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Some suggestion for the theory of the capitalistic firm. A cybernetic approach*

by

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In order to give a first insight into the relations characterizing the modern capitalism a model of a dynamic equilibrium for a two sector economy is presented. The first sector produces the intermediate goods utilized both as capital goods (everlasting) and as a variable and fixed input to the commercial activity, while the second one produces the consumers goods.

In the model presented, the rate of interest is considered as a predetermined variable. In fact, the changes in the rate of interest may be produced as feedback effect of the disequilibria entailed by the process of development. Public expenditures are not considered; they can be introduced as a predetermined variable. It is assumed that there is only one representative firm and that the consumers goods are only offered by a monopolistic firm. In the intermediate commodity sector competition is assumed.

1. Modern mon polies

In modern capitalism the monopolistic power of the firms is to a large extent groundet on their capacities to increase the obstacles to entry into their markets through the commercial activities (products diversification and differentiation and sales promotion). The resulting monopolistic profits are partly utilized to finance the commercial activities. Besides the monopolistic effect, the commercial activities have two consumption effects: a substitution effect (the concumption of the commodities offrered by the firms carrying on commercial activities invreases at the expenses of the commodities offered by the "competitive firms") and a global consumption effect (the increase in the propensities to consume). The monopolistic effect entails direct effects on real wages and/or on the rentiers income (the latter depending on the changes in the retention ratio). The monopolistic firms control the growth potentialisties of their markets: the financial potentialities depend on

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the retained profits and on the capability of actrating external finance which depends from the rate of monopolistic profits. Interesting phenomena are produced inducing structural changes when the growth potentiality is not congruent with the financial potentiality.

2. A first insight into problem of income distribution

A first insight in the relations characterizing the modern capitalism can be obtained by a model of dynamic equilibrium for a two sector economy. The first sector produces the intermediate good utilized both as a capital good (everlasting) and as variable and fixed input for the commercial activity; the second sector the consumers good. Both the variable a and the fixed input A of the commercial activities are function of the intensity π of such an activity (expressed as a ration of the level of the activity properly defined and the level of production). The mark up of the firm (ratio between the profit of the firm in excess on the interest on capital at the competitive rate and the level of production) is a function of the intensity of the commercial activity (market power function). Investments are financed out of profits and through external finance produced by the savings of the consumers each of them keeping a balanced portfolio. If the price of the intermediate commodity is p-th consumers good being the numeraire and the capital coefficient of the first industry is a_k we can normalize the book value of a share to be pa_k, the market value being equal to the book value. The book value of a share in the second sector is pc_a, a_c being the capital coefficient. Because in the second sector the firms enjoys a monopolistic profit, partly retained and partly distributed, the market value of the share is

$$d = pa_c + \frac{(1-r)\varrho(\pi)}{i} + b\frac{r\varrho(\pi)}{i}, \tag{1}$$

and the retention ratio

$$v = 1 + \frac{(1-r)\varrho(\pi)}{ipa_c} + b(g)\frac{r\varrho(\pi)}{ipa_c}, \tag{2}$$

where i being the rate of interest, $\varrho(\pi)$ the net monopolistic profit margin.

Let us indicate by w the real wage rate, c_1 and c_2 the propentities to consume of the workers and of the rentiers (booth function of π), by x and y the production of the consumers goods and of the intermediate commodity and by g the rate of growth.

The equations of the simple model are the following

(i) The price equation for the intermediate commodity

$$p = wl_k + ipa_k. \tag{3}$$

(ii) The price equation for the consumers' good (numeraire)

$$l = wl_c + ipa_c + m(\pi). \tag{4}$$

(iii) The mark up equation

$$\varrho(\pi) = m(\pi) - p\,[A(\pi)/x - a(\pi)]. \tag{5}$$

(iv) The equation representing the equilibrium in the intermediate commodity market: the quantity produced y must be equal to new investment and the input for the commercial activities

$$y = g(a_c x + a_k y) + A(\pi) + a(\pi)x. \tag{6}$$

(v) The equation representing the equilibrium in the consumers' good market

$$x = c_1 w(l_k y + l_c x) + c_2 \{ip(a_c x + a_k x) + (1-r)\varrho(\pi)x + \gamma r \varrho(\pi)x\}. \tag{7}$$

