Household Debt, Growth and Inequality

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First: growth, second: distribution. “Changes in debt are ‘pure redistributions’ which should have no significant macro-economic effects” (Bernanke, 2000, p. 24).

A perfectly flexible market determines a unique static equilibrium (Debreu (1970)).

This static equilibrium is always first-best efficient (Pareto).

No ordinal axiomatization of any concept of justice (the cardinality curse).

No room for justice?
However, a perfectly flexible market is efficient only if there are no externalities, increasing returns to scale, incomplete markets.

Incomplete markets are (almost) always second-best inefficient (Geanakoplos-Polemarchakis (1986)).

Incomplete markets exhibit a huge indeterminacy of equilibria (Mas-Colell (1984)).

Financial innovation does not necessarily improve the (third-best) efficiency of incomplete markets (Elul (1995)).
Moreover...

- With incomplete markets static equilibria may fail to exist in a robust manner... (Momi (2000)).

- There exist only 3 types of equilibria (Giraud - Pottier (2016)):
  - with inflation and growth
  - deflation without growth (Irving Fisher)
  - with speculative bubbles on financial markets

- A crisis like 2008 cannot occur at a static equilibrium (of only as a "black swan" (Taleb (2009), Giaud-Pottier (2009))).

- How do we know that South-African economy is already at equilibrium (if any)?
Moreover...(2)


- A Utilitarian solution need not coincide with the “market solution”.

- Refinements of the mere Pareto-optimality notion (e.g., nucleolus, Shapley value, Harsanyi value...) need not coincide with Arrow-Debreu equilibria.

- Justice makes sense and does not emerge spontaneously from market interactions. (SDG 10.)
Banchard (PIIE, 2016):
*I see the current DSGE models as seriously flawed...*

Romer (2016):
*For more than three decades, macroeconomics has gone backwards...*

Kocherlakota (2016):
...we simply do not have a settled successful theory of the macroeconomy. *The choices made 25-40 years ago - made then for a number of excellent reasons - should not be treated as written in stone or even in pen.*
Need for **change in our analytical framework.**

Articulation between ecological sustainability / inequality / prosperity.

Main takeaways

1) Need to incorporate the dynamics of private debts

2) An increase of income inequality is a signal for a decline in growth in the long-run.

3) $r > g$ is a necessary condition for the stability of a debt-deflationary long-run equilibrium with exploding inequalities.

An increase in $K/Y$ reinforces its stability.
I. Critics of Piketty (2014)

- \( Y_n = (Y_n - W) + W \) (total income equals capital income plus labor income)
- \( r_k = \frac{(Y_n-W)}{pK} \) (rate of return on capital)
- \( \alpha_k = \frac{Y_n-W}{Y_n} \) (capital share of total income)
- \( \beta_k = \frac{pK}{Y_n} \) (capital-to-income ratio)
I. Critics of Piketty (2014)

- First "fundamental law of capitalism" $\alpha_k = r_k \beta_k$: trivial accounting equation.
- Second "law" is false: $\beta \to s/g$ (Stiglitz, Acemoglu, Varoufakis, Taylor, Giraud...)
- $r_k > g$ well-known, and so what? (Acemoglu, Mankiw, IMF...). Confusion between $r$ and $r_k$.
- Cambridge controversy about capital (Varoufakis, Giraud, Taylor...)
- A model without money? Is money neutral? No endogenous creation of credit by banks?
II. Debts and credit

Figure 6. The exponential increase in debt to GDP ratios till 2006

Figure: Keen (2017)
Debts and credit

Figure: Keen (2017)
Debts and credit

**Figure:** Households vs firms. Keen (2017)
Debts and credit

Figure: Keen (2017)
Debts and credit

Figure: Keen (2017)
Debts and credit

Figure: China (Keen (2017))
Debts and credit

Figure: UK (Keen (2017))
III. An alternative approach

Suppose our economy is a ball...
Figure: Les trajectoires du scénario *Business-As-Usual*.
Figure: Trajectoires du scénario Burke et al. (2015).
Figure: Portrait de phase de la combinaison de Burke et al. et de Dietz-Stern case.

