A Model to Measure the Profit Rate of Specific Industrial Capitals by Computing their Turnover Circuits

Juan Iñigo Carrera

Buenos Aires, June 1996
(List of practical applications updated in 1998)

CICP
Centro para la Investigación como Crítica Práctica

e-mail: jinigo@inscri.org.ar

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1. Measuring the profitability of specific industrial capitals

Industrial capitals open their process of valorization by being advanced under the form of money, of money-capital, *M*. Money capital is then transformed into commodity capital, *C*, with the purchasing of the commodities needed to perform the process of production. Commodity capital is turned into productive capital, *P*, as soon as the labor power that is part of it is put into action upon the means of production that form its other part. When the process of production reaches its end, productive capital has been transformed into a new product able to reach the market. Still, the amount of this renewed commodity capital does not only correspond to the amount of that which open this circuit of industrial capital. It includes now a surplus to be realized. It is now *C'*. When the product is sold, the industrial capital returns to its original form, that of money capital. But it does so with its amount increased, as *M'*. The industrial capital has completed its turnover, emerging from this circuit with its amount increased, that is, after valorizing itself[1]. We represent schematically the circuit of industrial capitals as:

$$M - C \left\langle \begin{matrix} L \\ Mp \end{matrix} \right. \ldots P \ldots C' - M'$$

where
M: money capital
C: commodity capital
P: productive capital
L: labor power
Mp: means of production
$-$: circulation process
...: production process

The only difference that makes sense of this return to the original form is the quantitative difference rendered in each circuit and, on a general basis where each individual capital enters as an aliquot part of the total social capital, in the summation of the circuits developed in a year. The degree in which an industrial capital is able to valorize itself on this general basis is the most concrete expression of the organicity of the general autonomous regulation of today's social life through capital accumulation. As such, this degree has its immediate expression in the relationship between the profit appropriated in a year and the capital advanced to obtain it, the concrete annual rate of profit. So the annual turnover of an industrial capital corresponds to:

$$K' = K(t + p)$$

where
K': valorized capital that emerges from the turnover circuits completed during the year, i.e., the capital materialized in the production sold during the year,
K: capital advanced for the annual operation,
t: annual rate of turnover of *K*,
p: annual rate of profit of *K*,
from where:

[1] Marx, Karl, *Capital*, Vol. II, Part I, "The Metamorphoses of Capital and their Circuits," Moscow: Progress Publishers, 1967, pp. 25-155.

$K.t$: capital consumed for the production sold during the year, i.e., the cost of *K'*,
$K.p$: total annual profit.

Nevertheless, being the annual rate of profit the concrete expression of the organicity of the autonomously regulated economic process, its determination has no way of making itself immediately apparent in its realization through the annual turnover of each industrial capital. The annual rate of profit always manifests itself as an ex-post - therefore, merely external - relation between the amount of capital as a premise and as a result of the aggregate of its annual circuits, although the true dependent variable is the latter amount of capital. As we are going to deal here with the appropriate procedures to compute the annual rate of profit when industrial capital takes a specific form - in its double determination given by the material division of social labor and by the development of the general rate of profit into different normal capacities of valorization - we must start moving in this field where:

$$p = \frac{K' - K\,t}{K}$$

$$K\ t = \sum P_i\ Q_i$$

$$K' = \sum\ P_o\ Q_o$$

$$t = \sum_{i=1}^{n} \left(\frac{P_i\ Q_i}{\sum (P_i\ Q_i)} \,.\, t_i \right)$$

with
P: commercial prices
Q: physical units
i: inputs
o: outputs
t_i : inverse of the time taken by the portion of capital materialized in each input to complete its turnover, as it is determined by the unity of the respective technical, commercial and financial conditions.

Any conscious action that is going to affect in whichever way the capacity to valorize itself of a given industrial capital can only be such provided it includes in its own ruling the awareness of the profitability at stake. In other words, it demands we properly reflect the turnover of the industrial capital in question and measure its profitability in an unequivocal way.

From its very principles, business accounting is structured to reflect the changes in form through the turnover circuits and to compute the realized profit, concerning any actually existing industrial capital, i.e., any individual industrial capital. In this very sensible field, where a mistaken computation could mean bankruptcy, the criteria of business accounting are applied even when the analysis of a hypothetical or projected profitability is at stake. In fact, the accurate computation of the annual rate of profit is the essential base that supports the whole structure of business accounting, whether respecting actual or budgeted data.

The picture changes completely as soon as we look at what is the current practice concerning the measuring of the profitability of industrial capitals that have not an actual immediate existence. We are basically referring to purely hypothetical singular capitals and to specific (in the twofold sense already defined) industrial capitals. The former mainly inherits in the field currently defined as of "evaluation of investment projects"; the latter, in the field currently defined as of "analysis of typical economic agents." The current practice in these two fields altogether excludes the computation of the rate of profit through the reflection of capital's turnover. In the former, the internal rate of return and the net present value hold the absolute primacy as the unequivocal expressions of capital's profitability. In the latter, the internal rate of return surely enjoys popularity too. But the primacy in measuring profitability belongs here to the margin over costs, and secondarily, to the computation of the advanced capital through procedures that are external to the computation of its turnover.

Yet, the theorists that support these procedures do not constrain the question to a matter of achieving a more or less accurate substitute for the annual rate of profit and its accountancy basis. They put into question the meaning itself of the annual rate of profit as the unequivocal expression of industrial capital's profitability. And some carry such a question to the extreme of demanding from business accounting to abandon its criteria and turn to the direct computation of the internal rate of return in its everyday practice[2]. Neoclassical economic theory substitutes the "marginal productivity" that capital yields in physical terms according to the respective production function - in which capital takes part represented as a "production factor," together with other "production factors," particularly labor – for the rate of profit. According to what happens in practice, not even the most enthusiasts supporters of the theory of marginal productivity ratify their faith in production functions far enough to resort to them when they have to evaluate the profitability of investment projects or of specific capitals. At best, they turn the question upside down. They start by computing what they present as the proper indicator of capital's profitability through one of the mentioned methods, to end up by shaping a pseudo production function (pseudo, as the equilibrium capital's "marginal productivity" is not its dependent variable but enters as a given amount). Yet, those methods show by their very form that they are rooted on the same theory of the production factors and their sources of revenue.

In fact, it is quite hard to make such theory and the circuit of industrial capital into one piece. On facing the latter unfolded, labor cannot be abstractly opposed to capital, since the purchase of its capacity, of labor power, distinctly appears as a specific form that capital takes while it turns over in its metamorphosis process. At the same time, the circuit of industrial capital makes obvious that the price of the product cannot be resolved into "revenues," since it

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[2] For instance, Palle Hansen complains about what he believes professional accountant's reluctance towards adjusting accounting principles and practice to Irving Fisher's definition of capital and income, on the basis of what he names "the principle of anticipated capital interest" (*The Accounting Concept of Profit: An Analysis and Evaluation in the Light of the Economic Theory of Income and Capital*, Amsterdam: North-Holland Publishing Company, 1962). Truly, the problem is the other way round. Pushed by mainstream economic theory, that starts by putting aside capital's circuit, accounting practice forces the definition of its categories to the limit compatible with its basic aim: to properly reflect the valorization circuit of an actual industrial capital in its annual unity. How accounting practice suffers from this contradiction between its positive specific aim and the ideological need to achieve this aim while presenting mainstream economic theory as its true foundation, is immediately visible when it degrades the turnover of fixed capital to a depreciation, or to a non less external determination as the apparent repayment of a debt, an amortization. The same happens with the *ad hoc* treatment given by practical accounting to profit's realization when each circuit of circulating capital extends itself through many years. But as soon as accounting practice has strained its criteria to make it fit into mainstream economy's categories, mainstream economic theory gets back into the scene. It does so to condemn the thus enervated accounting categories and complete their forcing into the Procrustes' bed of the economists' abstract, "golden age" categories, stepping on the build in inconsistency between their apparent definition and their true content to reflect capital's turnover. At this stage, mainstream economic theory normally concludes by - in a patronizing tone - bringing all the question down to the accountants' abstract "inability" or "naiveté," that rather sound more like "stupidity," to grasp the "true economic content or meaning" of accounting concepts (F. Fisher and J. McGowan, "On the Misuse of Accounting Rates of Return to Infer Monopoly Profits," *American Economic Review*, 73, 1983, pp. 82-97; Harcourt, G., "The Accountant in a Golden Age," *Oxford Economic Papers*, xvii, 1965, pp. 66-80). Hansen himself points out some of the build in inconsistencies, though only to claim for the complete abstraction of accounting from its basic aim as if this was the true way to achieve it; and he is certainly not a dilettante concerning practical accounting, as any accountant who has started learning the matter through the textbook he directed, can tell.

includes the capital embodied in the means of production that has been consumed to render that product. Furthermore, it suffices to look at this circuit to be confronted with the fact that capital's profitability has nowhere to arise from but through the changes in capital's forms themselves. And yet, however distasteful its revelations may result to the theory of production-factors, the circuit cannot be simply dropped out of consideration when the concrete measurement of profitability is at stake. On so doing, it takes away with itself the basis upon which the very possibility of identifying the two moments in a capital's life that have to be placed in relationship to measure its capacity for self-valorization rests[3].

As they cannot have the best of both worlds, the followers of productive-factors theory take two different paths. The first one preserves capital's circuit. Still, it represents the circuit of industrial capital by the circuit of capital lent for an interest. This circuit is the most developed on the basis of industrial capital's one, as it comes to the point where every change in capital's form along its turnover vanishes away:

circuit of interest yielding capital: M – – – – – – – – – – – – – – – – – – M'

\ /

circuit of industrial capital: $M - C\left\langle\begin{array}{c}L\\ Mp\end{array}\right. \ldots P \ldots C' - M'$

where:
- - -: appearance in circulation.

Once isolated, the valorization of this interest-bearing capital appears as a process completely external to this capital's own circuit. This substitution of the circuit of interest-bearing capital for industrial capital's circuit is precisely what the computation of the net present value and the internal rate of return do.

The second path directly overlooks the unity inherent in the movements to be placed into relation, given by the circuit of industrial capital. Deprived from this unity, it finds not one but a collection of different profitability indicators, according to the ways and procedures it follows to determine the capital that it will consider to be meaningful in relation with profit. The absolute margin, the margins over cost and sales, and the different cases of the so-called "costs accounts" fall into this category.

Can the circuit of industrial capital be consistently represented by the circuit of the capital lent for an interest? Can margins and costs accounts properly represent the annual capacity of industrial capitals to valorize themselves? Or do these procedures have to pay a price for evading the direct computation of industrial capital's circuit, ending up with an equivocal computation of their capacity for valorizing themselves? In other words, are managers mistaken when they base everyday decisions on the rate of profit that results from the accounting reflection of the turnover of industrial capital and this accounting needs to be reestablished on new basis? Or is it that the substitutes for the annual rate or profit proposed by mainstream economic theory lack the accuracy needed for concrete decision making, and what has to be redefined is the type of model used for the economic analysis of industrial capitals?

[3] The principle "of perception" overlooks the unity of capital's circuits, reducing it to a completely external relation. Instead of tracking each disbursement so as to relate its origin and its return, it jut brings together the disbursements and returns collected in the same annual period, regardless if they open and close the same circuit or they belong to different circuits. Not vainly this criterion is absolutely excluded today from the general accepted principles of business accounting.

In what follows, we will analyze how each of the instruments currently used for reflecting the profitability of industrial capitals lacks the capacity to do it in an unequivocal way. We will then define the basis of a model that determines the profitability of a specific industrial capital by directly representing its turnover[4].

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[4] For a complete analysis of the forms taken by the turnover circuits of industrial capitals, and therefore, of the specificity in the form of turnover of fixed and circulating capital, see Marx, Karl, *op. cit.*, Part II, “The Turnover of Capital,”, pp. 156-348.