Let us indicate $\nu(r) = 1 - r(1-\gamma)$ the quota of net profits which induces a (proportional) consumption by the rentiers. Then

$$P(\pi, r) = c_2 \nu(r) \varrho(\pi) \tag{8}$$

in the consumption out of the monopolistic profit per unit of production, i.e. out of the profits that the firm can obtain through the obstacles to entry produced by the commercial activities. Let us call $P(\pi, r)$ *monopolistic consumption.*

The equation (7) can be rewritten

$$x = c_1 w(l_k y + l_c x) + c_2 ip(a_c x + a_k y) + P(\pi r)x. \tag{7b}$$

(vi) The valuation ratio equation

$$v = 1 + \frac{[1 - r\{1 - b(g)\}\varrho(\pi)}{ipa_c}. \tag{2b}$$

(vii) The equations expressing the propensities to consume

$$c_1 = c_1(\pi), \tag{9}$$

$$c_2 = c_2(\pi). \tag{10}$$

The model also includes the relations expressing the properties of $a(\pi)$, $c_i(\pi)$ and $m(\pi)$ as well as the non negative conditions for the endogeneous variables.

It is easy to see that the investment-savings equation is implied by the other equations of the model (Walras law). There are eight equations to determine the eight unknown; p, $z = y/x$, w, ϱ, v, g, c_1 and c_2.

The main results obtained by the solution of the model are:

(a) In a golden age, normally an increase in the retention ratio produces a decrease in the valuation ratio. An increase in the intensity of the commercial activity may produce an increase or a decrease in the valuation ratio. In fact from the equation of our model we obtain

$$\frac{\partial v}{\partial \pi} = \frac{l_c - iD}{il_k a_c} \frac{\{1 - r[1 - b(g)]\}\{\varrho'(\pi)[1 - m(\pi)] + m'(\pi)\varrho(\pi)\}}{[1 - m(\pi)]^2} + \varrho(\pi)[1 - m(\pi)]rb'(\partial g / \partial \pi) \tag{11}$$

where $D = l_c a_k - l_k a_c$ depend on the ratio of the capital output coefficient of the two sectors.

Since $\partial g / \partial \pi$ is likely to be increasing for value of π less than a critical value π_g and decreasing afterwards and since the valuation ratio increases also for negative value of $\partial g / \partial \pi$ provided

$$\left|\frac{\partial g}{\partial \pi}\right| > \frac{\{1-r[1-b(g)]\varrho'(\pi)\}\{[1-m(\pi)]+m'(\pi)\varrho(\pi)\}}{\varrho(\pi)[1-m'(\pi)]rb'(g)} \tag{12}$$

the valuation ratio is likely to increase for a while and then to decrease.

(b) The surplus depends also on the commercial activity. We can distinguish two main effects of the commercial activity on the surplus and on the rate of growth: an exploitation effect entailed by the increase in the price of the consumers good (marxian effect) and a consumption effect (keynesian effect). To, express the surplus and the rate of growth let us indicate by

$$L(\pi) = l_c + l_k d(\pi)$$

where

$$d(\pi) = \frac{m(\pi)-\varrho(\pi)}{p} = A(\pi)/x + a(\pi) \tag{13}$$

the labour required to obtain a unit of consumers good: more precisely the labour employed both for its production and for the production of the input of the associated commercial activity, and by

$$K(\pi) = a_c + a_k d(\pi) \tag{14}$$

the capital required to obtain a unit of consumers good. Then

$$S = l - c_1 wL(\pi) - c_2 ipK(\pi) - P(\pi, r) \equiv S(w, \pi, r) \tag{15}$$

is the surplus entailed by the production of one unit of consumers good. It is worthwhile noticing that in our economy the surplus does not only depend on technology and on other exogeneous parameters (the exogeneous distribution variable and the consumers' tastes) but also on the firm's parameters: the retention ratio and the intensity of the commercial activity. Let us assess the effects of changes in the intensity of the commercial activities and in the retention ratio on the suprlus:

$$\frac{\partial S}{\partial \pi} = -cL(\pi)w'_\pi - c_2 iK(\pi)p'_\pi - P'_\pi(\pi, r) - (c_1 wl_k + c_2 ipa_k)d'(\pi) - wL(\pi)c'_1 - ipk(\pi)c'_2. \tag{16}$$

The effect of change in π on S is an algebraic sum of various effects:

(a) The workers' exploitation-induced by an increase in π and represented by the term $c_1 L(\pi)w'$ (which is always negative) entails an increase in the surplus.

