ECONOMIC ANALYSIS AND WORKERS' MANAGEMENT, 3, XVI (1982), 261—272

THE GOALS AND THE SECTORAL CHOICE OF TECHNIQUE UNDER WORKER-MANAGEMENT

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I

The purpose of this paper is to show that the choice of technique depends on the goals adopted by self-managed firms, and that there are some differences between the choice of technique made from the point of view of the entire economy and the choice of technique made from the point of view of the firms.

We shall consider the simple model of an economy, which is well known. (Garegnani, 1970; Harcourt, 1972; Harris, 1978; Jarsulic, 1980.). The economy has two sectors, the first producing capital goods, the second producing consumption goods. There is no net investment, so that all surplus product is composed of the consumption good. Competition assures that all self-managed firms in the first sector choose the same technique, relating capital goods and labour to the unit level of output in a fixed proportion, and it does the same in the second sector. Labour is homogeneous; there are equal wage rates and rates of profit across all self-managed firms in the economy.

Taking the price of the consumption good as the numeraire, the two price equations can be written as:

$$\begin{aligned} P_1 &= (1 + r)a_{11}P_1 + a_{01}w \\ 1 &= (1 + r)a_{12}P_1 + a_{02}w \end{aligned} \qquad (1)$$

where a_{0j} = labour input per unit of good j; a_{1j} = capital good input per unit of good j; w = the real wage rate in terms of consumption good and r = the rate of profit. The technology of the entire economy can be defined as any set of a_{1j}'s and a_{0j}'s, that is:

$$\begin{bmatrix} A \\ \hline a_0 \end{bmatrix} = \begin{bmatrix} a_{11} & a_{12} \\ 0 & 0 \\ \hline a_{01} & a_{02} \end{bmatrix}$$

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Each column represents a process of production in the respective sector. The capital good is a basic commodity (entering into each process of production), but the consumption good is a non-basic commodity. Technique and related prices are differentiated by the superscripts α, β.

As is well known, for any particular technique we can solve the price equations (1) for a wage rate:

$$w = \frac{1 - a_{11} - ra_{11}}{a_{02}(1 + a_{11}(Z - 1)) + r(a_{02}a_{11}(Z - 1))} \tag{2}$$

where

$$Z = \frac{a_{12}/a_{02}}{a_{11}/a_{01}} = \frac{\textit{machine-labour ratio in consumption-good sector}}{\textit{machine-labour ratio in capital-good sector}}$$

The wage curve (2) slopes downward in the w — r space, with the maximum rate of profit $R = \frac{1 - a_{11}}{a_{11}}$ (for $w = o$) and the maximum wage rate $W = \frac{1 - a_{11}}{a_{02}(1 + a_{11}(Z - 1))}$ (for $r = o$).

Since the net output per worker will be divided between profits and wages, we have by definition $y = rk + w$, where y = net output per worker and k = value of capital per worker for the entire economy. We assume that there is no net investment and since the price of the consumption good is taken as unit, y will be equal to the maximum wage rate under a given technique. Therefore, the surplus product can be measured as $y - w$. The value of capital goods depends on the rate of profit, and it can be expressed as capitalized surplus product by the prevailing rate of profit:

$$k = \frac{y - w}{r} \tag{3}$$

II

The wage curve (2) relates the wage rates to each level of the profit rates, under a given technique. Competition equalized wage rates and rates of profit across all self-managed firms in the economy. Therefore, the wage curve (2) holds for the entire economy as well as for each self-managed firm.