2. The internal rate of return

1. Conceptual definition

According to its conceptual definition (directly associated with Keynes' "marginal efficiency of capital"), the internal rate of return is the annual rate of compound discount that balances the net present value (or that makes it zero) of the series of money inputs and outputs that open and close the circuits of an industrial capital, when applied to each of these movements at the moment it occurs. Let us assume the simplest circuit for circulating capital (where its disbursement takes place at the beginning, and its return at the end, of each year) and a disbursement of fixed capital that completes its turnover in *n* years. That is:

Kc_j : circulating capital advanced for the year *j*

$tc = 1$

Kf_j : fixed capital disbursed in the year *j*

$tf = \frac{1}{n}$

K'_j : total capital that completes its turnover at the end of the year *j*

Thus, the internal rate of return *r* results from satisfying:

$$0 = -\frac{Kf_1}{(1+r)^0} - \frac{Kc_1}{(1+r)^0} + \frac{K'_1}{(1+r)^1} - \frac{Kc_2}{(1+r)^1} + \frac{K'_2}{(1+r)^2} - \quad \dots \quad - \frac{Kc_n}{(1+r)^{n-1}} + \frac{K'_n}{(1+r)^n}$$

2. The basic relationship that underlies the capacity of the internal rate of return for representing profitability

a) Concerning circulating capital

Let us start to evaluate the capability of the internal rate of return to represent the annual rate of profit by taking circulating capital in isolation. The calculation of the internal rate of return is able to relate each disbursement with its return as valorized capital through the elemental relationship:

$$Kc_1 = \frac{K'_1}{1+r}; \quad \frac{Kc_2}{1+r} = \frac{K'_2}{(1+r)^2}; \quad \dots \quad ; \frac{Kc_n}{(1+r)^{n-1}} = \frac{K'_n}{(1+r)^n}$$

and in general:

$$\frac{Kc_j}{(1+r)^{j-1}} = \frac{K'_j}{(1+r)^j}$$

that actually corresponds to:

$$K'_j = Kc_j\,(1+r)$$

with

$$t\,c = 1$$

and, consequently,

$$r = p$$

Provided circulating capital turns over once along the year and the elemental relationship that corresponds in the representation to the valorization capacity remains constant through the circuits considered, the internal rate of return unequivocally represents the annual rate of profit.

b) Concerning fixed capital

For the sake of clarity, let us start with an example: an instrument that is used in identical conditions and rendering the same physical output for three productive circuits. After the third circuit its usefulness has been completely exhausted, so no value is left in it. Under these conditions, there is no reason for the price of the product to change from one circuit to another. Thus we have, considering the movements of fixed capital in isolation:

$$Kf_1 = 300; \quad Qo_1 = Qo_2 = Qo_3; \qquad Po_1 = Po_2 = Po_3; \quad K'_1 = K'_2 = K'_3 = 140$$

In the terms of the internal rate of return, this results:

$$0 = -300 + \frac{140}{1+r} + \frac{140}{(1+r)^2} + \frac{140}{(1+r)^3}$$

with:

$$r = 18.9\%,$$

Let us reflect now the turnover circuits of this capital. Since the material conditions in which the instrument is used remain unchanged from one circuit to another, the instrument's value gradually reappears in the product's value following a constant proportion. That is,

$$t\,f = 1/3$$

In real life, the portions of fixed capital that have completed their turnover, and therefore returned to the money form, follow two possible paths. They can be kept as money capital until the moment the original instrument completely exhausts its useful life. At that moment, the money reserve is transformed again into productive capital in the form of a new machine. When the gradually returned fixed capital follows this path, the amount of advanced capital does not change from one year to the next. Only its composition changes, starting from being completely materialized in the new instrument to end being completely transformed into a money reserve, Km, when the time for the renewal arrives. Being the rest of the production conditions constant, the annual rate of profit remains constant along time, even *ceteris paribus* when the renewal takes place. Thus we have:

	year			
	1	2	3	average circuit
$Kf_j \cdot tf_j$	100	100	100	100
$Kf_j \cdot p_j$	40	40	40	40
K'_j	140	140	140	140
Kf_j	300	200	100	200
Km_j	0	100	200	100
K_j	300	300	300	300
p	13.33%	13.33%	13.33%	13.33%

The returned fixed capital follows its second possible path in real life, by being immediately transformed into a new productive capital. Then, the renewal of the original one when its elements exhaust their useful life can only take place in the proportion in which the total fixed capital in action at that moment returns to the money form vis-à-vis the price of the instruments to be renewed. Nevertheless, the amount of the advanced capital remains unchanged, since the new instruments are purchased with the value of the previously existing ones that have returned to the money form immediately before. What happens is that this constant amount of advanced capital has multiplied its capacity for appropriating profit by constantly remaining as productive capital. This modality, that accelerates the rate of capital accumulation by multiplying its profitability (although the conversion of profit itself into new capital is the consequence but not the cause of this multiplying effect) produces by itself a cyclical fluctuation in the scale of production and in the annual rate of profit. Now, the average of the annual rates of profit for a given number of years is immediately equal to the annual rate of profit rendered by the average capital advanced and consumed in those years. Thus we have, with the average determined for the first three years, but showing for clarity how the movement projects itself beyond this period by representing also two more years:

	year					
	1	2	3	average circuit	4	5
index of instruments in use	1	1.3333	1.7778	1.3704	1.3704	1.4938
$Kf_j \cdot tf_j$	100	133.33	177.78	137.04	137.04	149.38
$Kf_j \cdot p_j$	40	53.33	71.11	54.81	54.81	59.75
K'_j	140	186.67	248.89	195.85	195.85	201.91
Kf_j	300	300	300	300	300	300
Km_j	0	0	0	0	0	0
K_j	300	300	300	300	300	300
p	13.33%	17.78%	23.70%	18.27%	18.27%	19.92%

In real life, the return of fixed capital follows a path that is a mix of these two alternatives. Nevertheless, the mechanics of the internal rate of return does not correspond to either of them. It considers the portion of the fixed capital that returns to the money form with each sale, a net withdrawal from the cash flow. In the terms of reflecting capital's turnover, this means that the returned portions are no longer considered a part of the advanced capital, either as a money reserve or as an additional productive capital. They only reenter the cash flow when they are required for the renewal of the completely depleted instrument. In other words, to follow in the computation of the annual rate of profit a criterion that corresponds to that implicit in the computation of the internal rate of return, the fixed capital advanced for each circuit must be computed for each year at the value that still remains materialized in the original instruments. The portion already returned, must be consequently excluded. Then the average annual rate of profit for the whole period considered results from the relation between the average annual profit and the average fixed capital advanced that remains embodied in the instrument; in other words, the average rate results from the weighted average of the annual rates[5]. Thus we have:

	year			
	1	2	3	average circuit
$Kf_j \cdot tf_j$	100	100	100	100
$Kf_j \cdot p_j$	40	40	40	40
K'_j	140	140	140	140
Kf_j	300	200	100	200
p	13.3%	20%	40%	20%

Let us assume now an arbitrary pattern for the gradual return of fixed capital. For instance:

	year			
	1	2	3	average circuit
$Kf_j \cdot tf_j$	117.73	99.01	83.26	100
$Kf_j \cdot p_j$	22.27	40.99	56.74	40
K'_j	140	140	140	140
Kf_j	300.00	182.27	83.26	188.51
p	7.42%	22.49%	68.15%	21.22%

This is an arbitrary pattern since, despite the uniform consumption of the use value of the instrument along its life, a variable proportion of its value is assumed to reappear in the value of the product. Still, this is actually the pattern of "depreciation" that corresponds to Hotteling's "mathematical formulae" based on an "economic truism"

[5] We will come back to the reflection of the actual concrete conditions of fixed capital turnover later.

that overcomes "the naive type of economic thought" and "gives the same rate of profit in every period"[6]. Hotteling computes each annual advanced capital as the difference between successive accumulated terms of the present net value of the cash flow, and the sum of such elements equals by definition the fixed capital originally advanced when the rate of discount applied equals the internal rate of return. Then he defines the annual "depreciation" as the difference between two successive values. Furthermore, Hotteling considers that the average of these annual "depreciations," that mechanically agree with the proportional consumption of the fixed capital along its use, can be used if "accuracy is not worth while." To complete the picture of the emptiness of this "depreciation" concerning the gradual consumption of fixed capital, let us consider that, although its total and average agree with the latter, it must be applied not against the annual returns, but to the net present value of these returns. Thus we have:

	year 1	year 2	year 3	average circuit
$Kf_j \cdot tf_j$	117.73	99.01	83.26	100
$Kf_j \cdot p_j$	0	0	0	0
K'_j	117.73	99.01	83.26	100
Kf_j	300.00	182.27	83.26	188.51
p	0%	0%	0%	0%

Far from making the annual rate of profit agree with the internal rate of return, Hotteling's "depreciation" either pushes it further away or turns it into a meaningless calculation that renders zero by definition[7]. It is about a truism, indeed, but about a truism that starts by mistaking a loss in price, a depreciation, for the transfer of the value of the fixed capital to the value of the product through the former's productive consumption; that goes on by mistaking the transferred value for the transferred value plus the profit; and that closes the circle by mistaking the transferred value plus the profit for a discounted loss in price. No wonder Hotteling's "depreciation" does not even get the chance of being considered in accounting practice, where operative business decisions are at stake [8].

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[6] Hotteling, H. "A General Mathematical Theory of Depreciation," *Journal of the American Statistical Association*, 1925, pp. 340-53. Joe S. Bain supports an analogous criterion, on the basis that "the total cost per unit ... would be the same in each period." ("The Profit Rate as a Measure of Monopoly Power," *Quarterly Journal of Economics*, 1941, Vol. LV (2), p. 279).

[7] This evidence does not prevent A. P. Xepapadeas ("Measuring Internal Rates of Return: The Transfer Function Approach," *Empirical Economics*, 1991, p. 269) claiming that unless Hotteling's concept of "economic depreciation" is used, "the ARR on a particular investment will vary from year to year, and, in general, will deviate from the IRR in all years." J. A. Kay ("Accountants, Too, Could be Happy in a Golden Age: The Accountants Rate of Profit and the Internal Rate of Return," *Oxford Economic Papers*, 1976, pp. 447-60) asserts the same.

[8] On the basis of Hotteling´s criterion, F. M. Fisher and J. J. McGowan arrive at the conclusion that, given a sufficiently progressive flow in profits, "taking economic depreciation would require writing up the value of assets for the first years" (*op. cit.*, p. 92). Of course, they find "nothing bizarre about" this criterion, that just states that a certain degree in the consumption of the productive aptitude of a machine does not transfer a proportional part of its value to the product's value, but that it adds value to the now partially deteriorated machine. It could seem that this sort of used cars salesperson's ideal can only fit into theoretical lucubrations having the least relationship to any practical matter whatsoever concerning capital accumulation. Yet, Fisher and

Let us go back to our analysis on the basis of the simplest and more general form of fixed capital turnover. In it, the use value of the instruments is gradually consumed in the same proportion for each production circuit that renders a constant quantity of product along its whole useful life. Under this condition, the elemental relation that enables the internal rate of return to represent the relationship between the disbursement of a fixed capital (taking for simplicity one placed at the beginning of the first year) and its gradual returns once valorized is:

$$0 = -Kf_1 + \frac{\frac{Kf_1}{n} + \left[\frac{Kf_1}{n}(n-0)\right]r}{1+r} + \frac{\frac{Kf_1}{n} + \left[\frac{Kf_1}{n}(n-1)\right]r}{(1+r)^2} + \ \ldots \ + \frac{\frac{Kf_1}{n} + \left[\frac{Kf_1}{n}\left[n-(n-1)\right]\right]r}{(1+r)^n}$$ [9]

McGowan produced their piece on pursuing a very concrete and practical objective. It is not just another academic article, but the concrete allegation they were hired to produce on behalf of IBM in a trial against it for monopoly profits. The true essence of their article can be summarized through three claims they make: a) "Surely, accounting information tells us IBM generates more dollars of profit per dollars of assets than does AMC, but, ..., that information alone does not tell us which firm is more profitable in the sense of having a higher economic rate of return." (*op. cit.*, p. 82) [Let us recall that at that time American Motors (AMC) had run into bankruptcy]. b) "The economic rate of return is difficult -perhaps impossible- to compute for entire firms. Doing so requires information about both the past and the future which outside observers do not have, if it exists at all." (*op. cit.*, pp. 90-91) c) "Economists (and others) who believe that analysis of accounting rates of return will tell them much (if they can only overcome the various definition problem which separate economists and accountants) are deluding themselves." (*op. cit.*, p. 91) In other words, the rate of profit that can be computed is meaningless from an economic point of view, the meaningful rate cannot be computed, and nothing can be done to overcome this situation. In brief, how could IBM be charged with monopoly profits when nobody can actually measure its profits, monopoly or not, in any meaningful way? Judging from how IBM stocks performed from then on, we must believe its executives have somehow managed themselves to solve the problem their consultants Fisher and McGowan once declared under oath to be irresolvable.

