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His main work is “Positive Studies on Rates of Surplus Value” (in Japanese), 1992, Horitsubunkasya.

Significance of Total Labor Account in Economic Research

[JP] Hiroshi Izumi

I. Introduction

Total labor means direct labor plus indirect labor. Direct labor means labor required in the sector to produce it. Indirect labor means labor inputted in the raw materials and the fixed capitals required to produce it. We can calculate total labor quantity¹ per unit quantity of product using input-output tables. A model by using national input-output tables is the following.

¹ labor quantity = working hours×intensity×complexity, See Izumi, Hiroshi (1992)

A Model of Total Labor Account using national input-output tables

t: total labor quantity per unit product, row vector

A: input coefficient of domestic material, matrix

D: consumption coefficient of domestic fixed capital, matrix

e: share of products in export, column vector

m: input coefficient of import material + consumption coefficient of import fixed capital, row vector

r: direct labor quantity per unit product, row vector

$$\mathbf{t} = \mathbf{t}(\mathbf{A} + \mathbf{D}) + \mathbf{t} \cdot \mathbf{e} \cdot \mathbf{m} + \mathbf{r} \quad (1)$$

Substantial meanings of equations (1) are the following.

$\mathbf{t} \cdot \mathbf{A}$ means row vector indicating labor quantities inputted in the domestic raw materials required to produce unit quantity of product. $\mathbf{t} \cdot \mathbf{D}$ means row vector indicating labor quantities inputted in the decrease of domestic fixed capitals required to produce unit quantity of product. $\mathbf{t} \cdot \mathbf{e}$ means the scalar indicating average total labor quantity inputted unit quantity of export. $(\mathbf{t} \cdot \mathbf{e}) \cdot \mathbf{m}$ means row vector indicating total labor quantities inputted in the import raw materials and the decrease of import fixed capitals required to produce unit quantity of product on the assumption that the labor quantity inputted in one dollar of import equals the average labor quantity inputted in one dollar of export. \mathbf{r} means row vector indicating direct labor quantity required to produce unit quantity of product.

Briefly, (1) means that total labor quantity equals direct labor quantity plus labor quantity inputted in the domestic raw materials and the domestic fixed capitals plus labor quantity inputted in the import raw materials and the import fixed capitals.

We solve (1) concerning \mathbf{t}

$$\mathbf{t} = \mathbf{r}(\mathbf{I} - \mathbf{A} - \mathbf{D} - \mathbf{e} \cdot \mathbf{m})^{-1} \quad (2)$$

II. First Area of the Use of Total Labor Accounts: Study on Surplus Labor

Labor is indispensable to sustain and develop human society. It is clearly an important theme in social science to research quantitatively and positively which classes bear how much labor quantities and which classes for what purposes use how much of the results. Total labor accounts are necessary for such researches.

Many Marxian economists, for example Uesugi, S., Yamada, K. and others, estimated rate of surplus value by using formula (3).

$$\text{the profit/the wage} = (\text{the value added} - \text{the wages})/\text{the wages} \quad (3)$$

Okishio, N. invented an estimation method for rate of surplus value based on formula (4)¹.

$$\text{the unpaid labor / the paid labor} = (W - \sum B_i t_i) / \sum B_i t_i \quad (4)$$

where W is the labor quantity offered by a worker one day, (B_1, \dots, B_n) is the consumption basket obtained by a worker per one day, t_i is total labor quantity inputted in the i th commodity.

Izumi, H. estimated rates of surplus value in the era of the rapid growth in Japan, the U.S.A and the Republic of Korea, based on formula (4) and indicated that there are the under-mentioned differences between the results estimated by using formula (3) and those estimated by using formula (4)².

1. The rates of surplus value estimated by using formula (4) considerably rose in the era of the rapid growth in Japan, whereas those estimated by using formula (3) little rose in the same era.

The main reasons why these differences have arisen are the following. The numerator of formula (3) includes not only the exploited value from employees but also exploited value from self-employed workers. The rate of surplus value of employees and the rate of exploitation of self-employed workers rose, but the number of self-employed workers decreased, therefore exploited value from self-employed workers also decreased.

2. The rates of surplus value of employees in small business estimated by using formula (4) are higher than those in big business, whereas those in small business estimated by using formula (3) are lower than those in big business.

3. Not only employees but also self-employed workers are severely exploited by capital. Formula (4) can indicate the rate of the exploitation of self-employed workers, whereas Formula (3) cannot indicate them.

4. The rates of surplus value of employees in Japan based on formula (4) were lower than those in the U.S.A. and were higher than those in Republic of Korea. (Izumi's estimations are till 1985.) The rates of surplus value of employees in Japan based on formula (3) were higher than those in U.S.A.

III. Second Area of the Use of Total Labor Accounts: Study on Productivity

Measurement of productivity is an important theme beyond sector in economics. Total labor accounts are necessary for measurement of total labor productivity. Total labor productivity is ratio of output to total labor quantity. Total labor productivity combines direct labor productivity, raw material productivity and fixed capital productivity.

1 See Okishio, Nobuo (1959)

2 See Izumi, Hiroshi (1992)

We can calculate total labor productivity by using formula (5).

$$V = [v_1, v_2, \dots, v_n] = \left[\frac{1}{t_1}, \frac{1}{t_2}, \dots, \frac{1}{t_n} \right] \quad (5)$$

Where (v_1, v_2, \dots, v_n) is ratio of output to total labor quantity,

t_i is total labor quantity per unit quantity of i th output.

