Profit vs Wage Led Growth:

Models, Empirics and Possibilities

Alejandro González

Master in Economics - Universidad de Chile

Ph. D student - University of Washington

agonzalezc@fen.uchile.cl

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Outline

Introduction

Motivation

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

Introduction

A normative note

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.

Outline

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 α, 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.

Models

Mainstream models II

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!

Models

A Kaleckian Benchmark I - Assumptions

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 goverment 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.

Models

A Kaleckian Benchmark II - Investment and Saving functions

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.

$$\frac{I_t}{K_t} = \gamma + \gamma_u u_t \tag{1}$$

$$\frac{S_t}{K_t} = s_\pi r \tag{2}$$

$$r_t = \frac{\pi u_t}{v} \tag{3}$$

Where I, S, K, r, π, u, v stand for Investment, Savings, Capital, the profit rate, the profit share, capital utilization and the capital-output ratio, respectively.

Models

A Kaleckian Benchmark III - Goods Market Equilibrium and Comparative Statics

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:

$$u^* = \frac{v\gamma}{s_\pi \pi - \gamma_u v} \tag{4}$$

$$\left(\frac{I}{K}\right)^* = g^* = \frac{s_\pi \pi \gamma}{s_\pi \pi - \gamma_u v} \tag{5}$$

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.

Models

A Kaleckian Benchmark V - Extending the investment function

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:

$$\frac{I_t}{K_t} = \gamma + \gamma_u u_t + \gamma_\pi \pi \tag{6}$$

$$\frac{S_t}{K_t} = s_\pi r \tag{7}$$

$$r_t = \frac{\pi u_t}{v} \tag{8}$$

This modification can be appealed on the basis of cash-flow concerns (Fazzari et. al, 1987) or by appealing to the classical tradition.

Models

A Kaleckian Benchmark VI - Profit vs Wage Led Growth

In this modified model, equilibrium utilization and accumulation are:

$$u^* = \frac{v\gamma + \gamma_\pi \pi v}{s_\pi \pi - \gamma_u v} \tag{9}$$

$$g^* = \frac{s_\pi \pi (\gamma + \gamma_\pi \pi)}{s_\pi \pi - \gamma_u v} \tag{10}$$

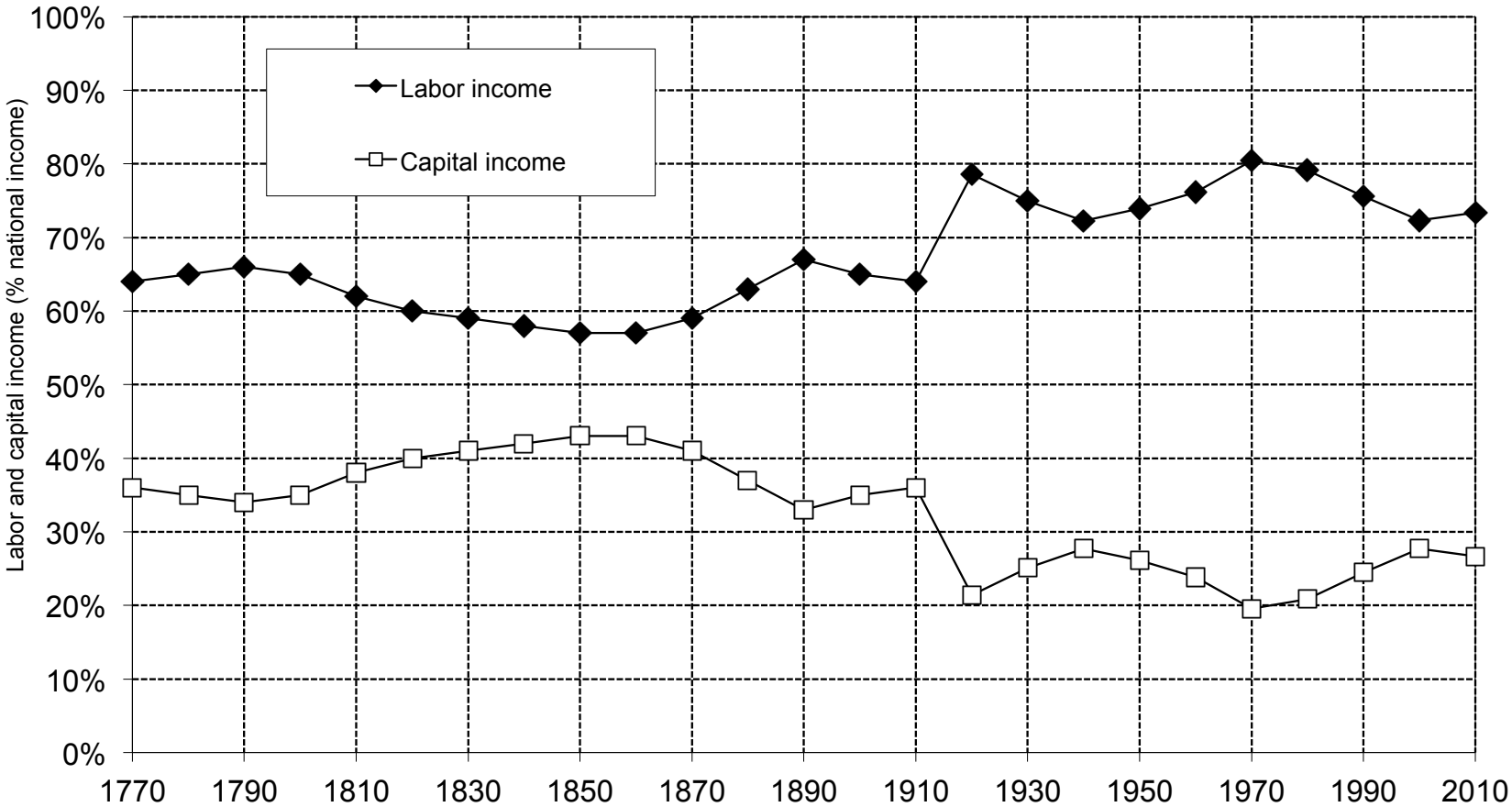
Now, the effect of an increase in the profit share on both utilisation and growth depends on the relative sizes of the investment effect (γ_π) and the savings effect (s_π). If the effect is positive, we call the model **profit-led**, if its negative, we call it **wage-led**.

