Rising Prices after the Introduction of a New Technique

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Abstract

We support labour contents as an absolute and reliable measurement unit and as an accounting procedure that expresses the real costs and profits of the economic system.

As far as this measurement capacity of labour is concerned, we try to demonstrate, that, from a theoretical point of view, the introduction of more efficient production techniques of goods and services produces an increase in the “prices divided by their corresponding values” ratio, when the wage is fixed, and, in addition, allows, a lower set of prices at the previous – lower - rate of profit.

Current measures of inflation do not detect such price increases and normally interpret price changes – often bundled together with more product features -, as a price decrease. Furthermore, when two economies with different innovation levels, interchange products and services, the one with more intense innovation gives less labour time per unit of price to the other and receives a quantity of labour time proportionally higher than before.

These results are obtained in a model under the following assumptions: Simple – not joint - production is considered where only circulating capital exists. Every good or service considered, is a basic commodity; there is only one quality of labour.

Definitions

We use[2] a Leontief matrix and the wage is expressed as a basket of goods. The resulting price system is as follows:

$$P' = (1+r)P'\left(\begin{bmatrix} a_{11} & a_{12} & \dots & a_{1n} \\ a_{21} & a_{21} & \dots & a_{2n} \\ \dots & \dots & \dots & \dots \\ a_{n1} & a_{n2} & \dots & a_{nn} \end{bmatrix} + \begin{bmatrix} b_1 l_1 & b_1 l_2 & \dots & b_1 l_n \\ b_2 l_1 & b_2 l_2 & \dots & b_2 l_n \\ \dots & \dots & \dots & \dots \\ b_n l_1 & b_n l_2 & \dots & b_n l_n \end{bmatrix}\right) \quad (1)$$

Unknowns

P’, the row vector of prices
r, the common rate of profit

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Based on the presentation to the IWGVT group during the Meeting of the Eastern Economic Association, February 2004
[2] Terminology and developments of Josep Maria Vegara i Carrió, **Economía política y modelos multisectoriales**, Biblioteca Tecnos de Ciencias Económicas, Madrid: Editorial Tecnos, 1979, 190 pp.84-309-0795-5.

Data

$a_{1i},\ldots,a_{ni}$ (column of the *A* matrix), are the necessary inputs to produce a unit of product i

B is the column vector that corresponds to the basket of goods where components: $b_1,\ldots b_n$, are the quantities of good, 1 to n, that need to be consumed to reproduce a unit of work

L’ is a row vector where components $l_1,\ldots,.l_n$, are the quantities of work needed to produce a unit of product of branches, 1 to n

Equation (1) can also be expressed in this way:

$$P' = (1+r)P'(A+BL')$$

And this way:

$$P' = (1+r)P'BL' + (1+r)P'(A)$$

And also this way:

$$P' = (1+r)P'BL'(I - A(1+r))^{-1}$$

Labour values are calculated in this way:

$$\Lambda' = \Lambda' A + L'$$
$$or: \qquad (2)$$
$$\Lambda' = L'(I-A)^{-1}$$

Λ’ is a row vector of the total, direct and indirect, labour time incorporated in each unit of the commodities produced in the system.

Assumptions are: *A* is a non-decomposable and productive matrix, a case of simple production is considered where only operating capital exists. Every good or service considered is a basic commodity; there is only one quality of labour. Constant returns to scale and equalization of rates of profit are, also, assumed.

Conditions for an increase in the "prices divided by values" ratio after a new more productive technique is applied

It has already been demonstrated (see Vegara) that taking the wage: P'B, as a unit for prices, these are always higher than their corresponding values. By taking this unit, we remove the wage from formulas.

It can now be demonstrated, that after a new, more productive technique is introduced, these prices in terms of wage, divided by their corresponding values, increase. This can be deduced by comparing the following expressions of prices (3) and values (5) before and after the introduction a new technique. The increase is due to the fact that the rate of profit in price terms is higher than before (according to Okishio theorem) whereas the *A* matrix is equal for price and value expressions, both before and after the introduction of a new technique, even though it has changed due to the new technique employed.