We shall consider now a particular case of the choice of technique. Suppose there is only one way of producing a capital good, but two different ways of producing the consumption good. Let us reflect these differences in the α and the β techniques, which can be written as:

$$\begin{bmatrix} A \\ \hline a_0 \end{bmatrix}^{\alpha} = \begin{bmatrix} 0{,}6 & 0{,}8 \\ 0 & 0 \\ \hline 0{,}3 & 0{,}4 \end{bmatrix} \qquad \begin{bmatrix} A \\ \hline a_0 \end{bmatrix}^{\beta} = \begin{bmatrix} 0{,}6 & 1{,}0 \\ 0 & 0 \\ \hline 0{,}3 & 0{,}2 \end{bmatrix} \tag{4}$$

All the technical coefficients of the technique β are identical to those in the technique α, except that $a^{\beta}_{12} > a^{\alpha}_{12}$ and $a^{\beta}_{02} < a^{\alpha}_{02}$. This implies that the β technique is more mechanized in the consumption good sector than the α technique. Since the process of production of the capital good remains unchanged, it also implies that the β technique is more mechanized than the α technique for the entire economy.

The price equations for the two techniques can be written as:

$$\begin{aligned} P_1^{\alpha} &= (1 + r)\, a_{11} P_1^{\alpha} + a_{01} w \\ 1 &= (1 + r)\, a_{12} P_1^{\alpha} + a_{02} w \end{aligned} \tag{5}$$

and

$$\begin{aligned} P_1^{\beta} &= (1 + r)\, a_{11} P_1^{\beta} + a_{01} w \\ 1 &= (1 + r)\, a_{12} P_1^{\beta} + a_{02} w \end{aligned} \tag{6}$$

The particular shapes of the wage curves (2) are:

$$w^{\alpha} = 1 - 1{,}5\, r \qquad w^{\beta} = \frac{0{,}4 - 0{,}6\, r}{0{,}38 + 0{,}18\, r} \tag{7}$$

These wage curves are shown in Fig. 1.

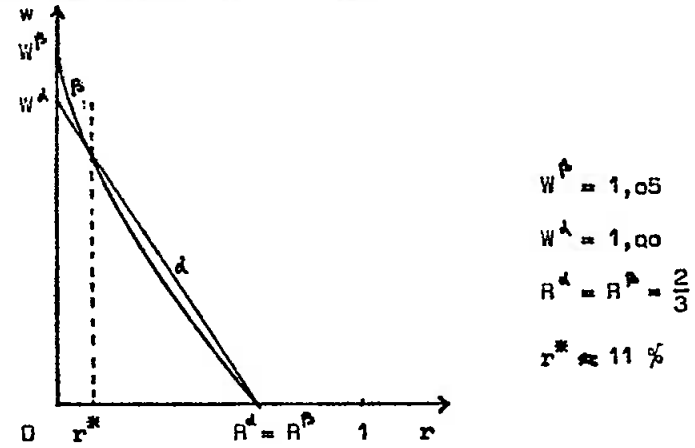

Fig. 1.

Since there is no change in the process of production of the capital good, both the maximum rates of profit are identical, $R^{\alpha} = R^{\beta}$. The switch point of techniques is at $r^* \approx 0{,}11$. We are concerned with a competitive situation in the capital market, so the rates of profit can be taken as given constants from the point of view of the self-managed firms.

We assume now that workers employed in self-managed firms in the consumption goods industry can choose the technique they want, independently of workers employed in the other firms of the capital goods industry. The question is: What technique will be chosen?

The choice depends on the goals adopted by the self-managed firms. We shall consider two particular goals. The first is the highest net income per worker, that is, the highest wage rate. The second is the highest profit per worker.

If the motivation of the workers in the consumption goods industry requires maximization of the wage rate, the choice of technique is apparent in Fig. 1. For the rates of profit $0 \leqslant r < r^*$ they will select the β technique, and for the rates of profit $r^* < r < R^{\alpha} = R^{\beta}$ they will choose the α technique.
They are indifferent to the two special values of the profit rate, namely if $r = r^*$ and $r = R^{\alpha} = R^{\beta}$.

The second goal, which requires maximization of the profit per worker, needs some more elaboration. Profit per worker in the consumption goods industry can be written as: $\pi_2 = r \frac{a_{12}}{a_{02}} P_1$ and the price of the capital good can be written as: $P_1 = \frac{a_{11}}{a_{12}} + \frac{a_{02} a_{11}}{a_{12}} w(Z-1)$.

