Can we avoid another financial crisis?

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How can we avoid what we can’t see coming?

• Not the OECD’s finest hour: OECD Economic Outlook June 2007:
  
  • “the current economic situation is in many ways better than what we have experienced in years.
  • Our central forecast remains indeed quite benign...
  • sustained growth in OECD economies would be underpinned by strong job creation and falling unemployment.” (Cotis, OECD 2007, p. 7)

• Not a good hour for most other economists either:
  
  • FOMC December 2007 (Date recession began)
    • “Overall, our forecast could admittedly be read as still painting a pretty benign picture:
      • despite all the financial turmoil, the economy avoids recession…”

Why did they not see it coming?
Was it impossible to predict?

- David Miles, MPC member 2009-15
  Financial Times, January 11 2017:
    - Andy Haldane is wrong: there is no crisis in economics

- So crises are random, no more predictable than lottery results?

- **It depends on the theory you use**

- In Neoclassical models, instability and crises are
  - The anomalies
  - Caused by “exogenous shocks”

- In complex systems/Minsky economics, they are
  - The rule
  - Endogenous…
Different approach to modelling, different result

• Take three simple, “true by definition”, macroeconomic definitions
  • Employment Rate
  • Wages Share of GDP
  • Private debt to GDP ratio

• Convert into “true by definition” dynamic statements (proof in Appendix slides)
  • “Employment will rise if economic growth exceeds the sum of population & labor productivity growth”
  • “Wages share of output will rise if wage rises exceeds growth in labor productivity”
  • “Debt ratio will rise if rate of growth of debt exceeds rate of growth of GDP”

• Convert into a model with simplest possible assumptions
  • Production a linear function of Capital
  • Investment a linear function of profit rate
  • Wage change a linear function of employment rate
  • Investment in excess of profits financed by borrowing from banks
Complex Systems Economics Warned of the Crisis

- Highly stylized model doesn’t predict when a crisis will occur
- But predicts one will if Private Debt to GDP ratio keeps rising
- Low desire to invest leads to stable Private Debt to GDP ratio
- Tapers from zero to equilibrium value of 75% of GDP
- Employment & Income distribution also stabilize
- Simulation from zero initial private debt to GDP for 72 years:
Complex Systems Economics Warned of the Crisis

• High desire to invest leads to rising Private Debt to GDP level:

• Eventual crisis when debt burden overwhelms capacity to service debt (Debt/GDP ratio exceeds 150%)

• Rising inequality as Bank share of GDP rises at expense of Workers (not Capitalists)

• And unexpectedly: crisis is preceded by a “Great Moderation”
Complex Systems Economics Warned of the Crisis

• Conventional economists saw the “Great Moderation” as a good thing:
  • Ben Bernanke in 2004
  • “The sources of the Great Moderation remain somewhat controversial, but as I have argued elsewhere, there is evidence for the view that improved control of inflation has contributed in important measure to this welcome change in the economy.”

• I saw it as a warning in 1992 (model developed & paper written in August 1992)
  • “this vision of a capitalist economy with finance requires us to go beyond that habit of mind which Keynes described so well, the excessive reliance on the (stable) recent past as a guide to the future.
  • The chaotic dynamics explored in this paper should warn us against accepting a period of relative tranquility in a capitalist economy as anything other than a lull before the storm”. (Keen, 1995, “Finance and Economic Breakdown”)

The Empirical Insights: Private Debt is **THE** Problem

- Private debt is *the main destabilizing force in capitalism*
- Mainstream economics ignores it—even encourages it via “Modigliani-Miller Theorem”

- We’re living in the biggest private debt bubble in the history of capitalism...
The Empirical Insights: Credit (Change in Debt) matters too

- Rising credit caused the boom from 1992-2007 (& 1922-30 & 1835-37)
- Falling & negative credit caused Great Depression, Great Recession, & Panic of 1837

Massively negative credit events in the USA
- Panic of 1837
- Great Depression
- Great Recession
Why both Debt & Credit Matter