Price system - in wage units - is[3]:

$$P'_w = (1+r)\mathrm{L}'((1+r)A + (1+r)^2 A^2 + ... + (1+r)^k A^k + ...) \ (3)$$

Expression equivalent to:

$$P'_w = (1+r)\mathrm{L}'(I - A(1+r))^{-1} \ (4)$$

Labour values are calculated in this way

$$\Lambda' = \mathrm{L}'(A + A^2 + ... + A^k + ...) \ (5)$$

expression equivalent to (2).

We proceed, now, to analyze the same result when prices are measured taking another unit that allows the introduction of the wage concept that has been kept concealed with the previous unit.

The prices in system (1) are relative and can be normalized, with an additional equation. We normalize assuming that the wage in prices is equal to the wage in value terms (7), where the wage is expressed by a basket of goods and advanced. And from expression (6) - expression equivalent to (1) -:

$$P' = (1+r)P'B\mathrm{L}'((1+r)A + (1+r)^2 A^2 + ... + (1+r)^k A^k + ...) \ (6)$$

with the above assumption, that can be stated as follows:

$$P'B = \Lambda' B \ \ (7)$$

[3] The comparability of the prices measured in wage units and the labour values may be deduced by looking at the following formulas, where the difference of both prices and values lies in the presence of the rate of profit in the prices equation. Incidentally, this means that as r increases so does the sum of prices and they are always greater than values as long as r is positive.

we get:

$$P'_{w\Lambda} = (1+r)\Lambda' B L'((1+r)A + (1+r)^2 A^2 + ... + (1+r)^k A^k + ...) \ (8)$$

This wage here is the product of the value vector by the wage goods vector and is also a scalar.

The prices are now expressed in wage value units or paid value units. This allows us to keep the wage independent of the prices system, although not of the techniques employed. Comparing expressions (3) and (8) it can be seen that these prices $P'_{w\Lambda}$ are equal to the product of the prices in wage units by the wage amount expressed in value terms in the following way:

$$\overline{P_{w1}}\Lambda'_1 B \ (9)$$

And

$$\overline{P_{w0}}\Lambda'_0 B \ (10)$$

Where

$\overline{P_{w1}}$ is the price vector in wage units after the new technique has been introduced

$\overline{P_{w0}}$ is the price vector in wage units before the new technique has been introduced

Λ_1 is the value vector after the new technique has been introduced

Λ_0 is the value vector before the new technique has been introduced

According to what has been demonstrated above, prices increase in relation to values when measured in wage units:

$$(\overline{P_{w1} / \Lambda_1}) > (\overline{P_{w0} / \Lambda_0}) \ (11)$$

If we now calculate this ratio but in wage value units we obtain the following expression:

$$(\overline{P_{w1} / \Lambda_1})\Lambda_1 B > (\overline{P_{w0} / \Lambda_0})\Lambda_0 B \ (12)$$

It must be noted that this means that, if once we have obtained the new set of prices, we make the wage in prices equal to the wage in the new value units: Λ'_1B, in this case, we can deduce that a sufficiently intense reduction of the wage in terms of value, after the technical change, could compensate the increase in “price divided by labour value” ratio. This would result in the “greater than” operator in (12) not being true for some or all price-value ratios (both sides of the expression are, indeed, comparable provided that they are in the same labour unit).

It is also clear that if the wage were to be kept the same in value terms as before: Λ'_0B, – considering, for instance, that the monetary wage has greater purchasing power as a consequence of the technical change -, the prices divided by values would increase and the inequality (12) would remain true.

There is no contradiction between both units. It is worth noting (see annex, table & graphic 1 & 2) that the ratio: “price expressed in wage units divided by value” is equivalent to “price in wage value units divided by the paid value per unit” (both numerator and denominator are multiplied by the wage in terms of value). Hence, it does take into account the reduction of wage generated after a new more productive technique is employed.

Consequences of the previous analysis

After a technical change has taken place, there is an increase in the ratio price with regard to its corresponding value if the wage is maintained at its previous level. When measuring inflation, we must consider any increase in the ratio price-value as a genuine increase in prices regardless of the observable price decrease.