Hence, for a given technique:

$$\pi_2 = r\left(\frac{a_{11}}{a_{02}} + a_{11} w(Z-1)\right)$$

In the case we are examining, we have the following expressions for profit per worker in the consumption goods industry under each technique:

$$\pi_2^{\alpha} = r\left(\frac{a_{11}}{a_{02}^{\alpha}}\right) = 1{,}5\, r \qquad (8)$$

$$\pi_2^{\beta} = r\left(\frac{a_{11}}{a_{02}^{\beta}} + a_{11} w\,(Z-1)\right) = r(3 + 0{,}9\, w) \qquad (9)$$

because $Z^{\alpha} = 1$.
The profit per worker curves in the consumption goods sector is shown in Fig. 2.

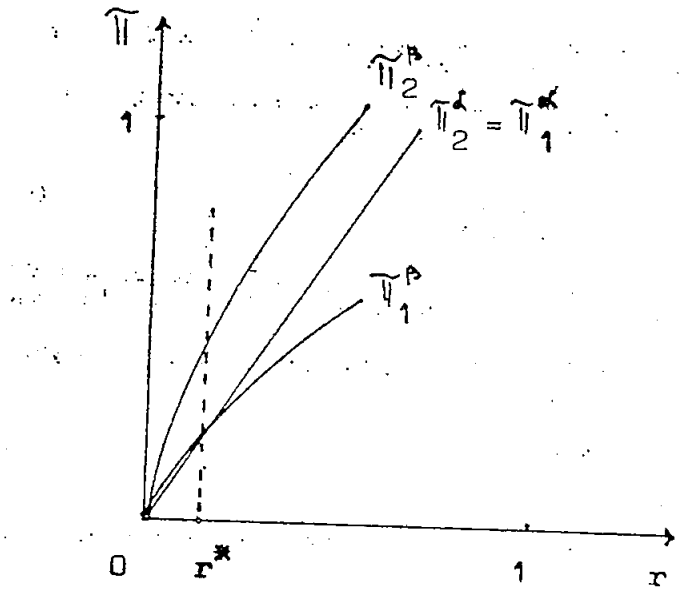

Fig.2.

We can see that the self-managed firms in the consumption goods sector will receive higher profit per worker for the technique β than for the technique α, whatever the rates of profit are. That means there are no opportunities to switch from one technique to the other, from the point of view of the workers in the consumption goods industry. The consequence will be a lower wage rate, if the rates of profit are between r^* and R.

The paradox is that workers in the capital goods sector, attempting to maximize their own profit per worker, would choose the same technique as workers in the consumption goods industry if they maximized the wage rate.

It is clear that the two goals conflict from the point of view of the best chosen technique. It also implies the economic struggle between workers employed in different sectors of production.

We now turn to the question of what will happen to the employment and the (relative) outputs, when self-managed firms select technology under different goals.

Taking the output of the consumption goods sector as the numeraire, the two quantity equations can be written as:

$$x_1 = (1 + g)\, a_{11} x_1 + a_{01} c$$
$$1 = (1 + g)\, a_{12} x_1 + a_{02} c \qquad (10)$$

where, g = the rate of growth, $c = (d_1, d_2) \cdot \begin{bmatrix} x_1 \\ 1 \end{bmatrix}$ = consumption per worker, d_j = coefficients of consumption (in this case $d_1 = 0$), x_1 = (relative) output of the capital goods sector.

For any particular technique we can solve the quantity equations (10) for a level of the consumption per head:

$$c = \frac{1 - a_{11} - g a_{11}}{a_{02}(1 + a_{11}(Z - 1)) + g(a_{02} a_{11}(Z - 1))} \qquad (11)$$

The monotonically falling wage curve w(r), (2), is identical with the curve for the consumption per head c(g), (11), in the function of the rate of growth.