Outline

Time-Series evidence

Long-Run Profits Shares I

Figure 6.1. The capital-labor split in the Britain, 1770-2010

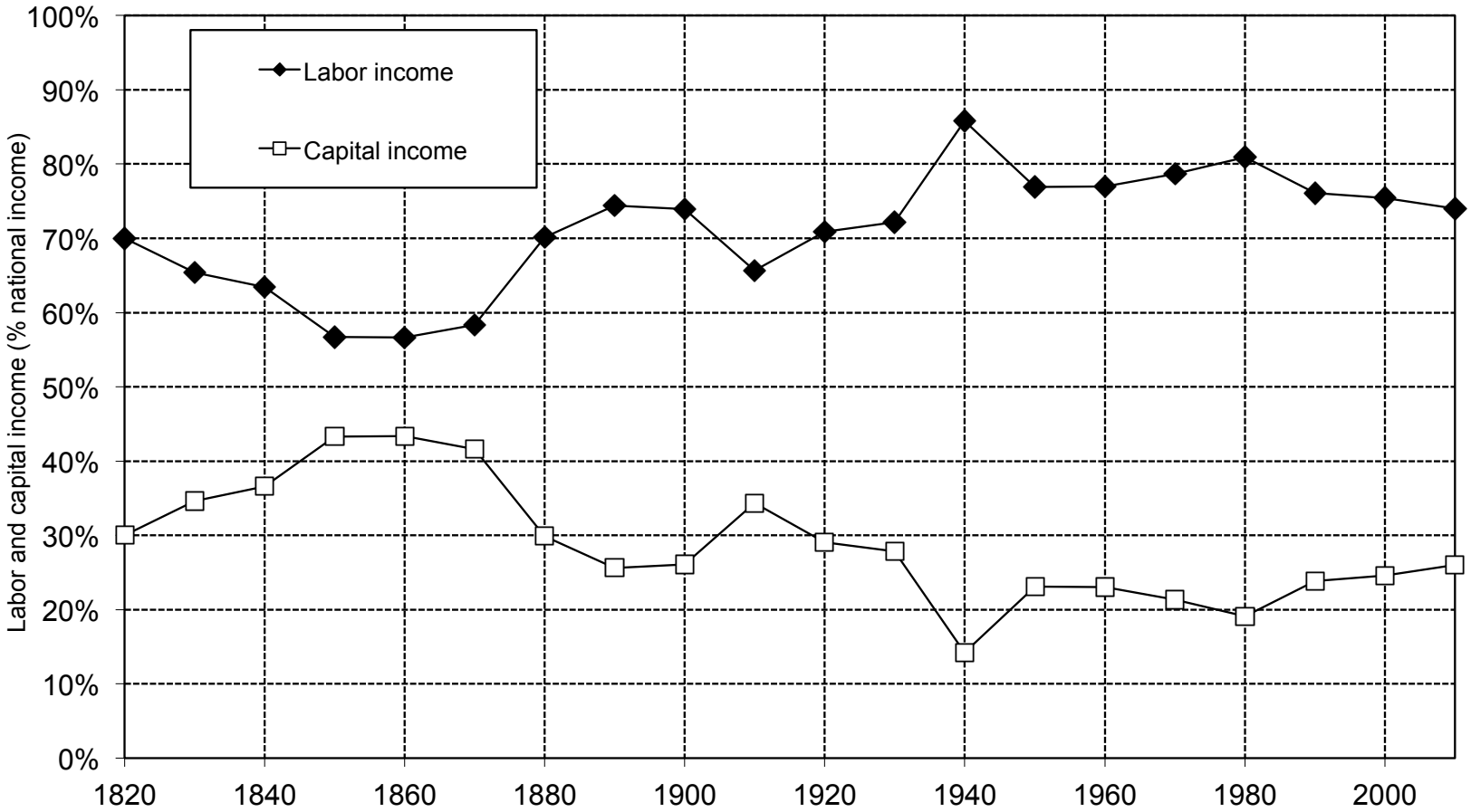


During the 19th century, capital income (rent, profits, dividends, interest,..) absorbed about 40% of national income, vs. 60% for labor income (salaried and non salaried). Sources and series: see piketty.pse.ens.fr/capital21c.