We can calculate total labor productivity growth by using formula (6).

$$P = \left[\frac{v_1^1 - v_1^0}{v_1^0}, \frac{v_2^1 - v_2^0}{v_2^0}, \dots, \frac{v_n^1 - v_n^0}{v_n^0} \right] \\ = \left[\frac{t_1^0 - t_1^1}{t_1^1}, \frac{t_2^0 - t_2^1}{t_2^1}, \dots, \frac{t_n^0 - t_n^1}{t_n^1} \right] \quad (6)$$

Where (v_1, v_2, \dots, v_n) is ratio of output to total labor quantity,

t_i is total labor quantity per unit quantity of i th output

0 means the beginning of a period

1 means the end of a period.

Total factor productivity of neo-classical economics also combines direct labor productivity, raw material productivity and fixed capital productivity. But I think total labor productivity is better than total labor productivity.

Total factor productivity of neo-classical economics is based on production function.

$$X_0 = F_0(L_0, K_0, M_0) \quad (7)$$

where X is output

L is labor

K is fixed capital

M is raw material

0 means base-period.

F_0 is specified by using either of the following methods.

- (a) least squares method by using data set of output, labor, fixed capital and raw material which are in the same technique
- (b) Based on marginal theory of neo-classical economics, to be more precise, based on the assumption of perfect competition and cost-minimization

Productivity Growth is calculated by using Formula (8)

$$X_1 - F_0(L_1, K_1, M_1) \quad (8)$$

I doubt about this method because F_0 cannot be specified precisely by using the above mentioned methods. Concerning (a), we cannot know whether the data set are concerning the same technique, because the same technique means the same productivity and from now we begin to measure productivities. Concerning (b), Perfect competition and cost-minimization are not generally available. Especially in developing countries, there are

not such conditions.

Positive researches by Izumi, H. and others¹ show that total labor productivity growth in China is larger than total factor productivity growth. These researches indicate that Krugman, P. and others' opinion, the recent growths in Asian countries have been based on input increase, not on productivity growth, has no scientific grounds.

IV. Third Area of the Use of Total Labor Accounts: Study on Volume Comparison of Product

Total labor accounts are necessary for spatial or temporal volume comparison of aggregated or total products.

Products consist of various things different in physical property. Units to measure them are different.

Rice: a ton

Iron: b ton

Electricity: c watt

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We cannot aggregate product volumes expressed in different physical unit.

If prices are the following,

Rice: α yen per ton

Iron: β yen per ton

Electricity: γ yen per watt

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Then we can aggregate them.

$$\alpha \times a + \beta \times b + \gamma \times c + \dots$$

If we use uniformed prices among countries or among time-points, we can compare aggregated product volumes among countries or among time-points. We can calculate rates of aggregated product volumes among countries or among time-points. In this case, rate of aggregated product volumes among countries or among time-points is an average of rates of each product volume among countries or among time-points and these uniformed prices play a role as weight in this average. Even if rates of each product volume among countries or among time-points are the same, rates of aggregated product are different according to weight. Therefore it is important to use which prices in spatial or temporal comparison of aggregated volumes of products which have different physical property.

Value prices (prices which are in proportion to average total labor quantity) are optimum as uniformed prices to compare volumes among countries or among time-points.

¹ See Izumi, Hiroshi and Li, Jie(2005), Izumi, Hiroshi and Ren, Wen (2005)

In international comparison, average total labor quantity means average of ‘average total labor quantities in each country’.

The reasons are the following:

1. This is a method which fits the essence of production and production volume. Productions are actions in which human beings create or increase use values by labor. Production volumes are sizes of their results. Production volume does not mean size of useful things. Useful things which are not results of labor are not products. Spatial or temporal comparison of aggregated volumes of products which have different physical property had better be done by a method which fits the essence of production and production volume.

2. The subject, how to compare volumes of aggregated products spatially or temporally, exists not only in commodity producing societies but also in other all societies. Whether products have price or not, if there are productions, this subject exists. The concept, total labor, is a concept which is always effective wherever production is. The idea, to aggregate volumes of various products different in physical property by using total labor quantity as weight, can apply at any period regardless of economic system.

3. Marxian price theory is framed by value price(=price which is proportion to total labor quantity)→production price→real market price. Value price is better as price for aggregation than production price and real market price. This is essentially based on the reason mentioned above. But we can say so from the following reason. Production prices change, even if product volumes and production techniques do not change, if only distribution changes. For example, if wage rates change, surplus value rates and average profit rate change. Then if organic compositions of capital are different by industry, production prices by industry change. It is needless to say that real market price changes according to various factors which include not only real production states but also other various factors.

4. Utility function (or indifference curves) of neo-classical economics cannot serve a basic theory to aggregate various products different in physical property. Evaluation for product is different by income class, culture, viewpoint on life, hobby Macro utility function changes, even if product volumes and each individual person’s utility function do not change, if only distribution among persons changes.

5. Purchasers consist of not only persons (households) but also enterprises, government and foreign countries. Relative prices of consumer goods, investment goods, export goods and intermediate goods cannot be led by utility function.

6. General equilibrium theory also cannot serve a basic theory to aggregate various products different in physical property. General equilibrium prices change, even if product volumes and production techniques do not change, if other factors changes.

Izumi, H. and others¹ have begun to do positive researches concerning international comparison of volumes of aggregated and total products or economic sizes by using total labor accounts. International volume comparisons by using prices which are proportion to international average total labor quantities show that Chinese relative economic size comparing Japanese and Korean economic sizes are larger than the one by using active prices.

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¹ Izumi, Hiroshi, Jie Li, and Hyun-Ok Yang, (2007), Izumi, Hiroshi, Masahiro Ogawa, Jie Li, and Hyun-Ok Yang, (2007)