Aggregate Tobin’s Q and Inequality: The Role of Capital Taxation and Rents

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Outline of the presentation

Introduction

Facts

Literature

The Model

Calibration and Results

Conclusions
Piketty (2014)’s two empirical findings:
- Capital Output Ratio is rising $\beta = \frac{K}{Y} \uparrow$
- Capital’s Share of Output is rising: $\alpha = r\beta \uparrow$

At that time, the debate was very focused on the value of $\sigma$. Is $\sigma > 1$? or $\sigma < 1$?

The evidence that wealth-income ratios were driven mostly by an asset price recovery (Piketty and Zucman 2014) received less attention.
- other alternative theories also emphasized this: financialization literature, Rowthorn (2014), etc.

We focus here on equity Tobin’s $Q=W/K$ and the divergence between stock aggregates: $\frac{W}{Y} \uparrow$ and $\frac{K}{Y} \downarrow$
Our contribution

- Tobin’s Q has increased during the period in which inequality has rocketed and investment has slow down.
  - We can't simply assume that $q = 1$ and use $F = (W, L) = F(qK, L)$.
  - In fact, and perhaps more interestingly, changes in the valuation $q$ have crowded out capital formation $K$.

- Aggregate Tobin’s Q reflects the role of pro-capital policies that have real effects on aggregate outcomes.
  - Potential candidates: capital taxation and rents.

- Heterogeneous agents framework to explain evolution of Tobin’s Q and its macro effects on equity wealth, investment, equity returns, impact on inequality/welfare.
Equity Tobin’s Q

\[ Q = \frac{E}{K + (E - W)} \]

Year | Tobin Q
---|---
1950 | 0.2
1960 | 0.4
1970 | 0.6
1980 | 0.8
1990 | 1.0
2000 | 1.2
2010 | 1.4

decomposition
Figure: Financial Wealth decomposition. $Q = \frac{E}{K + FA - NEL}$
Wealth and Capital Ratios

Figure: Equity-Wealth-Output and Corporate-Capital-Output ratios
**Figure: Corporate Investment**

[Image of corporate investment ratios from 1950 to 2010, showing trends in gross and net investment relative to output and capital.]

- **Gross Investment / Output**
- **Net Investment / Output**
- **Net Investment / Capital**

The figures illustrate the historical trends in corporate investment ratios, indicating periods of growth and decline.
Secular Aggregate Movements: A Hypothesis

Figure: Capital Market

Pre-1980 equilibrium:
W<K and Q<1

Post-2000 equilibrium:
W=K and Q=1
Equity Returns adjusted for Inflation, Taxes and Portfolio Costs. 1960-2012
Tobin’s $Q$ and Inequality

- We build a model where changes in asset prices can occur at the expense of corporate investment.

  - Asset prices and Tobin’s $Q$ drivers:
    - Capital Taxation
    - Monopoly Rents

  - Investment is low due to high Tobin’s $Q$, not despite high Tobin’s $Q$ (conceptual difference with respect to traditional $Q$ theory and recent papers like Gutierrez and Philippon (2017))

- We believe that there are good reasons to study monopoly power in an heterogeneous agents setting.
Literature

- On asset prices and capital taxation:
  - Sialm (2009): negative relation between taxes on equity and aggregate stock valuations

- On the desired level of capital in an incomplete markets economy.
  - Davila et al. (2012): The U.S. economy has too little capital because a large proportion of the population relies mainly on labor income

- Monopoly power and its implications.
  - Barkai (2016)
  - De Loecker and Eeckhout (2017)
The Model

Environment

- A financial economy with **one tradable asset** (stocks) that capitalizes conventional and pure profits.
  - No distinction between “capital share” vs “pure profit share”. We believe this is important for realistic tax policy

Households:

- Make consumption/savings decisions under uncertain income
- Save in stocks (actually, a composite of stocks, i.e., a portfolio).
- Pay taxes on dividends and capital gains

Firms

- Monopolistic Competition
- Own physical capital, invest using retained earnings and distribute dividends
- Make investment decisions to maximize shareholder value
- Pay corporate taxes

Taxes and monopoly rents

- create a wedge between the market value of firms and the replacement cost of physical capital (Tobin’s $Q \neq 1$)
The Household Problem

Preferences

\[ \max U(c_i) = \mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t u(c_{it}) \quad \text{where} \quad c_{it} = \left( \sum_{j=1}^{n} (c_{jit})^{\frac{\xi-1}{\xi}} \right)^{\frac{\xi}{\xi-1}} \]