• Crisis begins when debt stops growing from already high level
• Both high debt stock & high growth of debt (=credit) needed for crisis:
  • Economy crashed *simply because rate of growth of debt slowed down*
• Aggregate demand = Turnover of existing money + credit

• Low Debt Ratio Example: Turnover of existing money
  • Initially $1000bn/Year
  • Growing at 10%/Year
  • Private debt: Initially 50% of turnover of existing money = $500bn
    • Growing at 20%/Year: Credit = $100bn/Year
• Total demand $1,100bn/Year
• Next year turnover of existing money = $1,100bn/Year
• Growth of debt slows to 10%/Year
  • Credit = $60bn/Year (10% of $600bn)
• Total demand $1,160bn/Year: $60bn *higher* than previous year...
Why both Debt & Credit Matter

• High Debt Ratio Example:
  • Turnover of existing money initially $1000bn/Year
    • Growing at 10%/Year
  • Private debt initially 200% of turnover of existing money = $2,000bn
    • Growing at 20%/Year: Credit = $400bn/Year
  • Total demand $1,400bn/Year
  • Next year turnover of existing money = $1,100bn/Year
  • Growth of debt slows to 10%/Year
    • Credit = $240bn/Year (10% of $2,400bn)
  • Total demand $1,340bn/Year: $60bn lower than previous year

• Both level of private debt/GDP ratio and rate of growth matter

• Aggregate Demand ≡ Income ≈ GDP+Change in Debt (10-30% error)
  • Change in Debt (Credit) + GDP rough guide to total demand
From Prosperity to Crisis & then Stagnation

- USA: undisputed source of (and major victim of) Global Financial Crisis

- Negative credit event first since Great Depression
From Prosperity to Crisis & then Stagnation

- Credit drives employment: Credit:Unemployment Correlation -0.91 since 1990
From Prosperity to Crisis & then Stagnation

• Change in Mortgage Credit caused house price change & thus Subprime Bubble
From Prosperity to Crisis & then Stagnation

- Japan in 1990, USA/UK/Spain etc in 2008 all had negative credit

Credit in "Walking Dead of Debt"
Avoiding Crisis by Continuing Credit Bubble

- China, Canada, South Korea, Australia all avoided negative credit:
Avoiding Crisis by Continuing Credit Bubble

• Simply put off crisis to later, with higher debt ratio as a result
Precursors to a Crisis

• Criteria for serious credit crisis are (see Richard Vague, Private Debt Project):
  • Private Debt Level exceeding 150% of GDP
  • Growth in debt exceeding 17% of GDP over preceding five years

• Countries which qualify for crisis in the next 1-3 years include:

<table>
<thead>
<tr>
<th>Country</th>
<th>2017 GDP (US$bn)</th>
<th>2012</th>
<th>Now</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>China</td>
<td>11091</td>
<td>148</td>
<td>210</td>
<td>63</td>
</tr>
<tr>
<td>Canada</td>
<td>1540</td>
<td>182</td>
<td>217</td>
<td>35</td>
</tr>
<tr>
<td>South Korea</td>
<td>1483</td>
<td>180</td>
<td>193</td>
<td>12</td>
</tr>
<tr>
<td>Australia</td>
<td>1318</td>
<td>178</td>
<td>201</td>
<td>22</td>
</tr>
<tr>
<td>Sweden</td>
<td>495</td>
<td>227</td>
<td>233</td>
<td>6</td>
</tr>
<tr>
<td>Belgium</td>
<td>455</td>
<td>197</td>
<td>217</td>
<td>20</td>
</tr>
</tbody>
</table>
Precursors to a Crisis

Other possible crisis countries include:

<table>
<thead>
<tr>
<th>Country</th>
<th>2017 GDP (US$bn)</th>
<th>2012</th>
<th>Now</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>France</td>
<td>2390</td>
<td>176</td>
<td>187</td>
<td>16</td>
</tr>
<tr>
<td>Netherlands</td>
<td>758</td>
<td>242</td>
<td>230</td>
<td>-12</td>
</tr>
<tr>
<td>Switzerland</td>
<td>652</td>
<td>200</td>
<td>215</td>
<td>15</td>
</tr>
<tr>
<td>Malaysia</td>
<td>285</td>
<td>122</td>
<td>137</td>
<td>15</td>
</tr>
<tr>
<td>Finland</td>
<td>233</td>
<td>169</td>
<td>175</td>
<td>6</td>
</tr>
<tr>
<td>Singapore</td>
<td>211</td>
<td>134</td>
<td>178</td>
<td>44</td>
</tr>
<tr>
<td>New Zealand</td>
<td>184</td>
<td>174</td>
<td>177</td>
<td>2</td>
</tr>
</tbody>
</table>
Is Austerity the best way to handle a crisis?

