Profit vs Wage Led Growth:
Models, Empirics and Possibilities

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The relation between (functional) income distribution and growth is one of the key topics of various heterodox research programs (Post-Keynesian and Marxian, mostly). In this lecture, we want to:

1. Use a benchmark model to understand the relationship between functional income distribution and growth
2. Understand the empirical literature around this issue, and
3. Suggest some interesting avenues for future research
From the outset, I want to recognize that we lack a (consensual) normative framework from which to evaluate the consequences of, say, the observation that an increase in the wage share decreases growth:

1. Growth may be one of the many objectives which macroeconomists, policy circles, and civil society pursue.
2. Unlike neoclassical economists, we don’t have something like Pareto optimality to evaluate even within a single model this normative issue.
3. This is an obvious but overlooked point. See Skott (2017) for a discussion.
Models
Mainstream models I

Neoclassical models with varying production functions have seen a revival to explain the recent evidence...

1. In the standard Solow-Swan model with Cobb-Douglas technology, recall that the profit share equals $\alpha$, the output-capital elasticity. This is an exogenous parameter which reflects solely technology (no endowments or preferences).

2. In versions with more general (i.e., CES) technology, the profit share depends on the elasticity of substitution, the form of technical progress, and initial endowments of capital against labor.

Note that Piketty’s (2015) explanation for long-run movements in the capital-share and capital-output ratio rests on a CES production technology with an elasticity of substitution bigger than 1.
Endogenous growth models have usually paid much less attention to the distribution of income

1. In many variations of the AK growth model, the capital share is (asymptotically) 1(!). Usually, two-sector models must be introduced to achieve a stable long-run capital share (see Acemoglu (2009), ch. 11)

2. Other models of endogenous growth center on personal income inequality, which is not of our interest here. A good survey (but slightly date) is Aghion et. al (1999).

So there is some interesting mainstream work out there which is word reading!
To fix ideas and start the discussion - and also because it has become the workhorse model of heterodox economics - we introduce a baseline Kaleckian model. Good Textbook treatments are in Lavoie (2014) and Hein (2014). Assumptions:

1. Closed economy, no government sector.
2. Fixed coefficient production function.
3. No technical progress.
4. Two social classes: Capitalists which save a fraction of their income, and Workers which do not save at all.
5. There is an infinite supply of labor (or industrial reserve army). This leaves unemployment indeterminate; the wage rate is assumed exogenous.
6. The profit share is exogenous - or determined by a mark-up which is exogenous.
The main equations relate investment, savings and the profit rate. Recall also that a fixed-coefficient production function guarantees that the growth rate of capital and output share are equal up to a multiplicative constant.

\[ \frac{I_t}{K_t} = \gamma + \gamma_u u_t \]  

(1)

\[ \frac{S_t}{K_t} = s_{\pi} r \]  

(2)

\[ r_t = \frac{\pi u_t}{\nu} \]  

(3)

Where \( I, S, K, r, \pi, u, \nu \) stand for Investment, Savings, Capital, the profit rate, the profit share, capital utilization and the capital-output ratio, respectively.
Substituting the profit rate into the savings function, goods market equilibrium (investment equals savings) allows us to obtain the equilibrium capacity utilisation and accumulation rate:

\[ u^* = \frac{\nu \gamma}{s \pi \pi - \gamma_u \nu} \]  

\[ \left( \frac{I}{K} \right)^* = g^* = \frac{s \pi \pi \gamma}{s \pi \pi - \gamma_u \nu} \]

Given we assume that the profit share is an exogenous parameter, it’s easy to show that an increase in the profit share leads to a decrease in both the accumulation rate and the capacity utilization rate.
Models
A Kaleckian Benchmark IV - Important points

A few things that emerge from the model that have been ignored by the empirical literature:

1. The effect of distribution is on growth rates and capacity utilization, not on output!

2. Note that the relationship is non-linear, even in this simple model. So we can interpret a linear regression as a linearised version around the steady state.
So far, our Kaleckian model predicts that a higher wage share should induce higher accumulation and utilisation. However, let’s restate the model with an extended investment function:

\[
\frac{I_t}{K_t} = \gamma + \gamma_u u_t + \gamma \pi \pi
\]  

(6)

\[
\frac{S_t}{K_t} = s_{\pi} r
\]  

(7)

\[r_t = \frac{\pi u_t}{v}\]  

(8)

This modification can be appealed on the basis of cash-flow concerns (Fazzari et. al, 1987) or by appealing to the classical tradition.
In this modified model, equilibrium utilization and accumulation are:

\[
\begin{align*}
    u^* &= \frac{v \gamma + \gamma_\pi \pi v}{s_\pi \pi - \gamma_u v} \\
    g^* &= \frac{s_\pi \pi (\gamma + \gamma_\pi \pi)}{s_\pi \pi - \gamma_u v}
\end{align*}
\]  (9)