Budget Constraint

\[ \sum_{j=1}^{n} p_{jt} c_{jit} + \sum_{j=1}^{n} v_{jt} s_{jit+1} = w_t \epsilon_{it} + \sum_{j=1}^{n} \left( v_{jt} + (1 - \tau_d) d_{jt} - \tau_g (v_{jt} - \frac{p_{jt}}{P_{t-1}} v_{jt-1}) \right) s_{jit} \]

\[ \frac{\epsilon_{it} + \sum_{j=1}^{n} \left( v_{jt} + (1 - \tau_d) d_{jt} - \tau_g (v_{jt} - \frac{p_{jt}}{P_{t-1}} v_{jt-1}) \right) s_{jit}}{1 + \kappa} \]

Euler Equation

\[ \frac{u'(c_{it})}{\mathbb{E}_t[\beta u'(c_{it+1})]} = \frac{v_{jt+1} + (1 - \tau_d) d_{jt+1} - \tau_g (v_{jt+1} - \frac{p_{jt+1}}{P_{t+1}} v_{jt})}{v_{jt}} \times \frac{P_t}{P_{t+1}} \frac{1}{1 + \kappa} = 1 + r_{jt+1} \]

Imposing no bubble condition, the real price of firm’s j is:

\[ \frac{v_{jt}}{P_t} = \frac{1 - \tau_d}{1 - \tau_g} \sum_{k=1}^{\infty} \frac{d_{jt+k}}{P_{t+k} \prod_{l=1}^{k} (1 + \tilde{r}_{t+l})} \quad \text{where} \quad \tilde{r} \approx \frac{r + \kappa}{1 - \tau_g} \]
The Firm’s problem

Capital is accumulated according to the standard equation:

\[ K_{jt+1} = (1 - \delta)K_{jt} + i_{jt} \quad \text{where} \quad i_{jt} = \left( \int_0^1 \frac{\xi - 1}{\xi} \frac{1}{i_{jht}} \, dh \right)^{\frac{\xi}{\xi - 1}} \]

Total demand for product \( j \) is the sum of the consumption demand and the investment demand for that product:

\[ y_j = \int_0^1 c_{ijt} \Phi_{t-1}(s, e) \, d\xi + \int_0^1 i_{hjt} \, dh = \left( \frac{p_{jt}}{P_t} \right)^{-\xi} (C_t + I_t) = \left( \frac{p_{jt}}{P_t} \right)^{-\xi} F(K_t, L_t) \]

The firm’s financing constraint:

\[ d_{jt} + P_t i_{jt} + w_t L_{jt} - \tau_c (p_{jt} F(K_{jt}, L_{jt}) - w_t L_{jt} - \delta K_{jt}) = p_{jt} F(K_{jt}, L_{jt}) \]
Firm’s Capital

Using constant returns to scale assumption and the ”no-bubble condition”:

\[ K_{jt+1} = \sum_{k=1}^{\infty} \left( \frac{d_{jt+k}}{P_{t+k} \prod_{l=1}^{k} (1 + \tilde{r}_{t+l})} - \frac{1}{\xi} \frac{(1 - \tau_c) p_{jt+k} F(K_{jt+k}, L_{jt+k})}{P_{t+k} \prod_{l=1}^{k} (1 + \tilde{r}_{t+l})} \right) \]
Tobin’s $Q$

The Tobin’s $Q$ is the ratio between the financial valuation of the firm $\frac{v_{jt}}{P_t}$ and the value of its capital stock $K_{jt+1}$:

$$Q_{jt} = \frac{v_{jt}}{P_t K_{jt+1}} = \frac{1 - \tau_d}{1 - \tau_g} \left( 1 + \frac{1}{\xi} \frac{1 - \tau_c}{K_{jt+1}} \sum_{k=1}^{\infty} \frac{p_{jt+k} F(K_{jt+k}, L_{jt+k})}{P_{t+k} \prod_{l=1}^{k} (1 + \tilde{r}_{t+l})} \right)$$

In the steady state with symmetric equilibrium: $K_j = K$; $p_j = P$; $v_j = v$; $d_j = d$), Tobin’s $Q$ is:

$$Q(r, K) = \frac{1 - \tau_d}{1 - \tau_g} \left( 1 + \frac{1}{\xi} \frac{1 - \tau_c}{K} F(K, L) \left( \frac{1 - \tau_g}{r + \kappa} \right) \right)$$
Comparative Statics

- A decrease in $\tau_d$ increases $Q$
- A decrease in $\tau_g$ decreases $Q$
- A decrease in $\xi$ (increase in markup) increases $Q$
- If markets are competitive (i.e. $\xi = \infty$) neither $\tau_c$ nor $\kappa$ affect $Q$ in equilibrium. Under monopolistic competition:
  - A decrease in $\tau_c$ increases $Q$
  - A decrease in $\kappa$ increases $Q$
Effective Corporate Tax Rate