• It sounds so sensible:

Theresa May: Britain must live within its means

The Prime Minister defends the Government's public sector pay cap policy as Jeremy Corbyn denounces a "low pay epidemic".

By Alessandra Rizzo, Political Reporter

Theresa May during Prime Minister's Questions

Top Stories

LIVE: Three dead as Irma batters Florida

Many lose power as Irma hits Sunshine State

How strong are category four hurricanes?

Tony Blair's bid to stop Brexit 'hopeless'

Because this looks like a good idea:

<table>
<thead>
<tr>
<th>Sector A</th>
<th>Year 0</th>
<th>Year 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Expenditure</td>
<td>-200</td>
<td>-190</td>
</tr>
<tr>
<td>Income from Sector B</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>Income from Sector C</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>Savings</td>
<td>0</td>
<td>10</td>
</tr>
</tbody>
</table>

• Start with zero savings
• Spend £10 less
• Put away £10 “for a rainy day”
• Excellent! Let’s ALL do that…
The Austerity Delusion

• But how does that look from Sectors B and C’s point of view?

<table>
<thead>
<tr>
<th></th>
<th>Sector A</th>
<th>Sector B</th>
<th>Sector C</th>
<th>Sum must be zero</th>
</tr>
</thead>
<tbody>
<tr>
<td>Expenditure Year 0</td>
<td>-200</td>
<td>100</td>
<td>100</td>
<td>0</td>
</tr>
<tr>
<td>Expenditure Year 1</td>
<td>-190</td>
<td>95</td>
<td>95</td>
<td>0</td>
</tr>
<tr>
<td>Savings and Income Change</td>
<td>+10</td>
<td>-5</td>
<td>-5</td>
<td>0</td>
</tr>
</tbody>
</table>

• Not so crash hot after all...
  • Sector A’s savings of £10 has caused an identical fall in income for Sectors B & C
  • Sectors B and C are now dis-saving by £5 each
    • Not because they are irresponsible
    • But because Sector A’s savings came at the expense of their income

• The problem?
  • “Living within our means” means spending less than you earn
  • But at the macro level, expenditure is income: *they can’t be different*
    • What you spend becomes someone else’s income
    • Individual savings causes a identical fall in aggregate income
The Austerity Delusion

• What if we all try to save?
  • We started here: Total GDP = £600: Individual & aggregate savings = £0

<table>
<thead>
<tr>
<th>Expenditure≡Income Table</th>
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<th>Sector B</th>
<th>Sector C</th>
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</thead>
<tbody>
<tr>
<td>Sector A</td>
<td>-200</td>
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</tr>
<tr>
<td>Sector B</td>
<td>100</td>
<td>-200</td>
<td>100</td>
</tr>
<tr>
<td>Sector C</td>
<td>100</td>
<td>100</td>
<td>-200</td>
</tr>
<tr>
<td>Savings</td>
<td>0</td>
<td>0</td>
<td>0</td>
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</table>

• Sector A’s savings got us to here:

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<td>100</td>
</tr>
<tr>
<td>Sector C</td>
<td>100</td>
<td>100</td>
<td>-200</td>
</tr>
<tr>
<td>Savings</td>
<td>10</td>
<td>-5</td>
<td>-5</td>
</tr>
</tbody>
</table>

• We now have: GDP = £590: Individual savings (10,-5,-5) & aggregate savings = £0
The Austerity Delusion

• Now sectors B and C also decide to save £10 each:

<table>
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<td>95</td>
<td>-190</td>
<td>95</td>
</tr>
<tr>
<td>Sector C</td>
<td>95</td>
<td>95</td>
<td>-190</td>
</tr>
<tr>
<td>Savings</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

• We now have: GDP = £570: Individual savings (0,0,0) & aggregate savings = £0

• Individuals save—and they do try to “Accumulate! Accumulate! That is Moses and the Prophets” (Marx 1867, Chapter 24, Section 3)

• But whole economies cannot save
  • Unless...
The Austerity Delusion

• Unless there’s another mystery sector which can spend more than it earns...