Time-Series evidence

Long-Run Profits Shares II

Figure 6.2. The capital-labor split in France, 1820-2010

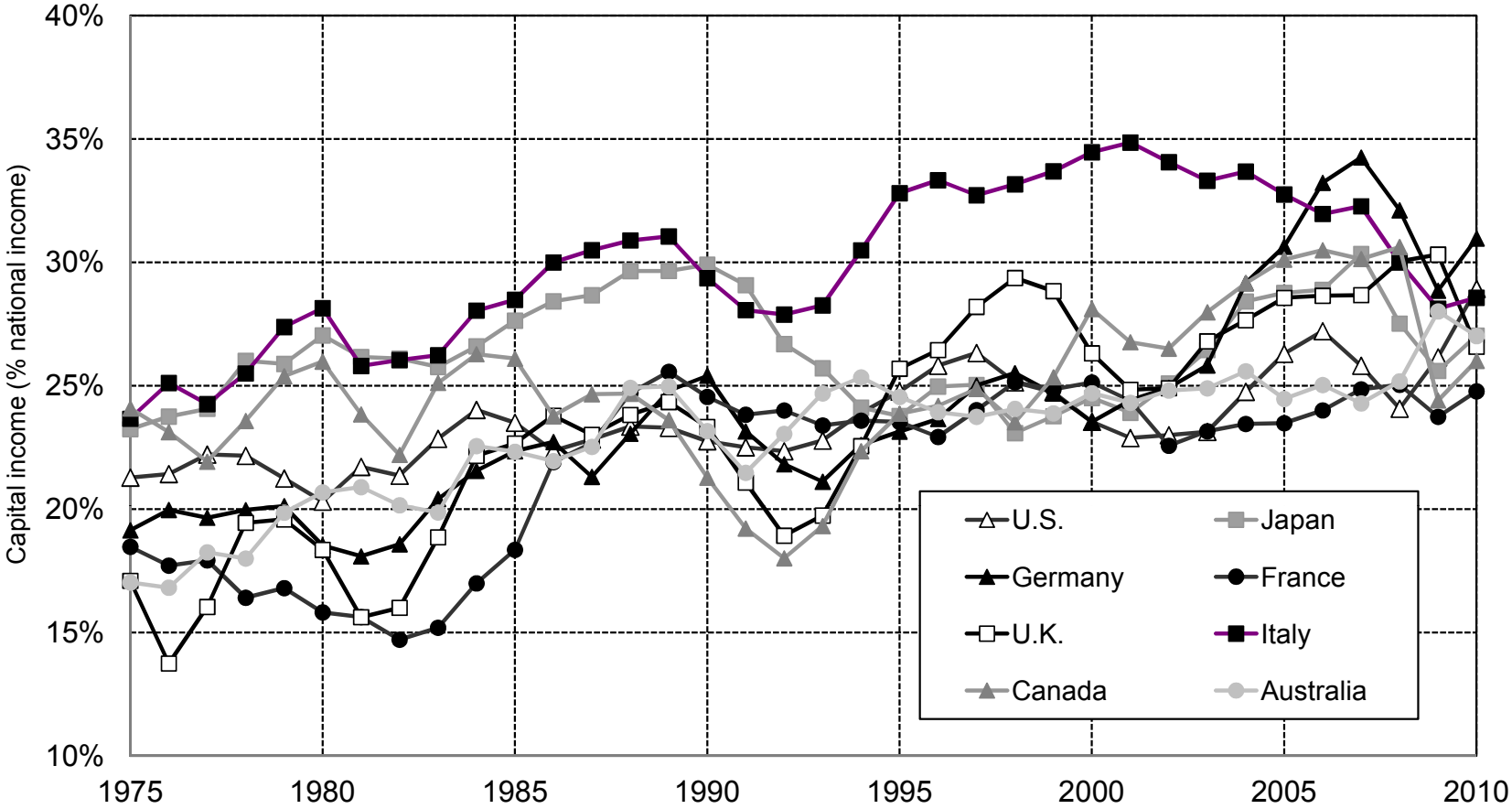


In the 21st century, capital income (rent, profits, dividends, interest,..) absorbs about 30% of national income, vs. 