Mclsaac et al. (2016).
The basin of attraction of a "good" equilibrium without climate change (McIsaac et al. (2016)).
With climate change (McIsaac et al. (2016)).
Properties

- Stock-Flow consistency (Godley-Lavoie (2012)).
- Money is non-neutral and endogenous (Diamond-Dybvig, Tobin, Bank of England...)
- Collapses are possible
- Long-run dynamics out-of-equilibrium.
- Multiple equilibria.
- Key role of private debts.
In general, there are 3 types of long-run equilibria.

One equilibrium is not locally stable.

One stable equilibrium "à la Solow".
\[ g = \alpha + \beta + \text{"Golden rule"} \]
\[ \lambda \rightarrow \text{NAIRU (Tobin).} \]
Inequality remains stable

One stable equilibrium leads to a collapse
Inequality explodes.
\[ \lambda \rightarrow 0. \]
### SFC table for the dual Akerlof-Stiglitz (1969) model

<table>
<thead>
<tr>
<th></th>
<th>Households</th>
<th>Firms</th>
<th>Banks</th>
<th>Sum</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Balance sheet</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Capital stock</td>
<td></td>
<td>+pK</td>
<td></td>
<td>pK</td>
</tr>
<tr>
<td>Deposits</td>
<td>+M&lt;sub&gt;h&lt;/sub&gt;</td>
<td>+M&lt;sub&gt;f&lt;/sub&gt;</td>
<td>-(M&lt;sub&gt;h&lt;/sub&gt; + M&lt;sub&gt;f&lt;/sub&gt;)</td>
<td>0</td>
</tr>
<tr>
<td>Loans</td>
<td>-L&lt;sub&gt;h&lt;/sub&gt;</td>
<td>-L&lt;sub&gt;f&lt;/sub&gt;</td>
<td>+(L&lt;sub&gt;h&lt;/sub&gt; + L&lt;sub&gt;f&lt;/sub&gt;)</td>
<td>0</td>
</tr>
<tr>
<td>Sum (Net worth)</td>
<td>X&lt;sub&gt;h&lt;/sub&gt;</td>
<td>X&lt;sub&gt;f&lt;/sub&gt;</td>
<td>X&lt;sub&gt;b&lt;/sub&gt;</td>
<td>X</td>
</tr>
<tr>
<td><strong>Transactions</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Consumption</td>
<td>-pC&lt;sub&gt;h&lt;/sub&gt;</td>
<td>+pC</td>
<td>-pC&lt;sub&gt;b&lt;/sub&gt;</td>
<td>0</td>
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<tr>
<td>Investment</td>
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<td>-pI</td>
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<tr>
<td>Accounting memo [GDP]</td>
<td>[pY]</td>
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<td>Depreciation</td>
<td>-pδK</td>
<td>+pδK</td>
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<td>0</td>
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<tr>
<td>Wages</td>
<td>+wℓ</td>
<td>-wℓ</td>
<td></td>
<td>0</td>
</tr>
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<td>-rL&lt;sub&gt;h&lt;/sub&gt;</td>
<td>-rL&lt;sub&gt;f&lt;/sub&gt;</td>
<td>+r(L&lt;sub&gt;h&lt;/sub&gt; + L&lt;sub&gt;f&lt;/sub&gt;)</td>
<td>0</td>
</tr>
<tr>
<td>Interest on deposits</td>
<td>+rM&lt;sub&gt;h&lt;/sub&gt;</td>
<td>+rM&lt;sub&gt;f&lt;/sub&gt;</td>
<td>-r(M&lt;sub&gt;h&lt;/sub&gt; + M&lt;sub&gt;f&lt;/sub&gt;)</td>
<td>0</td>
</tr>
<tr>
<td>Dividends</td>
<td>+Δ&lt;sub&gt;b&lt;/sub&gt;</td>
<td></td>
<td></td>
<td>0</td>
</tr>
<tr>
<td>Financial balances</td>
<td>S&lt;sub&gt;h&lt;/sub&gt;</td>
<td>S&lt;sub&gt;f&lt;/sub&gt;</td>
<td>-pI + pδK</td>
<td>S&lt;sub&gt;b&lt;/sub&gt;</td>
</tr>
<tr>
<td><strong>Flows of funds</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Change in capital stock</td>
<td>+Ṁ&lt;sub&gt;h&lt;/sub&gt;</td>
<td>+Ṁ&lt;sub&gt;f&lt;/sub&gt;</td>
<td>+p(I − δK)</td>
<td>+p(I − δK)</td>
</tr>
<tr>
<td>Change in deposits</td>
<td>+Ṁ&lt;sub&gt;h&lt;/sub&gt;</td>
<td>+Ṁ&lt;sub&gt;f&lt;/sub&gt;</td>
<td>-(Ṁ&lt;sub&gt;h&lt;/sub&gt; + Ṁ&lt;sub&gt;f&lt;/sub&gt;)</td>
<td>0</td>
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<tr>
<td>Change in loans</td>
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<td>-L̇&lt;sub&gt;f&lt;/sub&gt;</td>
<td>+(L̇&lt;sub&gt;h&lt;/sub&gt; + L̇&lt;sub&gt;f&lt;/sub&gt;)</td>
<td>0</td>
</tr>
<tr>
<td>Column sum</td>
<td>S&lt;sub&gt;h&lt;/sub&gt;</td>
<td>S&lt;sub&gt;f&lt;/sub&gt;</td>
<td>S&lt;sub&gt;b&lt;/sub&gt;</td>
<td>S&lt;sub&gt;b&lt;/sub&gt;</td>
</tr>
<tr>
<td>Change in net worth</td>
<td>Ẋ&lt;sub&gt;h&lt;/sub&gt; = S&lt;sub&gt;h&lt;/sub&gt;</td>
<td>Ẋ&lt;sub&gt;f&lt;/sub&gt; = S&lt;sub&gt;f&lt;/sub&gt; + pK</td>
<td>Ẋ&lt;sub&gt;b&lt;/sub&gt; = S&lt;sub&gt;b&lt;/sub&gt;</td>
<td>X = pK + pK</td>
</tr>
</tbody>
</table>

