance of Minsky’s theories may not yet have publicized a deeper understanding of the reasons for the inherent instability of financial markets. L. Randall Wray wrote: “Krugman explained that Minsky’s problem is that he rejected the mainstream’s orthodox, neoclassical economics in favor of a heterodox approach... It is true that economists failed to predict the 2008 crisis... But this wasn’t because economics lacked the tools to understand such things—we’ve long had a pretty good understanding of the logic of banking crises. What happened instead was a failure of real-world observation—failure to notice the rising importance of shadow banking.” (Wray, 2016)

## **2. Background: Great Financial Crisis of 2008**

We review briefly the 2008 Great Financial Crisis, which made more economists

aware of Minsky's theories. The author published this case study earlier in *Modern Economy*. (Betz, 2015: pp. 1189-1208). We republish it here to show how Minsky's further admonition for improved analytic techniques in macro-economic theory can be implemented by systems graphics modeling (rather than by algebraic modeling).

In the crisis, there were a series of failures of financial firms, but the U.S. Fed tripping point (Minsky moment) came in the collapse of a money-market fund (shadow bank). Neil Irwin wrote: "On September 16, 2008, when the New York Fed's market-monitoring staffers made their daily calls to sources on the trading desks of Wall Street and beyond (and more senior Fed officials sounded out old contacts of their own), they were told of a situation that seemed on the verge of spinning out of control. Money funds would break the buck, putting \$ 3.8 trillion of Americans' savings at risk. And all that money being pulled out of mutual funds meant less cash available for banks, as well as companies that fund their operations with commercial paper. If the money market funds went, so would the solvency of banks (that had weathered the collapse of Lehman and the near collapse of AIG) along with the ability of much of corporate America to make its payroll. Later in 2009, Bernanke told Time magazine: 'We came very, very close to a depression. The markets were in anaphylactic shock.'" (Irwin, 2013)

Minsky emphasized the need to depict the institutional reality of financial systems can be seen in the temporal sequence of market and banking failures—in a bubble beginning in 2005 and ending in 2008. The shock of the failing institutions on the Wall Street financial market in the United states did not occur in one day but happened over several years:

2005. Collapse of the U.S. housing bubble.

2006. Collapse of the Mortgage-Based Derivatives Market.

June 2007. Collapse of Derivative Hedge Funds in Bear Stearns.

March 2008. Collapse of Bear Sterns Investment Bank (and sale to Morgan Chase Bank).

7 September 2008. Collapse of Fannie Mae and Freddy Mac (and into government conservatorship).

15 September 2008. Bankruptcy of Lehman Brothers Investment Bank.

15 September 2008. Collapse of AIG insurance firm (and rescue by U.S. Government).

15 September 2008. Reserved Primary Fund "breaks the buck".

18 September 2008. U.S. Government Guarantee of Money-Market Funds.

19 September 2008. U.S. Treasury Department announces TARP program (and conversion of Goldman Sachs and Morgan Stanley into holding banks).

A "Minsky Moment" was finally realized by the U.S. Federal Reserve System (U.S. central bank) in 2008. Joe Nocera wrote: "On Monday, Sept. 15, 2008, when the news broke that... there would be no last-minute reprieve for Lehman, à la Bear Stearns, all hell broke loose. The stock market tanked, dropping more than 500 points that day. The Reserve Primary Fund, a money market fund that held

Lehman bonds, ‘broke the buck’. Shortly afterward, the American International Group nearly collapsed, and had to be bailed out with an extraordinary \$85 billion loan from the government. Morgan Stanley was rumored to be next. Banks all over Europe were teetering. There were even fears about the stability of mighty Goldman Sachs. On Wall Street—indeed, in financial capitals all over the Western world—the panic was palpable.” (Nocera, 2009)

And finally, in the sequence of failing financial institutions, it was the “breaking of the buck” by the money market fund, Reserve Primary Fund, which poised the whole U.S. economy upon the brink of depression. Then, the Minsky ‘economic contagion’ from the chaos in the financial system into shutting down the production system occurred on September 15—with a bank run on the Reserve Primary Fund (and not the earlier runs on Bear Sterns, Merrill Lynch, or Lehman Brothers).

*Thus, in 2007-08, it was not an economic crisis in the U.S. production system (i.e., manufacturing) but one in the U.S. financial system (i.e., banking). This is what is particularly enlightening about this case study of a Minsky financial bubble—this direct “economic connection” of the “money-market funds” to financing the “daily demand of production capital” by U.S. companies.*

Let us review the details of how this “contagion” occurred. Neil Irwin wrote: “On September 16, as Bernanke and Geithner were focused on what to do about AIG (a giant insurance company which had to insure financial transactions of mortgage securitizations (the financial bubble). But then, another institution of the shadow banking system suddenly exploded. This was a shadow bank of a money market group, Reserve Management.” Neil Irwin wrote: “Founded in 1971, the Reserve Primary Fund, like all money market mutual funds, performed many of the functions of a bank, both for savers and for borrowers, but without all the costly regulation and overhead of a bank. What does a bank do? It takes money from people who wish to save and lends it out to others who wish to invest. A money market mutual fund does the same thing. Savers deposit money, and managers of the fund invest that money in safe, short-term investments, such as: for example, commercial paper issued by General Electric to manage its cash flow or Treasury bills issued by the U.S. government or the repurchase agreements that investment banks use to fund themselves.” (Irwin, 2013)

Money market funds had been allowed to proliferate in the U.S. financial system, providing banking functions, but without being regulated as banks. Ignoring Minsky’s caution about this shadow-banking and financial instability, U.S. Treasury and Federal Reserve officials had often pushed to deregulate financial markets. Neil Irwin wrote: “In the late 1990s, the economic theory of ‘perfect markets’ had been used by Summers, Rubin, and Greenspan to justify deregulation over all financial markets—so that even quasi-banks did not require regulation. The policy of deregulation had allowed quasi-banks (shadow banks) to grow and grow to \$3.8 trillion dollars.” (Irwin, 2013)

The Reserve Primary Fund was the first of the money market funds to suffer a

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classic “run”. Neil Irwin wrote: “The Reserve Primary Fund accounted for only \$62 billion of that total of \$3.8 trillion. And of its \$62 billion in assets, only a bit more than 1 percent—\$785 million—was invested in securities from Lehman Brothers. Yet when Lehman went under, the entire fund came close to collapse. From its earlier public disclosures, investors were well aware that the Reserve Primary Fund had significant investments in Lehman. The evening of Sunday, September 14, as the investment bank appeared headed for bankruptcy, Reserve Fund managers fretted that they could see people withdrawing money from the fund as a result—up to \$1.5 billion... At 8:37 A.M. on Monday, they had already received \$5 billion in redemption requests.” (Irwin, 2013)

After the announcement of Lehman Brothers bankruptcy, U.S. Treasury and Federal Reserve became aware of the financial perils of the Reserve Primary Fund. James Stewart wrote: “Bruce R. Bent, Sr., the chairman of the Reserve Management Company, which ran the country’s oldest money-market fund, had just arrived in Rome, where he was planning to celebrate his fiftieth wedding anniversary, when his son, Bruce Bent II, the firm’s vice-chairman, called him from New York... The subject they discussed was the Lehman bankruptcy. The Bent’s money-market fund owned hundreds of millions of dollars of Lehman debt securities... It was now publicly known that the Primary Fund was exposed to Lehman’s failure. Time Warner, which had \$820 million in the fund, requested redemptions that morning. The Bents contacted the New York Fed at 7:50 A.M., according to S.E.C. documents, to express concern about Lehman’s effect on the money-market industry and on the Primary Fund.” (Stewart, 2009)

On Wednesday, 17 September 2008, the financial crises continued and even increased around the world. James Stewart wrote: “Asian and European stock markets had dropped sharply, and trading was halted in Russia. News that the Primary Fund had broken the buck had called into question the safety and viability of the global money-market industry... Already, money-market redemption requests were surging. On Tuesday alone, they had been \$33.8 billion, compared with a total of \$4.9 billion for the entire previous week. Large money-market funds, including Fidelity, Vanguard, and Dreyfus, rushed to issue statements reassuring investors that their holdings were safe and would retain their one-dollar-per-share value. But that didn’t seem to stem the tide. Even more worrisome, funds that had no exposure to troubled securities were confronting huge redemptions. Putnam announced that it would close and liquidate the \$12.3-billion Institutional Prime Money Market Fund, even though the fund owned no Lehman or A.I.G. securities and maintained its one-dollar share value.” (Stewart, 2009)

The financial contagion from the money-market funds went next to manufacturing firms, such as General Electric (GE). James Stewart wrote: “In the face of mounting redemptions, money-market funds raced to sell whatever they could find buyers for, but there were no buyers for all but the safest, shortest-term securities. Early that morning, (U.S. Secretary of Treasury) Paulson had a disturbing phone conversation with Jeffrey Immelt, the chief executive of General Electric.