Now, the effect of an increase in the profit share on both utilisation and growth depends on the relative sizes of the investment effect (\(\gamma_\pi\)) and the savings effect (\(s_\pi\)). If the effect is positive, we call the model **profit-led**, if its negative, we call it **wage-led**.
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During the 19th century, capital income (rent, profits, dividends, interest,..) absorbed about 40% of national income, vs. 60% for labor income (salaried and non salaried). Sources and series: see piketty.pse.ens.fr/capital21c.
In the 21st century, capital income (rent, profits, dividends, interest,...) absorbs about 30% of national income, vs. 70% for labor income (salaried and non salaried). Sources and series: see piketty.pse.ens.fr/capital21c.
Figure 6.5. The capital share in rich countries, 1975-2010

Capital income absorbs between 15% and 25% of national income in rich countries in 1970, and between 25% and 30% in 2000-2010. Sources and series: see piketty.pse.ens.fr/capital21c
Cross-Country evidence

Cross-Country evidence

Gollin, twenty years later (2015)
Stylized Facts

Summary

1. Profit and Wage shares far from constant over the long-run. For some countries, inverted U-curve for labor shares over the XX century.
3. From cross-country perspective, slight positive relation between wage shares and GDP-per-capita; once we eliminate oil-producing countries.
4. What about cross-country growth rates and wage shares?
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Starting with Bowles and Boyer (1995), a common specification strategy has been:

1. Estimate Consumption, Investment and Net Exports functions with output and the Wage Share as independent variables, typically in log-form.
2. Use a partial equilibrium-model to add the partial effects to obtain the total effect.
3. See Stockhammer (2017) for an excellent review. Results tend to be overwhelmingly wage-led.
Consider an influential example; for example, Stockhammer et. al (2009) for the Euro area. The estimated equations are:

\[
\ln C_t = \alpha_1 + \beta_{11} \ln C_{t-1} + \beta_{12} \ln W_t + \beta_{13} \ln R_t + \varepsilon_1 \tag{11}
\]

\[
\ln I_t = \alpha_2 + \beta_{21} \ln I_{t-1} + \beta_{22} \ln Y_t + \beta_{23} \ln R_t + \varepsilon_2 \tag{12}
\]

Where \( C, I, Y, R, W \) are Consumption, Investment, Output, Gross Profits, and Wages. All of them are in **levels**! Additional lags are usually experimented with.
These ARDL-type models usually use Pesaran-Shin-Smith (2001) bounds test procedure to obtain long-run elasticities:

1. Traditional econometric theory requires either both variables to be $I(0)$ or $I(1)$, and thus, pre-testing of unit roots, and then cointegration in the case of $I(1)$.

2. Remember: If pre-testing, p-vals no longer remain valid! Specially troubling given power issues in unit root testing.

3. Pesaran-Shin-Smith offer theory and t-test to obtain long-run coefficients regardless series are $I(0)$, $I(1)$ or anything in between! Does not require pre-testing!

4. Readily available in eviews, stata, and easy to program.
The long-run effect of the wage bill on a single component of aggregate demand, for example, consumption, is:

$$\frac{\partial \ln C}{\partial \ln W} = \frac{\beta_{12}}{1 - \beta_{11}}$$

(13)

Additional lags add extra coefficients. Note that, again, this holds irrespective of the order of integration.

To close the model and add all the partial effects, it is noted that $Y = C + I$. Then, long run effects weighted by the relative expenditure shares are added.
**Table 7. The effects of a 1%-point increase in the profit share**

The effect of a 1%-point increase in the profit share in only one country on:

