Two Big Trends

- Global Corporate Saving / Total Saving (left axis)
- Global Corporate Labor Share (right axis)
Motivation

Corporate Saving / Total Saving (left axis)
Corporate Labor Share (right axis)
Related Literature


National Accounting and Data Sources

• System of National Accounts, starting with UN Report in 1947

• We use “Detailed National Accounts” with five sectors:
  1. $C = \{\text{Financial Corporations, Non-Financial Corporations}\}$
  2. $H = \{\text{Households, Non-Profits Serving Households}\}$
  3. $G = \{\text{Government}\}$

• Sources combined using various “smooth pasting” rules:
  • Internet: Country-specific (preferred source)
  • Electronic databases: OECD and UN
  • Printed materials: UN, OECD, and country-specific books

• We generally limit data to 1975-2007
% of Observations Not Available Digitally from UN/OECD

Share of Observations

Unweighted
Weighted by Corporate Saving

Unweighted
Weighted by Corporate Saving
Key National Accounting Concepts

GDP (Y)

<table>
<thead>
<tr>
<th>Corporate Gross Value Added (Q_C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Taxes on Products</td>
</tr>
<tr>
<td>Corporate Saving (S_C)</td>
</tr>
<tr>
<td>Dividends (d_C)</td>
</tr>
<tr>
<td>Other Payments to Capital (OPK_C)</td>
</tr>
<tr>
<td>Compensation of Labor (w_C n_C)</td>
</tr>
</tbody>
</table>

Government Gross Value Added (Q_G)

Household Gross Value Added (Q_H)

Corporate Gross Value Added (Q_C)
39 of 51 countries with $\geq$ 10 yrs of data have significant trend
29 of these 39 had a negative trend
Global Trends in Labor Share and PWT Investment Prices

- Cumulative Change (in Percentage Points)
- Cumulative Change (in Logs)

Year:
- 1947
- 1967
- 1987
- 2007

Lines:
- PWT Investment Price (left axis)
- EIU Investment Price (left axis)
- Corporate Labor Share (right axis)
Across-country (slope): 0.20 (p: 0.02)
Median Within-country: 0.26 (p: 0.01)
Robustness using EIU data: 0.14 and 0.19, but larger pvals
Same point holds in tax data
• 31 of 44 countries with ≥ 10 yrs of data have significant trend
• 22 of these 31 had a positive trend
Corporate Saving Rates and PWT Investment Prices

- Across-country (slope): -0.46 (p: 0.07)
- Median within-country: -0.49 (p: 0.01)
- Robustness using EIU data: -0.20 and -0.49, larger pvals
- Same point holds in tax data
Corroboration This is “Right” Shock

\[ \frac{S_C}{Y} = \frac{Q_C}{Y} \left( 1 - s_{L,C} - s_{K,C} \right) \left( 1 - \frac{d_C}{\Pi_C} \right) \]

• Other shocks (i.e. “markups”) can make \( s_L \uparrow \) and \( S_C/Y \downarrow \)
• Our simulation will get sign of all these terms correct
Summary of Empirics

1. Corporate Labor Share Fell 5 pp Globally

2. Corporate Saving Share Grew 20 pp Globally

3. Across (and Within) Country Trends in these Objects Covary with Trends in Investment Prices

Next, we use this information to build and calibrate a model and:
- Reproduce motivating facts with a decline in investment prices
- Compare model’s behavior to those that don’t use this info
Model Setup

- General equilibrium, perfect foresight model
- A single homogenous good is used for consumption and investment in both housing and business capital stocks
- Representative household works, consumes, and invests in housing. Owns the corporate sector.
- A unit mass of firms, indexed by productivity $z$, invest in corporate capital, produce, and choose debt, equity, and dividends (no debt today)
- Government exogenously taxes (no spending/debt today)
Basic Idea

- Corporate investment is funded out of three sources: corporate saving, debt, and equity.

- Corporate saving preferred due to capital market imperfections:
  - Minimum-dividend constraints
  - Equity flotation costs
  - Equity buyback constraints
  - Collateral constraint on debt

- These capital market imperfections imply “composition non-neutrality of saving” (CNNS).