Immelt reported that the capital markets were ‘very bad,’ and Paulson said he understood that the commercial-paper markets were under stress. ‘That’s bad for GE,’ Immelt replied. Like most large corporations, GE uses the commercial-paper market to fund its day-to-day operations, including those of GE Capital, its huge finance arm. GE was worried about its ability to roll over its short-term debt, and the previous day had paid 3.5 per cent, much higher than normal, for an overnight loan. (The lower-rated Ford Motor Credit reportedly had to pay 7.5 per cent.) For companies like GE, the uncertainty was as debilitating as the high rates.” (Stewart, 2009)

This is how, on Wednesday September 17, financial contagion had run from the financial sector into the production sector. James Stewart quoted a government official: “A Treasury official described the situation: ‘Lehman Brothers begat the Reserve collapse, which begat the money-market run, so the money-market funds wouldn’t buy commercial paper. The commercial-paper market was on the brink of destruction. At this point, the banking system stops functioning. You’re pulling four trillion out of the private sector’—money-market funds—and giving it to the government in the form of T-bills. That was commercial paper funding GE, Citigroup, FedEx, all the commercial-paper issuers. This was systemic risk. Suddenly, you have a global bank holiday.’ ” (Stewart, 2009)

This kind of financial contagion from banks to producers spreads both as a kind of ‘leverage burning’ and as a kind of ‘credit freezing’. Bankruptcy contagion from banks had ‘burned’ from one financial institution (Lehman Brothers) to another (Reserve Primary Fund). Then, this ‘burning’ actually ‘froze’ commercial credit for the production sector. Neil Irwin wrote: “When people demanded their money back, it meant that the Reserve fund’s managers needed to sell other assets to get the necessary cash. And the week of September 14, 2008, was one of the worst weeks in the history of finance to try to sell commercial paper and other short-term investments. The Reserve Primary Fund may not have been a bank, but it was experiencing a run on the bank nonetheless. It announced Tuesday evening that it would have to ‘break the buck’, meaning that shares in the fund normally worth \$ 1 would in fact be worth only 97 cents.” (Irwin, 2013)

“Breaking the buck” was the quaint term the mutual funds used to indicate how nominal shares purchased in their fund by savings depositors were always priced at “one buck per share”. Neil Irwin wrote: “In response, investors started pulling their money out of other money market funds, making \$169 billion in withdrawals the very next day. A vicious cycle was setting in. As investors yanked their money from the funds, the funds were forced to dump commercial paper into the market to free up cash, causing their value to fall further, creating more losses. At the same time, the withdrawals threw into doubt the funding that many U.S. corporations use to pay for everyday operations.” (Irwin, 2013)

In traditional economic theory, only commercial banks were central to the financial system, and the Federal Reserve banking staff had not paid much attention to the mutual funds. But in that week of September 14, Federal Reserve staff

started to pay attention. This was the “Minsky Moment” to the Federal Reserve Chairman Ben Bernanke, who was frightened of the U.S. economy tipping into a depression. Neil Irwin wrote: “The idea that money itself may be unsafe triggers an almost primal fear in even the most levelheaded of investors. The problem in the Panic of 2008 wasn’t that some investments lost value. It’s that many of the investments that lost value—money market mutual funds being a prime example—had been viewed as absolutely safe. The basic reality of modern monetary systems had been laid bare. Money is simply an idea, a concept—a giant confidence game, even. People wanted out. That was the feeling in the air that week in September 2008.” (Irwin, 2013)

The U.S. financial system was in a panic of bank runs, and Ben Bernanke knew that earlier in the 1930s, there had been three years of bank runs (1930, 1931, and 1932) which plunged the U.S. economy into the “Great Depression”. Bernanke resolved not to allow a second Great Depression. He would extend the “Bagehot principle” of the U.S. Federal Reserve (central bank) to act as a lender-of-last-resort not only to commercial banks—but to all financial institutions. Neil Irwin wrote: “Could Walter Bagehot’s time-honored approach to stopping a panic—lending freely to illiquid, not insolvent, firms at a penalty interest rate—be made to work when the panic was happening almost everywhere on earth at the same time, and in markets where traditional rules didn’t apply? The Fed’s strategy for dealing with the panic was emblematic of its overall approach to the crisis. Bernanke, the Great Depression scholar, had particular admiration for Franklin Delano Roosevelt’s strategy during the 1930s. Not every program his administration undertook did much good, but there was a spirit of experimentation, of throwing everything the government had against the wall to see what would stick. As the money market funds trembled, Bernanke directed his troops to adopt the same approach: ‘Try everything.’” (Irwin, 2013)

The U.S. Federal Reserve instituted a facility to bail out the mutual funds. Neil Irwin wrote: “First, just three days after the Reserve Fund broke the buck, came the Asset Backed Commercial Paper Money Market Mutual Fund Liquidity Facility, or AMLF. With Fed staffers in New York and Washington already stretched thin with crisis fighting, the program was administered by the Federal Reserve Bank of Boston, which had particular expertise in money market funds... The Fed would lend money to banks, which could then buy the securities the money market funds were selling off and pledge them to the Fed, with the banks themselves taking no financial risk for their role as intermediary. The program lent out \$24 billion on its first day of operation, September 22, 2008, and \$217 billion before the panic wound down, routing money through banks like State Street and J.P. Morgan Chase to mutual funds run by household-name companies such as Janus and Oppenheimer.” (Irwin, 2013)

*The run on money market funds stopped. Commercial short-term loans from the financial sector continued to fund the daily operations of U.S. production sector. A depression was avoided, although a recession occurred. But there are big*

*differences in economic depth and length between a depression and a recession.*

This example shows one of the major problems with traditional economic theory, which has been its “post-facto” rather than “pre-emptive” mode—fixing economic recessions after they occur rather than preventing them. Binyamin Appelbaum wrote: “The Fed (Federal Reserve System) began 2007 still deeply immersed in complacent disregard for problems in the housing market. Fed officials knew that people were losing their homes. They knew that subprime lenders were blinking out of business with every passing week. But, they did not understand the implications for the broader economy. August 2007 was the month that the Fed began its long transformation from somnolence to activism.” (Appelbaum, 2013)

The big banks had gained such large capital assets and were at risk that their failure would bring down a whole economy. C. Giles wrote: “The Fed started the biggest bank “bail-out” in U.S. economic history. What was the soporific which had put the Fed to sleep? It had been the so-called “mainstream economic theory”—which had assumed all markets was perfectly self-regulating, even financial markets. This soporific was not only in U.S. regulatory policy but also in British. Sir Mervyn King (Governor of the Bank of England in 2007) later said: “With the benefit of hindsight, we (Bank of England) should have shouted from the rooftops that a system had been built in which banks were too important to fail, that banks had grown too quickly and borrowed too much, and that so-called ‘light-touch’ regulation hadn’t prevented any of this.” (Giles, 2012)

Thus, “mainstream economic theory” had paid no attention to Minsky’s identification of “financial-bubbles” as inherent in financial markets (and precursors to recessions). In 2009, Paul Krugman wrote: “It’s hard to believe now, but not long ago, economists were congratulating themselves over the success of their field. Those successes—or so they believed—were both theoretical and practical, leading to a golden era for the profession. Few economists saw our current crisis coming, but this predictive failure was the least of the field’s problems. More important was the profession’s blindness to the very possibility of catastrophic failures in a market economy. There was nothing in the prevailing models suggesting the possibility of the kind of collapse that happened last year in 2008.” (Krugman, 2009)

And yet Minsky had published the possibility of “catastrophic failures” back in 1982 as *Can “It” Happen Again? Essays on Instability and Finance*. (Minsky, 1982: pp. 5-13) Why had none of the mainstream economic schools recognized Minsky’s cautions? Paul Krugman wrote: “Macroeconomists (remain) divided in their views. The main division was between those who insisted that free-market economies never go astray and those who believed that economies may stray now and then (but that any major deviations from the path of prosperity could and would be corrected by the all-powerful Fed). Neither side was prepared to cope with an economy that went off the rails despite the Fed’s best efforts. And in the wake of the crisis, the fault lines in the economics profession have yawned wider than ever.” (Krugman, 2009)

As Minsky pointed out, the issue of stability/instability of modern economies

cannot be empirically explained without understanding the structured-feature of the modern banking system. But in the traditional macro-economic growth models (such as those by Keynes and Hayek), shadow-bank institutions (such as hedge funds and money-market funds) were not included. Yet much earlier, Minsky had written about the importance and risks of shadow banking. (Minsky, 1982: pp. 5-13) In 2008, shadow-bank institutions played major roles in collapsing the U.S. economy.

### 3. Case Study Continued: Hyman Minsky and Instability of Financial Markets

Next, we review how Minsky had predicted inherent instability in financial markets. We begin with Minsky's history. L. Randall Wray wrote: "Hyman Minsky (1919-1996) studied mathematics as an undergraduate at the University of Chicago, graduating in 1941 with a major in math and a minor in economics. He was offered a fellowship to remain and study for a graduate degree in economics. However, he left for Harvard after only one semester to join a research group in postwar planning, working with Professor Wassily Leontief. He had planned to return to Chicago to resume studies, but Harvard offered a more generous fellowship to stay. That was short-lived, as he was drafted by the U.S. Army after only one semester. He was discharged in Berlin in 1946 but accepted a six-month civilian assignment in the Manpower Division of the Office of Military Government. He later said that his appreciation for the importance of specific institutions and historical circumstances grew out of that assignment. Minsky received graduate fellowship offers from both Chicago and Harvard, but he chose Harvard because several of the professors he preferred to work with at Chicago would be absent." (Wray, 2016)

Wassily Leontief is well known in economics for modeling the sources of production in an economic system as a series of industries. Thus, earlier on, Minsky learned to view production in an economic system—institutionally as industrial sectors. While completing his PhD. Minsky began his academic career at Brown University. L. Randall Wray wrote: "In 1949, he took his first permanent academic position at Brown University; and, like many Ph.D. candidates, he had to finish his dissertation while teaching. Minsky finished in 1954. He temporarily left Brown for a visiting position at the University of California at Berkeley, which led to a permanent position in 1957. He had a leave to work at the National Bureau of Economic Research in 1960 but remained at Berkeley until 1965. When he retired from teaching at Berkeley in 1990, he moved to the Levy Economics Institute at Bard College as a distinguished scholar, where he remained until his death in 1996. At the Levy Institute, he established two of the institute's ongoing research programs: Monetary Policy and Financial Structure, and the State of the U.S. and World Economies. He was also a driving force behind the institute's efforts to influence policy formation." (Wray, 2016).