The (relative) output of the capital goods industry for a given technique can be written as:

$$x_1 = \frac{a_{11}}{a_{12}} + \frac{a_{02} a_{11}}{a_{12}} c(Z - 1) \qquad (12)$$

For the technique α, the value of Z is unit, so the (relative) output of the capital good will be:

$$X_1^{\alpha} = \frac{a_{11}}{a_{12}^{\alpha}} = 0{,}75 \qquad (12')$$

For the technique β, the value of Z is greater than unit, so the (relative) output of the capital goods sector will be:

$$X_1^{\beta} = \frac{a_{11}}{a_{12}^{\beta}} + \frac{a_{02} a_{11}}{a_{12}^{\beta}} c^{\beta}(Z - 1) \qquad (13)$$

Having in mind that $w^{\beta}(r) = c^{\beta}(g) = \frac{0{,}4 - 0{,}6\, g}{0{,}38 + 0{,}18\, g}$, the relation (13) will take the particular shape of:

$$x_1 = 0{,}6 + 0{,}18 \frac{0{,}4 - 0{,}6\, g}{0{,}38 + 0{,}18\, g} \qquad (14)$$

Both curves (12) and (14) are shown in Fig. 3.

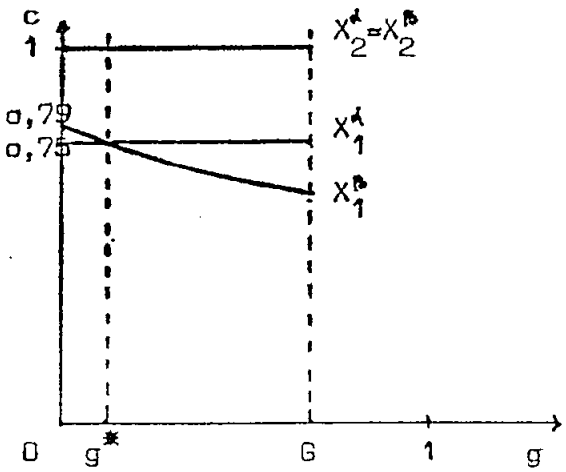

Fig.3.

The output of the consumption goods sector is relatively greater than the output of the capital goods sector, for both techniques. If self-managed firms seek to maximize net income per labourer, these differences slowly increase for the rates of growth between 0 and the switch point g*; afterwards, they are constant.

If self-managed firms seek to maximize profit per worker, the relative output of the consumption goods sector continously increases or (which is the same thing) the relative output of the capital goods industry continously decreases.

The changes of relative outputs will affect employment in the self-managed economy. As the rate of growth increases from zero to its maximum, employment will slowly decrease if the goal is maximizing profit per worker. This decrease will stop at the switch point g* if the self-managed firms in the consumption goods sector seek to maximize wage rates.

We have shown what different choices of technique would be made under the influence of different goals adopted by the self-managed firms. One of these goals, that is the profit per man, implies a conflict between workers employed in different sectors of production. Besides this conflict there is another one. From the point of view of the entire self-managed economy, it is rational to choose the technique which assures the greater aggregate net income per worker. In our case, this is the β technique. This choice coincides with the choice of technique made under the influence of the profit-per-man goal. Still, it is opposite to the other choice of technique, which maximizes the wage rate. Hence, there is an association of the conflict between workers employed in different sectors of production with the conflict of micro-macro decision rules for the choice of technique.

III

We shall consider the opposite case, namely, that workers in the capital goods industry can select the technique they want. We suppose now that there is only one way of producing a consumption good, but two different ways of producing the capital good. Let these differences be reflected in the α and the β technique, as follows:

$$\begin{bmatrix} A \\ - \\ a_0 \end{bmatrix}^{\alpha} = \begin{bmatrix} 0{,}6 & 0{,}8 \\ 0 & 0 \\ - & - \\ 0{,}3 & 0{,}4 \end{bmatrix} \qquad \begin{bmatrix} A \\ - \\ a_0 \end{bmatrix}^{\beta} = \begin{bmatrix} 0{,}7 & 0{,}8 \\ 0 & 0 \\ - & - \\ 0{,}1 & 0{,}4 \end{bmatrix}$$

All the technical coefficients of the technique β are identical to those of the technique α, except that: $a_{11}^{\alpha} < a_{11}^{\beta}$ and $a_{01}^{\alpha} > a_{01}^{\beta}$. Therefore, the technique β is more mechanized in the capital goods industry than the technique α.