<table>
<thead>
<tr>
<th>Expenditure≡Income Table</th>
<th>Sector A</th>
<th>Sector B</th>
<th>Sector C</th>
<th>Sector ???</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sector A</td>
<td>-220</td>
<td>100</td>
<td>100</td>
<td>20</td>
</tr>
<tr>
<td>Sector B</td>
<td>100</td>
<td>-220</td>
<td>100</td>
<td>20</td>
</tr>
<tr>
<td>Sector C</td>
<td>100</td>
<td>100</td>
<td>-220</td>
<td>20</td>
</tr>
<tr>
<td>Sector ???</td>
<td>30</td>
<td>30</td>
<td>30</td>
<td>-90</td>
</tr>
<tr>
<td>Savings</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>-30</td>
</tr>
</tbody>
</table>

• If Sector ??? “Spends” £30 more than it “earns”, then Sectors A to C can each save £10

• What can Sector ??? Be?
  • Banks “Lending” (“Spending”) more than they get back in repayments (+interest)
    • This increases bank deposit accounts by £30: savings!
    • But it also increases debt by £30: no net increase in financial assets
  • Government Spending more than it takes back in Taxation...
    • This increases bank deposit accounts by £30: savings!
    • No matching debt for recipients: net increase in financial assets… But…
The Austerity Delusion

- How can the government pay for it? Where does it get the money?
  - **From its own bank:**
    - Legal rules prevent most Central Banks doing this directly, but they can do it indirectly via Open Market Operations...

<table>
<thead>
<tr>
<th>Description</th>
<th>Assets</th>
<th>Liabilities</th>
<th>Equity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treasury Sells Bonds to Central Bank</td>
<td>33</td>
<td>-33</td>
<td></td>
</tr>
<tr>
<td>Treasury Spends on Public</td>
<td></td>
<td>30</td>
<td>-30</td>
</tr>
<tr>
<td>Treasury pays interest to Central Bank</td>
<td>3</td>
<td></td>
<td>-3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Description</th>
<th>Assets</th>
<th>Liabilities</th>
<th>Equity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treasury Spends on Public</td>
<td>30</td>
<td>-30</td>
<td></td>
</tr>
</tbody>
</table>
The Austerity Delusion

• What if the government does the opposite, and runs a surplus?

<table>
<thead>
<tr>
<th>Expenditure≡Income Table</th>
<th>Sector A</th>
<th>Sector B</th>
<th>Sector C</th>
<th>Sector G</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sector A</td>
<td>-220</td>
<td>100</td>
<td>100</td>
<td>20</td>
</tr>
<tr>
<td>Sector B</td>
<td>100</td>
<td>-220</td>
<td>100</td>
<td>20</td>
</tr>
<tr>
<td>Sector C</td>
<td>100</td>
<td>100</td>
<td>-220</td>
<td>20</td>
</tr>
<tr>
<td>Sector ?</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>-30</td>
</tr>
<tr>
<td>Savings</td>
<td>-10</td>
<td>-10</td>
<td>-10</td>
<td>30</td>
</tr>
</tbody>
</table>

• It drives the other sectors of the economy into deficits
• Which is one reason why we have private debt bubbles
• Major surpluses have preceded major crises
  • Great Depression
  • Great Recession
• Not “saving for a rainy day” but “Causing a hurricane”…
The Austerity Delusion

- 120 years of usually running a deficit: average 2.4%. Post WWII: 2.1%
What to do? Economic Theory

• Can’t understand capitalist economies with theory that assumes they are inherently stable, & effectively barter rather than monetary economies

• Hyman Minsky, “Can “It” Happen Again?” (1982)

• “Can "It"—a Great Depression—happen again?