70% for labor income (salaried and non salaried). Sources and series: see piketty.pse.ens.fr/capital21c.

Time-Series evidence

Profits Shares 1970-2010, Advanced Countries

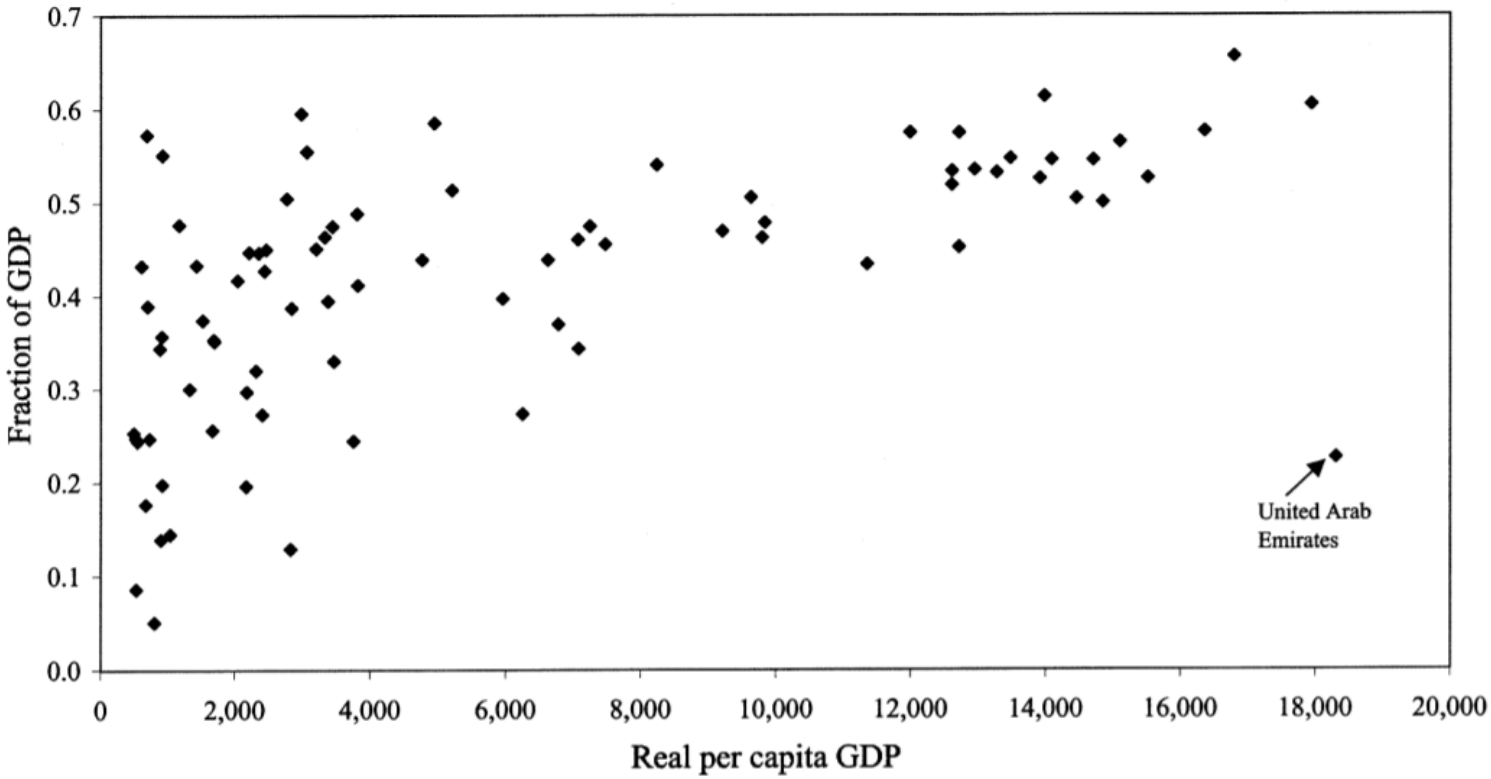
Figure 6.5. The capital share in rich countries, 1975-2010



