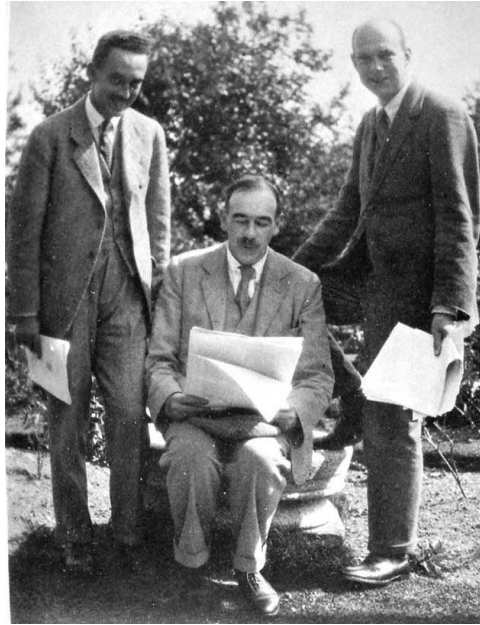Lausanne – 4 December 2018

Sraffa and the theory of distribution

PART ONE

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1.1 Introduction

Sraffa's *Appenix D - Reference to the Literature* (1960, p. 93):

> The connection of this work with the theories of the old classical economists has been alluded to in the Preface. A few references to special points, the source of which may not be obvious, are added here.
>
> It is of course in Quesnay's *Tableau Economique* that is found the original picture of the system of production and consumption as a circular process, and it stands in striking contrast to the view presented by modern theory, of a one-way avenue that leads from 'Factors of production' to 'Consumption goods'.

1.2 Introduction

There are two different conceptions of the production process:

1) **Circular process**: production of commodities by means of commodities (with labour and uses of natural resources)

2) **One-way avenue**: from labour, land and capital to final outputs

The adoption of one (or the other) of these standpoint has important implication for the **theory of distribution**.

1.3 Introduction

Surplus approach

- Production is a circular process

- Produced commodities – necessary commodities = Surplus

- The distribution of the surplus among social classes depends on the class struggle

Marginalist approach

- Production is a one-way avenue

- The distributive variables are the prices of the factors of production

- Income distribution depends on factor (marginal) productivity

2.1 The capitalist mode of production

CAPITAL : from the Latin word "*caput*" [head].

Roma, caput mundi / *Rome, capital of the world*

Used to denote the most important thing [e.g.: the capital city of a country] or something that is at the beginning [e.g.: a capital letter].

Referring to the capitalist mode of production, capital is the amount of value (purchasing power) invested at the beginning of the production process in order to finance the costs of production.

2.2 The capitalist mode of production

1) Society is organized in classes: **workers**, **landowners** and **capitalists**.

2) **Capitalists are the ruling class**. Capitalists are the direct or indirect organisers of production processes. Capitalists are the entrepreneurs.

3) The capitalist system is a **market system**. Commodities are produced in order to be sold on the market. Inputs are purchased on the market (the separation of the labourers from the means of production forces them to sell their labour-power).

2.3 The capitalist mode of production

Since the employment of inputs must precede the production of output for every single process, inputs are generally purchased before output is sold.

The costs and revenues of the same process are therefore not simultaneous, as the former generally precede the latter. As a result, **costs of a certain process cannot be financed by its revenues**.

2.4 The capitalist mode of production

4) Capital is the amount of purchasing power that is required for each process **to advance its costs**. The capital invested is then recovered out of revenues when the output is sold.

5) Profits are the difference between the revenues and costs of each process. They are a **surplus** or a residual that capitalists obtain from revenues over and above the costs, which correspond to their initial investment of capital.

3.1 The capitalist mode of production: an example

$\mathbf{K}_t \in \mathbb{R}_+^M$: vector of capital goods (means of production)

$\mathbf{L}_t \in \mathbb{R}_+^A$: vector of labour services

$\mathbf{N}_t \in \mathbb{R}_+^B$: vector of productive services of natural resources

$\mathbf{Y}_{t+1} \in \mathbb{R}_+^M$: vector of outputs

Production process

$$\mathbf{K}_t \oplus \mathbf{L}_t \oplus \mathbf{N}_t \rightarrow \mathbf{Y}_{t+1}$$

3.2 The capitalist mode of production: an example

$\mathbf{p}_t \in \mathbb{R}_+^M$: vector of commodity prices in period t

$\mathbf{w}_t \in \mathbb{R}_+^A$: vector of wage rates in period t

$\boldsymbol{\rho}_t \in \mathbb{R}_+^B$: vector of rent rates in period t

Costs (in period t)

$$\mathbf{p}_t \, \mathbf{K}_t + \mathbf{w}_t \, \mathbf{L}_t + \boldsymbol{\rho}_t \, \mathbf{N}_t = C_t$$

3.3 The capitalist mode of production: an example

$\mathbf{p}_{t+1} \in \mathbb{R}_+{}^M$: vector of commodity prices in period t+1

Reveneues (in period t+1)

$$\mathbf{p}_{t+1} \ \mathbf{Y}_{t+1} = \text{Revenues}$$

Revenues allow the capitalists to recover the capital advanced with profit.

$$\mathbf{p}_{t+1} \ \mathbf{Y}_{t+1} = C_t + \Pi_{t+1}$$

3.4 The capitalist mode of production: an example

$$\mathbf{p}_{t+1} \, \mathbf{Y}_{t+1} - C_t = \Pi_{t+1}$$

Profit is the difference (**surplus**) between revenues and costs (capital).