Minsky's views on market stability required the distinction between production and financial markets. Hyman Minsky wrote: "Fundamental flaw exists in an economy with capitalist financial institutions. No matter how ingenious and

perceptive Central Bankers may be, the speculative and innovative elements of capitalism will eventually lead to financial usages and relations that are conducive to instability.” (Minsky, 1986)

Minsky thought that traditional economic theory (about liberal markets as being perfect) was a flawed theory and that Keynes had pointed this out. Minsky wrote: “When designing and advocating policies, economists and practical men alike have to choose between the Smithian theory, that markets always lead to the promotion of the public welfare, and the Keynesian theory, that market processes may lead to the capital development of the economy being ill-done, *i.e.*, to other than the promotion of the public welfare.” (Minsky, 1982: pp. 5-13)

Hyman Minsky’s view of this “inherent instability of financial markets” did make the concept of “capitalism as a public good” a problematic idea. Minsky wrote: “One can read almost all of the textbooks, and most of the current journal literature without being made aware that the overriding issue in monetary economics is whether capitalism is flawed in that it is inherently subject to booms and busts. However, this was clearly the concern of Keynes and the Chicago school of the 1930s.” (Minsky, 1982: pp. 5-13)

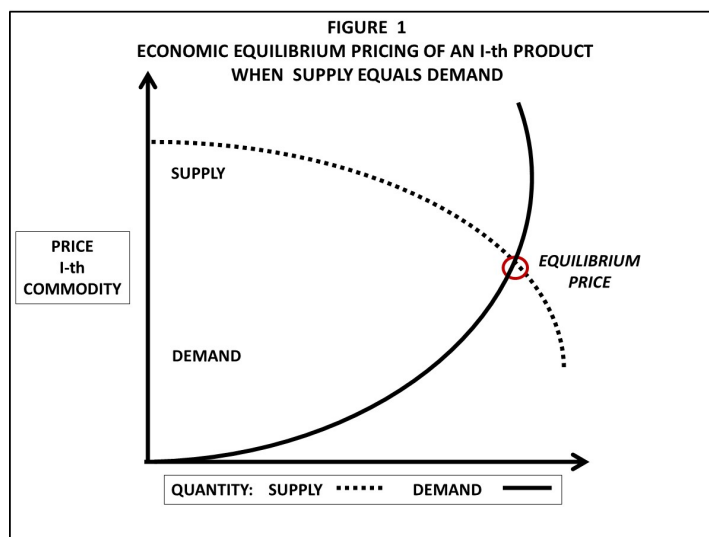
Keynes had identified two flaws in traditional market theory, and Minsky had added a third. L Randall Wray wrote: “Keynes’s *General Theory* (1936) identified two fundamental flaws of the capitalist system: chronic unemployment and excessive inequality. The two are linked. Excessive inequality puts too much of the income into the hands of the rich, who prefer high rates of saving rather than spending. That depresses demand and keeps jobs scarce. Minsky added a third flaw. ‘Instability’ is a normal feature of modern capitalism, which is a financial system. Furthermore, persistent stability cannot be achieved—even with apt policy—because it changes behavior in ways that makes a ‘depression and debt deflation’ likely.’ ” (Wray, 2016)

Interpreters of Keynes, afterward, still did not all see financial markets as inherently unstable, as Minsky did. L Randall Wray wrote: “Although it is true that other interpreters of Keynes emphasize that economies can experience downturns—even severe ones—almost all of them see these as deviations from equilibrium brought on by a wide variety of ‘shocks’ to the system. Or, to put it another way, they presume that the capitalist system is naturally stable. When it moves away from equilibrium, the government can use monetary and fiscal policy to push it back. Minsky argued that the situation is precisely the reverse: the system is fundamentally unstable, but instability can be constrained by apt use of fiscal and monetary policy.” (Wray, 2016)

#### 4. Modeling Minsky’s Theory of Financial Bubbles

Minsky viewed financial markets as unstable, because a realistic description of a financial market would require adding a time dimension into the two-dimensional model of a free market (having the two dimensions of price and quantity). Now we will show you how to do this.

**Figure 1** shows the traditional two-dimensional free-market model, with dimensions of price and quantity. It has no time dimension.



**Figure 1.** Supply-demand price equilibrium model of a liberal free-market.

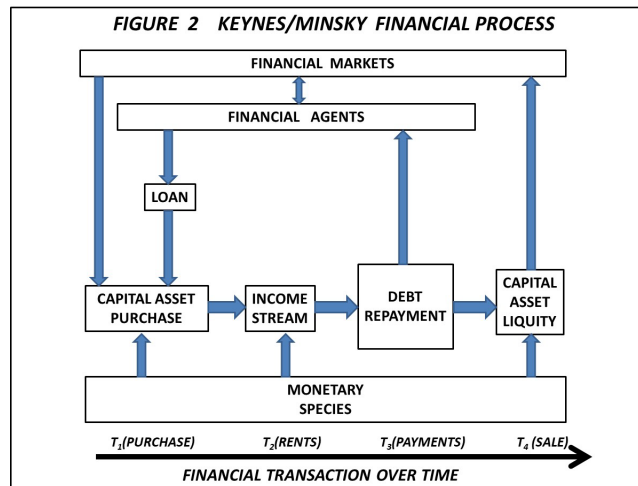
When the price of a commodity is charted as the quantity of the supply of the product (dotted line), then the price will decrease in an economy as the supply increases. Because of business competition, more goods flooding a market will force prices down. Also, if the demand for a product (solid line) increases, then the price will increase (as more consumers buy a limited amount of product). The optimal pricing of a product (commodity) in an economy will occur when supply equals demand. This is the equilibrium price, as supply and demand meet in quantity. If a market behaves like this, it is perfect. No control over pricing is necessary, as a “supply-demand equilibrium” in the market sets the optimal price for the public good.

And in policy a decade before the financial crisis of 2008, this 2-dimensional “perfect market” argument was actually used by Alan Greenspan in arguing for the deregulation of banking in the US and for repealing the Glass-Steagale Act (which earlier, since the 1930s separated U.S. investment and commercial banking back in the 1930s). This repeal allowed the creation of very large integrated banks. Martin Wolf wrote, “These integrated banks had proved too-big-to-fail and had needed the huge bailing out by the Federal Government in 2008.” (Wolf, 2008) Also in 2008, Bernanke pointed out that the school of classical economists had assumed that the “instability” of financial markets had little or no effect on an economy. (Bernanke, 2009)

However, earlier, Hyman Minsky argued that a time dimension on financial asset trades was needed. Minsky wrote: “The dominant microeconomic paradigm is an equilibrium construct that determines relative prices. (The assumption is that) money and financial interrelations are not relevant to the determination of these equilibrium variables. But if the basic microeconomic model is opened to include ‘yesterdays, todays, and to-morrows’, then finance can influence price equilibrium.” (Minsky, 1982: pp. 5-13).

Drawing upon John Maynard Keynes’ earlier work, Minsky wrote: “In the

*General Theory*, Keynes sought to create a model of the economy in which money is never neutral (to pricing). He did this by creating a model in which the price level of financial assets is determined in (financial) markets. Each capital and financial asset yields an in-come stream, (which) has carrying costs and possessing some degree of liquidity. The price level of assets is determined by the relative value (of) income and liquidity.” (Minsky, 1982: pp. 5-13) In 2014, the author graphed Minsky’s idea of a ‘time-dimension’ in transactions of financial assets, which is shown in **Figure 2**. (Betz, 2014: pp. 60-67)



**Figure 2.** Model of financial transaction over time.

*In this model of a Keynes/Minsky financial asset transaction, the “time-dependence” is that any “capital asset” has both a “present-income” and a “future-liquidity”.*

A capital-asset is an investment that creates income and can later be sold. It produces an income stream (present-income) and can also be sold in the future (future-liquidity).

*The time dimension is from (T1) of a present-income to (T2) of future-liquidity. This present- to-future (T1 to T2) temporal process occurs in a financial system as a transaction of “credit-debt”*

A financial asset market is essential to a capitalist economic system. Minsky wrote: “Every capitalist economy is characterized by a system of borrowing and lending. The fundamental borrowing and lending act is an exchange of ‘money-now’ for ‘money-in-the-future’. This exchange takes place in a negotiation in which the borrower demonstrates to the satisfaction of the lender—that the money of the future part of the contract will be forth-coming. The money in the future is to cover both the interest and the repayment of the principle of the contract.” (Minsky, 1982: pp. 5-13)

A financial market makes credit-debt contracts sellable over time as future liquidity. Thus, in a financial sub-system, three things are essential: 1) credit-debt

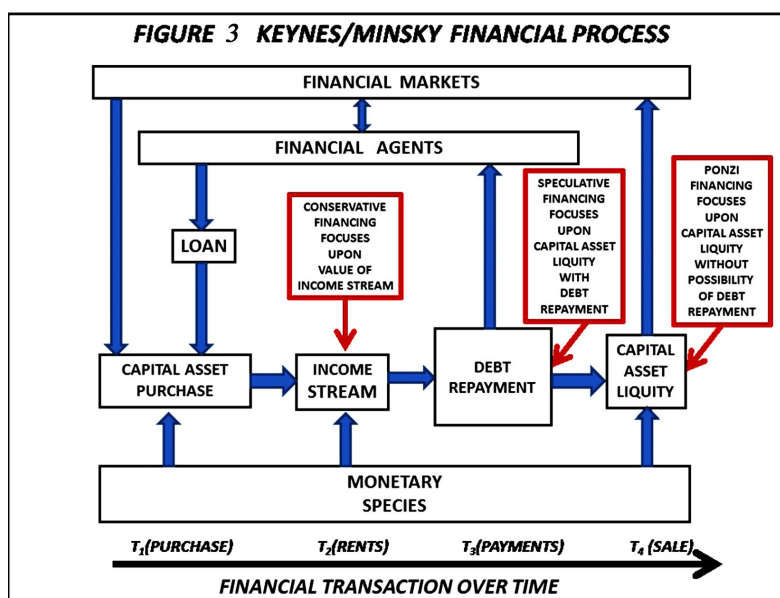
transactions as a fundamental financial process; and 2) a capital-asset market for liquidity of the asset; and 3) money as a medium of value-exchange. A financial capital-asset transaction occurs over time, beginning with a loan for an asset purchase, followed by rents (income stream) from the productivity of the capital asset, which are used for payments of the loan until the sale of the asset. Financial agents provide a purchase loan to the purchaser of the asset, in turn receiving loan payments on the debt over time from T1 through T3 from the purchaser. Financial markets price the capital asset for purchase at time T1 and later for sale at time T4. Debt makes a financial process operate, and debt for asset purchases is called “leverage”.