[9] To demonstrate the necessity of this relation let us make

$$0 = -Kf_1 + \frac{\frac{Kf_1}{n}\left[(1+r)^{n-1} + (1+r)^{n-2} + \ldots + 1\right] + \frac{Kf_1}{n}\ r\left[n\,(1+r)^{n-1} + (n-1)\,(1+r)^{n-2} + \ldots + 1\right]}{(1+r)^n}$$

from which, making

$$a = n\,(1+r)^{n-1} + (n-1)\,(1+r)^{n-2} + \ldots + 1$$
$$a\,(1+r) = n\,(1+r)^n + (n-1)\,(1+r)^{n-1} + \ldots + (1+r)$$
$$a - a\,(1+r) = -\,n\,(1+r)^n + (1+r)^{n-1} + (1+r)^{n-2} + \ldots + 1$$
$$a\,(-r) = -\,n\,(1+r)^n + \frac{(1+r)^n - 1}{r}$$

then

$$0 = -Kf_1 + \frac{\frac{Kf_1}{n}\left[\frac{(1+r)^n - 1}{r}\right] + \frac{Kf_1}{n}\ r\ \frac{\left[(n\,r-1)\,(1+r)^n + 1\right]}{r^2}}{(1+r)^n}$$

This relationship corresponds to the direct relation of each year's profit, and thus of the yearly valorized capital, with the portion of fixed capital that remains pending of return. That is,

$$K'_j = Kf_1 \,.\, tf_1 + \left[Kf_1 - Kf_1 \,.\, tf_1 \,(j-1) \right] p$$

Therefore, the consistency in the computational mechanics of the internal rate of return presupposes the direct reflection in the price of the product of the progressive return of fixed capital. To satisfy the basic relationship that underlies the reflection of profitability through the internal rate of return, the price of the product, Po_j, must fall in the proper proportion from circuit to circuit until the renewal of the means of production, when this cyclical movement starts again. If we assume this movement in the price in our example, we have:

$$0 = -300 + \frac{160}{1+r} + \frac{140}{(1+r)^2} + \frac{120}{(1+r)^3}$$

with:

r = 20% = p

that immediately agrees for each year and their average with:

	year			
	1	2	3	average
$Kf_1 \,.\, tf_1$	100	100	100	100
$\left[Kf_1 - Kf_1 \,.\, tf_1 \,(j-1) \right] p$	60	40	20	40
K'_j	160	140	120	140
p	20%	20%	20%	20%

On the contrary, the elementary relationship cannot be properly represented in the computation of the internal rate of return by the average of the turnover circuits it involves. That is, although

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$$0 = -Kf_1 + \frac{\frac{Kf_1}{n\,r}\left[(1+r)^n - 1 + (n\,r-1)\,(1+r)^n + 1\right]}{(1+r)^n}$$

$$0 = -Kf_1 + \frac{\frac{Kf_1}{n\,r}\,(1+r)^n\, n\,r}{(1+r)^n}$$

and finally

$$0 = -Kf_1 + Kf_1$$

$$\frac{\sum_{j=1}^{n} Po_j}{n} Qo = Kf_1 \,.\, t\,f_1 + \frac{\sum_{j=1}^{n}\left[Kf_1 - Kf_1 \,.\, t\,f_1\,(j-1)\right]}{n} p = Kf_1 \,.\, t\,f_1 + \frac{Kf_1}{2}\, p\,,$$

the internal rate of return cannot be computed on the basis of the corresponding succession of the average values. This was precisely the case of our initial example.

Now, there is no determination in price formation that makes actual prices follow the annual variations demanded to satisfy the basic relationship for each industrial capital, according to the date of its disbursement. There is even no need to get here into these determinations themselves to make the point clear. Besides the empirical evidence, it suffices with proving it *ab absurdo*: let us suppose an industry where the instruments of production have a useful life of n years and the total capital is also formed by n individual capitals each one disbursed in each of the different n years. Therefore, in each year, each individual fixed capital would be undergoing a different moment of its useful life. To which of these n simultaneous but different moments would the commercial price of the common product correspond? If this price follows the movements of one of the individual capitals, the internal rate of return could properly measure its profitability, but unavoidably it would miss the profitability of the rest. If the price corresponds to the average (which it actually does for its true determinations), the internal rate of return miscalculates profitability for the whole set.

When it comes to fixed capital, the internal rate of return falls into the dilemma of a twofold incoherence: either the actual prices that enter the calculation must be artificially adjusted for each year to make them correspond to the maintenance of the relationship upon which the internal rate of return is based, or its computation directly works with the real prices, falling into a conceptual incoherence. The former is the path universally followed in practice; of course, without its unavoidable conceptual incoherence, that renders the result of the computation significantly dubious, being acknowledged.

The problem for the internal rate of return does not arise from the way the turnover of fixed capital is currently registered, but from the way prices are determined in the real world. Chose whichever disgrace should fall on accountants for not following a procedure that fits into the abstractions of economic theory (that actually stresses the distortion), but computing the annual productive consumption of fixed capital in direct proportion to the degree in which the physical aptitude of its elements is used. Yet, the accounting criterion applied to reflect that consumption is impotent to change the determination of the prices of production as the synthesis of the autonomous regulation of the economic process. It is not that accounting criteria determine market prices, but that markets have taught accountants their criteria through everyday practice, and only then accountants have transformed their experience into a conceptual structure.

The conclusion already at this stage is that the internal rate of return is unable to properly measure the profitability of industrial capitals when fixed capital is involved.

c) The general consistency of the basic relationship and the concrete turnover of industrial capital

Our analysis has already shown the basic relationship that the turnover of an industrial capital must satisfy to allow the internal rate of return to unequivocally represent its profitability: each of the portions in which a capital fragments itself along its turnover must be valorized exactly in the same proportion and during the same period of time. In other words, the elemental relationship that represents the capacity of a capital to valorize itself must remain constant through all the circuits considered, and all this circuits must be equal in length. This condition applies both to circulating and fixed capital, and hence, to their aggregate.

As soon as a process of turnover does not satisfy the constancy of the double relation between each portion of capital and its valorized return, the internal rate of return starts to diverge from the average annual rate of profit. For instance, considering for simplicity only circulating capital with one turnover in each year[10]:

	Capital I				Capital II			
	year				year			
	1	2	3	average	1	2	3	average
$Kc_j \cdot tc_j$	100	100	100	100	100	100	100	100
$Kc_j \cdot p_j$	20	20	20	20	10	20	30	20
K'_j	120	120	120	120	110	120	130	120
p	20%	20%	20%	20%	10%	20%	30%	20%

But:

$r_{\mathrm{I}} =$ 20.0%
$r_{\mathrm{II}} =$ 18.9%

What does the internal rate of return actually measure as soon as it starts to diverge from the average annual rate of profit, given the variation in the relationship of valorization it is based on?

d) Differences in the magnitude of the basic relationship

It is commonly said that, in this case, the internal rate of return differs from the average annual rate of profit because the former ponders the difference in the time when the profit is realized, while the latter ignores it. Obviously, the closer to the present time profits are realized, the sooner they will be available to be transformed into new capital yielding its own profit. Hence, in a given period of time, a given original capital plus its capitalized profits would have summed to a higher amount, in direct relationship with the opportunity in which profits have been realized. And an accumulated higher amount in a given time for a given original capital means a higher profitability. The theorists that support the internal rate of return conclude then, that while this rate is able to capture that difference in profitability, even the average annual rate of profit is not.

Let us start with the assertion concerning the internal rate of return itself. Were it able to capture the difference in question, the same internal rate of return should correspond to capitals increased in the same proportion at the end of a common computing period, including that alleged capitalization. For example:

[10] This can be seen as being equivalent to a four-month period rate with three turnovers during the year, that can be expressed on a yearly basis as their summation. It is unnecessary here to complicate the point by considering more complex forms in the rotation of circulating capital.

	Capital III			
	year			
	1	2	3	average
$Kc_j \cdot tc_j$	100	100	100	100
$Kc_j \cdot p_j$	10	10	46.4	22.1
K'_j	110	110	146.4	122.1
p	10%	10%	46.4%	22.1%

but:

$$r_{\mathrm{III}} = 20\%$$

with

$$\sum_{j=1}^{n} (Kc_j \, . \, p_j)(1+r)^{n-j} = 72.8,$$

equal to the corresponding amount for Capital I, with $r_{\mathrm{I}} = 20.0\%$ too, but arising from an accumulated lower though uniform flow.

Therefore, it may appear as if the internal rate of return does not represent the annual rate of profit as the former is determined just by capital's valorization, but by capital's accumulation. The following example starts to say this is a false conclusion, through the explicit transformation of the realized profit into additional capital for Capital IV and the opposite movement for Capital V:

	Capital IV				Capital V			
	year				year			
	1	2	3	average	1	2	3	average
$Kc_j \cdot tc_j$	100	120	144	121.3	144	120	100	121.3
$Kc_j \cdot p_j$	20	24	28.8	24.3	28.8	24	20	24.3
K'_j	120	144	172.8	145.6	172.8	144	120	145.6
p	20%	20%	20%	20%	20%	20%	20%	20%

with:

$$r_{\mathrm{IV}} = 20.0\%$$
$$r_{\mathrm{V}} = 20.0\%$$

although, respectively

$$\left.\sum_{j=1}^{n} (Kc_j \cdot p_j)(1+r)^{n-j}\right|_{\mathrm{IV}} = 86.4$$

$$\left.\sum_{j=1}^{n} (Kc_j \cdot p_j)(1+r)^{n-j}\right|_{\mathrm{V}} = 80.3$$

The fact that a greater amount of profit becomes available for Capital V at an earlier time is completely ignored by the internal rate of return, provided the relationship of valorization remains unchanged from one circuit to another.

What really happens is that, when the amount of capital does not change from one circuit to another, the apparent capitalization of profit is just the inverse of the operation previously done to calculate the internal rate of return. When there are changes in the amount of capital, the inverse calculation lacks part of the movements that have originally intervened. Thus, its meaningless basis is made immediately apparent. The calculation of the internal rate of return does not rely on compound interest so as to reflect profit reinvesting. In the first place, it really needs being computed on the basis of a power function - both for fixed and circulating capital - just to reflect the elemental relationship of valorization. That is, for circulating capital the general relationship appears as:

$$\frac{Kc_j}{(1+r)^{j-1}} = \frac{K'_j}{(1+r)^j}$$

but actually it corresponds to:

$$Kc_j = \frac{K'_j}{1+r}$$

It is to satisfy this relationship, not to capitalize any realized profit whatsoever, that the calculation of the internal rate of return needs to take a shape that resembles that of the compound interest[11]. Simple interest, which following the same appearance can be said to exclude profit capitalization from the flow[12], will just fail to correspond to the elementary relationship, even when this relationship remains unchanged from circuit to circuit. For circulating capital:

$$\frac{Kc_j}{1+(j-1)\,r} = \frac{K'_j}{1+j\,r}$$

[11] For instance, E. Reinshaw ("A Note on the Arithmetic of Capital Budgeting Decisions," *The Journal of Business*, Vol. XXX, p. 193), J. Van Horne (*Administración financiera*, Buenos Aires: Ediciones Contabilidad Moderna, 1973) and J. Mao (*Corporate Financial Decisions*, Palo Alto: Pavan Publishers, 1976, p. 125) directly fall to the appearance that the computational mechanics of the internal rate of return presupposes that profits are reinvested at that rate. And such point of view is also very popular among the practical users of the procedure. On the contrary, C. Dudley points out the falsity of the appearance of implicit reinvestment ("Hipótesis sobre reinversión inmediata: métodos de valor actual y tasa de rendimiento," *Administración de Empresas*, T. V, 1974, pp. 56-57, originally published in *The Journal of Finance*, Vol. XXVII, 4).

[12] A simple calculation would have prevented O. Gaspar ("Tasa de rentabilidad y valor actual neto: una comparación crítica," *Administración de Empresas*, T. VII, 1977, p. 553-554) from stating such a nonsense.

fails to render the elemental relationship of valorization.

In the second place, the power function allows to chain the successive circuits under the form of a string of elemental relations. This form is forcefully needed to represent the circuits of fixed capital through a cash flow and, then, to represent the circuits of the circulating capital associated with it. Furthermore, it appears as being necessary to represent the circuits of circulating capital when the elemental relationship of valorization varies from circuit to circuit. But the compound interest appearance of the internal rate of return does not equal in time closer and further profits by capitalizing them to the same point in time. It just degrades the weight of the latter with respect to the former. This degradation goes unnoticed with a uniform direct relationship between each portion of capital and its profit. Nevertheless, it immediately shows when the relationship is not uniform, rounding the appearance of an interest capitalization given that, the earlier the elemental relationships higher than the average enter the flow, the higher the rate results[13].

The internal rate of return is so empty concerning the representation of capital's profitability under a variable elementary relationship from circuit to circuit, that moving forward or backwards the starting point of the registration period in a cyclically determined production process that can begin at any of them and go on reproducing itself indefinitely, will make it render different results. For example, starting one period later for Capital II, we have:

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[13] The appearance of profit capitalization reflects itself again in the claim that, even provided a constant rate of valorization for each portion of the advanced capital, the annual rate of profit equals the internal rate of return only when the former equals, at the same time, the annual growth rate of the capital in question. This is the case of F. Fisher and J. McGowan (*op. cit.*, p. 84), A. P. Xepapadeas (*op. cit.*, p. 269), J. Kay (*op. cit.*, p.p. 455-456) and F. Wright ("Accounting Rate of Profit and Internal Rate of Return," *Oxford Economic Papers*, July 1963, p. 464). G. Harcourt (*op. cit.*, p. 76) and M. van Breda ("The Misuse of Accounting Rates of Return: Comment," *The American Economic Review*, June 1984, p. 507) offer another face of the same appearance, when they state that the greater the growth rate, the closer to the internal rate of return the annual rate of profit will get.

