Supplemental Appendix: Labor Share, Markups, and Input-Output Linkages – Evidence from the U.S. National Accounts*

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Abstract

This appendix contains supplemental material for "Labor Share, Markups, and Input-Output Linkages – Evidence from the U.S. National Accounts."

*The views expressed in this paper are solely those of the authors and not necessarily those of the U.S. Bureau of Economic Analysis or the U.S. Department of Commerce.

1 Returns to Scale and Markups

The model does not have fixed costs while many micro estimates of markups do. In this section, we show the relationship between these measures.

We split production costs into marginal (MC) and fixed costs FC. Firm level profit rate is given by:

$$\frac{\pi_i}{p_{G,i}G_i} = \frac{p_{G,i}G_i - (MC_i \cdot G_i + FC_i)}{p_G G}$$
$$= 1 - \frac{1}{\mu_i^F} \cdot \frac{AC_i}{MC_i}$$

where μ_i^F denotes markups with fixed costs. The relationship between our markups μ and μ^F is given by:

$$\mu_i^F = \mu_i \cdot \frac{AC_i}{MC_i}$$

The higher AC/MC, the higher are the markups with FC.

Multiplying by sales and summing gives:

$$\sum_i \pi_i = p_G G - \sum_i p_{G,i}G_i \frac{MC_i}{p_{G,i}} \cdot \frac{AC_i}{MC_i}$$

Following the assumption in Edmond et al. (2023), assume that returns to scale are constant across firms $AC_i/MC_i = \upsilon$. Aggregate profit rate is:

$$\frac{\Pi}{p_G G} = 1 - \frac{\upsilon}{\hat{\mu}^F}$$

where $\hat{\mu}^F$ is the harmonic average of μ^F. This is equivalent to cost weighting under the assumptions used by Edmond et al. (2023).

We can use profit share from the model and estimated fixed cost markups from Edmond et al. (2023) to back out the implied returns to scale. (Edmond et al. (2023) data end in 2014, so we use 2001-14 averages for fixed cost markups.) We weight sectoral profit rates by gross output to obtain the profit share. Table 1 reports the results.

2 Intellectual Property Products

It is of interest to study the effect on the aggregate labor share of the recent inclusion in the NIPA of the investment in intellectual property products (IPP). IPP investment comprises the expenditure on software, research and development, and entertainment, literary, and artistic

Table 1: Constant vs Returns to Scale Markups Exercise

	1957–1973	1984–2000	2001–2016
Sales wtd markups	1.272	1.343	1.486
Cost wtd markups	1.193	1.222	1.246
Sales wtd profit rate (Model)	0.036	0.045	0.066
Avg returns to scale υ	1.151	1.167	1.164

Source: Authors' calculations and Edmond et al. (2023).

originals. The NIPA revision of 1999 included software in NIPA and the NIPA revision of 2013 included the rest of IPP in NIPA. IPP investment is a sizeable and growing subset of unmeasured investment that importantly affects the aggregate labor share.

Koh et al. (2021) studied what happens to the aggregate labor share when one takes IPP investment and the related factor income out of the NIPA, which captures how the NIPA was constructed before 1999. They found that without IPP investment, the aggregate labor share hardly decreased over the postwar period. We now show that our analysis is consistent with their results. Since they analyzed the aggregate economy, and since it is challenging to apportion IPP investment to the two sectors, we will analyze only the aggregate effects of taking IPP investment out.

Excluding IPP capital in the measurement of the output elasticity of labor and of markups requires two modifications to paper Equations 42 - 44: first, one must take the user costs paid to the stock of unmeasured capital, r^*K^*, out of factor payments; second, one must expense IPP investment, X^*, thereby taking it out of total GDP.[1] Given that the income and product approaches to measuring GDP must give the same answer, the two modifications must be equal in value: $r^*K^* = X^*$. Since $Y > rK + wL$, paper Equation 44 implies that excluding unmeasured capital *increases* the aggregate output elasticity of labor:

$$\alpha_L = \frac{wL}{rK + wL} < \frac{wL}{rK - r^*K^* + wL} = \alpha_L^*. \tag{1}$$

Moreover, paper Equation 42 implies that excluding unmeasured capital *increases* aggregate markups:[2]

$$\mu = \frac{Y}{rK + wL} < \frac{Y - X^*}{rK - r^*K^* + wL} = \mu^*.$$

Table 2 reports the results. As expected, the aggregate output elasticity of labor and the aggregate markup are both larger without than with IPP capital. In terms of changes, the output

[1] We use stars to indicate variables from the economy without IPP capital. The detailed steps of the adjustment are explained in Koh et al. (2021).

[2] Atkeson (2020) arrived at a similar conclusion regarding the effect of unmeasured capital on markups.

elasticity of labor increases without IPP capital, instead of staying constant with IPP capital. Markups increase less without IPP capital than with IPP capital, by 0.49 instead of 0.65 percentage points. The effects of excluding IPP capital on both changes make intuitive sense when one recognizes that the share of IPP capital in total capital has increased over time, implying that the effects of IPP capital are stronger towards the end of the period than the beginning.

Interestingly, the changes in the output elasticity of labor and the markups largely offset each other without IPP capital. As a result, the aggregate labor share declines by only one percentage point from 0.743 to 0.732 without IPP capital, instead of by 4.9 percentage points with IPP capital. This is a version of the finding of Koh et al. (2021).

Table 2: Aggregate calibration without IPP capital and real estate

Targets	1957–1973	1984–2000	2001–2016
wL/Y^*	0.743	0.732	0.732
α_L^*	0.814	0.811	0.840
μ^*	1.096	1.108	1.147

Source: Authors' calculations.

References

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