<table>
<thead>
<tr>
<th>Country</th>
<th>C/Y</th>
<th>I/Y</th>
<th>X/Y</th>
<th>M/Y</th>
<th>NX/Y</th>
<th>Private excess demand</th>
<th>Multiplier</th>
<th>% Change in aggregate demand (F*G)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>-0.277</td>
<td>0.000</td>
<td>0.234</td>
<td>-0.161</td>
<td>0.396</td>
<td>0.119</td>
<td>1.039</td>
<td>0.124</td>
</tr>
<tr>
<td>B</td>
<td>-0.151</td>
<td>0.206</td>
<td>0.000</td>
<td>-0.053</td>
<td>0.053</td>
<td>0.108</td>
<td>0.740</td>
<td>0.080</td>
</tr>
<tr>
<td>DK</td>
<td>-0.155</td>
<td>0.169</td>
<td>0.185</td>
<td>0.000</td>
<td>0.185</td>
<td>0.198</td>
<td>1.246</td>
<td>0.247</td>
</tr>
<tr>
<td>FIN</td>
<td>-0.243</td>
<td>0.000</td>
<td>0.074</td>
<td>0.000</td>
<td>0.074</td>
<td>-0.169</td>
<td>1.316</td>
<td>-0.222</td>
</tr>
<tr>
<td>F</td>
<td>-0.324</td>
<td>0.101</td>
<td>0.062</td>
<td>-0.078</td>
<td>0.140</td>
<td>-0.083</td>
<td>1.559</td>
<td>-0.129</td>
</tr>
<tr>
<td>D</td>
<td>-0.397</td>
<td>0.000</td>
<td>0.049</td>
<td>0.000</td>
<td>0.049</td>
<td>-0.348</td>
<td>1.136</td>
<td>-0.395</td>
</tr>
<tr>
<td>GR</td>
<td>-0.564</td>
<td>0.000</td>
<td>0.099</td>
<td>0.000</td>
<td>0.099</td>
<td>-0.465</td>
<td>1.984</td>
<td>-0.923</td>
</tr>
<tr>
<td>IRL</td>
<td>-0.229</td>
<td>0.161</td>
<td>0.000</td>
<td>-0.074</td>
<td>0.074</td>
<td>0.006</td>
<td>0.863</td>
<td>0.005</td>
</tr>
<tr>
<td>I</td>
<td>-0.410</td>
<td>0.156</td>
<td>0.050</td>
<td>-0.087</td>
<td>0.137</td>
<td>-0.117</td>
<td>1.451</td>
<td>-0.170</td>
</tr>
<tr>
<td>L</td>
<td>-0.153</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>-0.153</td>
<td>0.535</td>
<td>-0.082</td>
</tr>
<tr>
<td>NL</td>
<td>-0.322</td>
<td>0.078</td>
<td>0.000</td>
<td>-0.069</td>
<td>0.069</td>
<td>-0.175</td>
<td>0.820</td>
<td>-0.144</td>
</tr>
<tr>
<td>P</td>
<td>-0.402</td>
<td>0.000</td>
<td>0.000</td>
<td>-0.182</td>
<td>0.182</td>
<td>-0.219</td>
<td>1.546</td>
<td>-0.339</td>
</tr>
<tr>
<td>E</td>
<td>-0.410</td>
<td>0.088</td>
<td>0.044</td>
<td>-0.068</td>
<td>0.113</td>
<td>-0.210</td>
<td>2.147</td>
<td>-0.450</td>
</tr>
<tr>
<td>S</td>
<td>-0.388</td>
<td>0.128</td>
<td>0.057</td>
<td>-0.056</td>
<td>0.113</td>
<td>-0.147</td>
<td>1.058</td>
<td>-0.155</td>
</tr>
<tr>
<td>UK</td>
<td>-0.252</td>
<td>0.000</td>
<td>0.074</td>
<td>-0.066</td>
<td>0.140</td>
<td>-0.112</td>
<td>1.129</td>
<td>-0.126</td>
</tr>
</tbody>
</table>

EU15*  -0.298

Notes: A = Austria, B = Belgium, DK = Denmark, FIN = Finland, F = France, D = Germany, GR = Greece, IRL = Ireland, I = Italy, L = Luxembourg, NL = Netherlands, P = Portugal, E = Spain, S = Sweden, UK = United Kingdom

* Change in each country is multiplied by its share in EU15 GDP.
An alternative, less popular approach, uses VAR methods. This approach estimates a system of the form:

\[ Y_t = A_1 Y_{t-1} + \ldots + A_k Y_{t-k} + \varepsilon_t \]  

(14)

Where \( Y_t \) is the vector of 1\( \times k \) endogenous variables, in this case, the wage share and some measure of utilization. \( A_k \) is an unrestricted matrix of coefficients. We can think of the single system approach as restricting to 0 the coefficients which load on the wage-share equation.
A popular example of this approach is Barbosa-Filho and Taylor (2006), for the US. Long-run coefficients are measured the same way as before.

<table>
<thead>
<tr>
<th>Period</th>
<th>Effective demand $d\psi/du$</th>
</tr>
</thead>
<tbody>
<tr>
<td>1948–2002</td>
<td>$-3.1334$</td>
</tr>
<tr>
<td>1954–2002</td>
<td>$-2.7867$</td>
</tr>
<tr>
<td>1948–1970</td>
<td>$-2.0362$</td>
</tr>
<tr>
<td>1954–1970</td>
<td>$-1.4337$</td>
</tr>
<tr>
<td>1971–2002</td>
<td>$-6.9026$</td>
</tr>
</tbody>
</table>
In general, this literature tends to find:

1. More modest effects of the wage share on demand
2. Profit-Led results
3. Small, but significant effects from demand to distribution.
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The first we might notice is that there is a disconnection between the theory and the empirical methods:

1. Model is in **growth rates**, while empirical work is usually in levels. **Vastly** different to say that 10% increase in the Wage Share increases GDP by 6% than to say it increases the growth rate of GDP by 6% (Why?)