The falsity of these assertions becomes immediately visible through the simple numeric examples already presented for Capital IV and Capital V. To make it even more visible, let us order here the same flows that correspond to these examples, but following an erratic order in growth and de-accumulation:

Disordered Capital IV/V

	year			
	1	2	3	average
$Kc_j \cdot tc_j$	100	144	120	121.3
$Kc_j \cdot p_j$	20	28.8	24	24.3
K'_j	120	172.8	144	145.6
p	20%	20%	20%	20%

with:

$r_{\mathrm{IV/V}} =$ 20.0%

	Capital VI			
	year			
	1	2	3	average
$Kc_j \cdot tc_j$	100	100	100	100
$Kc_j \cdot p_j$	20	30	10	20
K'_j	120	130	110	120
p	20%	30%	10%	20%

with

$$r_{\mathrm{VI}} = 20.6\%$$

Just imagine an accountant trying to explain the income tax collector that the profitability of a firm has not actually increased, but that they just changed the starting point of the fiscal year.

e) The concrete annual rate of profit

Positively, being an accumulation process, the autonomous regulation of social life develops the general annual rate of profit beyond its determination by the valorization process as such. The sooner a profit can be realized, the sooner it can be transformed into a new capital, therefore increasing the amount of profit the original capital can render in a given period. Above all, given the general rate of profit, the turnover rate determines the potentiality of each specific capital for this multiplication. A low turnover rate implies more time to wait until the profit becomes available for its transformation, and vice versa. Thus, the general equalization of the different specific capitals that together shape society's total capital takes shape in different concrete annual rates of profit. That is, the general annual rate of profit takes shape in specific rates for each specific industrial capital, primarily in an inverse relation with its turnover rate. Those with the lower turnover rate would appear as having a higher specific annual rate of profit, which is compensated through the slower conversion of their profit into new capital, and vice versa. The general annual rate of profit will be immediately visible in the specific concrete rate only for those capitals having the social average turnover rate.

Still, the concrete accumulation capacity is not simply determined by the turnover rate of a specific capital vis-à-vis the social average, but by the very forms and conditions in which the turnover process is unfolded. The opportunities for a profit to turn into new capital, and the profitability that will emerge from this transformation, synthesize many concrete determinations. This determinations range from whether its owner needs to consume or can accumulate the profit given the amount of the original capital, to the conditions in which a certain flow of realized profits can be directly transformed into new industrial capital, or only transformed into capital lent for an interest before it accumulates itself in the degree needed to undergo the former transformation. The absence of a general necessity excludes any mechanical way to determine whether a regular continual flow of profits allows a greater accumulation capacity than an irregular one which peaks at the beginning but falls afterwards, one with loses in the middle, etc., given a certain general annual rate of profit.

Nevertheless, what is certain is that a profit rate higher than the average for an individual circuit at the beginning of the computing period cannot be followed by circuits all individually yielding the average rate. As an aggregate, the following circuits must yield a rate lower than the average, just to reach this one in their annual unity with the first circuit. *Mutatis mutandi*, the same applies to an inverse flow and to fluctuations in the flow from year to year.

Even such obvious determinations tell us about the inconsistency of a method aimed at measuring a capital’s accumulation capacity, that supposedly would go on capitalizing (at the average rate yield by the original capital) even a biased profit flow.

Moreover, profits transformed into new capital are not the only source that enhance capital’s capacity to accumulate itself. A circulating capital with a low turnover rate but that remains as money during most of its circuit, can intervene in the circuits of another specific industrial capital, thus multiplying its capacity to produce a profit. Fixed capital goes even further. The way fixed capital turns over specifically allows its already consumed, and hence returned, part to get into new circuits while its remaining part still acts in the original one. Thus, fixed capital can expand the scale of capital’s accumulation until it is called back to its original material form, once this one’s useful life has been exhausted. Or this expansion can be indefinitely sustained, provided it can produce enough profit plus its own returns as to cover the original’s renewal in due time. Again, there is no general determination that makes a fixed capital with a faster turnover render, directly plus indirectly, more profit than a capital with a slower turnover in the same period of time. On the contrary, mechanically considered, a fixed capital with a slower turnover, and therefore a lower cash flow in the starting years, comes out from this process of self-expansion increased in a higher degree than a fixed capital with a faster turnover. Besides, if the returned part of the former can enter at an earlier time into a new circuit, it must also come back to the original one in a shorter time, thus constraining the spheres for that entrance. Albeit the alleged consideration given by the internal rate of return to the capitalization of profits as a determinant of capital’s profitability, this second determination of specific industrial capitals’ concrete rate of profit that arises from fixed capital’s turnover itself, currently passes completely unnoticed.

This second specification of the concrete valorization capacity concurs with that arising from the transformation of profit into new capital, without providing a general necessity to the development of the general annual rate of profit into its specific manifestations, either. Thus, the very possibility of a general rule that relates the latter with the former remains absent. To measure the profitability of an industrial capital in its condition as a specific part of the total social capital, we must start by measuring its concrete annual rate of profit. We must go on by analyzing the possible specific turnover determinations that mediate from this concrete rate to the general rate of profit. Then we must eliminate the eventual reflections of these determinations on the concrete rate. Only once we have accomplished these steps, we can compare different specific capitals, identifying their rates of profit as concrete manifestations of the same general valorization capacity.

The starting point is always the accurate measuring of the specific annual rate of profit. The internal rate of return can only be such accurate measure when all the portions in which a capital is fragmented along its turnover process are valorized exactly in the same proportion. Under this condition, the internal rate of return does not capitalize the realized profit but properly eliminates it from the computation. It does the same with the partial returns of fixed capital. Nevertheless, the valorization of industrial capital is, according to its form, a process of annual unity between the advanced capital and its turnover circuits during the year as a whole. Thus, this process imports no necessity whatsoever tending to make capital keep a constant relationship between its amount as a premise and as a result of each turnover circuit, from one circuit to another. On the contrary, being the economic system an autonomously regulated one, no norm applies but that the annual unity can only impose itself through a perpetually oscillating relationship inside each turnover circuit. That is, from an external viewpoint, the absence of constancy in this relationship is a necessary condition for the formation of the general rate of profit and, therefore, for the regulation of social production and consumption themselves.

Furthermore, the subordination of labor’s productivity to natural conditions beyond the control of a normal capital in some specific spheres of production results in a low number of turnover circuits during each year and the volatility of productivity from one circuit to another. This collides against the even flow of the general process of capital accumulation. Specially in these spheres, the general autonomous regulation necessarily imposes itself through rates of profit that fluctuate from year to year. The cyclical forms proper of capital accumulation give the concrete annual rates of profit the corresponding pattern. Such fluctuations in the annual rate of profit are completely random from the viewpoint of individual capitals. So the general annual rate of profit necessarily imposes itself as a simple average that comprises those fluctuating concrete annual rates. As such, this simple average remains indifferent concerning the position each annual rate keeps in the series, and *a fortiori*, concerning the position of each turnover circuit in the life of the specific capital at issue.

The annual rate of profit acts as the general ruler of the process of social production in capitalism not despite its constant fluctuation from year to year, but precisely thanks to its capacity for this constant fluctuation. Its normal level can only manifest itself through these fluctuations themselves, as the average they tend to in their restless change. To develop a model able to compute this normal level, one must check the capacity of the computational structure to properly reflect the formation of the normal annual rate of profit as an average of its singular concrete forms. The theorists of the internal rate of return turn the question upside down. They start by taking for granted that the internal rate of return corresponds to the actual concrete generation of profit. They go on by presenting the actual fluctuation of the annual rate of profit, reflected in the accounting rate of profit, as a shortcoming of this rate. And, since the fluctuations (including the build in inconsistency concerning fixed capital) of the elemental relationship whose constancy makes sense of the internal rate of return cause it to quantitatively disagree with the average of the annual rates of profit, they end up by claiming that the latter misses the proper measure of capital's profitability. They actually believe reality must adjust itself to fit into their ideal constructions[14].

f) Differences in the turnover time

Let us consider now how the internal rate of return deals with the different duration of the turnover circuits inside a circulating capital. When circulating capital develops more than one turnover during each year, $tc > 1$, the computation of the internal rate of return must place each capital's movement in its proper moment inside the year. Still, let us recall that the 1 in the $1+r$ factor stands for a single turnover circuit unfolded covering the whole basic period. And this single turnover is a condition for the computation to get hold of the elemental relationship of valorization upon which its meaningfulness rests. When $tc > 1$, the direct computation of the internal rate of return on a yearly basis can only represent the pertinent year fractions through fractional exponents. But such procedure immediately breaks the necessary agreement between the time to which the elemental relationship corresponds and the single turnover circuit developed in it, even provided the stability of the elementary relationship from circuit to circuit. Let us consider, for instance, two identical successive circuits each one covering six months, with:

$Kc_j =$ 100; $tc =$ 2; $p =$ 20%

Capital VII	year
$Kc_j \cdot tc_j$	200
$Kc_j \cdot p_j$	20
K'_j	220

[14] Fisher, F. M. and J. J. McGowan, *op. cit.*, p. 83.

The attempt to directly calculate the annual internal rate of return on the basis of

$$\frac{Kc_{ju}}{(1+r)^{j+(\frac{u-1}{v})}} = \frac{K'_{ju}}{(1+r)^{j+(\frac{u}{v})}}$$

where
v: number of fractions in which the year j is fragmented according to capital's movements
u: each of the fractions inside the year j
results in:

$$0 = -100 + \frac{110-100}{(1+r)^{1/2}} + \frac{110}{1+r}$$

with

$$r = 21\%$$

We have already seen that the basic computational mechanics of the internal rate of return, where the unitary computational period immediately corresponds to each turnover of the circulating capital, sterilizes the realized profits in the very moment they enter the funds inflow. But as soon as the latter period fragments the former, a self-incoherence arises in the computational mechanics. The original criterion for the realized profits remains unchanged concerning the basic period itself. But, at the same time, the fragmentation produced inside each of these periods by the shorter turnover time of the circulating capital forces a distortion in the annual rate, equivalent to an apparent capitalization at the basic internal rate of return of the profit realized prior to the end of the computing year and up to the end of this one. Beyond the obvious evidence of a computational procedure that includes two criteria that disagree with each other, the distorted nature of this apparent capitalization becomes immediately visible when the true capitalization is explicitly considered:

$$0 = -100 + \frac{110-100-10}{(1+r)^{1/2}} + \frac{110+11}{1+r}$$

again with

$$r = 21\%$$

despite the total annual profit now amounts to \$ 21 against the \$ 20 that corresponds to the original calculation.

Thus we have two different movements in the realized profit. One excludes it from the turnover of the capital at stake (therefore, leaves it available for its valorization elsewhere multiplying the mass of the total annual profit; or, moreover, leaves it available for its immediate individual consumption, thus sterilizing its capacity for rendering a profit whatsoever). The other explicitly immobilizes the realized profit together with the original capital. Yet, both movements appear in these distorted terms as being able to render the same annual rate of profitability over the original capital. Furthermore, in the latter case, the advanced capital averages 105 during the year, making the actual annual rate of profit equal 20% and not the apparent 21% presented by the internal rate of return.

To comply with the annual unity, the internal rate of return must be calculated on the basis of the proper year fraction determined by the turnover time of each portion of the circulating capital (for instance, a semiannual or monthly rate), and only then transformed into an annual rate as the corresponding multiple of the fractional one. *Mutatis mutandi*, the same happens when $t_c < 1$. In our example, the internal rate of return calculated on a semiannual basis results:

$$0 = -100 + \frac{110-100}{1+r} + \frac{110}{(1+r)^2}$$

with

$$r_{\text{S VII}} = 10\%$$

and then

$$r_{\text{VII}} = 20\%$$

So far, all the circuits considered in each case had the same length and followed each other without any lag or overlapping. Nevertheless, nothing determines a general necessary uniqueness concerning the time that runs from the disbursement of each portion of capital through its valorized return. Nothing determines the orderly succession of this circuits with a general necessity, either. On the contrary, the regular flow of capital's valorization tends to impose the overlapping of partial circuits and their combination on the basis of their different duration. Seasonally determined variations in production and circulating conditions have the variation of the length of the circuits among their normal forms. The same applies to cyclical and accidental variations from year to year.

As soon as an industrial capital realizes its valorization process developing circuits that differ in their length, the basic relationship losses the uniqueness for all the portions of capital that enables it to represent the valorization capacity, now concerning the time that mediates between each portion of capital and its valorized return. When a capital develops partially superposed circuits - even having the same length - the proper computation for some of these circuits introduces by itself arbitrary points that act as apparent year fractions concerning the computation of others[15]. In both cases, the internal rate of return lacks the capacity to accurately represent capital's annual profitability.

For example, let us consider a capital that is formed by two identical parts, *a* and *b*. Each part is advanced in halves at the beginning and the middle of each process of production. These processes take a year to be completed, while the circulation process is instantaneous. The first portion of part *a* is advanced at the beginning of the calendar year, and the first portion of part *b* six months later. Therefore, the advanced capital is equal to the total capital used in one complete production process plus half of the capital used in the other; the remaining quarter of the total capital used during each year is provided by the return of the portion used in the previously finished circuit that has to wait still for another half-year to be required in the circuit currently opened. Therefore, after the original disbursements have taken place, the advanced capital never remains as a money-reserve, but it remains constantly under the form of productive capital. Thus we have:

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[15] This sort of distortion, that arises from forcing a relationship between disbursements and returns that do not correspond to the same turnover circuit, is what has been expressly ruled out from business accounting, by banning any computation based on the principle "of perception."