• And if "It" can happen, why didn't "It" occur in the years since World War II?

• These are questions that naturally follow from both the historical record and the comparative success of the past thirty-five years...

• To answer these questions it is necessary to have an economic theory which makes great depressions one of the possible states in which our type of capitalist economy can find itself.”
What to do? Economic Policy

• Since excessive private debt is the problem, *reducing private debt is the solution*
  • Market solution compounds the problem. “Fisher’s Paradox”
    • “the very effort of individuals to lessen their burden of debts increases it
    • because of the mass effect of the stampede to liquidate in swelling each dollar owed.
  • Then we have the great paradox which, I submit, is the chief secret of most, if not all, great depressions:
    • The more the debtors pay, the more they owe.” (Irving Fisher, “The Debt-Deflation Theory of Great Depressions”)
• Government money creation can replace fiat-based money with debt-based money
What to do? Economic Policy

• “QE For the People”
  • Direct per-capita injection into household bank accounts
    • Those with debt have debt reduced
    • Those without debt get cash injection
      • Cash must be used to buy corporate shares
      • Corporate shares must be used to reduce corporate debt
  • Reverse income inequality rise caused:
    • By private debt bubble in the first place
    • By misguided QE since then
      • Massive increase in share prices has benefited wealthy who own shares
      • Benefit to poor via pension funds, etc., relatively trivial

• The alternative? Continued stagnation like Japan’s “Lost Decade”
• Political turmoil as voters reject mainstream for extremists of Left or Right
Help bring about a new economics

In 2008, conventional economics led us blindfolded into the greatest economic crisis since the Great Depression. Almost a decade later, with the global economy wallowing in low growth that mainstream economists also can’t explain, they are reluctantly coming to realise that their models are useless for understanding the real world.

I realised that over 45 years ago, when I was an undergraduate student. Since then, I have worked tirelessly to develop an alternative, realistic economics. My book Debunking Economics has tens of thousands of readers learn in one month the critical knowledge of economics that I spent four decades acquiring. The “complex systems” model of Hyman Minsky’s “Financial Instability Hypothesis” developed in 1992 let me warn of the 2008 crisis before it happened. I designed Minsky, the Open Source dynamic modelling program, to make it possible for anyone to build and understand monetary models of the economy. My latest book Can We Avoid Another Financial Crisis? explains why the crisis happened, and what we have to do to end it. I have just developed the first explanation of production in which energy plays an essential role, opening up the possibility to finally integrate economics and ecology.

But much more needs to be done, and I need your help to do it.

I have done everything still now with support from many colleagues, but with no support from official funding agencies. Almost all the money for economics research goes to develop the mainstream—even after it has failed so abjectly. That will continue to be the case.
Complex Systems Dynamics: Building Macro from Macro

• A positive agenda. No longer just Debunking Economics but Rebuilding Economics

• Derive macro from macroeconomic definitions. Start with
  • Output relation: Employment Rate
  • Income distribution relation: Wages Share of GDP

• Define Employment Rate, Wages Share, Productivity, Profit

  Employment Rate: \( \lambda \equiv L/N \)

  Wages Share of GDP: \( \omega \equiv W/Y \)

  Labor Productivity: \( a \equiv Y/L \)

  Profit: \( \Pi \equiv Y - W \)

  Profit Rate: \( \pi_r \equiv \Pi/Y = (1 - \omega) \)
The Foundations of Macroeconomics: Macro Method
• Deriving basic macro model from strict identities:
  • Employment rate \( \equiv \text{Employment/Population} \)