**Table:** SFC table for the dual Akerlof-Stiglitz (1969) model.
\( D_h := L_h - M_h \) and \( D_f := L_f - M_f \)
Assume \( \Delta_b = r(D_h + D_f) \) and \( C_b = 0 \).

\[ \Rightarrow S_b = 0, \text{ so we take } X_b = 0, \Rightarrow D_h = -D_f. \]

\[
\dot{D}_h = pC_h - w\ell + rD_h - r(D_h + D_f) \\
= pY - pI - w\ell - rD_f = -\dot{D}_f.
\]

“Deposits create loans”...
Dual Akerlof-Stiglitz (1969) model - Definitions

- \( \omega := \frac{W}{pY} \), \( d_h := \frac{D_h}{pY} \)

- Assume consumption \( C := c(\omega - rd)Y \)
  Disposable income \( (\omega - rd) \).

- \( I := Y - C \),

\[
\dot{K} = Y - C - \delta K = \left( \frac{1 - c(\omega - rd)}{\nu} - \delta \right) K
\]

where \( \nu := K/Y \) is a constant capital-to-output ratio.
Assume further a wage-price dynamics (short-run Phillips curve, Gordon (2012), Mankiw (2010), ECB...)

\[
\frac{\dot{w}}{w} = \Phi(\lambda) + \gamma \left( \frac{\dot{p}}{p} \right)
\]

\[
i(\omega) = \frac{\dot{p}}{p} = \eta_p (m\omega - 1),
\]

for a constant mark-up factor \( m \geq 1 \).