$Kc_j =$ 150; $tc =$ 1.33; $p =$ 20%

Capital VIII year

$Kc_j \cdot tc_j$	200
$Kc_j \cdot p_j$	30
K'_j	230

In the terms of the internal rate of return calculated on a semiannual basis (for a period of 25 years, to avoid any distortion that could arise from taking a too short number of periods when movements of capital from one of them to the next are involved and to tend to represent the indefinite reproduction of the circuits), that is:

$$0 = -50_a - \frac{50_a + 50_b}{1+r} + \frac{115_a - (50_a + 50_b)}{(1+r)^2} + \frac{115_b - (50_a + 50_b)}{(1+r)^3} + \ldots + \frac{115_b - 50_a}{(1+r)^{49}} + \frac{115_a}{(1+r)^{50}}$$

with

$r_{\mathrm{S\ VIII}} =$ 9.687%

and then

$r_{\mathrm{VIII}} =$ 19.374%

The mechanism of the internal rate of return produces a distorted result, failing to unequivocally deal with the difference in the form of turnover of the two portions of the advanced capital. And this distortion is alien to the way the initial net disbursements are computed. If they are placed as being totally advanced at the beginning of the first year, the internal rate of return obviously changes, but to a new distorted amount. With:

$$0 = -(50_a + 50_a + 50_b) - \frac{0}{1+r} + \frac{115_a - (50_a + 50_b)}{(1+r)^2} + \ldots + \frac{115_b - 50_a}{(1+r)^{49}} + \frac{115_a}{(1+r)^{50}}$$

$r_{\mathrm{S\ VIII}} =$ 9.160%, and: $r_{\mathrm{VIII}} =$ 18.320%[16]

3. From conceptual distortion to practical inconsistency

With a necessity that arises from the very mechanics of its calculation, the internal rate of return grounds its capacity to unequivocally represent the annual rate of profit in the double constancy of a relationship that is not only inessential to the determination of this rate, but that is variable by nature. *Mutatis mutandi*, the same happens with

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[16] By the way, notice that the self-incoherent apparent capitalization of the profit realized before the end of the year cannot deal with this distortion either: this criterion renders a 20.313% internal rate of return in the case of the first flow of disbursements and a 19.160% rate in the latter.

the order in which the circuits follow one another. Still, its practical computation always renders a result. And it does so, even though the procedure universally used for this practical computation substantially disagrees with the definition of the internal rate of return. Or, rather, it sometimes renders a result thanks to this disagreement!

Let us recall that, according to its definition, the internal rate of return results from satisfying:

$$0 = -\frac{Kf_1}{(1+r)^0} - \frac{Kc_1}{(1+r)^0} + \frac{K'_1}{(1+r)^1} - \frac{Kc_2}{(1+r)^1} + \frac{K'_2}{(1+r)^2} - \quad \ldots \quad - \frac{Kc_2}{(1+r)^{n-1}} + \frac{K'_n}{(1+r)^n}$$

Nevertheless, in normal practice this internal rate of return would be calculated as:

$$0 = -\frac{Kf_1}{(1+r)^0} + \frac{K'_1 - Kc_1}{(1+r)^1} + \frac{K'_2 - Kc_2}{(1+r)^2} + \quad \ldots \quad + \frac{K'_n - Kc_n}{(1+r)^n}$$

This practical form ignores, at least, the actual turnover of circulating capital, forcing it into the calculation as being instantaneous whichever its actual determination. Only the ordinary presence of an initial disbursement of fixed capital conceals the absurd into which such a procedure turns the whole calculation. Were that disbursement not present, it would be openly visible that to any positive and finite annual rate of profit would correspond an infinite internal rate of return, according to the practical procedure: only an infinite rate would equal to zero a sum made of all positive terms. With very rare exemptions (only circulating capital with an actual instantaneous turnover, that unavoidably would correspond to an infinite rate of profit), this procedure obviously introduces significant distortions concerning the representation of capital's profitability. It biases the internal rate of return upwards, yet in different degrees according to the weight of fixed and circulating capital, and the true turnover rate of the former. For example:

	Capital IX	Capital X
Kc_j	10.0	60.0
Kf_j	100.0	50.0
K'_j	42.0	80.5
tc	1.0	1.0
tf	0.2	0.2
r % according to		
- definition	15.8	11.4
- usual criterion	18.0	29.9

Furthermore, it suffices with adding more and more identical elements to the computation to get an increasing internal rate of return (albeit in a declining proportion). Only to begin with, the portion of fixed capital that completes its turnover in the first period of each successive renovation enters the calculation for the first time with an apparent infinite turnover rate. If the computational period is extended from 5 to 10 years, therefore including a renewal of the original fixed capital followed up to its complete turnover,

r % (usual criterion)	20.2	32.4

Now with 50 years:

r % (usual criterion)	21.2	33.2

and so on.

At the same time, this procedure fortifies the non less extended than erroneous reduction of capital to the instruments of production, as it makes only the corresponding portion of capital to appear advanced as such. Obviously, at this stage we cannot just accept it is used merely for the sake of computing simplicity. Even the materiality of the distortion it introduces immediately obliterates such a justification.

According to its form, the calculation of the internal rate of return is but the resolution of a polynomial equation in grade n with $n+1$ terms. Therefore, its resolution will necessarily render not one but n roots. Following Descartes' rule, given the $n+1$ terms, there will be no more real positive roots than sign changes in the equation, nor more real negative roots than sign contiguous repetitions are there, and pairs of conjugated imaginary roots up to complete their total.

What do the theorists that support the internal rate of return currently say concerning the potentiality its procedure has to produce multiple results or no real result at all? The mass of possible negative real roots given by the string of signs repetitions in any "pure" or "conventional" investment project with only one sign change, are dismissed. At best, just by declaring they lack "economic meaning" or "representativity of the funds flow series"[17], but in the absolute majority of the cases, their possibility is not even mentioned. Notice that these neglected real roots conceptually should correspond to losses ranging between 0% > r > -100% over advanced capital, thus including a level of loss whose possibility cannot be disregarded beforehand in any empirical case. It goes without saying that the meaning of the possible imaginary roots does not even deserve the slightest mention from the theoreticians of the internal rate of return. The possibility that the equation renders no real rate at all is exceptionally declared to correspond to the abstract absence of any "equilibrium rate of return"[18], or presented as a curio itself[19]. But, again, it is normally disregarded without notice.

All the problem concerning the representation of capital's capacity to valorize itself by the internal rate of return thus has come down to guaranteeing that its calculation renders one, and only one, real positive root[20]. Regardless of its concrete adequacy to represent a capital's valorization capacity, the only positive root can then be presented as having an absolute necessity to be this representative given its uniqueness. The apparent legitimating is completed just by calling this root "the" internal rate of return. The mere possibility of getting in practice more than one positive root, or none at all, is seen as the Achilles' heel of the whole construction. Questions that can only be answered provided the representation of the circuit of industrial capital by the circuit of interest-bearing capital is abandoned, would be impossible to withhold. Which would be the root that properly represents capital's profitability while the rest are mere meaningless "accidents"? Or, furthermore, why should one of these internal rates of return be taken as the unequivocal representation of profitability?

Instead of facing the conceptual question, the theorists that support the internal rate of return turn it upside down. The essential question about the lack of meaning of a model that changes its results as soon as identical circuits of

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[17] Fernández Seco, M., "Evaluación de proyectos mediante el análisis de los flujos de fondos: limitaciones," *Administración de Empresas*, T. III, p. 226; Gaspar, *op. cit.*, p. 546.

[18] Ramsey, J., "The Marginal Efficiency of Capital, the Internal Rate of Return, and Net Present Value: An Analysis of Investment Criteria," *Journal of Political Economy*, Sept./Oct. 1970, pp. 1022-1023.

[19] Gaspar, *op. cit.* p. 552.

[20] "If the economic rate of return fails to be unique, ..., profitability cannot be summarized correctly by *any* rate of return, ..." Fisher, F. M. and J. J. McGowan, *op. cit.*, p. 83.

capital are added or subtracted from the series is inverted into the question of “truncating” the series. Then, the essential question about the conceptual emptiness of a model that renders a multiplicity of different simultaneous results for a given case is inverted into the question of “optimally truncating” the series to avoid any change in sign beyond the first one or feeding a collection of “simple investment” or “pure” cases[21]. The same essential question concerning the incapacity of the model to point out which of these simultaneous multiple results is the only one conceptually meaningful, is inverted into the question of asserting the primacy of the maximal rate[22], the rate that is closer to the (completely external to the concrete turnover of the industrial capital) market interest rate[23], or any rate higher than the latter[24]. The wealth of algebra that these inversions currently exhibit does not suffice to cover their true content: the attempt to justify what is conceptually unjustifiable.

The theorists that support the internal rate of return have so much at stake in this question of multiple roots as the main limitation of the internal rate of return, that they justify the self-inconsistent practical criterion though their own research makes the facts clear: they themselves seem to make a point in developing examples that show the meaningless nature of the internal rate of return concerning the profitability of industrial capital with an overwhelming strength. Let us take, for instance, the well-known case of the oil pump[25]:

$$0 = -1600 + \frac{10000}{1+r} - \frac{10000}{(1+r)^2}$$

More generally, such sequence can correspond to a capital that develops only one circuit along its whole life, and whose disbursement is completed a period after its return; or to a capital that develops two circuits, losing in the latter the profit it has earned in the former. The complete circuit renders a loss, as it is immediately visible given that the total disbursed amount is bigger than the returned one. Still, as the corresponding series does not include a single

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21 Karmel, P., “The Marginal Efficiency of Capital,” *Economic Records*, vol. 35, Dec. 1959, pp. 429-434; Soper, C., “The Marginal Efficiency of Capital: A Further Note,” *The Economic Journal*, vol. 69, March 1959, pp. 813-816; Wright, J. F., “Notes on the Marginal Efficiency of Capital,” *Oxford Economic Papers*, July 1963, pp. 124-29; Arrow, K. and D. Levhari, “Uniqueness of the Internal Rate of Return with Variable Life of Investment,” *The Economic Journal*, vol. 79, Sept. 1969, pp. 560-566; Flemming, J. S. y J. F. Wright, “Uniqueness of the Internal Rate of Return: A Generalization,” *The Economic Journal*, June 1971, pp. 256-263; Gronchi, Sandro “On Investment Criteria Based on the Internal Rate of Return” *Oxford Economic Papers*, 38, 1986, pp. 174-180; Wright, J. F., “On Investment Criteria Based on the Internal Rate of Return: A Response,” *Oxford Economic Papers*, 38, 1986,, pp. 181-184; Norstrom, Carl “A Sufficient Condition for a Unique Nonnegative Internal Rate of Return” *Journal of Financial and Quantitative Analysis*, June 1972, pp. 1835-1839; de Faro, Clovis, “A Sufficient Condition for a Unique Nonnegative Internal Rate of Return: A Comment,” *Journal of Financial and Quantitative Analysis*, Sept. 1973, pp. 683-684; Aucamp, Donald and Walter Eckardt, “A Sufficient Condition for a Unique Nonnegative Internal Rate of Return - Comment,” *Journal of Financial and Quantitative Analysis*, June 1976, pp. 329-332; Herbst, Anthony, “The Unique, Real Internal Rate of Return: Caveat Emptor!,” *Journal of Financial and Quantitative Analysis*, June 1978, pp. 363-370; de Faro, Clovis, “A Sufficient Condition for a Unique Nonnegative Internal Rate of Return: Further Comments,” *Journal of Financial and Quantitative Analysis*, Sept. 1978, pp. 577-584; Bernhard, Richard, “A More General Sufficient Condition for a Unique Nonnegative Internal Rate of Return,” *Journal of Financial and Quantitative Analysis*, June 1979; 337-341; Capettini, Robert, Richard Grimlund and Howard Toole, “Comment: The Unique Real Internal Rate of Return,” *Journal of Financial and Quantitative Analysis*, Dec. 1979, pp. 1091-1094.

22 Wright, J. F., *op. cit.*, pp. 125.

23 Massé, P., *Optimal Investment Decisions*, Englewood: Prentice-Hall, 1962, p.22; Karmel, *op. cit.*, p. 431.

24 Ramsey, *op. cit.*, p. 1023.

25 Lorie, J. H and L. J. Savage, “Three Problems in Rationing Capital,” *Journal of Business*, Oct. 1955, pp. 236-237.

permanency in the signs, it is immediately clear that it cannot render a negative root. Still worse, it renders not only a positive root, but two:

$r' = 25\%$
$r'' = 400\%$

The theoretical supporters of the internal rate of return consider it suffices with labeling the movements of capital that are transformed into such an absurd result by the mechanics itself of the internal rate of return a "non-simple or mixed investment," "an investment as well as a financing transaction"[26], to account for it. Nevertheless, only a procedure emptied of any necessity beyond its mere form can yield the result in question. And how could a procedure that renders such an absurd result be trusted in any other case, since they differ from this one in their form but not in their content? No wonder the supporters of the internal rate of return try to keep its meaningless concept out of sight at the price of universally using the practical criterion of placing together movements in the cash flow that correspond to different points in time, despite this criterion systematically deprives that rate even of its proper formal requirements. Moreover, they even extend the vicious criterion from current practice, where it passes just as a procedure for the sake of computational simplicity, to the formulas given in the abstract conceptual developments themselves, as if it obviously corresponded to the definition. Instead of placing circulating capital advances at a point in time and their valorized returns at a different one, the net flow is commonly placed in the middle of the year or any turnover time changed into an instantaneous fraction through continual capitalization.