\[
\lambda \equiv \frac{L}{N} \\
\frac{d}{dt} \lambda \equiv \frac{d}{dt} \left( \frac{L}{N} \right) \\
\frac{d}{dt} \lambda \equiv \frac{1}{N} \frac{dL}{dt} - \frac{1}{N} \frac{dN}{dt} \\
L = \frac{Y}{a} \\
\frac{1}{N} \frac{dN}{dt} \equiv \hat{N} \\
\frac{d}{dt} \lambda \equiv \frac{1}{N} \left( \frac{1}{a} \frac{dY}{dt} \right) - \frac{1}{N} \frac{1}{a} \frac{da}{dt} - \lambda \cdot \hat{N} \\
\frac{d}{dt} \left( \frac{1}{N} \left( \frac{L}{Y} \right) \frac{dY}{dt} \right) \equiv \lambda \cdot \hat{Y} \\
\lambda \equiv \lambda \cdot \hat{Y} - \lambda \cdot \left( \hat{a} + \hat{N} \right) \\
\frac{1}{\lambda} \frac{d}{dt} \lambda \equiv \hat{\lambda} \equiv \hat{Y} - \left( \hat{a} + \hat{N} \right)
\]

• “Employment will rise if economic growth exceeds the sum of population & labor productivity growth”
The Foundations of Macroeconomics: Macro Method

• Similarly for Wages Share of GDP

\[
\frac{1}{\omega} \cdot \frac{d}{dt} \omega = \hat{\omega} \equiv \hat{W}_R - \hat{a}
\]

• “Wages share of output will rise if wage rise exceeds growth in labor productivity”

• Gives us two undeniably true dynamic equations:

\[
\frac{d}{dt} \lambda \equiv \lambda \cdot \left( \dot{Y} - \left( \hat{a} + \hat{N} \right) \right)
\]

\[
\frac{d}{dt} \omega \equiv \omega \cdot \left( \hat{W}_R - \hat{a} \right)
\]
The Foundations of Macroeconomics: Macro Method

• Both statements are undeniably true

• Lead directly to cyclical model with neutral equilibrium (Goodwin 1967) once assumptions added. Start with simplest possible assumptions:
  • Production system: Output a linear function of capital
    • Energy incorporated in new model (on its way)
  • Investment a linear function of the rate of profit
  • Wage demands a linear function of employment rate

\[ Y = \frac{K}{v} \]
\[ I_G = I_G \cdot Y \]
\[ \dot{K} = I_G - \delta_K \cdot K \]
\[ \dot{\alpha} = \alpha \]
\[ \dot{N} = \beta \]
\[ \lambda = \lambda \cdot \left( Y - (\hat{\alpha} + \hat{N}) \right) \]
\[ \lambda = \lambda \cdot \left( I_G / v - (\alpha + \beta + \delta_K) \right) \]
\[ \omega = \omega \cdot \left( w_{ch} - \alpha \right) \]
The Foundations of Macroeconomics: Macro Method

- Add the private debt to GDP ratio
  \[ d \equiv \frac{D}{Y_R} \]
- Redefine profit net of interest
  \[ \Pi \equiv Y_R - W - r \cdot D \]
- “Debt ratio will rise if debt grows faster than GDP”
  \[ \dot{d} \equiv \dot{D} - \dot{Y}_R \]
- Simplest possible model: debt used to finance investment in excess of retained earnings
  \[ \dot{d} \equiv \frac{D}{Y_R} \left( \frac{1}{D} \frac{d}{dt} D - \frac{1}{Y_R} \frac{d}{dt} Y_R \right) \]
  \[ \dot{d} \equiv d \cdot \left( \dot{D} - \dot{Y}_R \right) \]
  \[ \dot{d} = \left( \frac{l_G - \Pi}{Y_R} - d \cdot \left( \frac{i_g}{v - \delta_K} \right) \right) \]
  \[ \frac{d}{dt} d = \left( \frac{i_g}{v - \pi_s} - d \cdot \left( \frac{i_g}{v - \delta_K} \right) \right) \]
The Foundations of Macroeconomics: Macro Method

• Generates 3D model with (realized!) potential for bifurcation & chaos

\[
\frac{d}{dt} \lambda = \lambda \cdot \left( \frac{i_G}{v} - (\alpha + \beta + \delta_K) \right)
\]

\[
\frac{d}{dt} \omega = \omega \cdot (w_{ch} - \alpha)
\]

\[
\frac{d}{dt} d = \left( \frac{i_G}{v} - \pi_s - d \cdot \left( \frac{i_G}{v} - \delta_K \right) \right)
\]
The Foundations of Macroeconomics: Macro Method