- Degree to which CNNS matters is function of investment, which increases with the elasticity of substitution of K/L.
Household Problem

- Representative household owns the corporate sector: \( \theta_t(z) = 1 \)

- Household chooses \( \{c_t, n_t, x_t^h, k_t^h, \theta_{t+1}(z)\} \) to solve:

\[
\max \sum_{t=0}^{\infty} \beta^t \left( \frac{(c_t)^{1-\gamma}}{1-\gamma} - \chi \frac{n_t^{1+\frac{1}{\phi}}}{1+\frac{1}{\phi}} + \nu \frac{(k_t^h)^{1-\rho}}{1-\rho} \right)
\]

subject to standard housing capital accumulation.
Household Budget Constraint (No Debt)

Household funds come from the following sources:

1. Labor income: \( w_t n_t (1 - \tau_t^n) \)
2. Lump sum transfers: \( T_t \)
3. Dividends: \( \theta_t d_t (1 - \tau_t^d) \)
4. Previous purchased equity: \( \theta_t (p_t - e_t) - \tau_t^g \theta_t (p_t - e_t - p_{t-1}) \)

Household funds go to the following uses:

1. Consumption: \( c_t \)
2. Housing Investment: \( x_t^h \)
3. New equity: \( \theta_{t+1} p_t \)
Household Budget Constraint

\[ c_t + x_t^h + \int \theta_{t+1}(z)p_t(z)\pi(z)dz + \int b_{t+1}^c(z)\pi(z)dz = \]
\[ w_t n_t(1 - \tau_t^n) + T_t + \tau_t^k \delta^h k_t^h \]
\[ + \int \theta_t(z)d_t(z)(1 - \tau_t^d)\pi(z)dz \]
\[ + \int \theta_t(z)(p_t(z) - e_t(z))\pi(z)dz \]
\[ - \int \theta_t(z)\tau_t^g (p_t(z) - p_{t-1}(z) - e_t(z))\pi(z)dz \]
\[ + \int b_t^c(z)(1 + r_t(1 - \tau_t^k))\pi(z)dz. \]
Corporation’s Technology

• Firm uses its own capital and labor to produce the final good:

\[ Q_t = A_t z \left( \alpha_k^{\frac{\sigma-1}{\kappa \sigma}} (k_t^c)^{\frac{\sigma-1}{\sigma}} + \alpha_n^{\frac{\sigma-1}{\kappa \sigma}} (n_t)^{\frac{\sigma-1}{\sigma}} \right)^{\frac{\kappa \sigma}{\sigma-1}} \]

• Calibrate \((\sigma, \alpha_k)\) to match \(s_L\) and \(ds_L/d\ln\xi^c\) in cross-section. Cobb-Douglas by definition ignores info on \(ds_L\).

• Corporate capital accumulation:

\[ k_{t+1}^c = (1 - \delta^c) k_t^c + \frac{\chi_t^c}{\xi_t^c} \]

• Lower \(\xi^c\) represents a decline in relative price of investment
Corporate Saving is Interesting: Feldstein-Horioka

Average Corporate Investment / GDP

Average Corporate Saving / GDP
Corporation’s Problem

- Corporation chooses \( \{ n_t, x^C_t, k^C_{t+1}, d_t, e_t \} \) to maximize:

\[
V_t = \max \sum_{s=t}^{\infty} \beta_s^C \left( \left( \frac{1 - \tau^d_s}{1 - \tau^g_s} \right) d_s - e_s \right),
\]

- Financing decisions are subject to constraints:

\[
x^C_t = (\Pi_t(\lambda) - d_t) + e_t = S^C_t + e_t \implies S^C_t = x^C_t + (-e_t)
\]

\[
d_t \geq 0
\]

\[
e_t \geq - (e^0 + e^1 k^C_t)
\]

- Calibrate \((e^0, e^1)\) to match \(S^c/S\) and \(d(S^c/S)/d \log \xi^c\) in the cross section. With perfect cap mkts, \(S^c\) is uninformative.
Simplified Corporate Policies: A Pecking Order

\[ Q_{k,t+1} = (1 + r_{t+1}) \left( \frac{1 - \tau^d + \mu_t^d}{1 - \tau^d + \mu_{t+1}^d} \right) - (1 - \delta^c) \]
• Corporate investment funded internally (corporate saving) or externally (debt and equity).

• Corporate saving preferred because of equity flotation costs and debt collateral constraints.

• Corporate saving (profits minus dividends) cannot increase without limits due to minimum-dividend constraints.

• Equity buybacks preferred to dividends because of higher dividend taxes. But there are equity buyback constraints.

• Capital market imperfections imply “composition non-neutrality of saving.”
Perfect Capital Markets

- Household is now subject to constraint:

\[ c_t + x_t^h = \text{wages} + \text{taxes and transfers} + R, \]

where \( R \) indicates a frictionless transfer from corporations.

- Each corporation is now subject to:

\[ x_t^c = \text{output} - \text{taxes} - R. \]

- Corporate saving with perfect capital markets is undefined/indeterminate and \textit{by definition} ignores \( dS_c/d\ln\xi^c \).