Minsky identified three levels of “leverage” in the financing. When the leverage in the loan is low enough to allow the “rent” from the income stream to fully service the loan (pay the interest plus principal increments), then Minsky called this “hedge” (conservative) financing.

When speculative traders purchase capital assets with leverage high enough to only allow servicing of interest but not principal payments, Minsky called this state for market financing as “speculative finance”. Then, on the sale of a capital asset by the trader, the trader must pay back the principal of the loan from receipts of the sale. As long as a financial market rises, speculative trading can be profitable.

However, when prices in a financial market rise speedily and traders purchase capital assets with very high leverage, rents from the assets cannot serve either the interest or the principal payments in the loan. Then, the trader must “flip” (immediately resell) the asset. This is the stage of a financial bubble, and Minsky called this “Ponzi financing”. At this stage, when the financial bubble bursts, all Ponzi-financed assets collapse.

**Figure 3** shows these three levels of leverage in the purchase of assets in a financial market.



**Figure 3.** Three levels of leverage in the purchase of assets in a financial market.

Leverage’ is one aspect of debt that can destabilize the financial process. To increase profit, a financial system uses debt to finance the purchase of capital assets. Profits can be increased through financial leverage, and this is the financial rationale of “leverage” (more “present-debt” toward greater “future-wealth”). However, when present debt is too large (too highly leveraged), it might not create future—wealth but, instead, bankruptcy! Excessive “leverage” increases the likelihood of bankruptcy and not future—wealth.

This was earlier pointed out by Irving Fisher, who called a financial state of excessive leverage as “debt deflation”. (Fisher, 1933: pp. 337-357) Later, Hyman Minsky called a state of excessive financial leverage a “Ponzi finance”. (Minsky, 1982: pp. 5-13) Even later, Paul McCulley emphasized the importance of the economic role of “leverage”. McCulley wrote: “At its core, capitalism is all about risk taking. One form of risk taking is leverage. Indeed, without leverage, capitalism could not prosper. And it is grand, while the ever-larger application of leverage puts upward pressure on asset prices. There is nothing like a bull market to make geniuses out of levered dunces. (Speculation) begets ever riskier debt arrangements, until they have produced a bubble in asset prices. Then the bubble bursts.” (McCulley, 2009)

*The inherent instability of a financial market occurs because speculation can, in the short-term, increase profitability from transactions. A financial bubble is a longer-term temporal change in a market due to excessive speculation in market trades.*

Next, we can show how adding a time dimension to the traditional liberal free market model can depict financial bubbles. In 2014, the author did this—by changing the traditional 2-dimensional model of a free-market into a 3-dimensional time-dependent model of a financial market. (Betz, 2014: pp. 60-67)

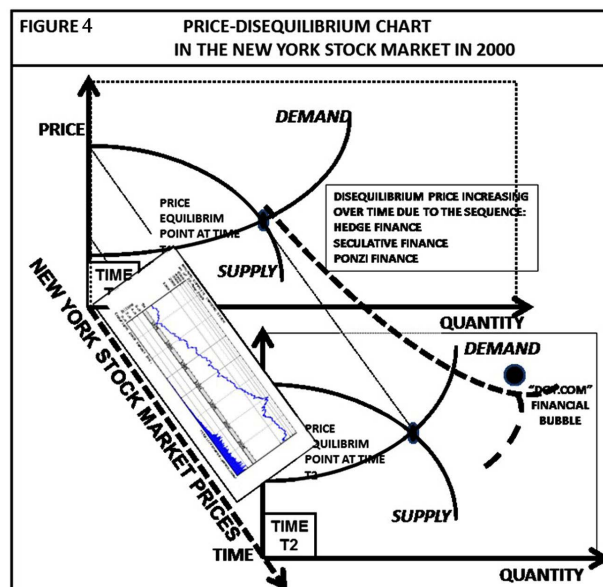


Figure 4. Financial bubble due to excessive leverage in asset values.

**Figure 4** depicts how the Minsky stages of financing in a financial bubble can occur over time—by adding a third dimension of time to the two-dimensions (price and quantity) in a market supply-demand curve for price equilibrium. Over time, from a period at T1 to a later time at T2, prices in a financial market price can move up into the price-disequilibrium of a financial bubble. And in the figure, one can see that a stock market chart (covering the time of a financial bubble) appears in the plane of the price-time dimensions, as a stock market chart depicts the *prices* in a financial market over *time*.

Minsky pointed out that “excessive leverage” in a financial market is possible because loans from banks to enable asset purchases increase the money supply in an economy. L. Randall Wray wrote: “Minsky took a broad approach to money creation, arguing that “everyone can create money; the problem is to get it accepted. Money is really just an IOU denominated in the money of account, but there is a hierarchy of monies—some are more widely accepted than others—with the monetary IOUs issued by the treasury and the central bank sitting at the top of the money pyramid. Minsky saw banking as essentially the business of “accepting” IOUs, making payments on behalf of customers, and holding their liabilities. Banks make payments in their own IOUs, which are then cleared using the central bank’s reserves.” (Wray, 2016)

Because banks loan money to asset speculators (who provide the asset as collateral to the bank), the money supply in an economy expands. If and when that asset market collapses, then the asset collateral held by the bank becomes illiquid (toxic). And bank runs can occur, collapsing the economy (which is what happened in the collapse of the U.S. stock market in 1929-30). L. Randall Wray wrote: “Furthermore, because bankers live in the same expectational climate as businessmen, profit-seeking bankers will find ways of accommodating their customers; this behavior by bankers reinforces dis-equilibrating pressures. Symmetrically, the processes that decrease the prices of capital assets will also decrease the willingness of bankers to finance business. In other words, the ‘money supply’ expands and contracts as bankers accommodate the demands of their customers in a procyclical manner: when business is good, loans are easy to get; when prospects are bad, banks do not want to lend.” (Wray, 2016)

Thus, the “business cycle” in an economy can be of two sorts: (1) a production-delay cycle or (2) a financial cycle. Minsky emphasized the financial cycle. L. Randall Wray wrote: “The procyclical behavior of bank lending amplifies the business cycle, increasing the thrust toward instability. For Minsky, the modern business cycle is a financial cycle. Rising spending and asset purchases require finance. So long as banks are willing to meet the demand for finance, output and asset prices grow. This growth can increase the demand for credit as well as banks’ willingness to lend. As Citigroup’s CEO Chuck Prince famously explained: “As long as the music is playing, you’ve got to get up and dance.” If everyone else is lending, your bank has to lend. But when the music stops, you suddenly find that your bank is holding assets it does not want and cannot sell. Lending and spending and asset

prices collapse.” (Wray, 2016)

## 5. Harrod-Domar Supply-Side Macro-Economic Model

Hyman Minsky was also a proponent of analytical tools and models that depict the institutional reality of financial operations. Minsky wrote: “The lessons I learned from Paul Douglas are that any formal analytical tool—such as the Cobb-Douglas production function—explains but little of what happens in the world, and that to be useful, analytical tools have to be embedded in an understanding of the institutions, traditions and legalities of the market.” (Minsky, 1982: pp. 5-13)

Historically, before Minsky, John Maynard Keynes had reformulated traditional economic models. Hendrik Van den Berg wrote: “When Keynes published his *General Theory* in 1936, the neoclassical paradigm was well-established in the economics profession. Even though the Great Depression weighed heavily on economists’ minds, economists were somewhat hesitant to jump to a new paradigm that seemed to contradict conventional mainstream economic thought. Most mainstream economists were more accepting of Hicks’ interpretation of Keynes’ General Theory, which omitted Keynes’ more complex and radical ideas... (and afterwards) the growth models were derived from Keynesian macroeconomic foundations by Roy Harrod and Evsey Domar.” (Van den Berg, 2013: pp. 2-28)

Harrod and Domar are important followers of Keynes and expressed their macroeconomic models in algebraic equations. It is useful to treat their models as basically similar. Hendrik Van den Berg wrote: “Harrod and Domar independently developed what turned out to be identical growth models, which we now refer to as the Harrod-Domar model. That two economists would independently produce the identical model was not surprising; their models were logical extensions of the same Keynesian macroeconomic model. In analyzing how macroeconomic policy could restore full employment, Keynes had focused on aggregate demand, especially the potentially volatile component called investment. Harrod and Domar pointed out that investment changed the economy’s supply side as well as the demand side, and full employment could be maintained only if investment and the other sources of aggregate demand grew just fast enough to exactly absorb the increased output that the new investment made possible.” (Van den Berg, 2013: pp. 2-28)