To actually solve the problem, it must be placed on its feet again: only provided an industrial capital presents a constant relationship of valorization (in its double determination) for all the portions in which it fragments itself along its turnover and the circuits of these portions are not partially superposed nor differ in their length, one amongst the roots of the polynomial equation that can be constructed following those movements coincides with the annual rate of profit.

The problem with the internal rate of return does not start to arise with its multiple roots, nor with the practical procedure commonly used to avoid the manifestation of these multiple roots. The true problem arises from the fact that, even correctly calculated, none of those roots can properly express the profitability of industrial capitals in any normal case. Only by a very rare accident, rather a miracle, the circuits of a specific industrial capital can fit into the extremely restricted basis upon which the internal rate of return can unequivocally represent capital's profitability.

[26] Mao, James C. T., *Corporate Financial Decisions*, Palo Alto: Pavan Publishers, 1976, pp. 116-120.

3. The net present value

The net present value is an indirect attempt to measure an industrial capital's profitability. It is also based upon the attempt to represent the circuit of industrial capital by the circuit of capital lent for an interest. But now the rate of discount is directly introduced into the calculation as an externally given data. The greater the present discounted value at a given rate of the series of money inputs and outputs that open and close the circuits of an industrial capital, the greater the profitability of the industrial capital at issue is supposed to be.

As the net present value proceeds upon the same basis the internal rate of return does, it starts by suffering from the same incapacity of the latter to represent the annual rate of profit of specific industrial capitals. Of course, it does so except concerning the ability to render multiple rates, as it lacks the capacity to render even a single one. Actually, the problem of computing a capital's self-valorizing capacity as a portion of the total social capital is, due to its nature, the problem of computing the relationship of a specific capital with itself as a premise and as a result of its turnover circuits on an annual basis. It is, therefore, the problem of computing a rate of profitability. On the contrary, the computation of the net present value starts by placing the problem upside-down, taking as known what truly should be its result.

Such external starting point turns the calculation procedure into an empty formality. Consequently, it can render but an infinite multitude of results, following the change in the given rate along its infinite possible values. In other words, it renders no individually meaningful result whatsoever. In its turn, any intention to assert a certain rate as meaningful by itself to express the profitability of a specific industrial capital through the net present value must rely upon a non less external foundation. Thus, always a rate of this type is introduced, it is presented as the alternative profitability the capital at stake can hypothetically obtain elsewhere, as its "cost of opportunity." The attempt to base this hypothetical rate within the field of industrial capital is condemned to a hopeless hound from a special sphere of industrial production to the next searching for its determination, which has always vanished to a further one. The only apparently available gateway points to the field of capital lent for an interest and, therefore, outside the proper of industrial capital. Now not only the circuit of capital lent for an interest takes the place of industrial capital's circuit, but the determinants of the rate of interest are represented as the true determinants of industrial capital's profitability in itself. Even the briefest unfolding of the determinations that run from the rate of profit to its concrete development into the rate of interest escapes our present objective. Still, it suffices here with recalling how industrial capital's concrete rate of profit peaks precisely when inflation overwhelms the rate of interest actually turning it into the negative, to immediately appreciate how far the latter can take its claim to represent the former. Or it suffices with recalling the leverage effect, which any manager knows is the concrete manifestation of the different determinations of those two rates, necessarily present for an industrial capital based upon lent capital to make sense. Still, above all, there is not even a point in assuming whatever *a priori* meaningful rate to calculate an industrial capital's profitability. Such an assumption immediately turns this calculation redundant for any specific existing capital, thus showing by itself the inverted nature of the opening point.

The infinite multitude of net present values generated by this calculation lacks a necessary meaning even in its unity. Although each rate introduced to the polynomial equation renders a net present value, this is not necessarily a biunique relationship. Depending on the shape taken by the polynomial equation that represents the turnover circuits, the function of present values determined by the sequence of possible discount rates can follow a non-monotonous pattern. So to higher rates, lower present values can correspond, and vice versa; as well as the same value for different rates. This is just the formal reverse of the multiple root problem inherit in the internal rate of return. Only that, for the net present value, the function does not even need to take more than one zero value to show its inconsistency. It suffices with just one fluctuating pattern followed by the resulting function as a consequence of the presence of more than one root for the original polynomial equation at any of the infinite possible present values to make this inconsistency visible.

Even provided the functions of present values that correspond to two different capitals follow a monotonous pattern, their slopes obviously are reciprocally independent. The slope of each monotonous function results from the particular combination of all the individual movements that conform the annual turnover process of an industrial capital. Different proportions of fixed and circulating capital, along with diverging turnover rates for their different portions, produce functions that differ in their slopes without any general bias. Therefore, although each of the capitals in question presents a biunique relationship concerning the rates and their corresponding present values, nothing forces the two functions formed by these present values to keep a univocal relationship along their unfolding. The form of capital turnover that renders the higher present value at a low rate will not necessarily honor its presumed superior profitability at a higher one. As this is a well-known case, we can skip the corresponding example here. Still, since the theoretical supporters of the net present value are fond of looking down to the internal rate of return's shortcomings (despite all of these shortcomings are not only inherent to the former but appear in it multiplied since a given rate has been forced into it) let us consider here the already seen case of the oil pump. Let us assume a 100% forced rate:

$$NPV_{\mathrm{I}} = -1600 + \frac{10000}{1+1} - \frac{10000}{(1+1)^2} = 900$$

This investment of capital will be taken as a profitable one and "ranked" high above the following "detrimental" one:

$$NPV_{\mathrm{II}} = -1600 + \frac{1440}{1+1} + \frac{3040}{(1+1)^2} = -120$$

The only problem is that the one that has to be "rationally" chosen according to the net present value criterion vis-à-vis the 100% "cost of capital to the firm"[27], actually produces a 1600 net loss of capital, while the other one actually renders a "modest," but quite positive, 90% true annual profit.

The calculation of the net present value shows its true nature as an empty formality. Only when the represented capital circuits maintain the elemental relationship of valorization constant in its twofold determination from circuit to circuit and these do not partially overlap nor differ in length, producing only one change of sign in the output-input flow, and the rate forced into the equation accidentally makes the present value to equal zero, can this calculation be taken as representing the profitability of the capital at issue. Yet another accident added to the many required by the internal rate of return itself to properly represent the annual rate of profit. And certainly too many not to consider such a procedure completely incapable to unequivocally reflect an industrial capital's profitability.

[27] Mao, J. C. T., *op. cit.*, p. 120.

4. Profit margins

1. The absolute margin

We come now into the field of the procedures to measure the profitability of specific industrial capitals that, in a greater or lesser extent, leave outside their basis of computation the unity in capital's movements that define its circuits. Once this unity is expelled from the model's structure, the annual profit and the capital valorized through it can only be placed into relationship in an external way. The most external relationship in which a profit can be placed with respect to the capital that yields it, is to take it by itself as the proper expression of that capital's profitability.

Absurd as it may sound, this criterion enjoys quite a popularity. To begin with, it is precisely what "gross or net margins" (Mg) aim at measuring:

$$Mg = K' - K\,t$$ [28]

Commonly - and at best - the margin as such is presented as an appropriate procedure to evaluate the profitability of productive alternatives given a set of productive instruments and, therefore, a fixed capital. The already pointed out reduction of capital to the instruments of production, therefore letting outside its computation circulating capital in all (both concerning its disbursement in means of production and in labor power), underlies the question. From such perspective, any difference in circulating capital from one alternative to another can only affect the amount of profit - i.e., the margin - but is impotent concerning the denominator in the relationship of profitability. Thus, the margin is seen as accounting by itself for that difference. Obviously, this is not the case:

	Capital I	Capital II
Kc	100.0	20.0
Kf	100.0	100.0
t_c	1.0	5.0
t_f	0.2	0.2

that present as a result

K'	160.0	156.0
$K\,t$	120.0	120.0
Mg	40.0	36.0

although

p	20%	30%

Still the generalized usage of the amount of profit as the proper expression of a capital's profitability does not stop here. It appears in every linear programming model that follows the maximization of profit as its objective. This

[28] Since from here on we are going to deal with direct single-year based computations, we do not need to go on specifying the values for a year *j*.

criterion is immediately grounded in the impossibility to take the relationship between the annual profit and the capital that yields it as the function to maximize, at the same time that these two enter the calculation as dependent variables. However, a chance apparently remains for linear programming not to be immediately expelled from the field of profitability analysis. Both considered, the annual profit remains a dependent variable even when the amount of capital enters as a given and not as a dependent variable only subjected to restraints. The programming model is thus left only with the task of determining the concrete forms in which that given amount must take shape along its turnover to maximize profit (which is not a trivial question as we are going to see later) and therefore, its rate. Yet, this is only the first step. It has to be repeated within the range of amounts of capital that are presumed significant for the specific industrial capital whose representation is attempted, so as to produce a series of rates of profits. Only then, the higher rate of profit produced can be taken as the significant one. Nevertheless, such a procedure would certainly harm the image linear programming currently enjoys concerning profitability analysis. Its apparent objectivity, rooted in the automated determination of its dependent variables, does not go hand in hand with the procedure here described. More substantially, the technical combinations of means of production and of labor power are obviously forced to fit exactly into the fixed amount of capital. Furthermore, the meaning of the result itself is put into question, as the problem the model aims to solve is to compute the amount of a specific industrial capital and its profitability. And the former computation necessarily starts from the concrete forms in which that capital's turnover circuits take shape, which are the only variables directly accessible to registration. Of course, the widespread neglect of capital's circuit is the true underlying reason for the *instrument abuse* implied in using linear programming as a means to measure industrial capital's profitability.

2. The margin on price

The margin on price (m_p) does not consider the amount of profit by itself any longer, but places the annual profit in relationship with the valorized capital that has emerged form the metamorphosis circuits. That is:

$$m_p = \frac{K' - K\,t}{K'}$$

Still, the true relationship involved in the turnover of capital, that is, the relationship between capital as a result and as a premise of its circuits through the mediation of the consumed capital, has been degraded here to an abstract relationship of the valorized capital with itself. Aside from the case of zero annual profit, that nullifies by itself any distortion, the margin on price has no organic way of agreeing with the annual rate of profit. It is not just about a numerical disagreement, with a given bias. Since the margin on price fails to put into relationship the three moments in the circuit of industrial capital - advanced, consumed, valorized capital - it is completely insensible to differences in the two former moments. For instance:

$$K' = 600;\ K' - K\,t = 500$$

with

$$m_p = 16.667\%$$

can indistinctly correspond to such different valorization processes as:

	Capital III	Capital IV	Capital V
K	2100.0	500.0	200.0
with			
p	4.8%	20%	50%

3. The margin over costs

The margin over costs (m_c) starts to place the annual profit in relationship with the capital from whose metamorphosis circuits it has emerged. That is:

$$m_c = \frac{K' - K\,t}{K\,t}$$

Still, the exteriority concerning the annual unity of these circuits as an organic part of the valorization process of total social capital immediately reappears. It does so in the very representation of the valorization capacity as a relationship between the annual profit and the capital productively consumed to obtain it. Each specific industrial capital can claim for its egalitarian right upon the total surplus-value socially produced in the proportion its advanced amount, i.e., it itself, is an aliquot part of the total social capital. Although the turnover rate of its variable part determines its capacity to add to the total social surplus-value, it has nothing to do when the time comes for each one to appropriate its pro rata part. Only provided a unitary annual turnover rate, $t = 1$, that corresponds to advanced capital being equal to consumed capital, can the profit margin over cost correspond to the annual rate of profit:

$$m_c = \frac{K' - K\,1}{K\,1} = p$$

Obviously, this coincidence is a mere, and rather rare, accident in practice. Worse still, the computation of the margin does not give by itself a hint concerning the degree in which its results are distorted, nor even that accidentally they are not distorted at all. For instance, the previous example where:

$$K' = 600;\ K\,t = 500$$

with

$$m_c = 20\%$$

can indistinctly correspond to such different valorization processes as:

	Capital III	Capital IV	Capital V
Kc	100.0	300.0	100.0
Kf	2000.0	200.0	100.0
K	2100.0	500.0	200.0
tc	3.0	1.5	4.8
tf	0.1	0.25	0.2
with			
p	4.8%	20%	50%

4. The inversion of an operative partial tool into the ruler itself of capital accumulation

In any of its forms, the profit margin lacks the capacity to properly express the profitability of a specific industrial capital. The rate of profit margin is a typical case of an indicator fitting some practical necessity in business management that ends up theoretically placed as the true determinant of capital accumulation. In business management, the margin over cost is used only as what it is: an indirect indicator of the concrete normal capacity for valorizing itself of an actual industrial capital. It is determined on the basis of the normal levels of annual activity and of capital's turnover rate. Given these levels, the at this stage equally given annual rate of profit can be represented by a direct ratio between the profit and the capital consumed per output unit. That is, the annual profit rate is fractionated into:

$$p = \frac{K' - K\,t}{K\,t} \cdot \frac{K\,t}{K} = m_c \cdot t$$

This margin rate satisfies a specific kind of operational necessity, where considering the annual valorization process in its unity exceeds the scope of the concrete decision to be made - e.g., sales management as such, where it appears as a mark-up margin. In a further step towards this operative flexibility, even the computation of the cost is put aside (always on the basis of a normal activity level) and the margin transformed into a self-contained tool apt to be directly handed by the sales management, as a margin on price. That is, with the second element turned now into a meaningless relation in itself:

$$p = \frac{K' - K\,t}{K'} \cdot \frac{K'}{K} = m_p \cdot \frac{K'}{K}$$

Even in the operative restricted fields they are specifically aimed at, the profit margins show their shortcomings; e.g., they are unable to reflect a change in the terms of credit. But then, theoretical economy comes into the scene, willing to take the immediate form of phenomena for their cause.