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

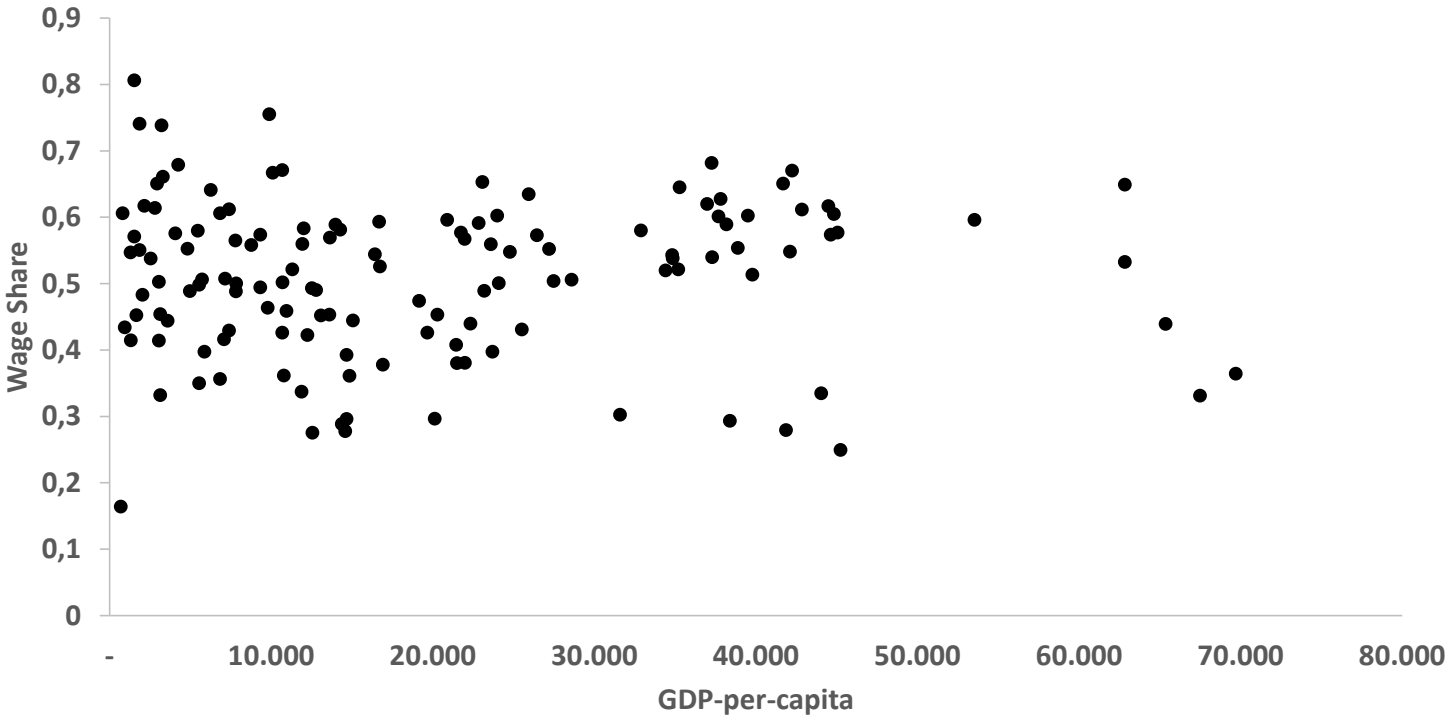
Cross-Country evidence

Gollin, 2002 (1994)



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
2. Global fall in the Labor share from the 1980 to the 2010. Less pronounced in the anglo-saxon world.
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?

Outline

Common Empirical Strategies

Single-Equation Methods I

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.