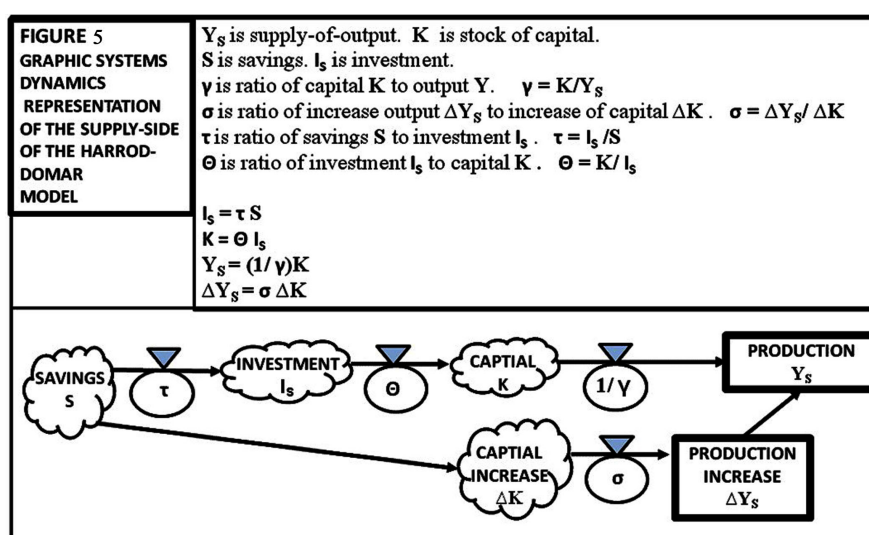
We now show how Minsky’s suggestion (of including institutional forms in financial analysis) can be accomplished by constructing models of operations in systems graphic form. Earlier, the author published this in *Modern Economy* (Betz, 2015: pp. 1189-1208). We review it here to show how economic models need to be expressed in different mathematical forms from algebraic equations—to achieve Minsky’s admonition for realistic macro-economic models.

The Harrod-Domar model consisted of two parts: a supply-side model of production and a demand-side model of demand. For the supply side, Harrod-Domar assumed that in a steady state of production, the quantity of production  $Y_S$  is

proportional to the capital  $\mathbf{K}$  invested in production capacity by the factor of  $(1/\gamma)$ . About these, the Harrod-Domar model posited three equations:

1. A “constant marginal product of capital” is that an economy exhibits a constant capital-output ratio  $K/Y_s = \gamma$ , so that the supply of output  $\mathbf{Y}_s$  is proportional to the stock of capital  $\mathbf{K}$ :  $\mathbf{Y}_s = (1/\gamma)\mathbf{K}$ .
2. An increase in capital  $\Delta\mathbf{K}$  creates a proportional ( $\sigma$ ) increase in production  $\Delta\mathbf{Y}_s$ .  $\Delta\mathbf{K} = \sigma\Delta\mathbf{Y}_s$ .
3. Harrod-Domar also assumed that all savings  $\mathbf{S}$  goes into productive investment  $\mathbf{I}_s$  and all productive investment goes into capital  $\mathbf{K}$ :  $\mathbf{S} = \mathbf{I}_s = \mathbf{K}$ .

We show these equations in **Figure 5**, and below them, we translate these equations into systems graphics notation.



**Figure 5.** Systems graphics representation of harrod-domar supply side macro-economic model.

In **Figure 5**, the Harrod-Domar algebraic model is re-depicted as a flow from savings  $\mathbf{S}$  to investment  $\mathbf{I}_s$  to capital  $\mathbf{K}$  into production  $\mathbf{Y}_s$ , with flows controlled by the proportionate factors of  $\tau$ ,  $\Theta$ ,  $\gamma$ , and  $\sigma$ .

In the steady-state of production  $\mathbf{Y}_s$ : some proportion  $\tau$  of savings  $\mathbf{S}$  flows into investment  $\mathbf{I}_s$ , from which some proportion  $\Theta$  flows into capital  $\mathbf{K}$ , from which some proportion  $(1 - \gamma)$  finances the production level  $\mathbf{Y}_s$ . Also, an increase of capital  $\Delta\mathbf{K}$  from savings  $\mathbf{S}$  creates a proportionate  $\sigma$  increase in production  $\Delta\mathbf{Y}_s$ .

*Components of a systems graph are nodes connected by lines, and the lines denote flows of things, controlled by valves. Thus, in graphic systems notation, flows are depicted by “arrows” in the direction of the flow; the source of a flow is depicted by a “cloud” symbol; and the stock of things resulting from a flow is depicted by a “rectangle” symbol; and the control of a flow by “triangle-over-oval” symbol.*

In this systems graphics notation, one can improve upon the algebraic form by

introducing controls in the flows from savings **S** to investment **I** to capital **K**. Savings, investment, and capital may not all be in equal ratio, and one can add more proportional factors to relate variable levels of transformation of savings to investment to productive capital:

$\tau$  is the ratio of savings **S** to investment **I<sub>s</sub>**.  $\tau = I_s/S$ .

$\Theta$  is the ratio of productive capital  $\Delta K$  to investment **I<sub>s</sub>**.  $\Theta = \Delta K / I_s$ .

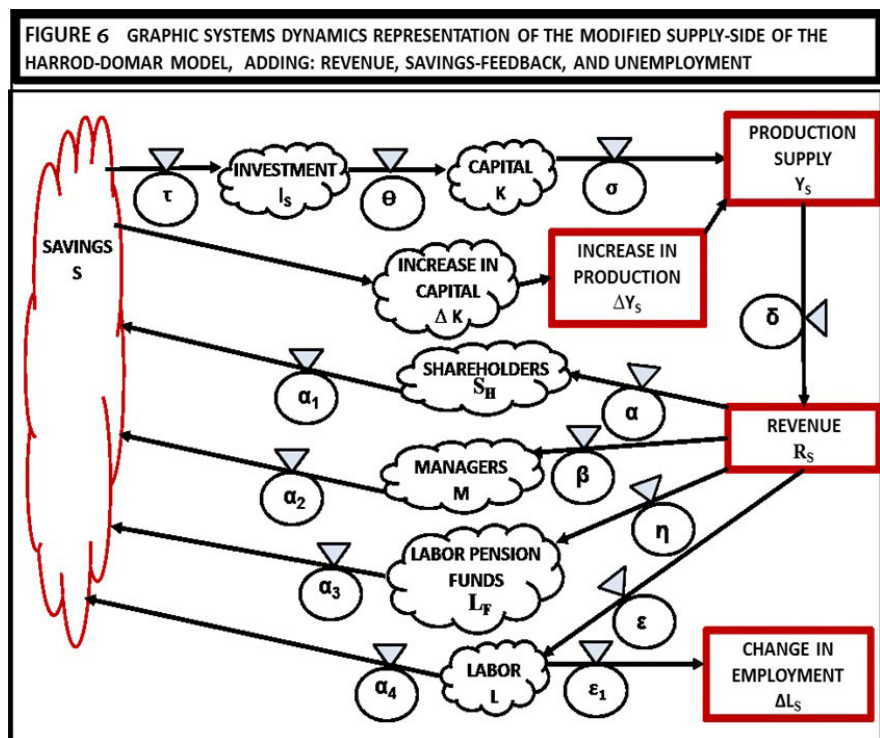
### 6. Expanded Systems Representation of the Harrod-Domar Model

In terms of system feedbacks, what is still left out of the Harrod-Domar model is the return-of-profits (revenue feedback) to savings from profits of the sales of production (produced things).

*The methodological advantage of translating the algebraic equations of the Harrod-Domar-Solow model in the graphic representation of systems dynamics is that one can add feedback loops in the system.*

In **Figure 6**, one can next expand the Harrod-Domar model into a more complete institutional feedback system, showing how revenue **R<sub>s</sub>** is created from production **Y<sub>s</sub>** and contributes to future investment. The main feedback loops in the expanded H-D supply model are:

- revenue **R<sub>s</sub>** created by production **Y<sub>s</sub>**
- additions to savings **S** from the revenue **R<sub>s</sub>**
- unemployment **L<sub>s</sub>**, which can result from cost-cutting  $\epsilon_1$  to Labor **L**



**Figure 6.** Harrod-domar investment macro-economic model with revenue returns.

These institutional additions to the Harrod-Domar model show that sales from production create revenue  $R_s$ , part of which can become future savings  $S$  and can contribute to future investment  $I_s$ . Revenue  $R_s$  from sales of produced commodities contributes back to savings  $S$ :

(1) *Principal savings from production revenue arise from the distribution of revenue to shareholders, managers, and labor pension funds.*

(2) *Reduction of revenue distributions to labor can occur from lay-offs which increase unemployment.*

Such feedback-loops bring the theoretical economic assumptions in the Harrod-Domar model closer to the empirical reality of economic operations, particularly showing how levels of production can affect levels of employment. (This was the connection about which John Maynard Keynes was concerned about in the Great Depression of the 1930s).