- Our model exhibits composition non-neutrality of saving iff its user cost differs from that with perfect capital markets.
Composition Non-neutrality of Saving (CNNS)

- **Definition:** Our model exhibits CNNS iff its allocations differ from those in the benchmark neoclassical model

\[ u^P_{t+1} = \xi^c_t \left( 1 + (1 - \tau^k) r_{t+1} \right) \left( 1 + \psi^c_{1,t} \right) - \xi^c_{t+1} \left( 1 - \left( 1 - \frac{\tau^c}{\xi^c_{t+1}} \right) \delta^c - \psi^c_{2,t+1} \right) \]

\[ u^I_{t+1} = \xi^c_t \left( 1 + \left( \frac{1 - \tau^k}{1 - \tau^g} \right) r_{t+1} \right) \left( \frac{1 - \tau^d}{1 - \tau^g + \mu^d_{t+1}} \right) \left( 1 + \psi^c_{1,t} - \eta \mu^b_t \right) - \xi^c_{t+1} \left( 1 - \left( 1 - \frac{\tau^c}{\xi^c_{t+1}} \right) \delta^c - \psi^c_{2,t+1} \right) - \frac{\mu^e_{t+1} e_1}{1 - \tau^d + \mu^d_{t+1}} \]

- CNNS (or user-cost differences) emerge when:
  1. \( \tau^g_t > 0 \)
  2. \( \mu^b_t > 0 \)
  3. \( \mu^d_t \neq \mu^d_{t+1} \)
  4. \( e_1 \neq 0 \) and \( \mu^e_{t+1} > 0 \)
Calibration

Key parameters to calibrate:

- Production function: $\alpha_k$ and $\sigma$
- Capital market imperfections: $e^0$ and $e^1$

Moments to match:

1. Corporate labor share
   - Level $s_L = 0.614$
   - Slope $ds_L/d \log \xi^c = 0.207$

2. Corporate saving / total saving
   - Level $S^c/\Pi = 0.721$ (or $d/\Pi$)
   - Slope $d(S^c/S)/d \log \xi^c = -0.460$
Calibration

- Log for consumption and housing.
- Unitary Frisch elasticity.
- Tax rates GDP-weighted from OECD
- Technologies: \( \{ z_H = 1.09, \pi_H = 0.2 \} \) and \( \{ z_L = 0.98, \pi_L = 0.8 \} \) to match cdf of market shares
Calibration

- Discount factor $\beta = 0.9723$ to match $r = 4.5\%$
- DRS $\kappa = 0.961$, adjust costs from Gourio and Miao (2010)
- Housing preference $\nu$ to match steady state $x^h/c$
- Depreciation $\delta^h = \delta^c = 0.06$ to match $S/Y$ equal to 22.5%
- Flotation costs $\lambda = 0.972$ from Gomes (2001) and collateral parameter $\eta = 0.2548$ to match U.S. debt/investment ratio
Steady State Results

<table>
<thead>
<tr>
<th>Statistic</th>
<th>Steady State Value</th>
<th>Relative to Benchmark</th>
</tr>
</thead>
<tbody>
<tr>
<td>(i) Total Saving / GDP</td>
<td>0.230</td>
<td>0.872</td>
</tr>
<tr>
<td>(ii) Corporate Investment / Total Investment</td>
<td>0.660</td>
<td>0.921</td>
</tr>
<tr>
<td>(iii) Corporate Saving / Total Saving</td>
<td>0.798</td>
<td>–</td>
</tr>
<tr>
<td>(iv) Dividends / Profits</td>
<td>0.279</td>
<td>–</td>
</tr>
<tr>
<td>(v) Corporate Labor Share</td>
<td>0.614</td>
<td>1.038</td>
</tr>
<tr>
<td>(vi) Household Capital / Corporate Capital</td>
<td>0.516</td>
<td>1.302</td>
</tr>
<tr>
<td>(vii) User Cost of Capital</td>
<td>0.072</td>
<td>1.166</td>
</tr>
</tbody>
</table>
Response to a Negative Investment Price Shock

- We shock $\xi^c$ from 1 to 0.79 as in PWT and study steady state to steady state changes.

- Capital market imperfections matter more with high desired investment, which depends on $\sigma$.

- We quantify this interaction by comparing:
  1. Cobb-Douglas with perfect capital markets
  2. Cobb-Douglas with CNNS
  3. CES with perfect capital markets
  4. Our model (CES with CNNS)

(1) ignores both of our key motivating facts, (2) and (3) add them individually, and (4) incorporates both.
## Response to a Negative Investment Price ($\xi^c$) Shock