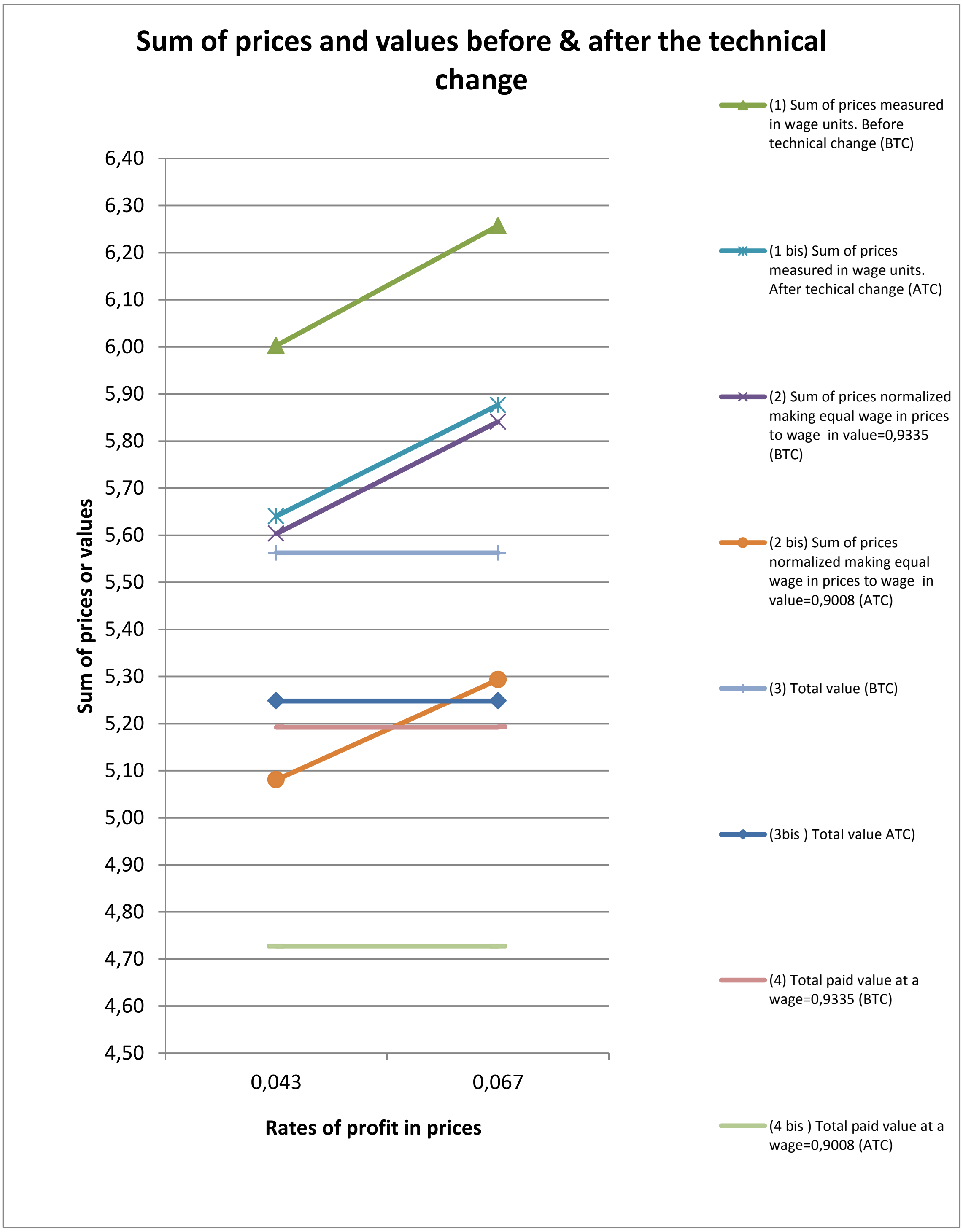
The intention of considering product quality gains offered to the public at the same existing price, as a decrease of price, is aimed at maintaining the real wage by discounting any productivity gains in the wage goods: $\Lambda'_1B < \Lambda'_0B$

Conversely, after a technical change there is also the possibility of devoting this change to lower the prices by not increasing the rate of profit and maintaining it at the same level as before the technical change. Any maintenance of prices due to the increase in the rate of profit should then be considered, by the same token, as an increase in prices.