## 7. Demand-Side of Harrod-Domar Model

In the Harrod-Domar approach, both a supply-side and demand-side were modeled.  $Y_s$  expressed the quantity of the supply side of production, and  $Y_D$  expressed the quantity of the demand side of the production. Hendrik Van den Berg wrote: “To capture the potential inconsistencies between investment’s dual effects on aggregate demand and the economy’s productive capacity, Harrod and Domar specified separate demand and supply sides in their model ( $Y_D$  and  $Y_s$ )—because they wanted to make a fundamental point about the potential dynamic inconsistency between aggregate demand and aggregate supply. They hypothesized a very simple supply side model in which investment was the only contributor to economic growth... Harrod and Domar intended the simple supply-side equation to be used in combination with a demand side model in order to provide a valuable insight into the dynamic behavior of an economy.” (Van den Berg, 2013: pp. 2-28)

Harrod and Domar assumed the demand for investment  $I_D$  could differ from the supply of investment  $I_s$  because the behavior of investors could differ from the needs of an economic system. Hendrik Van den Berg wrote: “Like Keynes, Harrod and Domar focused on investment as a source of instability in the circular flow of aggregate output and income. In his *General Theory*, Keynes argued that investment was always a potential source of instability because the decision to invest could not be based on a precise comparison of estimated future returns and current opportunity costs of investment. In reality, no one has enough information about the future to perform such a deterministic exercise.” (Van den Berg, 2013: pp. 2-28)

The reason for the difference between the actual supply of investment  $I_s$  and demand for investment  $I_D$  was that an investment decision based on past experience might not be accurate for the future. Van den Berg wrote: “Fundamentally, future events cannot be accurately estimated from past events because the economy

is not ergodic, that is, the world is not a stable, unchanging system... Because investment is based on so little solid information, Keynes argued that investment was driven by ‘animal spirits’, by which he meant the complex combination of confidence, optimism, and unsubstantiated faith in the future of the economy.” (Van den Berg, 2013: pp. 2-28)

Investment behavior depends upon investor confidence (based on recent events). But optimism can decline when forecasts prove inaccurate. Harrod and Domar assumed that investment demand  $I_D$  would be based upon an extrapolation from recent economic performance. And investment demand  $I_D$  would be proportional  $b$  to production demand  $Y_D$ :  $I_D = b(\Delta Y_D)$ . Van den Berg wrote: “The parameter  $b$  relates new investment to the change of aggregate demand, which Harrod and Domar assumed aggregate demand consisted just of consumption and investment.” (Van den Berg, 2013: pp. 2-28)

The economy is in equilibrium when desired investment equals actual savings:

$$I_D = S \text{ or } b\Delta Y_D = \sigma Y_S.$$

Thus  $\Delta Y_D/Y_S = \sigma/b$  defines the balance in the dynamics of an H-D model of an economic system:  $\Delta Y_D/Y_S = \sigma/b$  and  $\Delta Y_S/Y_S = \sigma/\gamma$ .

This Harrod-Domar model assumes that an economy continues on a given growth path only as long as  $b = \gamma$ . And this was the part of the model which Robert M. Solow disliked. Solow wrote: “The characteristic and powerful conclusion of the Harrod-Domar line of thought is that, even for the long run, the economic system is at best balanced on a knife-edge of equilibrium growth. Were the magnitudes of the key parameters (the savings ratio, the capital-output ratio, the rate of increase of the labor force) to slip ever so slightly from dead center, the consequence would be either growing unemployment or prolonged inflation.” (Solow, 1956: pp. 65-94)

Then Solow constructed his model: “There is only one commodity, output as a whole, whose rate of production is designated  $Y(t)$ . Thus, we can speak unambiguously of the community’s real income. Part of each instant’s output is consumed, and the rest is saved and invested. The fraction of output saved is a constant  $s$ , so that the rate of saving is  $sY(t)$ . The community’s stock of capital  $K(t)$  takes the form of an accumulation of the composite commodity. Net investment is then just the rate of increase of this capital stock  $dK/dt$  or  $K$ , so we have the basic identity at every instant of time:  $dK/dt = sY$ . Output is produced with the help of two factors of production, capital and labor, whose rate of input is  $L(t)$ . Technological possibilities are represented by a production function:  $Y = F(K, L)$ . Thus  $dK/dt = s F(K, L)$ .” (Solow, 1956: pp. 65-94)

As shown in **Figure 7**, in a graphic systems representation, the next one needs to add Solow’s supply-production  $Y_S$  as a function of both capital  $K$  and labor  $L$ . Also, since labor  $L$  is a system input to production  $Y_S$ , one needs to add a source of labor  $L$  into the system’s representation.

What Solow’s model did was introduce the productive factor of labor into the production function.  $Y_S = F(K, L)$ .

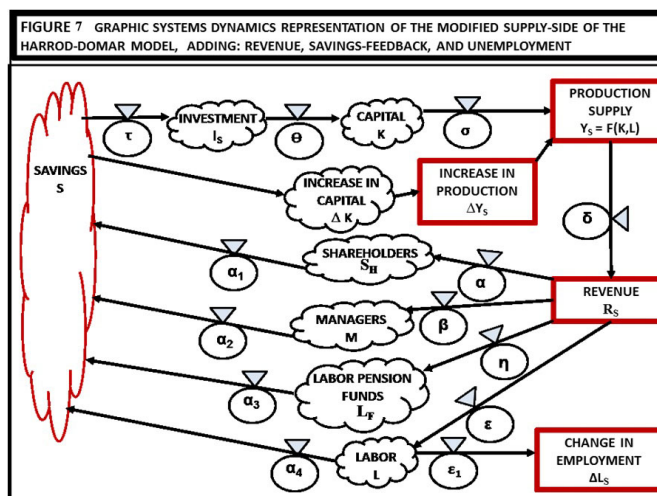


Figure 7. Systems graphics representation of Solow's macroeconomic model.

In this graphics model, we have integrated the two models of the H-D supply economic growth model with Solow's model. We have added the feedback loops into the models of how revenue  $R_s$  (creating profits) results from sales of production and then can flow back into future savings  $S$ . Profits from revenue can be distributed to shareholders  $S_H$  or to managers  $M$  or to labor pension funds  $L_F$  or to labor  $L$ .

*We see in the feedback loops that future savings can be increased by a return-of-capital as profit. And the systems model extends Solow's introduction of the contribution of labor into the production system. It also shows production's contribution to employment/unemployment, added thusly into the economic growth models.*

In the proportion of revenue  $R_s$  going to labor, it is a common business practice to increase or decrease employment. Not only can profits flow to labor, but reductions in labor costs can also result in changes in employment. Sometimes, a reduction of labor costs may occur to increase profits for managers/shareholders, but sometimes, the increase in labor costs may increase production (or even inflation).

Thus, the H-D-S feedback systems model can also depict a reduction or increase in labor costs—which creates labor unemployment/employment  $\Delta L_s$  in proportion  $\epsilon_1$  to the reduction/increases in labor expenses:  $L = \epsilon_1 \Delta L_s$ .

*If  $\epsilon_1$  is positive, there will be an increase in employment. But if  $\epsilon_1$  is negative, there will be a decrease in employment.*

Since the difference between  $I_s$  and  $I_D$  is difficult to measure (e.g., Keynes' "animal spirits"), we next turn to a different model of production demand  $Y_D$ , which is that of the Leontief model.

Earlier, the Leontief model of production-consumption had not been used in previous Harrod-Domar-Solow kinds of models because of lying between macro and micro models. Mauro Boianovsky and Kevin D. Hoover wrote: "Domar reacted positively to Solow's aggregative neoclassical growth model. Domar later noted that before the Solow 1956 paper, he had treated capital as the only explicit

production factor because he thought including labor as well would require a complex, highly disaggregated production function along the lines of Leontief's dynamic input-output system.” (Boianovsky & Hoover, 2009: pp. 1-23) But now, with a systems graphic model, we can now add a Leontief model.

Thus, one of the advantages of a systems graphic representation of the H-D model is that one can include an aggregate version of the Leontief input-output system as the demand side. Wassily Leontief formulated an economic model of the national economy as an input-output balance of products produced and consumed. He described the production (**P**) from an economic sector (such as manufacturing or agriculture) as consisting of the sum of the I-th products **P<sub>I</sub>** produced in the region. (Leontief, 1986)

Then the Harrod-Domar demand output can be set as  $Y_D = \sum_I P_I$ .

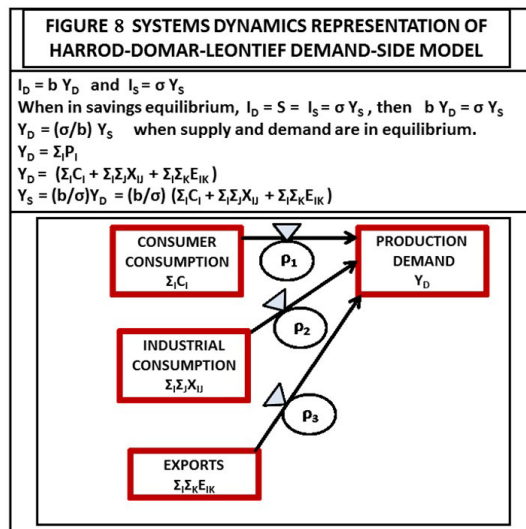
Leontief traced the distribution of the quantity of production **P<sub>I</sub>** into the quantity consumed by consumers **C<sub>I</sub>** or by the other J-th industrial sectors  $\sum_j X_{IJ}$  or exported to other K-th countries  $\sum_k E_{IK}$ . Leontief wrote this input-output economic model for commodity production as the vector equation:  $P_I = C_I + \sum_j X_{IJ} + \sum_k E_{IK}$ .

The quantity of production **P<sub>I</sub>** of the I-th product in an economic region is distributed to the regional consumer's **C<sub>I</sub>** of the I-th products and to the sum of the regional industrial purchasers  $\sum_j X_{IJ}$  of the I-th product and to exports  $\sum_k E_{IK}$  to all the K-th counties.

Now, we set the production demand **Y<sub>D</sub>** in the economy as equal to the sum of all the products **P<sub>I</sub>** produced for distribution in the economy:  $Y_D = \sum_I P_I$ .

The sum  $\sum P_I$  is equal to the production demand **Y<sub>D</sub>**, since this is the production actually sold to the consumer, industrial, and export markets:  $Y_D = \sum_I P_I = \sum_I C_I + \sum_I \sum_j X_{IJ} + \sum_I \sum_k E_{IK}$ .