The price equations for the technique β can be written as:

$$\begin{aligned} P_1^{\beta} &= (1+r)\, a_{11}^{\beta} P_1^{\beta} + a_{01}^{\beta} w \\ 1 &= (1+r)\, a_{12}^{\beta} P_1^{\beta} + a_{02}^{\beta} w \end{aligned} \tag{15}$$

The price equations for the technique α are the same as before, that is, as the relation (5). The particular shape of the wage curve is:

$$w = \frac{0{,}3 - 0{,}7\, r}{0{,}2 - 0{,}2\, r} \tag{16}$$

The maximum rate of profit is $R^{\beta} = \frac{3}{7}$ and the maximum wage rate is $W^{\beta} = \frac{3}{2}$. Both wage curves for the α and the β techniques are shown in Fig. 4.

Workers in the capital goods industry will select the β technology for the rates of profit between 0 and $r^* = \frac{1}{3}$, and then turn to the α technology until the rate of profit reaches its maximum $R^{\alpha} = \frac{2}{3}$ if their goal is the maximum of the wage rates.

If the workers of the capital goods industry are motivated by a different goal, that is to maximize profit per worker, they would make

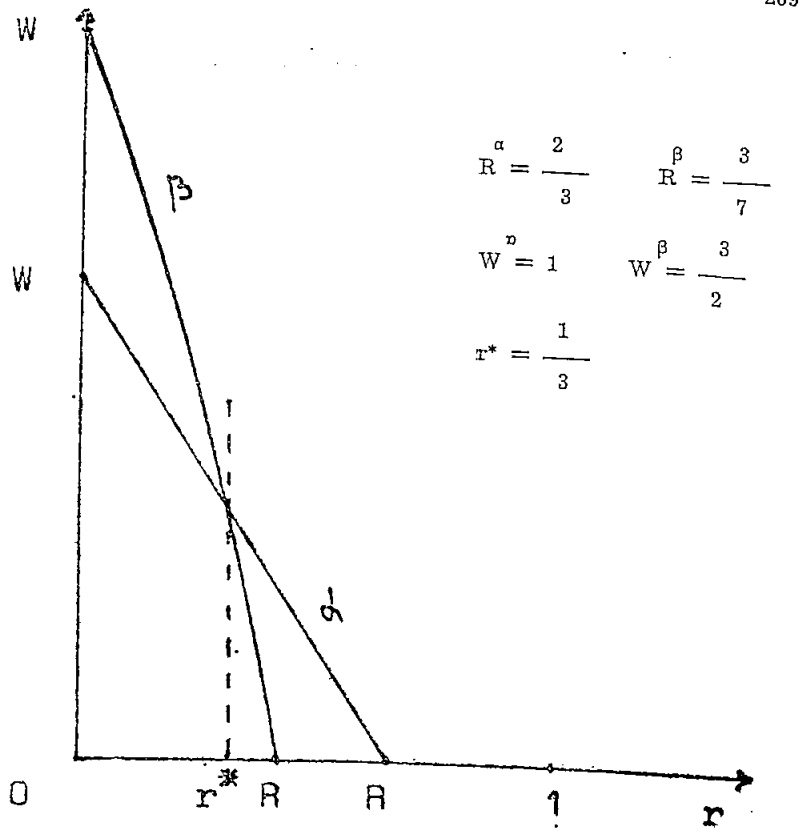

Fig. 4.