(b) The rentiers' exploitation represented by the sum of the term $c_2 iK(\pi)p'$ which is always negative and the term $p'(\pi, r)$ which can be positive or negative (when it is positive the rentiers exploitation is mitigated by monopolistic princing).

(c) The effects on the input of commercial activities represented by the term $(c_1 wl_k + c_2 ipa_k)d'(\pi)$ which may be positive or negative.

(d) The consumption effect which represented by the increase in the workers and rentiers' consumption due to the increase in their propensities to consume $wL(\pi)c'_1 + c'_2 ipK(\pi)$: the increase in the intensity of the commercial activities causes a decrease in the surplus because, of its effect on consumption.

At a certain point such a decrease is likely to effect the increase produced through the exploitation effects.

An increase in the retention ratio produces a decrease in the monopolistic consumption and thereby an increase in the surplus. In fact

$$\frac{\partial S}{\partial r} = -\frac{\partial P}{\partial r} = c_2 \varrho(\pi)(1-\gamma) > 0. \tag{17}$$

We can now easily express g as a function of w, π, r

$$g = \frac{S(w, \pi, r)}{-c_1 WD + a_k[1-P(\pi, r)]}. \tag{18}$$

The rate of growth is the ratio between the surplus and the capital required for the production of one unit of intermediate commodity less the associated monopolistic consumption, increased or decreased by a quantity dependent on the divergence in the capital labour ratios of the two sectors and on the consumption of one unit of labour.

The rate of growth can be also expressed in term of z and

$$g = \frac{z-d(\pi)}{a_c + a_k z}. \tag{18b}$$

We can assume that also at a zero level of the commercial activities g is positive: the value of g for $\pi = 0$ can be considered as the immanent rate of growth in the Marris' sense. That means that our economy has come out of the stationary state, namely that at a spontaneous subsistence level of wages it can produce a surplus. (A necessary condition is: $a_k\{1-P(\pi, r)-cWD\} > 0$.

Since there is always a positive rate of savings g cannot fall below a certain level g_m.

We can now evaluate the effects of changes in on the rate of growth. From equation (18) we obtain

$$\frac{\partial g}{\partial \pi} = \frac{\partial S/\partial \pi\{a_x[1-P(\pi, r)-c_1 wD\} + \{a_k[1-P(\pi, r)]-c_1 wD\}^2}{+\{a_k P'(\pi, r)+D(cw'_\pi - wc'_1)\}S(\pi, w, r)} \tag{19}$$

From the equation (18b) we get

$$\frac{\partial g}{\partial \pi} = \frac{\partial Z/\partial \pi K(\pi) - d'(\pi)(a_c + a_k z)}{(a_c + a_k z)^2}. \tag{19b}$$

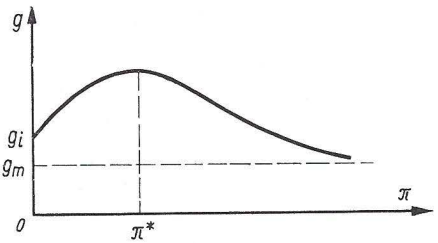

Fig. 1

We can easily find the most likely behaviour of z: rising up to a certain value of π and then decreasing. The behaviour of $d(\pi)$ is not likely to induce a different

pattern of behaviour in g: it may only induce a more (or less) rapid increase in g as compared with the increase in z. Therefore a possible behaviour of g is the one represented in Fig. 1: $\partial g/\partial \pi$ is positive up to a certain value and negative afterwards. The maximum value of g occurs at the point (π) in which

$$\frac{\partial z}{\partial \pi} = d'(\pi)\frac{a_c + a_K z}{K(\pi)} > 0.$$

Other possible variations in g — in corresponding to changes in π—cannot be ruled out. Two interesting cases are represented in Fig. 2.