Imperfect competition on commodity market.
The model can now be described by the following system

\[ \dot{\omega} = \omega \left[ \Phi(\lambda) - \alpha - (1 - \gamma)i(\omega) \right] \]

\[ \dot{\lambda} = \lambda \left[ \frac{1 - c(\omega - rd_h)}{\nu} - (\alpha + \beta + \delta) \right] \]

\[ \dot{d}_h = d_h \left[ r - \frac{1 - c(\omega - rd_h)}{\nu} + \delta - i(\omega) \right] + c(\omega - rd_h) - \omega. \]
Analogously to the original Akerlof-Stiglitz (1969)/Goodwin (1967)/Van der Ploeg (1974) models, there is a good equilibrium characterized by

\[ \bar{\omega}_1 = \eta + r \left[ \frac{1 - \eta - \nu(\alpha + \beta + \delta)}{\alpha + \beta + i(\bar{\omega}_1)} \right]. \]

\[ \bar{\lambda}_1 = \Phi^{-1} (\alpha + (1 - \gamma) i(\bar{\omega}_1)). \]

\[ \bar{d}_1 = \frac{1 - \eta - \nu(\alpha + \beta + \delta)}{\alpha + \beta + i(\bar{\omega}_1)}, \]

where \( \eta_1 := c^{-1}(1 - \nu(\alpha + \beta + \delta)) \).

It also exhibits a bad equilibrium of the form \((0, 0, +\infty)\).

Both equilibria can be locally stable for some parameter values, but not at the same time.

There’s also an equilibrium of the form \((\bar{\omega}_3, 0, \bar{d}_{h3})\).
Example 1: convergence to the interior (good) equilibrium (phase space)

\[ \omega_0 = 0.75, \lambda_0 = 0.9, d_0 = 0.5, Y_0 = 100 \]

Figure: \( \nu = 3, \eta_p = 0.35, \gamma = 0.8 \)
Example 1: convergence to the interior equilibrium (time)

\[ \omega_0 = 0.75, \lambda_0 = 0.9, d_0 = 0.5, Y_0 = 100 \]
Example 2: business cycles (phase space)

Figure: $\nu = 3$, $\eta_p = 0.45$, $\gamma = 0.96$
Example 2: business cycles (time)

\( \omega_0 = 0.75, \lambda_0 = 0.9, d_0 = 0.5, Y_0 = 100 \)
Example 3: convergence to debt-deflationary equilibrium (phase)

\[ \omega_0 = 0.75, \lambda_0 = 0.7, d_0 = 0.5, Y_0 = 100 \]

Figure: \( \nu = 15, \eta_p = 0.35, \gamma = 0.8 \)
Workers versus investors - motivation

Distribution of U.S. Wealth, 2010

Source: “The Asset Price Meltdown and the Wealth of the Middle Class,” by Edward N. Wolff, NYU (November 2012)

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Two different classes of households, namely workers and investors, with wealth given by

\[
X_w = -D_w \\
X_i = E_f + E_b - D_i.
\]

Budget constraint that

\[
\dot{D}_w = pC_w - w\ell + rD_w \\
\dot{D}_i = pC_i - r_k pK - \Delta_b + rD_i.
\]

Finally, assume that consumption is of the form

\[
C_w = c_w(y_w) Y \text{ and } C_i = c_i(y_i) Y
\]

with

\[
\frac{\partial c_w}{\partial y_w}(\omega - r_d) > \frac{\partial c_i}{\partial y_i}(r_k\nu - r_d).
\]
## SFC table for the two-class Akerlof-Stiglitz (1969) model