Mainstream economic theory finds natural to take out of sight, and rather to directly avoid, any profitability relation that makes visible that profit roots itself in the changes in form that capital undergoes along its turnover process. Not in vain it starts by inverting all the determinants involved in the turnover circuit of industrial capital to a matter of "marginal costs" and "marginal revenues" of the "productive factors" related through a "production function." Then it finds completely natural to isolate the first of each of those mechanically obtained couple of relations - the margins over cost and price - from the second element that involves the turnover rate, and attributes them an analytical meaning as unequivocal expressions of the capacity of industrial capital to valorize itself[29]. Then, it turns the "marginal" based categories into "average" based categories[30]. Which enables it to advance with these empty relations into empirical data[31]. Now the margins over cost or sales appear as just another measure of profitability that stands side by side with the annual rate of profit[32]. Or rather, that turns the latter into an inferior or "second best" to the former[33]. The inversion is completed by proclaiming the margin on price or cost (or mark-up margin) as an organic relationship around which the social process of capital accumulation regulates itself, as a relationship whose sole evolution determines by itself capital accumulation[34].

The role of capital turnover rate in determining the annual rate of profit has been erased from present-day economic theory (albeit the turnover rate reappears as a main point in management theory concerning the concrete forms it takes, particularly, the turnover rate of inventory). This happens to the extent that seldom criticisms of the margins over sales or costs can be found in the literature, that raise their inability to reflect the differences in turnover rates as their essential flaw to measure the capacity of industrial capitals to valorize themselves. Moreover, the isolated case that actually starts by raising the question, ends up falling even further from the annual rate of profit: it proposes the absolute annual profit itself as the proper measure of "monopoly power"[35]. One step forward, two steps backwards.

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29 Lerner, A. P., "The Concept of Monopoly and the Measurement of Monopoly Power," *Review of Economic Studies*, Vol. 1, June 1934, pp. 157-175.

30 Kalecki, M., "The Determinants of Distribution of the National Income," *Econometrica*, Vol. 6 (2) April 1938, pp. 100-102; Martin, Stephen, "The Misuse of Accounting Rates of Return: Comment," *The American Economic Review*, June 1984, pp. 501-506.

31 Bain, J. S., "Relation of Profit Rate to Industry Concentration: American Manufacturing, 1936-1940," *The Quarterly Journal of Economics*, Vol. LXV (3), August 1951, pp. 293-324; Cowling, Keith and Michael Waterson, "Price-Cost Margins and Market Structure," *Economica*, 43, August 1976, pp. 267-274; Ravencraft, David J., "Structure-Profit Relationships at the Line of Business and Industry Level," *Review of Economics and Statistics*, February 1983, pp. 22-31.

32 Martin, Stephen, "Entry Barriers, Concentration, and Profits," *Southern Economic Journal*, 46, October 1979, pp. 471-488.

33 Weiss, L. W., "The Concentration-Profits Relationship and Antitrust," in H. G. Goldschmid et al., eds., *Industrial Concentration: the New Learning*, Boston: Little, Brown & Co., 1974, p. 199; Scherer, F. M., *Industrial Market Structure and Economic Performance*, Chicago: Rand McNally, 1980, p. 269; respectively.

34 Kalecki, M., *op. cit.*, pp. 102-112, that starts with the section: "How is it Possible for the Degree of Monopoly to Determine the Distribution of the Product of Industry?"; Sylos Labini, Paolo, *Oligopolio y progreso técnico*, Oikos-Tau, Barcelona, 1966, pp. 106-107.

35 Whitman, Roswell H., "A Note on the Concept of 'Degree of Monopoly'," *The Economic Journal*, June-Sept. 1941, pp. 261-269.

5. Costs accounts

In the so-called costs accounts, computing the advanced capital almost appears as a purely matter of procedure. Almost, but not just, as this computation is not aimed at relating the annual profit with the amount of capital resulting from it, to obtain the rate of profit. On the contrary, it is aimed at determining an amount of capital upon which an interest rate (again, a “cost of opportunity”) can be applied so as to introduce the “cost” of capital into the account. The exteriority of this “cost” with respect to capital’s self-valorization actually occurred immediately appears in the impossibility to coherently close the representation of the annual valorization process. That is, normally this process would be represented through the cost accounts as:

$$K' \neq K\,(t+i)$$

with
i: rate of interest imputed upon industrial capital.

Only when accidentally i is taken equal to p, the equation of annual valorization is satisfied[36].

Still, this procedure does not only denaturalize the computation of industrial capitals’ profitability by forcing an assumed interest rate into it. On doing so, it undermines its own capacity for properly calculating the amount of capital upon which the concept of the “cost account” itself says that rate of interest is to be applied. The proper amount of capital immediately emerges from the computation of the turnover circuits the advanced capital at issue realizes in a year. Nevertheless, these are not just turnover circuits, but the means through which capital valorizes itself. Therefore, to compute the amount of capital implies, by itself, to compute the amount of its annual profit. In this strictly operative unity, any external computation of a supposed profitability immediately shows itself redundant, rather senseless, when the accurate measurement of capital’s profitability is supposed to be at stake. So, starting from its very concept, the cost account sees itself pushed to break apart the unity inherent in the capital circuits from where it is going to determine the advanced capital’s amount.

This is not a critical problem concerning the circuit of fixed capital. Unavoidably, this capital has to be represented apart from the calculation of its turnover, if capital’s annual turnover is to be modeled on a single year basis as the costs account does. Normally, costs accounts compute fixed capital and its turnover by implicitly abstracting from all interlacing between its circuits, both inside and outside the specific industrial capital

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[36] Sometimes the inverted conception of this rate of interest as the true determinant of industrial capital’s profitability reaches completely grotesque forms. For many years, this profitability was officially studied for agricultural capital in Argentina through the following criterion. Starting from the assumption that any capital, regardless the specific form of its circuit, yields an interest, and consequently having to look for this interest somewhere outside that circuit itself, each portion of capital was associated to the rate of interest charged for bank loans guaranteed by the corresponding assets. The capitalized rent of the land and the fixed capital implanted upon land, were imputed with mortgage interest rate; the fixed capital materialized in machinery, with the rate of interest charged for loans against specific assets; the circulating capital, with the rate corresponding to ordinary bank loans. So, in search of an external source where to base the representation of capital’s profitability, this procedure ended up taking the difference in the rates of interest of loans that correspond to their average risk according to the quality of their guarantee, as the true determination of capital’s profitability. This procedure was finally dropped, not because it was made clear its nonsensical nature, but because many years of negative real rates of interest make it impossible to take any current rate in the loan market, and a purely hypothetical rate started to be used. Since no sound foundation can be given to this rate’s amount, its supporters preferred not to make its feebleness even more visible by assuming some difference inside it on the basis of any actual interest rate.

represented. This is the criterion that properly fits fixed capital determinations into a single-year model. According to it, the portions of fixed capital that return along its turnover are excluded from its computation until they are needed again to renew the corresponding instrument of production, as the original one concludes its useful life. Consequently, fixed capital enters the computation of total capital represented by its average value along the useful life of the instruments in which it is materialized, while its annual consumption is computed upon the original value of these instruments. The lack of consciousness concerning the unity of capital's turnover process only occasionally shows here in some attempts to compute fixed capital by the original value of the instruments. This procedure presupposes that fixed capital's returned portions are condemned to sterility while they are not called again into action in the same production process, not abstracting from but just overlooking the interlacing of fixed capital circuits between separated production processes. More frequently, that lack becomes visible in the forcemeat of a presumed interest gain into the calculation of the portion of fixed capital annually consumed, as a way to reflect a complete interlacing of fixed capital circuits between separated production processes. This interlacing has no way of fitting into a single-year computation, let alone the appeal to a presumed interest rate when it is about calculating industrial capital's profitability. Finally, the same lack systematically shows as the turnover of fixed capital is represented by the proper of capital lent for an interest, "amortization," or the even more external category of "depreciation." What else could be expected? This name-calling is just the same exteriority already pointed out that from mainstream economic theory universally permeates business accounting itself.

Yet, concerning cost accounts, the real problem starts when they have to deal with advanced circulating capital and its turnover. Business accounting does not need to compute the ongoing turnover process of a capital to calculate its advanced amount. Regardless it has to deal with an actual turnover process or with an hypothetical one (budget accounting), it always starts from an actual circulating capital whose amount, composition and conditions of turnover are given. On the contrary, the representation of industrial specific or purely hypothetical capitals through a single-year model lacks this starting point. Therefore, this model must solve by itself the twofold question of representing the turnover of circulating capital at the same time it determines the advanced amount of this capital. Only a model that represents the valorization process in its internal unity can achieve this simultaneous solution. And cost accounts do not precisely aim at doing that. They therefore ordinarily rely upon procedures that, on the one hand, compute the circulating capital consumed during the year, and on the other hand, intend to compute the advanced circulating capital in a way external to the integral representation of its turnover process. And such procedures are used in this way even though the direct reflection of the partial or complete interlacing between different circuits of circulating capital inside, and even outside, a specific industrial capital is a condition to represent it through a single-year model.

A first type of practical criteria commonly found ranges from the mere omission of the circulating part when computing the advanced capital (a reduction that is not alien to the theoretical reduction of capital to the instruments of production), to the identification of advanced and annually consumed circulating capital. Some external, therefore rather arbitrary, estimation of circulating capital's turnover rate to be applied on the properly calculated annually consumed capital, stands in the middle. Obviously, all such procedures are little more than attempts to run away from the problem of computing circulating capital, but not true solutions whatsoever. Nevertheless, they are top ranked in current practice.

A second procedure commonly used represents circulating capital by the accumulated money reserves needed to cover the cash deficits along the year. It happens that there is no need to follow each portion of the advanced capital through its turnover process until it recovers its money form (i.e., to represent circulating capital's turnover process in its integrity) to build a cash flow. It suffices with bringing together all the movements of capital in and out its money form in their correct moment along the year. It is even possible to properly exclude from this movements the profit and the partial returns of fixed capital, both of them alien to the computation of circulating capital, without apparently transcending the exteriority inherent in computing a profit margin. Of course, provided this expurgation is properly done, the cash flow with its measure of the cash deficit is a necessary step in computing circulating capital in a one-year model. Though, it cannot satisfy by itself this computation. That there is a part of circulating capital missing immediately shows as the supposed amount of the capital thus computed changes just because the moment of the year defined as the starting point for the register is changed. For instance, given the cash flow:

	quarter			
	1	2	3	4
K'	-	55	90	75
Kc . tc	30	35	55	80
Kc . p	-	5	10	5
Net cash flow	-30	15	25	-10

the attempt to reduce circulating capital to the accumulated money reserves needed to cover the cash deficits would result in:

$$Kc_1 = 30; \quad Kc_2 = 0; \quad Kc_3 = 15; \quad Kc_4 = 40$$

as the starting point is shifted from quarter 1 to 4, thus rendering:

$$p_1 = 66.7\%; \quad p_2 = \infty\ \%; \quad p_3 = 133.3\%; \quad p_4 = 50.0\%$$

while this cash flow actually corresponds to:

$$Kc = 100; \quad tc = 2; \quad p = 20\%$$

Yet, there is a further procedure that, externally added to the cost accounts, accurately measures circulating capital. It demands two mutually independent computations. The first one starts by identifying each of the portions in which circulating capital becomes fragmented along its turnover. This means that each disbursement of circulating capital must be fragmented according to its conditions of payment; each of these fragments must be followed through its turnover until identifying the moment it returns to the money form with the collection of the respective sale; and each sale has to be fragmented according to its collecting conditions. Once achieved the complete identification of each disbursement along its turnover, the time required for this turnover is computed. A first part of circulating capital is now computed as the summation of each of its fragments weighted by the time their turnover demands:

$$Kc_I = \sum[\,(Kc\,.\,tc)_{ji} \cdot \frac{1}{tc_{ji}}]$$

where:
j: each of the fragments in which the consumed circulating capital is disbursed.
i: each of the portions in which the fragment *j* completes its return.

The second part of the circulating capital is determined as the summation of the accumulated money reserves needed to cover the cash deficits along the year, weighted by the fraction of time in the year that capital remains under this form:

$$Kc_{\mathrm{II}} = \sum_{f=1}^{n} mr_f \cdot \frac{1}{n}$$

where:
mr: money reserves
f: each of parts in which the year is fragmented to compute the cash flow.