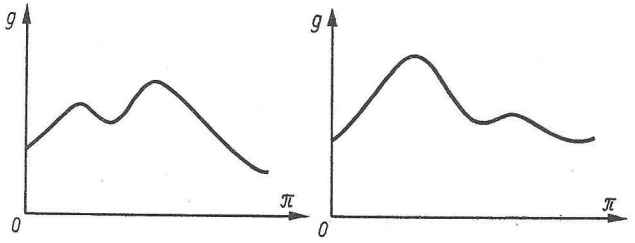

Fig. 2

We can easily prove that an increase in the retention ratio produces an increase in g. In fact:

$$\frac{\partial g}{\partial r} = \frac{\partial S/\partial r\{a_k[c_1 wL(\pi) + c_2 ipK(\pi)] - c_1 wD\}}{\{a_k[1 - P(\pi, r)] - c_1 wD\}^2} > 0.$$

In this simple model we have tacitly assumed that the two decision variables π and r can be determined independently of each other. In fact, a more realistic consideration of the P and D activities of the firm (by dropping the assumption of a golden age path) can show that there is a minimum level below which the retention ratio, cannot go, as some of these activities (which are very risky) are financed only out of the retained profits. We ought also to assume that there are several corporations each of them capable of entering other industries teritory by acquiring existing firms or by creating new plants. They have a better knowledge of the retained profits and of the growth potentialities of the firms in some other fields than their shareholders.

In the valuation ratio of these firms fall below a certain level because of an increase in the retention ratio (given π) the managers of certain corporations operating in other fields may take them over. Therefore the retention ratio can vary within a given interval.

Shareholders are supposed to strive for the maximization of v: managers wish to obtain a rate of growth as large as possible. Shareholders wish to keep the retention ratio at a minimum level: managers want to push it towards the maximum level. The actual value of the retention ratio is determined by the social and institutional features of the economy.

Given the retention ratio the problem to be solved by the firm is the determination of the intensity of the commercial activities. Let us suppose that for given w

and r the relation $g(\pi)$ is that represented in diagram 3 in which we have also represented, (upside down), the relation between v and π.

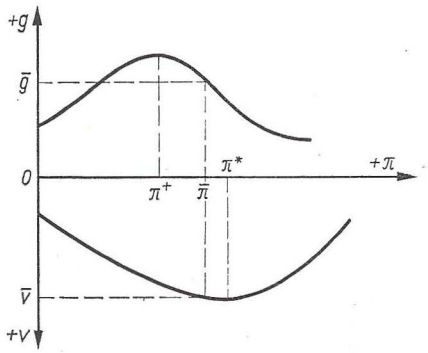

Fig. 3

π^+ is the intensity of the commercial activities which produces the greatest value of g, π^* is the one to which the maximum value of v corresponds. In general, $\pi^* < \pi^+$. The value of which will actually be chosen by the firm wull lie in the interval $\pi^+ - \pi^*$. Let it be $\bar{\pi}$.

3. Equilibrium, disequilibrium and planning

In the previous sector we have figure out a warranted rate of growth through an equilibrium path analysis. For such a rate to be produced, the various effects of the commercial activity (in particular the marxian and the keynesian ones) must be such as to keep the supply in balance with the total demand. If the marxian effects are stronger, then we can experience a stagnation, whereas a stronger keynesian effect produces inflationary tendencies. Such kinds of dynamics have some feedback effects on the market power functions of the firms.

Changes in the retention ratio and/or in the intensity of the commercial activity may result from the divergence between the warranted rate of growth and the natural rate: they may be induced also by stagnation or inflationary tendencies. Such changes may have stabilizing or destabilizing effects. The dynamic process becomes more complex if we assume that the propensities to consume depend on the changes in income and on income expectations.

In our model we have considered the rate of interest as a predetermined variable. In fact, changes in the rate of interest may be produced as feedback effects of the disequilibria entailed by the process of development. When there is a stagnation trend, an increase in the rate of interest could have a negligible effect on investments: the more the investments are financed out of profits the less remarkable is the effect of changes in the rate of interest. On the contrary such a change could stimulate consumption inasmuch it increases the rentiers income. Yet such a result is unlikely

to be obtained since the usual way for an increase in the rate of interest to be produced is a decrease in the stock exchange value of the bonds: the negative effect on wealth may then offset the positive effects on the future income obtained from the future savings.

In our model we have not considered public expenditure: it can be introduced as a predetermined variable. In fact, its changes may not be entirely autonomous: they may result from feedback effects of the disequilibria in the process of development. Public expenditure have both a monopolistic effects, inasmuch it entails a shift in the market power function, and a consumption effect.

