Capital Depreciation and Labor Shares Across The World: Measurement and Implications

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Global Labor Share

Three Questions

1. How did the labor share in net production evolve?
   - Globally, the net labor share declined together with the gross.
   - In the U.S., the net declined less than the gross.
2. What do we learn from these joint movements?
   - Declining price of capital goods consistent with decline in labor shares if $\sigma > 1$.
   - Not true for other shocks (e.g. interest rate) even if $\sigma > 1$.
3. What labor share should we use?
   - Measurement issues.
   - Even if you care only about inequality, during transitional dynamics it is not obvious that net is a preferable measure.

Measurement of Labor Shares

1. "Total Gross Labor Share":

$$s_L^{TG} = \frac{\text{Total Compensation of Employees}}{\text{Gross Domestic Product}}.$$

2. "Total Net Labor Share":

$$s_L^{TN} = \frac{\text{Total Compensation of Employees}}{\text{Gross Domestic Product} - \text{Total Depreciation}}.$$

3. "Corporate Gross Labor Share":

$$s_L^{CG} = \frac{\text{Corporate Compensation of Employees}}{\text{Corporate Gross Value Added}}.$$

4. "Corporate Net Labor Share":

$$s_L^{CN} = \frac{\text{Corporate Compensation of Employees}}{\text{Corporate Gross Value Added} - \text{Corporate Depreciation}}.$$

Summary: Global Labor Share Trends

	Percentage Points		Percent	
Labor Share	Unweighted	Weighted	Unweighted	Weighted
Total Gross	-4.6		-9.1	
Total Net	-7.0		-11.9	
Corporate Gross	-9.2		-14.5	
Corporate Net	-9.8		-13.4	

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Total Net	-7.0	-3.6	-11.9	-5.6
Corporate Gross	-9.2	-5.4	-14.5	-8.8
Corporate Net	-9.8	-3.7	-13.4	-5.1

Cross Country Patterns

Debate About Net vs. Gross Labor Share

- In Karabarbounis and Neiman (2014) we estimated $\sigma > 1$.
- This is the elasticity of substitution in the *gross production function*.
- Under $\sigma > 1$, the gross labor share falls when the capital-output ratio increases.
- Piketty (2014) and Piketty and Zucman (2014) focus on analyses of the *net labor share.*
- Rognlie (2014) and Summers (2014) note that one should be careful in importing σ to analyses of net labor shares.

Summers (2014) Critique of Piketty (2014)

"Piketty argues that the economic literature supports his assumption that returns diminish slowly (in technical parlance, that the elasticity of substitution is greater than 1), and so capital's share rises with capital accumulation."

"But I think he misreads the literature by conflating gross and net returns to capital ... And it is the return net of depreciation that is relevant for capital accumulation."

"I know of no study suggesting that measuring output in net terms, the elasticity of substitution is greater than 1, and I know of quite a few suggesting the contrary."

Two-Sector Neoclassical Growth Model in Steady State

- CES production function:

$$Y = \left(\alpha \left(A_K K\right)^{\frac{\sigma-1}{\sigma}} + (1-\alpha)\left(A_N N\right)^{\frac{\sigma-1}{\sigma}}\right)^{\frac{\sigma}{\sigma-1}}$$

- Rental rate of capital:

$$R = \underbrace{\xi}_{\text{price of capital}} \left(\underbrace{r}_{\text{real interest rate}} + \underbrace{\delta}_{\text{depreciation rate}} \right)$$

- Depreciation as a share of GDP:

$$\psi = \frac{\delta \xi K}{Y}$$

- Labor shares:

$$s_L^G = \frac{WN}{Y} \quad \text{and} \quad s_L^N = \frac{WN}{Y - \delta \xi K} = s_L^G \frac{1}{1-\psi}$$

Definition of Elasticities

- Elasticity of substitution in gross production:

$$\sigma = \frac{1}{1 - \frac{\mathrm{d}\log\left(1 - s_L^G\right)}{\mathrm{d}\log(K/Y)}} = -\frac{\mathrm{d}\log\left(\frac{K}{Y}\right)}{\mathrm{d}\log(R)}$$

- In our model σ is constant no matter what shock moves the system. It predicts movement of s_L^G in response to variations in K/Y or R.

- "Elasticity of substitution in net production":

$$\epsilon = \frac{1}{1 - \frac{\mathrm{d}\log\left(1 - s_L^N\right)}{\mathrm{d}\log(K/Y(1-\psi))}} = -\frac{\mathrm{d}\log\left(\frac{K}{Y(1-\psi)}\right)}{\mathrm{d}\log(R - \xi\delta)}$$

- Not a structural parameter. Its value depends on the shocks. Still interesting object because $\epsilon < 1$ or $\epsilon > 1$ predicts the directional response of s_L^N.