As shown in **Figure 8**, we use this Leontief production equation to construct a demand side for a Harrod-Domar-Leontief model.



**Figure 8.** Systems graphic model of Leontief macroeconomic production demand.

When in savings equilibrium:

$$Y_D = (\sigma/b) Y_S$$

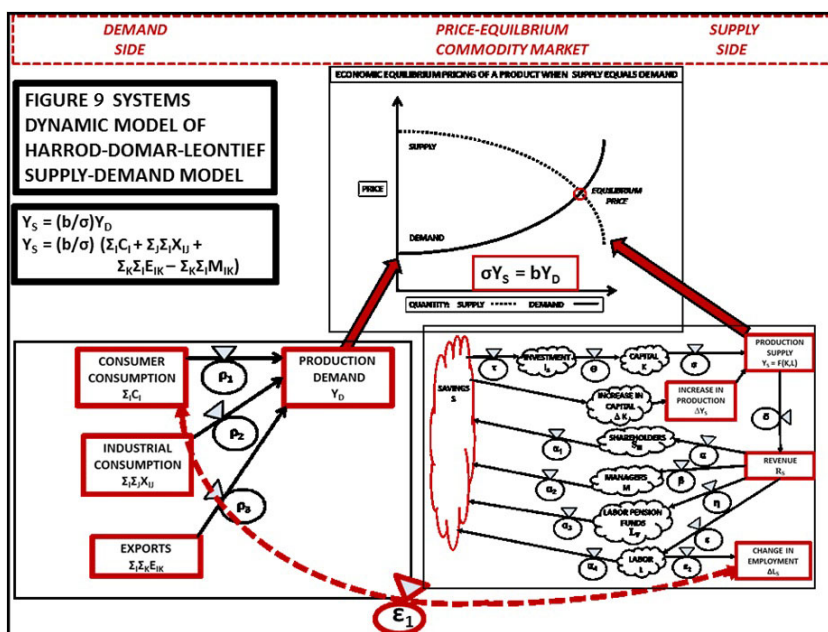
$$Y_D = \Sigma_I P_I$$

$$Y_D = (\Sigma_I C_I + \Sigma_I \Sigma_j X_{IJ} + \Sigma_I \Sigma_K E_{IK})$$

$$Y_S = (b/\sigma)(\Sigma_I C_I + \Sigma_I \Sigma_j X_{IJ} + \Sigma_I \Sigma_K E_{IK})$$

In the graphic systems representation, the Production Demand ( $Y_D = \Sigma_I P_I$ ) grows as the flow of the demand of consumer consumption ( $\Sigma_I C_I$ ) plus the flow of industrial demand ( $\Sigma_I \Sigma_j X_{IJ}$ ) plus the export demand ( $\Sigma_I \Sigma_K E_{IK}$ ). One can add control valves ( $\rho_1, \rho_2, \rho_3$ ) to each flow to indicate how production demand  $Y_D$  could vary as demand from each sector varied.

As shown in **Figure 9**, one can integrate the two systems models of production supply  $Y_S$  and demand  $Y_D$ . Their systems feedback connection occurs when, in the production supply, a reduction ( $\epsilon_1$ ) in employment costs creates labor layoffs—which feeds back to reduced consumer consumption  $\Sigma_I C_I$ —which in turn reduces demand in the commodity market of the economy.



**Figure 9.** Systems graphics Harrod-Domar-Leontief macroeconomic model of supply and demand.

*This system graphic expression of a Harrod-Domar-Solow-Leontief model shows how the supply and demand curves in the traditional free-market chart result from the model—which expresses Minsky’s view that an analysis of operations should be shown on how operations create a liberal free-market.*

*When the supply-side and demand-side of the model are presented together in systems graphics representation, one can see that the equilibrium condition is for balance between the supply and demand of production:  $\sigma Y_S = b Y_D$ . Then, the price equilibrium of the commodity market occurs in this balance.*

*This model also shows how production change can increase or decrease employment (a John Maynard Keynes concern). The feedback  $\epsilon_1$  between two production values is the employment level, which then impacts the Harrod-Domar equilibrium condition of  $(b/\sigma) = 1$ .*

*When  $(b/\sigma) < 1$ , then supply exceeds demand, and production will be cut, leading to a recession. Labor will be reduced, increasing unemployment  $\Delta L_S$ . This increase in the unemployment factor  $\Delta L_S$  (from revenue distribution  $R_S$  of the supply production  $Y_S$ ) provides a proportionate decrease  $\epsilon_1$  of consumer consumption. This pattern is the traditional business cycle, when excess production leads to a decrease in employment which, in turn, further reduces demand.*

*The model also indicates that in an economy (wherein consumer consumption is a significant proportion of production demand), a proportionate decrease in employment ( $\epsilon_1$ ) will result in a decrease in consumer consumption  $\Sigma_I C_I$ . This is the condition for a recession in an economy, when  $Y_S > Y_D$ .*

*The systems graphic representation of the model thus enables one to explicitly include in the macro-economic equation not only “production” but also its connection to “employment”.*

## 8. Case Analysis: Minsky Analysis of the 2008 Financial Crisis

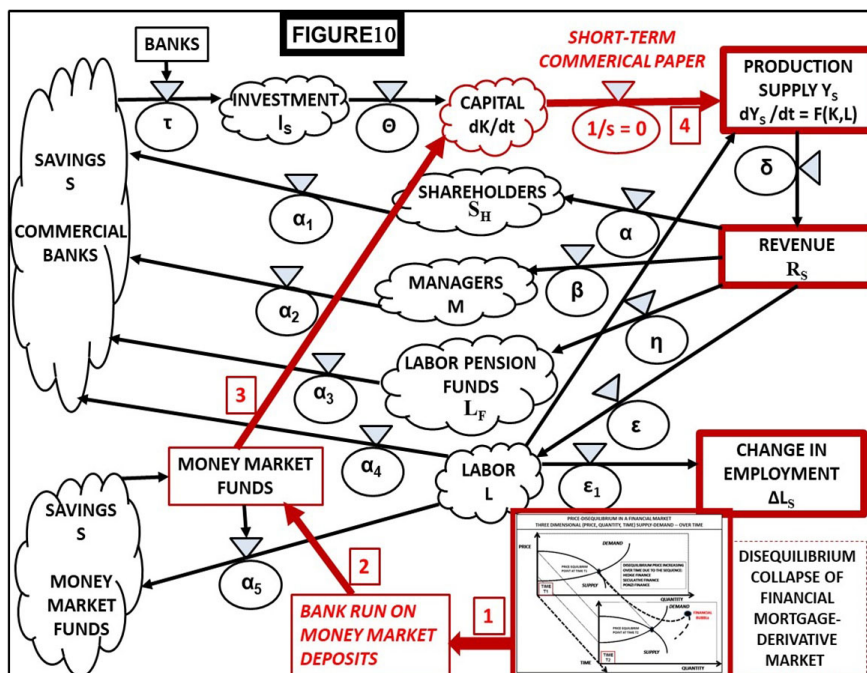
As we have just noted, Keynes, Harrod, and Domar had all assumed that “business cycles” were due to differences in investment between the supply and demand of investment. But, in the Global Financial Crisis of 2007-08, it was not a “business cycle” (cycles in supply of production) that created the crisis. Instead, it was a “failure of a financial market” which triggered the economic crisis. And we noted that Minsky had predicted this.

*In a graphic system model of Keynes-Harrod-Domar-Solow-Leontief model, one must add a feature of financial market failures to add Minsky into an economic growth model.*

As we saw, in the 2008 financial crisis, there was an economic contagion that ran from financial derivatives to investment banks to “money markets” and finally to “production”. Empirically, one needs to add to the systems-graphic model of the H-D-S-L macroeconomic model, a “crisis” model of financial market disequilibrium.

*This distinction between sources of economic instability (financial crisis or production business cycle) is important. We recall that Minsky had emphasized how a financial market differed from a commodity market—wherein the financial system required three components for trading capital assets: 1) credit-debt transactions as a fundamental financial process; and 2) a capital-asset market for liquidity of the asset; and 3) money as a medium of value-exchange.*

Next, in **Figure 10**, we insert into the systems graphic form of a Harrod-Domar-Solow-supply model the graphic dynamics of a financial market. It was the financial bubble of mortgage derivatives that triggered the 2007-08 financial collapse.



**Figure 10.** Harrod-Domar-Solow-Leontief-Minsky macroeconomic model of the 2008 financial market crisis.

This new model shows the connections between (1) the disequilibrium collapse of the financial mortgage-derivative market, (2) a bank run on money-market funds, (3) jeopardy of money-market funds and (4) freezing of credit for short-term commercial loans for commodity production firms.