When comparing commodities and services from areas where the rate of technological development is uneven, areas with the greater rate of innovation increase the labour time obtained in exchange for their commodities, raising in this way a technologically unequal interchange due to the fact that prices represent ever decreasing labour content in comparison. The problem for developed areas can be the realization of extended production to compensate possible constant cost increases. The promotion of technology transfer to less developed countries is, thus, needed to compensate this phenomenon.

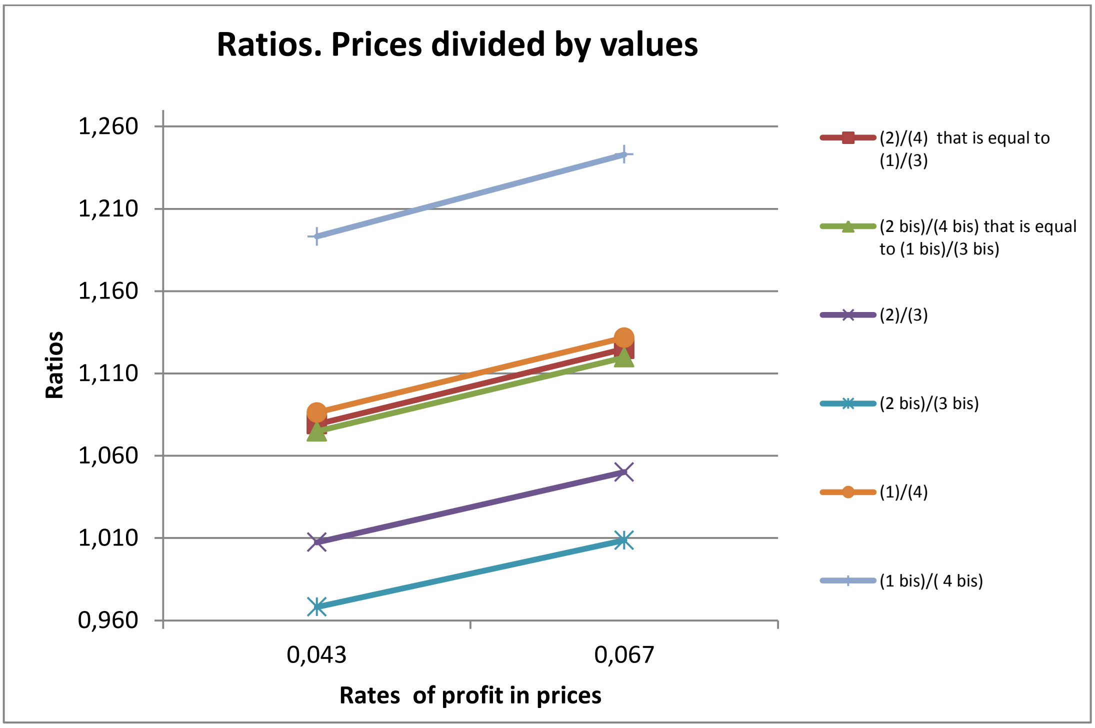
We must bear in mind that the previous analysis is independent of whether the classical tendency of the profit rate to fall operates. It is independent because we are comparing two parallel or relative situations (commodities from different systems, new price for the same commodity,…) where both may be affected by the same rate of profit tendency. It may happen that the profit rate has a tendency to fall but one country succeeds to mitigate this fall more than the other or there is a new way to produce a commodity in certain industry which is comparatively more productive.