<table>
<thead>
<tr>
<th></th>
<th>Workers</th>
<th>Investors</th>
<th>Firms</th>
<th>Banks</th>
<th>Sum</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Balance sheet</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Capital stock</td>
<td></td>
<td></td>
<td>+pK</td>
<td></td>
<td>pK</td>
</tr>
<tr>
<td>Deposits</td>
<td>+M_w</td>
<td>+M_i</td>
<td>+M_f</td>
<td>-(M_w + M_i + M_f)</td>
<td>0</td>
</tr>
<tr>
<td>Loans</td>
<td>-L_w</td>
<td>-L_i</td>
<td>-L_f</td>
<td>+(L_w + L_i + L_f)</td>
<td>0</td>
</tr>
<tr>
<td>Equities</td>
<td>+p^E</td>
<td></td>
<td>-p^E</td>
<td></td>
<td>0</td>
</tr>
<tr>
<td>Sum (Net worth)</td>
<td>X_w</td>
<td>X_i</td>
<td>X_f</td>
<td>X_b</td>
<td>X</td>
</tr>
<tr>
<td><strong>Transactions</strong></td>
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<td></td>
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<tr>
<td>Consumption</td>
<td>-pC_w</td>
<td>-pC_i</td>
<td>+pC</td>
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<td>-pC_b</td>
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<td>Investment</td>
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<td>+pI</td>
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<td>-pI</td>
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<td>-wℓ</td>
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<td>0</td>
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<td>Wages</td>
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<td>-pδK</td>
<td>+pδK</td>
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<td>Depreciation</td>
<td>-rL_w</td>
<td>-rL_i</td>
<td>-rL_f</td>
<td></td>
<td>+r(L_w + L_i + L_f)</td>
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<td>Interest on loans</td>
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<td></td>
<td>0</td>
</tr>
<tr>
<td>Interest on deposits</td>
<td>+rM_w</td>
<td>+rM_i</td>
<td>+rM_f</td>
<td></td>
<td>-r(M_w + M_i + M_f)</td>
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<td>Dividends</td>
<td></td>
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<td></td>
<td>-r_k pK</td>
<td>-Δ_b</td>
</tr>
<tr>
<td>Financial balances</td>
<td>S_w</td>
<td>S_i</td>
<td>S_f</td>
<td>-pI + pδK</td>
<td>S_b</td>
</tr>
<tr>
<td><strong>Flows of funds</strong></td>
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<tr>
<td>Change in capital stock</td>
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<td>+p(l - δK)</td>
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<td>p(l - δK)</td>
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<td>Change in deposits</td>
<td>+Ṁ_w</td>
<td>+Ṁ_i</td>
<td>+Ṁ_f</td>
<td>-(Ṁ_w + Ṁ_i + Ṁ_f)</td>
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<tr>
<td>Change in loans</td>
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<td>-L̇_i</td>
<td>-L̇_f</td>
<td>+(L̇_w + L̇_i + L̇_f)</td>
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<td>S_w</td>
<td>S_i</td>
<td>S_f</td>
<td>S_b</td>
<td>p(l - δK)</td>
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<tr>
<td>Change in net worth</td>
<td>X_w = S_w</td>
<td>X_i = S_i + p^E</td>
<td>X_f = S_f - p^E + pK</td>
<td>X_b = S_b</td>
<td>X = pK + pK</td>
</tr>
</tbody>
</table>

**Table:** SFC table for the workers and investors model.
Assume firms retain profits according to a constant retention rate $\Theta$, leading to an endogenous return on capital given by

$$r_k := r_k(\omega, d_w, d_i) = \frac{\Theta(pY - w\ell - rD_f - p\delta K)}{pK}$$

$$= \frac{\Theta}{\nu} (1 - \omega + r(d_w + d_i) - \delta \nu),$$

Savings by firms are endogenous

$$S_f = (1 - \Theta)(pY - w\ell - rD_f - p\delta K) = pY - w\ell - rD_f - p\delta K - r_k pK$$

Therefore, the amount to be raised externally by firms is

$$p(l - \delta K) - S_f = pl - pY + w\ell + rD_f + r_k pK$$

$$= (\omega - r(d_i + d_w) - c + r_k \nu) pY,$$

As in the Akerlof-Stiglitz (1969) model, this is raised solely through new loans from the banking sector.
The main dynamical system

- Aggregate consumption

\[ c(\cdot) \equiv c(w, d_w, d_i) = c_w(\omega - rd_w) + c_i(r_k \nu - rd_i), \]

- Dynamical system

\[
\begin{align*}
\dot{\omega} &= \omega \left[ \Phi(\lambda) - \alpha - (1 - \gamma)i(\omega) \right] \\
\dot{\lambda} &= \lambda \left[ \frac{1-c(\cdot)}{\nu} - (\alpha + \beta + \delta) \right] \\
\dot{d}_w &= d_w \left[ r + \delta - \frac{1-c(\cdot)}{\nu} - i(\omega) \right] + c_w(\omega - rd_w) - \omega \\
\dot{d}_i &= d_i \left[ r + \delta - \frac{1-c(\cdot)}{\nu} - i(\omega) \right] + c_i(r_k \nu - rd_i) - r_k \nu
\end{align*}
\]
With considerable more work, it is possible to show that the system exhibits a class of **good equilibria** of the form \((\overline{\omega}_1, \overline{\lambda}_1, \overline{d}_{w1}, \overline{d}_{i1})\) typically (but not always) satisfying \(\overline{d}_{w1} > 0\) and \(\overline{d}_{i1} < 0\).