2. Endogenous variable are utilization and accumulation. **None** of the empirical works cited above, and all of the others, to the best of my knowledge, use capacity utilization as measured by manufacturing enterprises.

3. All of the models cited above are linear, while even the simplest Kaleckian model recognizes that the relationship between distribution and growth is non-linear.
Let’s start by growth vs level effects. Suppose we want to understand cross-country income differences. Denmark has a GDP-per-Capita of 42.800; Chile has 22,300 (Penn World Tables, year 2015).

Denmark has a Labor-Share of 61,2%; Chile has a Labor-Share of 43,9%. If distribution alone explains this difference, we would need a output-distribution elasticity of 5,34. In other words, increasing the wage share by a 10% percentage points should raise output by 53,4%.

The most generous estimate by Onaran and Obst (2015) puts this elasticity at 0.544, roughly, 10 times less than needed.
Conversely, let’s think about growth rate differences. Over the period 1990-2015, Denmark grew by 3% on average, while Chile grew by 8% on average. Labor Shares were 62% and 45%, roughly. Even small effects of distribution on growth can explain fully this differences!
Another key disconnect between theory and empirics is that wage-led literature tends to use output, while the model uses capacity utilisation. This is rather bizarre, given that OECD compiles quarterly statistics on capacity utilisation which are readily available for a number of countries. In González and Gahn (2019), we explore some of these statistics.
### Econometric Problems

**Theory and Models V - Utilisation rates**

<table>
<thead>
<tr>
<th>Country</th>
<th>$\bar{u}$</th>
<th>$\bar{g}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Austria</td>
<td>85,2</td>
<td>0,44</td>
</tr>
<tr>
<td>Belgium</td>
<td>80,2</td>
<td>0,41</td>
</tr>
<tr>
<td>Czech Republic</td>
<td>84,0</td>
<td>0,68</td>
</tr>
<tr>
<td>Finland</td>
<td>81,6</td>
<td>0,45</td>
</tr>
<tr>
<td>Germany</td>
<td>84,1</td>
<td>0,36</td>
</tr>
<tr>
<td>Hungary</td>
<td>80,6</td>
<td>0,60</td>
</tr>
<tr>
<td>Italy</td>
<td>74,8</td>
<td>0,10</td>
</tr>
<tr>
<td>Luxembourg</td>
<td>79,5</td>
<td>0,86</td>
</tr>
<tr>
<td>Netherlands</td>
<td>81,7</td>
<td>0,44</td>
</tr>
<tr>
<td>Norway</td>
<td>79,8</td>
<td>0,44</td>
</tr>
<tr>
<td>Poland</td>
<td>74,3</td>
<td>0,93</td>
</tr>
<tr>
<td>Portugal</td>
<td>81,0</td>
<td>0,25</td>
</tr>
<tr>
<td>Slovak Republic</td>
<td>81,1</td>
<td>0,92</td>
</tr>
<tr>
<td>Spain</td>
<td>77,6</td>
<td>0,51</td>
</tr>
<tr>
<td>Switzerland</td>
<td>82,8</td>
<td>0,47</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>79,9</td>
<td>0,49</td>
</tr>
<tr>
<td>United States</td>
<td>77,5</td>
<td>0,56</td>
</tr>
</tbody>
</table>
Recall, again, that around the steady-state the relation between distribution and accumulation is non-linear! Thus, we should interpret the empirical work as linearized approximations around the steady-state.

**However**, linear approximations can capture very poorly the dynamics of distribution and growth. Think of Goodwin’s (1954) model. The solution is an orbit around the steady-state, and a linear approximation poorly captures the dynamics.

Some work being done in this direction; i.e, Carvhalo and Rezai (2015). However, it suffers from the same pitfalls that were mentioned before. Methods like threshold VAR’s, non-linear ARDL’s and Markov-Switching models can all be used to test whether these non-linearities are important.
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Main message: Integrate **theory and empirical work**!

1. Take seriously growth specification. Perhaps reduced-form regressions between wage shares and growth can be more informative and multi-equation exercises which have been done in levels.

2. Take seriously capacity utilization. It’s widely available, and it varies more across countries than growth rates. Does this tell us something about the parameters of the model?

3. Non-linearities are worth exploring.

4. Final word on endogeneity. Is it really that serious?
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