Common Empirical Strategies

Single-Equation Methods II

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.

Common Empirical Strategies

Single-Equation Methods III

These ARDL-type models usually use Pesaran-Shin-Smith (2001) bounds test procedure to obtain long-run elasticities:

1. Traditional econometric theory requieres either both variables to be I(0) or I(1), and thus, pre-testing of unit roots, and then cointegration in the casse 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 requiere pre-testing!
4. Readily available in eviews, stata, and easy to program.

Common Empirical Strategies

Single-Equation Methods IV

The long-run effect of the wage bill on a single component of aggregate demand, for example, consumption, is:

$$\frac{\partial \ln C}{\partial \ln W} = \frac{\beta_{12}}{1 - \beta_{11}} \tag{13}$$

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.

Common Empirical Strategies

Single-Equation Methods V - Onaran and Obst (2015)

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:								
	C/Y	I/Y	X/Y	M/Y	NX/Y	Private excess demand /Y	Multiplier	% Change in aggregate demand (F*G)	The effect of a simultaneous 1% - point increase in the profit share on % change in aggregate demand
	A	B	C	D	E (C-D)	F (A+B+E)	G	H	I
A	-0.277	0.000	0.234	-0.161	0.396	0.119	1.039	0.124	-0.185
B	-0.151	0.206	0.000	-0.053	0.053	0.108	0.740	0.080	0.009
DK	-0.155	0.169	0.185	0.000	0.185	0.198	1.246	0.247	0.107
FIN	-0.243	0.000	0.074	0.000	0.074	-0.169	1.316	-0.222	-0.304
F	-0.324	0.101	0.062	-0.078	0.140	-0.083	1.559	-0.129	-0.228
D	-0.397	0.000	0.049	0.000	0.049	-0.348	1.136	-0.395	-0.442
GR	-0.564	0.000	0.099	0.000	0.099	-0.465	1.984	-0.923	-1.027
IRL	-0.229	0.161	0.000	-0.074	0.074	0.006	0.863	0.005	-0.066
I	-0.410	0.156	0.050	-0.087	0.137	-0.117	1.451	-0.170	-0.238
L	-0.153	0.000	0.000	0.000	0.000	-0.153	0.535	-0.082	-0.128
NL	-0.322	0.078	0.000	-0.069	0.069	-0.175	0.820	-0.144	-0.191
P	-0.402	0.000	0.000	-0.182	0.182	-0.219	1.546	-0.339	-0.477
E	-0.410	0.088	0.044	-0.068	0.113	-0.210	2.147	-0.450	-0.544
S	-0.388	0.128	0.057	-0.056	0.113	-0.147	1.058	-0.155	-0.271
UK	-0.252	0.000	0.074	-0.066	0.140	-0.112	1.129	-0.126	-0.195
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.

Common Empirical Strategies

VAR Methods I

An alternative, less popular approach, uses VAR methods. This approach estimates a system of the form:

$$Y_t = A_1 Y_{t-1} + ... + A_k Y_{t-k} + \varepsilon_t \tag{14}$$

Where Y_t is the vector of $1xk$ 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.

Common Empirical Strategies

VAR Methods II

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.

Period	*Effective demand* $\mathrm{d}\psi/\mathrm{d}u$
1948–2002	–3.1334
1954–2002	–2.7867
1948–1970	–2.0362
1954–1970	–1.4337
1971–2002	–6.9026

Common Empirical Strategies

VAR Methods III

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.

Outline

Econometric Problems

Theory and Models I

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.

Econometric Problems

Theory and Models II - Growth and levels

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**.

Econometric Problems

Theory and Models III - Growth and levels

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 where 62% and 45%, roughy. Even small effects of distribution on growth can explain fully this differences!

Econometric Problems

Theory and Models IV - Utilisation rates

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

Country	$\bar{u}$	$\bar{g}$
Austria	85,2	0,44
Belgium	80,2	0,41
Czech Repulic	84,0	0,68
Finland	81,6	0,45
Germany	84,1	0,36
Hungary	80,6	0,60
Italy	74,8	0,10
Luxembourg	79,5	0,86
Netherlands	81,7	0,44
Norway	79,8	0,44
Poland	74,3	0,93
Portugal	81,0	0,25
Slovak Repulic	81,1	0,92
Spain	77,6	0,51
Switzerland	82,8	0,47
United Kingdom	79,9	0,49
United States	77,5	0,56

Econometric Problems

Theory and Models VI - Non-linearity

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.

Outline

Conclusions

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?

Outline

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