a different choice. Let us first define profit per worker in the capital goods industry. It can be written as: $\pi_1^{\beta} = r \frac{a_{11}^{\beta}}{a_{01}^{\beta}} P_1^{\beta}$. Recalling that the price of the capital good is:

$$P_1^{\beta} = \frac{a_{11}^{\beta}}{a_{12}^{\beta}} + \frac{a_{02}^{\beta} a_{11}^{\beta}}{a_{12}^{\beta}} w\,(Z^{\beta} - 1)$$

the profit per man can be written as:

$$\pi_1^{\beta} = \frac{r}{Z^{\beta}} \left(\frac{a_{11}^{\beta}}{a_{02}^{\beta}} + a_{11}^{\beta} w\,(Z^{\beta} - 1) \right) \tag{17}$$

Its particular shape for the technique β is:

$$\pi_1^{\beta} = r\,(6{,}125 - 1{,}7395\,w) \tag{18}$$

The profit per worker in the consumption goods industry can be written as:

$$\pi_2^{\beta} = r\left(\frac{a_{11}^{\beta}}{a_{02}^{\beta}} + a_{11}^{\beta} w\,(Z-1)\right) = r\,(1{,}75 - 0{,}5\,w) \tag{19}$$

Both curves (18) and (19) are shown in Fig. 5.

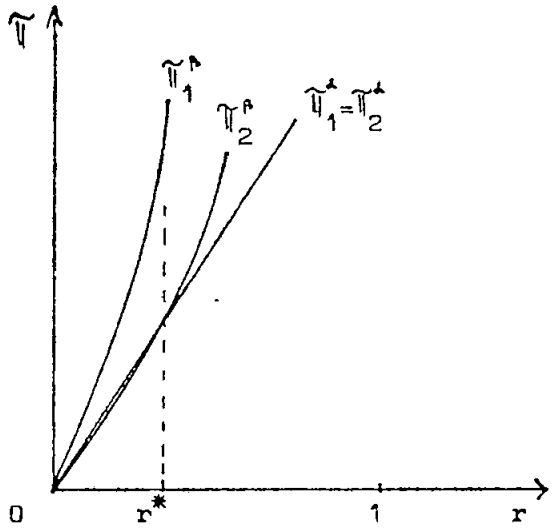

Fig.5.

If workers in the capital goods industry seek to maximize own profit per worker, they will choose the β technique, whatever the profit rates are. Its choice conflicts with the position of workers in the consumption goods industry for the rates of profit between 0 and 1/3.

The relative output of the capital goods industry can be written as:

$$X_1^{\beta} = \frac{a_{11}^{\beta}}{a_{12}} + \frac{a_{02}^{\beta} a_{11}^{\beta}}{a_{12}}\, c\,(Z-1) \tag{20}$$

The consumption per head curve (11) for the β technique is identical to the relation (16). Taking both relations (16) and (20), we get:

$$X_1^{\beta} = 0.875 - 0.2485\,\frac{0.3 - 0.7\,g}{0.2 - 0.2\,g} \tag{21}$$

All the output curves are shown in Fig. 6.

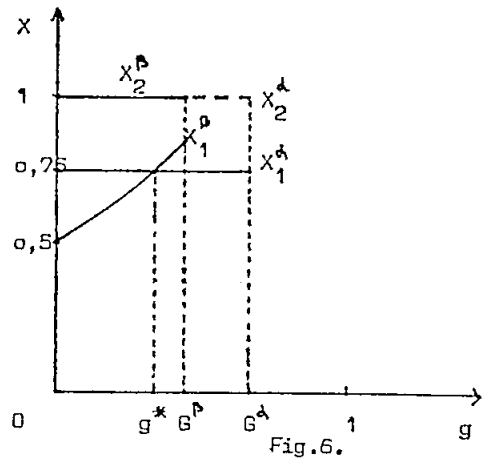

Fig.6.

The relative output of the capital good will continuously increase if the technique β is the only chosen technique. This increase will stop at the switch point g* if workers in the capital goods industry seek to maximize wage rates.

In the former case, employment is a decreasing function of the rate of growth, but in the latter case, this decreasing function will be stopped at the switch point: after then, it will be constant but at a higher level than before.