• Next more complex model with price dynamics, nonlinear behavioural functions

• Much more needed for more realistic model

• But essence of debt bubble & crisis captured by very simple model
How credit adds to aggregate expenditure & income

• “Milton Friedman” fixed money supply world:

\[
\begin{pmatrix}
-a - b & a & b \\
c & -c - d & d \\
e & f & -e - f
\end{pmatrix}
\]

\[SL := \begin{pmatrix}
-a - b & a & b \\
c & -c - d & d \\
e & f & -e - f
\end{pmatrix}
\]

\[-\text{tr}(SL) \quad \text{simplify}
\]

\[-\text{tr}(SL) \quad \text{simplify}
\]

substitute, \(a + b + c + d + e + f = V \cdot M\)

• “Paul Krugman” Loanable Funds world:

\[
\begin{pmatrix}
-a - b - l - r \cdot L & a + r \cdot L & b + l \\
c & -c - (d - l) & (d - l) \\
e & f & -e - f
\end{pmatrix}
\]

\[LF := \begin{pmatrix}
-a - b - l - r \cdot L & a + r \cdot L & b + l \\
c & -c - (d - l) & (d - l) \\
e & f & -e - f
\end{pmatrix}
\]

\[-\text{tr}(LF) \quad \text{simplify}
\]

\[-\text{tr}(LF) \quad \text{simplify}
\]

substitute, \(a + b + c + d + e + f = V \cdot M\)

\[\rightarrow M \cdot V\]

\[\rightarrow M \cdot V + L \cdot r\]
How credit adds to aggregate expenditure & income

- The real world of “Bank Originated Money and Debt” (BOMD):

\[
\begin{pmatrix}
-a - b - l - r \cdot L & a & b + l & r \cdot L \\
0 & c & -c - d & d & o \\
0 & e & f & -e - f & o \\
0 & g & h & i & -g - h - i \\
\end{pmatrix}
\]

\[\text{BOMD} := \begin{pmatrix}
-a - b - l - r \cdot L & a & b + l & r \cdot L \\
0 & c & -c - d & d & o \\
0 & e & f & -e - f & o \\
0 & g & h & i & -g - h - i \\
\end{pmatrix}\]

- \[\text{tr}(\text{BOMD}) = \begin{pmatrix}
-a - b - l - r \cdot L & a & b + l & r \cdot L \\
0 & c & -c - d & d & o \\
0 & e & f & -e - f & o \\
0 & g & h & i & -g - h - i \\
\end{pmatrix}
\]

- \[\text{tr}(\text{BOMD}) = a + b + c + d + e + f + g + h + i = V \cdot M \Rightarrow dDdt + M \cdot V + L \cdot r\]

- \[\text{tr}(\text{BOMD}) = a + b + c + d + e + f + g + h + i = V \cdot M \Rightarrow dDdt + M \cdot V + L \cdot r\]
How credit adds to aggregate expenditure & income

- Government spending can counteract effect of negative credit

\[
\text{BOMD}_{\text{Gov}} := \begin{bmatrix}
-a - b - l - r \cdot L - \tau_1 & a & b + l & r \cdot L & \tau_1 \\
c & -c - d - \tau_2 & d & 0 & \tau_2 \\
e & f & -e - f - \tau_3 & 0 & \tau_3 \\
g & h & i & -(g - h - i - \tau_b) & \tau_b \\
\gamma_1 & \gamma_2 & \gamma_3 & \gamma_b & -(\gamma_1 + \gamma_2 + \gamma_3 + \gamma_b)
\end{bmatrix}
\]

- \(-\text{tr}(\text{BOMD}_{\text{Gov}})\)

- simplify
- substitute, \((a + b + c + d + e + f + g + h + i = V \cdot M)\)
- substitute, \(l = dDdt\)
- substitute, \(\gamma_1 + \gamma_2 + \gamma_3 + \gamma_b = G\)
- substitute, \((\tau_1 + \tau_2 + \tau_3 + \tau_b) = -T\)