Table & graphic 1. Sum of prices and values before and after the technical change		
Rate of profit in prices (r)	***1,043***	***1,067***
(1) Sum of prices measured in wage units. Before technical change (BTC)	6,00	6,26
(1 bis) Sum of prices measured in wage units. After technical change(ATC)	5,64	5,88
(2) Sum of prices normalized making equal wage in prices to wage in value (=0,9335) (BTC)	5,60	5,84
(2 bis) Sum of prices normalized making equal wage in prices to wage in value (=0,9008) (ATC)	5,08	5,29
(3) Total value (BTC)	5,56	5,56
(3bis) Total value (ATC)	5,25	5,25
(4) Total paid value at a wage=0,9335 (BTC)	5,19	5,19
(4 bis) Total paid value at a wage=0,9008 (ATC)	4,73	4,73



- After the technical change, the sum of prices in wage units are lower (1 and 1 bis), at both rates of profit
- Depending on the reduction of wage, the sum of prices in terms of wage value or paid value descend even more
- The same occurs with the total value and the total paid value

Table & graphic 2. Ratios. Prices divided by values		
Rate of profit in prices (r)	***1,043***	***1,067***
(2)/(4) that is equal to (1)/(3)	1,079	1,125
(2 bis)/(4 bis) that is equal to (1 bis)/(3 bis)	1,075	1,120
(2)/(3)	1,007	1,050
(2 bis)/(3 bis)	0,968	1,009
(1)/(4)	1,086	1,132
(1 bis)/(4 bis)	1,193	1,243



- As has been said, prices after a technical change that increases the rate of profit are lower than at the previous rate of profit
- (1)/(3) is only slightly higher than (1 bis)/(3 bis) according to the previous statement. The increase in this ratio has to be measured comparing the value of the ratio (1)/(3) at the rate of profit (0,043) BFC, with the ratio (1 bis)/(3 bis) at the new rate of profit (0,067) ATC: 1,079 versus 1,120. The same is valid for (2)/(3) and (2 bis/(3 bis) 1,007 versus 1,009, but in this case a reduction in the wage ATC could compensate the increase in terms of (1)/(3)
- The highest ratio corresponds to prices in wage units divided by paid value
- The ratio of the prices in wage units over the paid value ATC, (1 bis)/(4 bis) increases and is higher than the corresponding ratio BTC (1)/(4) because of the reduction of the wage

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Annex

I/O matrix. Before technical change

$$\begin{bmatrix} 0,30 & 0,20 & 0,20 \\ 0,10 & 0,10 & 0 \\ 0,10 & 0,10 & 0,05 \end{bmatrix}$$

I/O matrix. After technical change

$$\begin{bmatrix} 0,30 & 0,20 & 0,20 \\ 0,10 & 0,10 & 0 \\ 0,10 & 0,10 & 0,05 \end{bmatrix}$$

Labour before technical change

$$\begin{bmatrix} 1 & 0,10 & 2 \end{bmatrix}$$

Labour after technical change

$$\begin{bmatrix} 1 & 0,09 & 2 \end{bmatrix}$$

Wage goods remain identical

$$\begin{bmatrix} 0,1 & 0,10 & 0,25 \end{bmatrix}$$

$$\begin{bmatrix} 0,1 & 0,10 & 0,25 \end{bmatrix}$$

Wage in value terms before t. change
$\Lambda'_0 B$

0,9335 hours/hour

Wage in value after t. change
$\Lambda'_1 B$

0,9008 hours/hour

	Good or serv. 1	**Good or serv. 2**	**Good or serv. 3**
Before technical change (BTC)			
Prices in wage units P_{w0}	2,11	1,23	2,66
Values Λ_0	1,95	1,10	2,51
Prices in wage units divided by values P_{w0}/Λ_0	1,08	1,11	1,06
Prices when wage in prices is made equal to wage in value –prices in wage value units (or paid value units) - $P_{w\Lambda 0}$	1,97	1,15	2,49
Prices in wage value units divided by values $P_{w\Lambda 0}/\Lambda_0$	1,01	1,04	0,9892
Rate of profit (r) 0,04			
After technical change (ATC)			
Prices in wage units P_{w1}	2,16	0,99	2,74
Values Λ_1	1,91	0,84	2,51
Prices in wage units divided by values P_{w1}/Λ_1	1,13	1,18	1,09
Prices when wage in prices is made equal to wage in value –prices in wage value units - (or paid value units) $P_{w\Lambda 1}$	1,94	0,89	2,47
Prices in wage value units divided by values $P_{w\Lambda 1}/\Lambda_1$	1,02	1,06	0,9856
Rate of profit (r) 0,07			