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CILJEVI I SEKTORSKI IZBOR TEHNIKE U SAMOUPRAVNOJ PRIVREDI

Miroljub LABUS

Rezime

U ovom članku je analiziran izbor tehnike u jednostavnom dvosektorskom modelu privrede u kojoj postoje samo opticajna proizvodna sredstva. Ceo mogući spektar tehnikâ je sveden samo na dve tehnike, α i β, s tim da je tehnika β više kapitalizovana tehnika. Promena tehnike alternativno pogađa jedan ili drugi sektor privrede. U tim okvirima posmatrano je ponašanje samoupravnog preduzeća u odnosu na dva moguća kriterijuma izbora tehnike: dohodak po radniku i dobit po radniku.

Kako od izbora tehnike u jednom sektoru zavisi primena tehnologije u celoj privredi, ukazano je na moguće konflikte između sektora, čak i u okviru primene istog kriterijuma izbora tehnike. Bolja tehnika sa stanovišta jednog sektora može nametnuti onu tehnologiju celoj privredi koja ne odgovara drugom sektoru. Istovremeno je prikazan i poznati zaključak da promena kriterijuma izbora tehnike vodi usvajanju različitih tehnologija.

Cela analiza je ilustrovana na jednostavnom primeru alternativnih tehnologija. Osim odnosa na strani raspodele i cena, analiziran je i uticaj izbora tehnike na relativne odnose obima proizvodnje po sektorima i na zaposlenost.

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AKTIVIZACIJSKI PERIOD INVESTICIJA U INDUSTRIJI JUGOSLAVIJE

*Tomislav VUKINA**

ANALITIČKA PODLOGA I PRIKAZ METODOLOGIJE EMPIRIJSKE ANALIZE

U ekonomskoj literaturi se pojam aktivizacijskog perioda investicija najčešće vezuje s problemom izračunavanja kapitalnih odnosno proizvodnih koeficijenata. Kapitalni koeficijent se definira kao omjer između kapitalnih dobara upotrebljenih u procesu proizvodnje i veličine proizvodnje koja je rezultirala između ostalog i njihovim djelovanjem, a proizvodni koeficijent predstavlja njegovu recipročnu vrijednost. Ako je riječ o kapitalnim modelima, gdje je pretpostavljena veza između kapitala i proizvoda u njihovoj ukupnosti, onda ocjena duljine trajanja aktivizacijskog perioda ne predstavlja ograničavajući faktor. Međutim, kod investicijskih modela gdje se pretpostavlja veza između investicija i godišnjeg prirasta proizvodnje, izbor odgovarajućih makroekonomskih agregata oštro nameće potrebu poznavanja veličine investicija u toku ili duljine trajanja aktivizacijskog perioda.

Najsažetije, aktivizacijski period možemo definirati kao razdoblje kapitalizacije investicija. Proizvodnja i montaža osnovnih sredstava zahtijeva određeno vremensko razdoblje, koje se s ekonomskog stajališta ne može zanemariti, u kojem je potrebno izdvojiti određeni dio sredstava za investicije u osnovna sredstva, a da ona još uvijek ne djeluju u smislu faktora proizvodnje.

Aktivizacijski period kao vremenski interval od isplate financijskih sredstava za investicije do upotrebe novih kapaciteta u proizvodnji, s jedne strane ovisi o efikasnosti u procesu investiranja i odraz je ponašanja proizvođača, dok je s druge strane određen tehnologijom proizvodnje samih osnovnih sredstava. Budući da najveći dio investicija otpada na građevinske objekte i opremu, to će razina tehničke opremljenosti te stupanj proizvodnosti i organizacije rada u građevinarstvu i u odgovarajućim industrijskim granama koje proizvode opremu, utjecati na duljinu aktivizacijskog perioda.

Ako investicije u osnovna sredstva tretiramo kao određeni trošak u sadašnjem razdoblju s ciljem povećanja proizvodnog kapaciteta u

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