Figure: Decrease in $\tau_c$, 1960-2012
Dividend and Capital Gains Taxes

**Figure:** Decrease in $\tau_d$ and $\tau_g$, 1960-2012
**Portfolio Costs**

*Figure: Decrease in $\kappa$, 1980-2012*
**Steady States**

**Figure:** Capital Market Equilibria in the 1970-1980 and the 2000-2010

1970-1980

2000-2010
## Results

### Table: Data vs Model

<table>
<thead>
<tr>
<th>Variable</th>
<th>Data 1970-1980</th>
<th>Model SS1</th>
<th>Data 2000-2010</th>
<th>Model SS2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dividend Tax Rate $\tau_d$</td>
<td>40.13%</td>
<td>40.13%</td>
<td>10.95%</td>
<td>10.95%</td>
</tr>
<tr>
<td>Capital Gains Tax $\tau_g$</td>
<td>18.91%</td>
<td>18.91%</td>
<td>10.09%</td>
<td>10.09%</td>
</tr>
<tr>
<td>Corporate Tax $\tau_c$</td>
<td>35.38%</td>
<td>35.38%</td>
<td>23.28%</td>
<td>23.28%</td>
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<tr>
<td>Portfolio Cost $\kappa$</td>
<td>2.26%</td>
<td>2.26%</td>
<td>0.99%</td>
<td>0.99%</td>
</tr>
<tr>
<td>Labor Tax $\tau_l$</td>
<td>-</td>
<td>30.71%</td>
<td>-</td>
<td>34.57%</td>
</tr>
<tr>
<td>Markup $\frac{\xi}{\xi-1}$</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>1.10</td>
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<tr>
<td>Equity-Output Ratio $\frac{E}{Y}$</td>
<td>0.99</td>
<td>1.01</td>
<td>2.12</td>
<td>2.03</td>
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<tr>
<td>Capital-Output Ratio $\frac{K}{Y}$</td>
<td>2.29</td>
<td>2.29</td>
<td>2.11</td>
<td>2.01</td>
</tr>
<tr>
<td>Tobin’s $Q = \frac{E}{K}$</td>
<td>0.44</td>
<td>0.44</td>
<td>1.01</td>
<td>1.01</td>
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<tr>
<td>Equity Return $r$</td>
<td>1.91%</td>
<td>1.87%</td>
<td>5.01%</td>
<td>6.14%</td>
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<tr>
<td>Labor Share $\frac{wL}{Y}$</td>
<td>64.27</td>
<td>66.18</td>
<td>61.39</td>
<td>58.52</td>
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<tr>
<td>Dividend-Output Ratio $\frac{d}{Y}$</td>
<td>7.13</td>
<td>4.21</td>
<td>8.06</td>
<td>14.60</td>
</tr>
</tbody>
</table>
Results

Figure: Decomposition Analysis

Share of total percentage change

- Share of total change

K/Y E/Y Q return Lshare d/Y
-0.5
0
0.5
1
1.5
2
Share of total change
Figure: Welfare Gain/Loss per Asset Holdings and Productivity
Conclusions

• Changes Q have
  • a direct effect on wealth
  • an indirect effect on investment, factor prices, factor shares and welfare.
  • at a global scale, González and Trivín (2016)

• Post-1980 drivers of Q: capital taxation and rents. Other drivers?

• Capital income taxation that lowers Q has a positive effect on capital formation and equality. This is the case of dividend income taxation or corporate taxation in interaction with monopoly markups
  • Implications for optimal tax policy. Brun, González and Rojas, forthcoming (2018)
Thanks!
Dividend Tax

An increase in $\tau_d$ reduces the Tobin’s Q
An increase in monopoly power increases the Tobin’s Q and reduces capital demand.
Capital Gains Tax

Figure: $\tau_g = 20\%$

$\tau_g$ reduces capital demand and increases the Tobin’s Q.
Portfolio Costs

Figure: $\kappa = 0.5\%$

Under perfect competition, $\kappa$ reduces capital demand but does not affect the Tobin’s Q.
Under monopolistic competition, $\kappa$ reduces capital and the Tobin’s Q.
Corporate Tax

Figure: $\tau_c = 20\%$

Under perfect competition, $\tau_c$ reduces capital demand but does not affect the Tobin’s $Q$.
Under monopolistic competition, $\tau_c$ reduces capital and the Tobin’s $Q$. 
Figure: Capital - Chained dollars

![Graph showing the ratio of capital to output over time. The x-axis represents years from 1960 to 2010, and the y-axis represents the ratio on a logarithmic scale. The graph includes data points for the years 1960, 1970, 1980, 1990, 2000, and 2010, with values ranging from -0.06 to 0.1. The trend shows a general decrease in the ratio over time.]
Figure: Corporate Investment
Figure: Corporate Profits

![Graph showing corporate profits over time for different categories: All Corp: Before Tax, All Corp: After Tax, Non-financial: Before Tax, Non-financial: After Tax. The graph includes data points for years 1950 to 2010.]
Figure: Returns adjustment