In addition, the system admits a class of **bad equilibria** \((\overline{\omega}_2, \overline{\lambda}_2, \overline{d}_{w2}, \overline{d}_{i2}) = (0, 0, \pm\infty, \pm\infty)\)
Which are locally asymptotically stable only if \(r_k > g\).

Finally, it also exhibits **deflationary equilibria** of the form \((\overline{\omega}_3, 0, \overline{d}_{w3}, \overline{d}_{i3})\), where \(\overline{d}_{w3}\) and \(\overline{d}_{i3}\) can be either finite or infinite.
Example 4: convergence to the interior equilibrium (phase space)

\[ \omega_0 = 0.75, \lambda_0 = 0.9, \text{dw}_0 = 0.5, \text{di}_0 = 0.5, Y_0 = 100 \]
Example 4: convergence to the interior equilibrium (time)
Example 5: business cycles (phase space)

ω₀ = 0.75, λ₀ = 0.9, dw₀ = 0.5, di₀ = 0.5, Y₀ = 100
Example 5: business cycles (time)

\[ \omega_0 = 0.75, \lambda_0 = 0.9, d_0 = 0.5, d_{i0} = 0.5, Y_0 = 100 \]
Example 6: convergence to debt-deflationary equilibrium (phase)
Example 6: convergence to debt-deflationary equilibrium (time)

\[ \omega_0 = 0.75, \lambda_0 = 0.9, d_0 = 0.75, d_i_0 = -0.25, Y_0 = 100 \]
Long-run inequality

- Income shares of nominal output for workers, investors, and firms:

\[ y_w = \frac{Y^n_w}{pY} = \omega - rd_w \]
\[ y_i = \frac{Y^n_i}{pY} = r_k \nu - rd_i \]
\[ \pi_r = \frac{\Pi^n_r}{pY} = (1 - \Theta)(1 - \omega - rd_f - \delta \nu), \]

⇒ income share of capital

\[ y_c = y_i + \pi_r = 1 - \omega + rd_w - \delta \nu = 1 - y_w - \delta \nu. \]

- Easy to see: the growth rate of real income for all three sectors coincide at the interior equilibrium = \( \alpha + \beta \).
Inequality as a hallmark of inefficiency

- However, at each of the equilibria $(\bar{\omega}_2, \bar{\lambda}_2, \bar{d}_{w2}, \bar{d}_{i2}) = (0, 0, \pm\infty, \pm\infty)$ we observe divergence in income between workers and capitalists.
- For example, if $d_w \to +\infty$ and $d_i \to -\infty$, then $y_w \to -\infty$, $y_i \to +\infty$, $\pi_r \to -\infty$, whereas $y_c \to +\infty$.
- Similarly, whenever $d_w \to +\infty$, we have $x_w \to -\infty$ and $x_i \to +\infty$.
- At the deflationary equilibrium $(\bar{\omega}_3, 0, \bar{d}_{w3}, \bar{d}_{i3})$, the income shares are $r_k \nu - r\bar{d}_{i3}$ and $\bar{\omega}^3 - r\bar{d}_{w3}$.
- An artifact of the fact that prices are falling faster than real output $Y \to \bar{\lambda}_3 N/a = 0$.
- Real income of both populations collapse, so both types of households end up ruined!
Concluding remarks

- We provided a stock-flow consistent model for debt dynamics of workers and investors.
- When the economy converges to an equilibrium with finite debt ratios, the income ratio between the two classes is constant.
- Increasing income (and wealth) inequality is a signature of convergence to the bad equilibrium with infinite debt ratios.
- In future work we explore the effects of default, variable capacity utilization, substitutability between capital and labor, and of migration between classes à la Acemoglu (2014).
- THANK YOU!