It is the self-valorization (self-expansion) of capital, namely the increase of the value of capital by means of its own employment.

The ratio $r_{t,t+1} = \Pi_{t+1} / C_t$ is the **rate of profit**, namely the profit for each unit of capital invested in the process from t to $t+1$.

4.1 The capitalist circuit

Money – Commodities – Money

- Pre-capitalistic circulation of commodities: **C – M – C**
- Capitalistic circulation of commodities: **M – C – M**

Capital, understood as an amount of **purchasing power**, is needed in order to advance the costs of production and therefore to start up the production process.

At the end of the production process, with the revenues from the sale of outputs, the capital invested becomes **purchasing power** again.

4.2 The capitalist circuit

Revenues leave a **surplus** over and above costs: **profit**. Profit is the self-expansion of capital. It represents the increase in the value of capital which arises as a result of its own employment.

$$M - C - M'$$

M : value of the costs anticipated by capital

C : commodities purchased or produced by means of capital

M' : value of the revenues generated at the end of the process, when outputs are sold

$$\text{Profit} : \Pi = M' - M$$

4.3 The capitalist circuit

<p align="center">**Remarks**</p>

i) **Capital is not an input**. The inputs are the capital goods (commodities); the labour services; the productive services of natural resources.

ii) Capital is an economic object of the same kind as costs and revenues. Thus, **capital is an amount of value**.

iii) **The rate of profits is not the price of capital**. Profits are just a residual.

5.1 The surplus equation

The ordinary level of the **general rate of profit** must determined simultaneously to the ordinary levels of prices, by means of a system of equation.

$$(A_a p_a + B_a p_b + \cdots + K_a p_k)(1 + r) + L_a w = A p_a$$
$$(A_b p_a + B_b p_b + \cdots + K_b p_k)(1 + r) + L_k w = B p_b$$
$$\vdots$$
$$(A_k p_a + B_k p_b + \cdots + K_k p_k)(1 + r) + L_k w = K p_k$$

$$[A - (A_a + A_b + \cdots + A_k)]p_a + [B - (B_a + B_b + \cdots + B_k)]p_b + \cdots$$
$$+[K - (K_a + K_b + \cdots + K_k)]p_k = 1$$

5.2 The surplus equation

We know that $w = 1$ implies $r = 0$ and $w < 1$ implies $r > 0$.

We want to obtain a "**surplus equation**", namely an equation that expresses r as a function of w: $r = f(w)$.

With the aim of doing that, Sraffa defines a "**standard commodity**" and builds a "**standard system**".

Standard commodity: a composite commodity that is produced by means of labour and itself.

5.3 The surplus equation

Actual system of production (Sraffa 1960, p. 19):

$$90 \text{ iron} \oplus 120 \text{ coal} \oplus 60 \text{ wheat} \oplus \frac{3}{16} \text{ labour} \rightarrow 180 \text{ iron}$$

$$50 \text{ iron} \oplus 125 \text{ coal} \oplus 150 \text{ wheat} \oplus \frac{5}{16} \text{ labour} \rightarrow 450 \text{ coal}$$

$$40 \text{ iron} \oplus 40 \text{ coal} \oplus 200 \text{ wheat} \oplus \frac{8}{16} \text{ labour} \rightarrow 480 \text{ wheat}$$

180 iron   285 coal   410 wheat   1 labour

Output proportions (180:450:480)

Input proportions (180:285:410)

5.4 The surplus equation

Reduced system of production (Sraffa 1960, p. 19):

$$90 \text{ iron} \oplus 120 \text{ coal} \oplus 60 \text{ wheat} \oplus \frac{3}{16} \text{ labour} \rightarrow 180 \text{ iron} \qquad [1]$$

$$30 \text{ iron} \oplus 75 \text{ coal} \oplus 90 \text{ wheat} \oplus \frac{3}{16} \text{ labour} \rightarrow 270 \text{ coal} \qquad [3/5]$$

$$30 \text{ iron} \oplus 30 \text{ coal} \oplus 150 \text{ wheat} \oplus \frac{6}{16} \text{ labour} \rightarrow 360 \text{ wheat} \qquad [3/4]$$

$$150 \text{ iron} \quad 225 \text{ coal} \quad 300 \text{ wheat} \quad \frac{12}{16} \text{ labour}$$

Output proportions (180:270:360) = (2:3:4)

Input proportions (150:225:300) = (2:3:4)

5.5 The surplus equation

Standard system of production:

120 iron $\oplus$ 160 coal $\oplus$ 80 wheat $\oplus \frac{4}{16}$ labour $\rightarrow 240$ iron   [4/3]

40 iron $\oplus$ 100 coal $\oplus$ 120 wheat $\oplus \frac{4}{16}$ labour $\rightarrow 360$ coal   [4/3]