Rognlie (2014) and Summers (2014) Argument

- Ratio of elasticities:

$$\frac{\epsilon}{\sigma} = \left[\frac{\mathrm{d}\log\left(\frac{K}{Y(1-\psi)}\right)}{\mathrm{d}\log\left(\frac{K}{Y}\right)}\right]\left[\frac{\mathrm{d}\log(R)}{\mathrm{d}\log(R-\xi\delta)}\right]$$

- Suppose $\mathrm{d}r \neq 0$, while all other shocks $\mathrm{d}\xi = \mathrm{d}\delta = \mathrm{d}A_K = 0$:

$$\frac{\epsilon}{\sigma} = \left[\frac{1}{1-\psi}\right]\left[\frac{r}{r+\delta}\right] = \frac{1-s_L^N}{1-s_L^G} < 1$$

$$\sigma = 1.25 \implies \epsilon = 0.94$$

Our Argument

- Ratio of elasticities:

$$\frac{\epsilon}{\sigma} = \left[\frac{\mathrm{d}\log\left(\frac{K}{Y(1-\psi)}\right)}{\mathrm{d}\log\left(\frac{K}{Y}\right)}\right]\left[\frac{\mathrm{d}\log(R)}{\mathrm{d}\log(R-\xi\delta)}\right]$$

- Suppose $\mathrm{d}\xi \neq 0$, while all other shocks $\mathrm{d}r = \mathrm{d}\delta = \mathrm{d}A_K = 0$:

$$\frac{\epsilon}{\sigma} = \left[\frac{1}{1-\psi}\left(1-\frac{\psi}{\sigma}\right)\right]\left[1\right] \quad \Longrightarrow \quad (\epsilon - 1) = \frac{s_L^N}{s_L^G}(\sigma - 1)$$

$$\sigma = 1.25 \Longrightarrow \epsilon = 1.29$$

Intuition and Implications

$$s_L^N = \frac{s_L^G}{1-\psi} \qquad \text{with} \qquad \psi = \frac{\delta \xi K}{Y}$$

- Decline in r causes an increase in ψ through increase in K/Y.
- Response of ψ muted when ξ decreases.
- In data, labor shares declined together (i.e. ψ did not increase that much).
- Therefore, decline in ξ more plausible explanation than decline in r.
- Result quantitatively robust to three-sector extension with endogenous movements in δ and ξ.

Inequality and Labor Shares

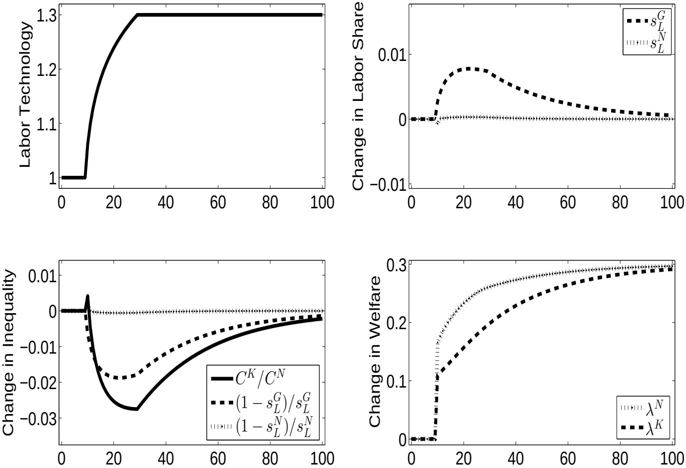
- Is the net labor share more informative about inequality?

- There is a clear mapping between net labor share and inequality in *steady state*:

$$\frac{C^K}{C^N} = \frac{(R - \delta\xi)\, K}{WN} = \frac{1 - s_L^N}{s_L^N}$$

- The link between inequality and the net labor share is not obvious over the transition.

Increase in A_N



Gross vs. Net Labor Shares During Transition

Shock	Inequality Measure	Change From Initial Steady State $t=10$	$t=20$	$t=50$	$t \to \infty$
$\uparrow A_N$	$(1+\lambda_t^K)/(1+\lambda_t^N)$	-0.062	-0.052	-0.018	0.000
	$(1-s_t^N)/s_t^N$	-0.002	-0.001	0.000	0.000
	$(1-s_t^G)/s_t^G$	-0.033	-0.032	-0.011	0.000
$\uparrow A_N = A_K$	$(1+\lambda_t^K)/(1+\lambda_t^N)$	-0.026	0.002	0.072	0.110
	$(1-s_t^N)/s_t^N$	0.078	0.102	0.109	0.110
	$(1-s_t^G)/s_t^G$	0.016	0.041	0.087	0.110
$\uparrow \beta$	$(1+\lambda_t^K)/(1+\lambda_t^N)$	-0.176	-0.145	-0.087	-0.033
	$(1-s_t^N)/s_t^N$	-0.001	-0.005	-0.016	-0.033
	$(1-s_t^G)/s_t^G$	0.030	0.058	0.107	0.151
$\downarrow \xi^H$	$(1+\lambda_t^K)/(1+\lambda_t^N)$	0.013	0.033	0.082	0.109
	$(1-s_t^N)/s_t^N$	0.105	0.119	0.108	0.109
	$(1-s_t^G)/s_t^G$	0.045	0.076	0.111	0.128