Discussion of *Capital-Labor Substitution, Structural Change and Growth* by F. Alvarez-Cuadrado, N. Van Long and M. Poschke

Cristiano Cantore[1]

[1] Banco de España and
School of Economics, University of Surrey

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What is this paper about

- I enjoyed reading the paper!
- The paper reports the opposite evolution in the trends of capital and labor shares across sectors and builds a model of structural change *potentially* able to replicate this evidence.
- The key model feature is the presence of non-unitary elasticity of substitution sectoral production functions.
- Differences in the degree of capital-labor substitutability across manufacturing and services are able to explain the different evolution of factor income share in the two sectors.
- The intuition is that as the economy grows, the fraction of capital allocated to each sector increases while the fraction of labor decreases. Different degrees of substitutability make this mechanism asymmetric between sectors with the capital labor ratio increasing more in the *flexible* one. Hence this sector experience a decline in the labor share.

The Model(s)

Using Cobb-Douglas sectoral PFs, even if parameters differ across sectors, the aggregate labor share may change with structural change but sectoral labor shares are, by definition, constant.

Symmetric : By introducing different degree of substitutability between K and L in the two sectors, capital accumulation is higher in the sector with higher substitutability (the *flexible* sector).

- Hence the $\frac{K}{L}$ increase more and labor share falls in the *flexible* sector.

Extended : including also differences in capital intensity and in the speed of technical change across models.

- K produced only in manufacturing, hence $Y_s = C_s$
- CES consumption aggregator

CES production function

- There is mounting empirical evidence against the hypothesis of unitary elasticity of substitution between inputs of production and neutral technical change.
- The link between economic growth and the size of the substitution elasticity has long been known. ([Solow(1956)], [La Grandville(1989)])
- Recently it has been introduced also in Business Cycle models. ([Cantore *et al.*(2010)])
- In modern growth, public finance, labor and innovation literatures (e.g., [Acemoglu(2009)], [Chirinko(2002)], [Acemoglu and Autor(2011)]) non-unitary substitution and factor-augmenting technical progress are key explanatory elements.
- However, when analytically investigating the significance of non-unitary factor substitution and non-neutral technical change in dynamic macroeconomic models, one faces the issue of ”normalization”.

Points

1. Why do you calibrate the substitution elasticities in both sectors to be greater than 1? ▸ CES Estimates
2. Is the evidence of higher K/L substitutability in manufacturing robust?
3. It seems to me that you do not normalize the CES production functions. This is perfectly fine if you keep the values of the elasticities of substitution fixed. But you cannot do comparative statics by varying the $\sigma's$ and you cannot interpret the $\alpha's$ as sectoral factor income shares. ▸ details
4. [Cantore and Levine(2011)] show that in two sector models CES utility functions need to be normalized as well.
5. Why do you use a Cobb-Douglas function for the aggregate output? You could use a three level nested CES.
6. One of the advantages of CES PFs is the presence of biased-technical change in both inputs. Why do you abstract from capital-augmenting technical change?

Clarifications

1. It is not clear to me which are the assumptions behind the result that the fraction of labor in each sector is a decreasing function of the fraction of capital. Any intuition?

2. In the extended model is not clear to me how do you relate sectoral prices with the aggregate price level.

CES empirics

return

Study	**Sample**	σ	$\gamma_N : \gamma_K$
	1890-1918	0.35	$\gamma_N - \gamma_N = 0.48$
[Brown and Cani(1963)]	1919-1937	0.10	$\gamma_N - \gamma_K = 0.62$
	1938-1958	0.11	$\gamma_N - \gamma_K = 0.36$
[David and van de Klundert(1965)]	1899-1960	0.32	$2.2 : 1.5$
[Wilkinson(1968)]	1899-1953	0.50	$\gamma_N - \gamma_K = 0.51$
[Sato(1970)]	1909-1960	$0.50 - 0.70$	$2.0 : 1.0$
[Panik(1976)]	1929-1967	0.76	$\gamma_N - \gamma_K = 0.27$
[Antràs(2004)]	1948-1998	0.80	$\gamma_N - \gamma_K = 3.15$
[Klump *et al.*(2007)]	1953- 1998	$0.50 - 0.70$	$1.5 : 0.4$
[León-Ledesma *et al.*(2012)]	1960- 2004	$0.40 - 0.70$	$1.6 : 0.7$

Table: **Source:[Klump *et al.*(2011)]**. Empirical Studies of the Aggregate Elasticity of Substitution and Technological Change in the US.

'Normalized' CES Production function

- Normalization, which consists in expressing the production function in terms of index numbers, is important because it ensures that the parameters of the CES are deep (*dimensionless*) and not a mixture of production parameters which depends on the choice of units.

- Indeed [Klump and Preissler(2000)] and [Klump and de La Grandville(2000)] explain that the normalized CES production function employed permits one to compare results with steady-state allocations and factor income shares that are constant as the elasticity of substitution is changed.

- The normalization procedure then identifies a family of CES production functions that are distinguished only by the elasticity parameter, and not by the steady-state allocations.

- This point is particularly important for growth and business cycle models which use steady-state (or BGP) values about which to approximate the model's local dynamics up to the first order. In practice, normalization consists of recalibrating (or re-parametrizing) the model to match the data each time the elasticity parameter is varied.

- For a more detailed discussion see [Cantore and Levine(2011)] and for a survey see [Klump *et al.*(2011)] return

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