<table>
<thead>
<tr>
<th>Production:</th>
<th>CD No</th>
<th>CD Yes</th>
<th>CES No</th>
<th>CES Yes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capital Markets Imperfections:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(i) $\Delta$ Corporate Labor Share</td>
<td>0.000</td>
<td>0.000</td>
<td>-0.058</td>
<td>-0.053</td>
</tr>
<tr>
<td>(ii) $\Delta$ Corporate / Total Saving</td>
<td>-</td>
<td>0.072</td>
<td>-</td>
<td>0.118</td>
</tr>
<tr>
<td>(iii) $\Delta$ Corporate Saving / GDP</td>
<td>-</td>
<td>0.031</td>
<td>-</td>
<td>0.064</td>
</tr>
<tr>
<td>(iv) $\Delta$ Corporate / Total Investment</td>
<td>0.031</td>
<td>0.029</td>
<td>0.065</td>
<td>0.066</td>
</tr>
<tr>
<td>(v) $\Delta$ Corporate Investment / GDP</td>
<td>0.023</td>
<td>0.018</td>
<td>0.058</td>
<td>0.044</td>
</tr>
<tr>
<td>(vi) $\Delta$ log GDP</td>
<td>0.202</td>
<td>0.194</td>
<td>0.317</td>
<td>0.272</td>
</tr>
<tr>
<td>(vii) $\Delta$ log $c$</td>
<td>0.174</td>
<td>0.173</td>
<td>0.242</td>
<td>0.219</td>
</tr>
<tr>
<td>(viii) Welfare Equivalent Consumption</td>
<td>0.204</td>
<td>0.205</td>
<td>0.321</td>
<td>0.290</td>
</tr>
</tbody>
</table>
Informativeness of Corporate Saving

\[ X = \frac{d (S_c)}{d (\log \xi_c)} \]

\[ d \log \text{GDP} (X) - d \log \text{GDP} (X = -0.46) \]

- \( d (s_L) / d (\log \xi_c) = 0.000 \)
- \( d (s_L) / d (\log \xi_c) = 0.104 \)
- \( d (s_L) / d (\log \xi_c) = 0.207 \)
- \( d (s_L) / d (\log \xi_c) = 0.414 \)
Can Model Reproduce Empirical Patterns?

- Increase in saving / GDP is counterfactual (Model A)
- Want to highlight role of change in composition of saving
- **Model B**: $\xi^c$ shock and stabilize $S$/GDP by $\downarrow \delta^h$
- **Model C**: $\xi^c$ shock and stabilize $S$/GDP by $\downarrow \beta$
  - we also $\downarrow \tau^k$ to keep the real interest rate $r$ constant
- **Model D**: introduce more shocks from the data
  - except for $\xi^c$, also feed $\tau^c$, $\tau^d$, and $\tau^g$ decreases from data
  - stabilize $S$/GDP and $r$ by $\downarrow \beta$ and $\downarrow \tau^k$
Reproducing Empirical Patterns: Results

<table>
<thead>
<tr>
<th>Δ Variable</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corporate Labor Share</td>
<td>-0.053</td>
<td>-0.053</td>
<td>-0.033</td>
<td>-0.044</td>
<td>-0.081</td>
</tr>
<tr>
<td>Corporate / Total Saving</td>
<td>0.118</td>
<td>0.238</td>
<td>0.114</td>
<td>0.215</td>
<td>0.161</td>
</tr>
<tr>
<td>Corporate Saving / GDP</td>
<td>0.064</td>
<td>0.055</td>
<td>0.026</td>
<td>0.050</td>
<td>0.039</td>
</tr>
<tr>
<td>Corporate / Total Invest</td>
<td>0.066</td>
<td>0.161</td>
<td>0.062</td>
<td>0.146</td>
<td>0.091</td>
</tr>
<tr>
<td>Corporate Invest / GDP</td>
<td>0.044</td>
<td>0.037</td>
<td>0.014</td>
<td>0.034</td>
<td>0.025</td>
</tr>
<tr>
<td>Total Saving / GDP</td>
<td>0.040</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>≈ 0</td>
</tr>
</tbody>
</table>
20% Positive A Shock (Unexpected and Permanent)
1 PP Negative $\beta$ Shock (Unexpected and Permanent)
Intuition

- Define ratio of user costs (imperfect/perfect capital markets):

\[ u_R = \frac{u_I}{u_P} > 1 \]

- The differential growth of the capital-labor ratio is:

\[
\frac{d \left( \frac{k_c^I}{n_I} \right)}{d \left( \frac{k_c^P}{n_P} \right)} = \left( 1 - \frac{u_R^{-1} - 1}{s_{L,I}} \right) \left[ 1 - \frac{1}{s_{L,P}} \left( \frac{\sigma \left( du_R / u_R \right)}{d \left( \frac{k_c^P}{n_P} \right) / \left( k_c^P / n_P \right)} \right) \right]
\]

- First term captures interaction with level of imperfections
- Second term captures interaction with growth of imperfections
Conclusion and Next Steps

- Striking global trends from 1975: labor share ↓, corp saving ↑
- Trends driven in part by decline in cost of capital. Model calibrated to cross-section, matches large part of global time-series
- Two facts informative for response of economy of various shocks

Related projects / Next Steps
- Current Account Imbalances: A Multi-Sector Perspective
- Declining Labor’s Share and the Global Rise in Inequality