*This graphic-systems form of the H-D-S-L-M growth model methodologically provides a direct empirical comparison of the theoretical model to empirical reality in the events in 2007-08 of the economic crisis: (1) → (2) → (3) → (4).*

### 9. Discussion—Minsky and Changes in Capitalism

Minsky recognized that “capitalism” in Britain and the US had historical dynamics—changes in form in history. Randall Wray wrote: “According to Minsky, capitalism has evolved through several stages, each marked by a different financial structure. The nineteenth century saw ‘commercial capitalism,’ where commercial banking dominated—banks made short-term commercial loans (for example, to allow firms to hire labor and buy raw materials) and issued deposits. Firms repaid these loans once they finished production and sold goods and services. Investment was mostly financed out of retained profits. Banking was relatively safe, except when a run on deposits developed—which governments learned to forestall by having the central bank act as lender of last resort.” (Wray, 2016)

However, as economic systems changed with technology and growth, banking operations also changed. L. Randall Wray wrote “This system was replaced by the beginning of the twentieth century, with ‘finance capitalism’ (a term coined by Rudolf Hilferding) where investment banks ruled. The distinguishing characteristic of

this stage was the use by firms of long-term external finance to purchase expensive capital assets... In this form of capitalism, the dominant financial players are ‘managed money’—lightly regulated ‘shadow banks,’ such as pension funds, hedge funds, sovereign wealth funds, and university endowments—with huge pools of funds in search of the highest returns. Innovations by financial engineers encouraged growth of private debt relative to income and increased reliance on volatile short-term finance.” (Wray, 2016)

After the Second World War, a shadow-banking sector in the U.S. grew to dominate the levels of capital flow and thereby increased financial instability. L. Randall Wray wrote: “As a result of these changes, cracks in the financial system began to appear. The first U.S. postwar financial crisis occurred in 1966 (in the municipal bond market), but it was quickly resolved by swift government intervention. This set a pattern. Crises came more frequently in the 1970s and 1980s, but the government saved the day each time. As a result, ever more risky financial arrangements were ‘validated’ by government intervention, leading to more experimentation. The crises became more severe, requiring greater rescue efforts by governments. Finally, the entire global financial system crashed in 2007-08, with many calling it the ‘Minsky Moment’.” (Wray, 2016)

Hyman Minsky had described the operations of the structured finance of shadow banking. Minsky wrote: “Our complex financial structure consists of a variety of institutions that leverage on owners’ equity and normally make on the ‘carry’, which is borrowing at a lower rate than their assets can earn.” (Minsky, 1982: pp. 5-13)

*The financial term “carry” means the “difference” in interest rate (that a financial firm can make from an investment) above the interest rate (the financial firm must pay to a bank to finance its investment). It is this “carry” which enables higher-level financial institutions to make money from leverage, during the time of a financing loan.*

*We recall that in a financial market, profits increase with leverage until excess leverage crashes the investment.*

## 10. Summary

In this case study, we reviewed Minsky’s contributions to progress in economic theory—beyond that of the twentieth-century economic “stars” of Keynes, Lasik, and Hayek. Minsky’s major contributions began with noting the difference between the operations of a production market and of a financial market. And this difference is very important for understanding the nature of modern capitalism.

The first difference is that financial markets are inherently unstable. The second difference is the need to model macroeconomic systems in the detail of institutional operations. We remember that Minsky wrote: “The lessons I learned from Paul Douglas are that any formal analytical tool—such as the Cobb-Douglas production function—explains but little of what happens in the world, and that to be useful, analytical tools have to be embedded in an understanding of the institutions,

traditions and legalities of the market.” (Minsky, 1982: pp. 5-13)

We have shown how to model Minsky’s analytic admonition by using graphic-systems mathematics to change the Harrod-Domar-Solow model from its earlier algebraic expression. We illustrated this kind of modeling by depicting the empirical reality of institutional operations (banks and shadow banks) in the 2008 Global Financial Crisis.

Modeling economic growth has long been a tradition in the discipline of economics, but with different approaches. Hendrik Van den Berg summarized: “Over the past several hundred years, economic thinkers have examined the economy from a variety of perspectives. Some have sought to describe the economy as a dynamic system that continually changes its shape and composition, while others analyzed the economy as a static system consisting of a constant and stable set of interconnected parts... We can also distinguish between those economic thinkers who chose to construct models that aggregated the whole economy into a few curves in a diagram or a small set of mathematical equations, while others have... alternatively viewed the economy as a system with a stable equilibrium and one that is continuously changing and potentially unstable.” (Van den Berg, 2013: pp. 2-28)

Methodologically, we have followed a “complex system approach” and modified the traditional economic-growth models to include dynamics of structural features in financial systems, such as “shadow banking”. (As algebra and calculus are topics in mathematics, so are topology and graph theory math topics.)

In modeling the failure of economic regulation during the financial bubble of 2005-08, we also illustrated the empirical importance of having analytical models of financial institutional operations, as Minsky had urged. For example, Ben Bernanke wrote: “In 2005, at the Council of Economic Advisers, (Steve Braun and I)... estimated the effects of a housing price bust in our presentation to President Bush. Steve’s and my presentation proved wrong because we did not take into account the possibility that losses on subprime mortgages could ultimately destabilize both the U.S. and global financial systems... Today, depositors (in banks) almost never line up at tellers’ windows to take out their cash. Since 1934, the federal government has protected bank depositors against losses, up to a limit, even if their bank fails. But that didn’t mean that runs were history. As we (the Federal Reserve) were learning, they (bank runs) now occur in different forms.” (Bernanke, 2002).

*The form of a model (representation of an economic event) can assist or impede empirical validation of the model.*

*In science, models can be directly validated or invalidated empirically, while theory cannot be so directly verified.*

*Instead, a theory is indirectly verified by means of the direct observational capabilities of a model, which is constructible within the theory.*

The importance of empirical verification of macro-economic theory was appreciated by Robert M. Solow when he published his paper on modeling economic

growth. Solow wrote: “All theory depends on assumptions which are not quite true. That is what makes it theory. The art of successful theorizing is to make the inevitable simplifying assumptions in such a way that the final results are not very sensitive. A ‘crucial’ assumption is one on which the conclusions depend sensitively, and it is important that crucial assumptions be reasonably realistic. When the results of a theory seem to flow specifically from a special crucial assumption, then if the assumption is dubious, the results are suspect.” (Solow, 1956: pp. 65-94)

Hyman Minsky wrote: “The problems we face now may well be the result of a misspecification by theories that guided past policies—of the processes that determine what happens in our type of economy.” (Minsky, 1982: pp. 5-13)

*Because commercial banking and shadow banking institutions operate differently in terms of investment, it is important to add institutional operations and feedback loops to the traditional macroeconomic models of growth.*

*This is needed in order to analyze how the instabilities of financial systems can connect to the dynamics of production systems—a contagion that can collapse an economy into a recession (or even a depression).*

## Conflicts of Interest

The author declares no conflicts of interest regarding the publication of this paper.

## References

- Appelbaum, B. (2013). Days before 2007 Crisis, Fed Officials Doubted Need to Act. *The New York Times*.  
<https://www.nytimes.com/2013/01/19/business/economy/fed-transcripts-open-a-win-dow-on-2007-crisis.html>
- Bernanke, B. (2002, November 21). *Remarks by Governor Ben S. Bernanke. Deflation: Making Sure “It” Doesn’t Happen Here*. The Federal Reserve System.  
<http://www.federalreserve.gov/BOARDDOCS/SPEECHES/2002/20021121/default.htm>
- Bernanke, B. S. (2009). *Global Imbalances: Recent Developments and Prospects. Bundesbank Lecture, Berlin*. The Federal Reserve System.
- Betz, F. (2014). Disequilibrium Pricing Theory—Bubbles and Recessions. *Theoretical Economics Letters*, 4, 60-67. <https://doi.org/10.4236/tel.2014.41009>
- Betz, F. (2015). Disequilibrium Systems Representation of Growth Models—Harrod-Domar, Solow, Le-Ontief, Minsky, and Why the U.S. Fed Opened the Discount Window to Money-Market Funds. *Modern Economy*, 6, 1189-1208.  
<https://doi.org/10.4236/me.2015.612113>
- Betz, F. (2024). Empirical and Normative Macroeconomic Theory and Monetary/Fiscal Policy in the Twentieth Century: A Case of Keynes, Laski, Hayek. *Modern Economy*, 15, 819-842. <https://doi.org/10.4236/me.2024.159043>
- Boianovsky, M., & Hoover, K. D. (2009). The Neoclassical Growth Model and Twentieth-Century Economics. *History of Political Economy*, 41, 1-23.  
<https://doi.org/10.1215/00182702-2009-013>
- Fisher, I. (1933). The Debt-Deflation Theory of Great Depressions. *Econometrica*, 1, 337-357. <https://doi.org/10.2307/1907327>

- 
- Giles, C. (2012) King Admits Failing to ‘Shout’ about Risk. *Financial Times*.  
<https://www.ft.com/content/9cd39a3e-9480-11e1-8e90-00144feab49a>
- Irwin, N. (2013). *The Alchemists: Three Central Bankers and a World on Fire* (Kindle Edition). Penguin Publishing Group.
- Krugman, P. (2009). The B Word. *The New York Times*.  
<https://www.nytimes.com/2008/03/17/opinion/17krugman.html>
- Leontief, W. (1986) *Input-Output Economics* (2nd ed.). Oxford University Press.
- McCulley, P. (2009) *Saving Capitalistic Banking from Itself*. PIMCO.
- Minsky, H. P. (1982). Can “It” Happen Again? A Reprise. *Challenge*, 25, 5-13.  
<https://doi.org/10.1080/05775132.1982.11470774>
- Minsky, H. P. (1986). *Stabilizing an Unstable Economy*. Yale University Press.
- Nocera, J. (2009). Lehman Had to Die So Global Finance Could Live. *The New York Times*.  
<http://www.nytimes.com/2009/09/12/business/12nocera.html>
- Solow, R. M. (1956). A Contribution to the Theory of Economic Growth. *The Quarterly Journal of Economics*, 70, 65-94. <https://doi.org/10.2307/1884513>
- Stewart, J. B. (2009). Eight Days: The Battle to Save the American Financial System. *The New Yorker*.
- van den Berg, H. (2013). Growth Theory after Keynes, Part I: The Unfortunate Suppression of the Harrod-Domar Model. *Journal of Philosophical Economics*, 1, 2-28.  
<https://doi.org/10.46298/jpe.10650>
- Wray, L. R. (2016). *Why Minsky Matters: An Introduction to the Work of a Maverick Economist*. Princeton University Press.
- Wolf, M. (2008). Why Greenspan Does Not Bear Most of the Blame. *Financial Times*.