40 iron $\oplus$ 40 coal $\oplus$ 200 wheat $\oplus \frac{8}{16}$ labour $\rightarrow 480$ wheat   [4/3]

200 iron 300 coal 400 wheat $\frac{16}{16}$ labour

Output proportions $(240{:}360{:}480) = (2{:}3{:}4)$

Input proportions $(200{:}300{:}400) = (2{:}3{:}4)$

5.6 The surplus equation

Gross output: 240 iron; 360 coal; 480 wheat

Means of production: 200 iron; 300 coal; 400 wheat

Net output: 40 iron; 60 coal; 80 wheat = 1 **standard commodity**

Accordingly:

Gross output: 6 units of standard commodity

Means of production: 5 units of standard commodity

Standard ratio: $R = \dfrac{\text{net output}}{\text{means of production}} = \dfrac{1}{5} = 20\%$

5.7 The surplus equation

General rate of profit: $r = \dfrac{40p_i + 60p_c + 80p_w - w}{200p_i + 300p_c + 400p_w}$

Let us assume the standard commodity is the numéraire commodity, i.e.:
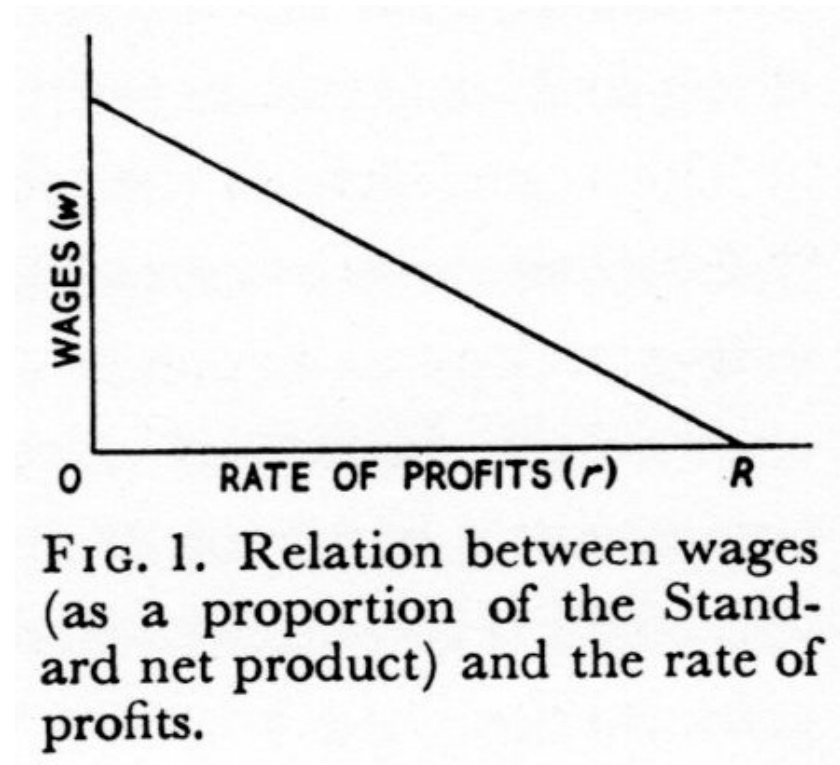
$40p_i + 60p_c + 80p_w = 1.$

Then:

$$r = \frac{1-w}{5} = \frac{1}{5}(1-w)$$

$$r = R(1-w)$$ **Surplus Equation!**

5.8 The surplus equation

Sraffa 1960, p. 22:

FIG. 1. Relation between wages (as a proportion of the Standard net product) and the rate of profits.

5.9 The surplus equation

1. "The straight-line relation between the wage and the rate of profits will … hold in all cases, provided only that the wage is expressed in terms of the Standard product" (Sraffa 1960, p. 23).

2. "there always is one, and only one, value of R to which there corresponds a set of positive multipliers (q's) [i.e.: q_a, q_b, …, q_k] which will transform a given economic system into a Standard system" (Sraffa 1960, p. 29).

6.1 Conclusion

The inverse relationship between w and r provides the analytical basis for the idea of income distribution grounded on class struggle.

> Masters are always and every where in a sort of tacit, but constant and uniform combination, not to raise the wages of labour above their actual rate. To violate this combination is every where a most unpopular action, and a sort of reproach to a master among his neighbours and equals. [...] Masters too sometimes enter into particular combinations to sink the wages of labour even below this rate. [...] Such combinations, however, are frequently resisted by a contrary defensive combination of the workmen; who sometimes too, without any provocation of this kind, combine of their own accord to raise the price of their labour. (Smith, *Wealth of Nations*, I.viii.13)

6.2 Conclusion

Ricardo, in his *Principle of Political Economy*, built a surplus equation:

Social Product (in terms of labour value): L

Social Capital (wages paid in advance, in terms of labour value): Lw

Rate of profit: $r = \frac{L - Lw}{Lw} = \frac{1}{w} - 1$

Ricardo's equation was based on the labour theory of value.

Sraffa has a similar equation, but based on general assumption.