A first preliminary remark has to be outlined: in order to interpret the real dynamic process a cybernetic model should be constructed. So far wages have been considered as a passive (endogeneous) variable which always assume its equilibrium value. In fact the wage level is the result of a game played by the trade unions and by the firms (the Government usually not being a passive operator). The strategic moves of each of the player depend on the development of the economy. The inverse is also true. The approach suggested by differential games cannot deal satisfactorily with the learning process and the divergences between the estimation and the perspectives and expectation of the various players.

The game between trade unions and workers may have some effects on the rentiers. In fact, in so far trade unions succeed in reducing the monopolistic exploitation, the rate of interest (and therefore the rentiers' income) will tend to be reduced to such an extent as to restore the dynamic equilibrium. An alternative reaction leading to the same results may be an increase in the retention ratio.

The rentiers exploitation, so much longed for by Keynes, may be the result both of the new monopolies' strategies and of the trade unions reactions (rather than the effect of an economic policy aiming at full employment by monetary and fiscal means).

In the model we have assumed that there is only one representative firm and that consumers goods are only offered by a monopolistic firm: moreover in the intermediate commodity sector competition has been assumed. In fact there are many monopolistic firms in the various sectors offering consumers goods: each of them heve different growth potentialities and financial capabilities of development. Some firms may operate side by side with competitive firms: the commercial activity may then induce structural changes (in particular the shrinkage of the competitive sectors). Some innovation activity may enable small firm to enter into the markets: then except for a few exception their incapability of pursing further development of the innovation activity and of the commercial activities may cause them to be absorbed by big firms. The process of development of the large firms may become a complex strategic decision inasmuch it may occur both as an enlargement of existing plant or by the creation of new plant or by the mergers.

The large firms when they have exausted the potentiality of growth offered by the strinage of the internal competitive sectors or by the mergers of weaker firms, in order also to avoid compet oligopolistic strugglemay find it convenient to establish new plants abroad (multinational firm).

The existence of monopolistic power in the market of intermediate commodity may make the economic development still more complex. The role of public expenditure has to be thought over again: the structure of public expenditure become of paramount importance and may help the various monopolies, able of affecting government activity, to keep their relative market power.

Economic policy analysis can thus be to a large extent integrated into the analysis of the actual economic development.

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Pewne sugestie na temat teorii przedsiębiorstwa kapitalistycznego. Podejście cybernetyczne

Aby dać wstępny pogląd na zależności charakteryzujące współczesny kapitalizm, przedstawiono model równowagi dynamicznej gospodarki dwusektorowej. Pierwszy sektor wytwarza dobra pośrednie używane albo jako środki produkcji (nie zużywające się), albo jako zmienne albo ustalone wejścia do sfery handlowej. Drugi sektor wytwarza dobra konsumpcyjne.

W przedstawionym modelu stopa procentowa traktowana jest jako z góry dana zmienna. Zmiany stopy procentowej mogą powstawać w wyniku nierównowagi spowodowanej procesem rozwoju. Nie uwzględnia się tu wydatków społeczeństwa; można je wprowadzić jako z góry zadaną zmienną. Zakłada się, że istnieje tylko jedno reprezentacyjne przedsiębiorstwo oraz że dobra konsumpcyjne są dostarczane przez przedsiębiorstwo monopolistyczne. W sektorze produkującym dobra pośrednie zakłada się istnienie konkurencji.

Некоторые предложения к теории капиталистического предприятия. Кибернетический подход

Для того, чтобы дать предварительное понятие о зависимостях характеризующих современный капитализм, представлена модель динамического равновесия двухсекторного хозяйства. Первый сектор производит промежуточные ценности употребляемые либо в качестве средств производства (не изнашивающихся), либо переменных или определенных ходов в область торговли. Второй сектор производит потребительские товары.

В представленной модели предполагается, что процентная норма является заранее известной переменной. Изменения процентной нормы могут возникать в результате отсутствия равновесия, вызванного процессом развития. Здесь не учитываются общественные издержки; их можно ввести в виде заранее заданной переменной. Предполагается, что существует только одно представительное предприятие, а также, что потребительские товары выпускает монолистическое предприятие. Предполагается существование конкуренции в секторе производящем промежуточные ценности.