Then the circulating capital results properly computed as:

$$Kc = Kc_{\mathrm{I}} + Kc_{\mathrm{II}}$$

Despite its accuracy, this method of computing the circulating capital is rarely applied in practice. The reason arises from the difficulty implied by the first part of the computation. It demands the identification and follow-up of the movements of each portion in which circulating capital is fragmented along its turnover, while, at the same time, it lacks a systematic accounting of the turnover process itself. If this difficulty significantly affects the computation of relatively simple processes of turnover, it amounts to a practical impossibility when it comes to those that typically correspond to repetitive activities along many years inside the same process of production (forestry, for instance). And this practical impossibility peaks when a portion of capital enters the turnover process to be completely consumed inside a single productive process and, therefore, as a part of circulating capital from a point of view restricted to this process itself, but that actually becomes a part of fixed capital and completes its turnover as such since the productive process in which it was completely consumed actually produces an instrument of production to be used by the same capital in a different productive process. The latter is the case of the production of instruments of production for self-use, normally present in agricultural production: self-production of cows, self-production of fruit plantations, etc.

Furthermore, this procedure lacks the structure needed to reflect the effect upon the capacity of capital to valorize itself that arises from the exposition of the monetary credits and debts, and of the money reserves themselves, to the loss of the unitary capacity of the money sign to represent value, i.e., the effect of inflation.

Finally, all the effort demanded to compute the turnover of circulating capital in this way, produces no result other than the amount of the corresponding circulating capital itself. All the movements that give shape to the turnover have to be identified and followed one by one along their development. Still, the analytical power that can be acquired through this process concerning the changes in the structure of circulating capital along the year is destroyed as soon as those individual movements become collapsed into the weighted average required by the computational mechanics. And, as we have seen above, this analysis is an unavoidable step in measuring the capacity of industrial capitals for valorizing themselves. Only through it, the specific annual rates of profit computed can be placed into relationship with the general annual rate of profit, given the differences in specific turnover patterns that mediate the regulation of the former rates by the latter. But this is as far as any computation of circulating capital separated from the registration of its turnover process itself can get.

6. The annual rate of profit model

The solution to the problem of properly computing the annual rate of profit of specific industrial capitals, which presupposes solving the problem of properly computing their circulating part, can only be achieved through a model that computes that rate in the same process that it determines this capital. Therefore, that solution can only be achieved through a model that determines the amount of profit by directly reflecting the turnover process of industrial capital and, *a fortiori*, of circulating capital.

The computation of the internal rate of return or the cost accounts is based on the set of assumptions that correspond to the reflection of the turnover of the specific industrial capital through them, however inaccurate this reflection results. Yet, the very exteriority of the procedure with respect to the object it aims at reflecting makes many of these assumption remain implicit, even to the extent of going unnoticed. It happens that their explicitness would result in the evidence of the inadequacy of the procedure itself. So these assumptions are sources of frequent misinterpretations of the model's results that add to their immanent lack of accuracy. In turn, this lack of accuracy frequently covers the necessity of making those assumptions clear. On the contrary, a model that directly reflects the turnover of a specific industrial capital can only be developed by starting from making explicit all those assumptions, since they determine the structure of the model itself.

1. Fragmentation inside the annual period

Each portion in which capital is fragmented along its turnover process has to be identified in its original disbursement and followed until its return. So the circuit of capital needs not only to be represented on a yearly basis, but this basis must be fragmented into so many parts as needed to represent the concrete moments of the turnover process. The amount of different points in time in which a movement of capital occurs determines the upper potential limit of this fragmentation. Still, as it happens in any computation, such breaking up of the data is at the same time limited by the amount of work and cost its achievement implies, vis-à-vis the gain in accuracy. Moreover, an excess of preciosity in this sense can back-fire and result in a loss in precision, since data from very different sources must be commonly brought together.

Business accounting aims at reflecting the turnover of each singular capital to enable the general operative ruling of its accumulation. This accounting points to a monthly basis as the fragmentation inside the year it needs to support that immediately operative general ruling without materially loosing accuracy. Therefore, this same base can be considered the general one and, moreover, the highest accurate degree of fragmentation, for modeling specific industrial capitals.

2. Basic structure

The starting point is here the measurement of the concrete rate of profit that rules the existence of a specific industrial capital as such, along its process of accumulation. At first sight, the apprehension of the concrete quantitative manifestations of any process of capital accumulation seems to require a multiyear model, given by the nature itself of the problem. But any attempt to follow the circuit of a specific industrial capital in its development along successive years to measure the normal rate of profit means that this pursuit must start at the very beginning of the life of the capital in question. Furthermore, it must be extended far enough to overcome any specificity inherent in the beginning of each capital's life, until it reaches its normal concrete level of accumulation. For some capitals (specially those that have the length of their turnover subordinated to natural determinations that escape to their control while achieving their normal valorization) this pursuit means the necessity of representing the turnover of specific industrial capitals along 5-10 (e.g., plantations), or even 30-50 years (e.g., forestry) before their normal level of accumulation can be reached. And capital accumulation is determined as a cyclical process by its own nature itself. So the representation that follows its development along time must properly reflect the value that corresponds to each concrete form that enters the model at each moment. Nevertheless, the normal annual rate of profit of each specific industrial capital takes concrete shape as the average around which the singular annual rates of profit fluctuate. Therefore, once achieved the year by year complete representation, the normal rate of profit must be computed as an average that cancels the year by year differences, that are irrelevant to it. That is, a lot of computing work, whose complexity can add to, rather than diminish, any computing imprecision, that ends up necessarily sterilized to achieve the pursued result.

The basic solution to the problem of unequivocally computing the normal rate of profit actually goes the other way round. It starts by representing the accumulation process of a specific industrial capital as a process of annual simple reproduction, as a process of simple valorization on an annual basis. And it follows by representing the concrete forms of capital accumulation that are to be taken as the independent variables of the model, not at their immediate annual value, but at their average value. The base of this average corresponds to the number of years needed to cancel the annual fluctuations that are irrelevant to the normal computation in question. The circuits that are opened during the represented year to be completed (whichever their length) only on a further one, become now equal to those that have been started on previous years to be closed in the represented one. The composition that capital has at the end of the year is the same that it has at its beginning, however this composition changes along the year according to seasonal determinations. Therefore, on the double basis of simple annual reproduction and average values, the turnover circuits of a specific industrial capital can be represented as an infinite repetition of its annual movements on a single-year model. And each portion of advanced capital can be identified and followed up to its return to the money form, through a circuit that appears to close upon itself.

In fact, exactly the same basis underlies the self-consistence of the internal rate of return and the costs accounts. The internal rate of return can only aim at unequivocally measuring the rate of profit provided no change in the conditions of valorization occurs along the computation period (let alone its further impossibility to reflect any real condition of the turnover of industrial capital). Its computational mechanics implies a direct average computation of a process of simple reproduction, even to the extent of immediately taking out from the represented turnover the realized profits and the gradual return of fixed capital. Its multiyear basis is only an apparent one. In turn, the single-year basis of the cost accounts is obvious, given their form itself.

In brief, the system of models able to reflect the annual valorization of an industrial specific capital by computing its advanced amount at the same time it represents the unfolding of this capital's turnover circuits, is formed by two complementary models:

1. A *single-year model* that reflects the process of capital accumulation as a process of simple reproduction of the annual valorization. This model is the core of the system, since it basically aims at measuring the concrete normal profitability that determines the specificity itself of an industrial capital beyond its material particularities, and the effect upon that profitability of any change in the conditions of production and circulation.

2. A *multiyear model* that reflects the process of accumulation directly as such. This model has only a specific purpose. Its use is required only when, on the basis of the measures attained through the single-year one, the concrete path itself of the accumulation process or its cyclical form become relevant by themselves given the particular objectives of each concrete research.

3. Specific criteria

a) The definition of the extremes of each turnover circuit and the treatment given to realized profit

The representation of capital accumulation through its simple reproduction means that in the single-year basic model, profit has to be taken away and excluded from the computation of the process of turnover as soon as it is realized with the closing of the turnover of the corresponding portion of advanced capital. But this exclusion has to go a step further in the definition of the computing criteria.

Capital completes its turnover when it returns to a form that enables it to start a new circuit. In its simplest determination, this form is money itself. But with the development of money as a means of payment, the flow of capital accumulation takes a specific juridical form concerning the individual industrial capitals. It suffices with having sold on credit for the right to collect (in a certain average proportion) this credit to become the concrete basis on which a new circuit can be opened by buying on credit too. So, concerning the accounting of individual capital, the circuit of each portion of capital runs from the moment of purchasing through the moment of selling. At the same time, the profit included in the selling price is computed as having been realized (in a certain average proportion too) at the moment of the selling itself. Therefore, this profit is added from that moment on to the capital advanced under the form of credits to be collected, since it is able to support the renewal of the turnover on an increased scale.

The exclusion of all profit from the advanced capital since the moment of its realization takes concrete shape in the definition of this moment itself and, therefore, of the extremes that limit each turnover circuit in the single-year model. These circuits are thus opened when a portion of capital leaves its simple money-form and are closed with its return to this form[37]. Obviously, the multiyear model directly follows the same criterion that corresponds to individual capital accounting.

b) The computation of advanced fixed capital and its turnover

The gradual turnover of fixed capital is by itself a source of change in the scale of production, while the total capital remains unchanged or vice versa. A certain mass of instruments of production can sustain a certain scale of production along their whole useful life. But, at the same time, a decreasing amount of capital remains materialized in them, since a part of it returns with each circuit of that production. The already returned portion is normally put into action inside the same specific industrial capital, or in a different one, until it is required again in the original one because the original instruments have been completely worn out in it. Therefore, the single-year model needs to start by excluding any change in the scale of production from year to year by taking into account the scale that corresponds to a given material structure of instruments of production and circulation. At the same time, it needs to exclude the portions of returned fixed capital from the computation of fixed capital (since these portions are no longer in use by the same specific industrial capital, according to the basic criterion of annual simple reproduction), in the very moment when that return takes place.

Consequently, the advanced fixed capital is computed by the single-year model as the average value of the instruments along their useful life. In its simplest form, this criterion computes fixed capital as:

[37] Since much of the information needed to construct the model in each concrete case comes from individual capital accounting sources, it is of practical convenience that the computing structure of the single-year model enters this information directly on the basis that corresponds to that accounting, to transform it to its own basis through an automated general procedure.

$$Kf_{(\bar{x})} = \sum_{i=1}^{n} \frac{\sum_{j=1}^{m} \left(Kf_i - \frac{Kf_i}{m} . (j-1) \right)}{m}$$

with:
i: each of the n instruments of production.
j: each of the productive circuits in which the instrument i is used.
m: total useful life of the instrument i measured in productive circuits.

When the instruments tend to remain useful for a relatively high number of circuits, the advanced fixed capital tends to:

$$Kf_{(\bar{x})} = \sum_{i=1}^{n} \frac{Kf_i}{2}$$

and this simplified expression can be used for its computation.

On the same basis, the consumption of fixed capital, its reposition, and the eventual sale of the consumed instruments for a residual price must be computed for their annual average value. Any financing related to the disbursement of fixed capital must be reflected as an average deduction in this disbursement, that remains indefinitely constant. Therefore, the payment of interests over this average credit is directly reflected in the computation of the industrial capital's annual profit, while the average annual payment of the principal itself appears as the corresponding proportion of the annual consumption of fixed capital.

The criteria that correspond to the multiyear model are similar to those of the accounting of individual industrial capital.

c) The computation of advanced circulating capital and its turnover

Here we are at the core of the difficulty of properly computing the amount of an advanced specific industrial capital and, therefore, its annual rate of profit, through a single-year structure.

This difficulty can only be solved, while at the same time keeping the data needed for the computation in a structure that enables its analytical use, through a double process to be performed on the same entry data. According to the criteria already developed, the advanced circulating capital takes two forms along its turnover: it remains as a money reserve or it has already changed its form into the material one that corresponds to its acting inside each concrete step of each circuit of production and circulation.

At the beginning of the year, the first portion corresponds to the money reserves needed to cover the cash deficits along the year. The second portion can only be computed by identifying each portion of the advanced circulating capital along its turnover, so as to determine if it has completed its circuit or not at the moment the year starts; in other words, so as to determine if it is still under a specific material form at that moment. Circulating capital is then determined as the summation of its two portions.

If now the beginning of the year is changed to the beginning of the next year-fraction, the computation will yield a different amount of money reserves and of productive and circulating advances. Nevertheless, the total amount will remain exactly the same. The model will have registered the change in the composition of circulating capital along its turnover, but the change in this composition while the total amount remains unchanged is precisely what corresponds to the simple reproduction of the process of valorization on an annual basis. The automatic repetition of this procedure for each year-fraction results in the complete display of the composition of circulating capital along its turnover. And this display is the tool needed to analyze how the conditions of the process of accumulation of a specific industrial capital, and what truly matters, the planed or unplanned changes in these conditions, take concrete form in the turnover of that capital.

Let us follow the concept through a simple example. Let us assume two successive identical circuits along the year, *a* and *b*, with the complete advancement of a circulating capital of $100 at their beginning, that returns at their end. On the basis of a quarterly fragmentation of the year and assuming that the first circuit starts at the beginning of the year, we reflect the movements of circulating capital as:

	quarter			
	1	2	3	4
advance *a*	100			
return *a*		100		
advance *b*			100	
return *b*				100

The cash flow will determine that the 100 to be advanced at the beginning of the year have to be kept as a money reserve, in the zero point in time. The 100 to be advanced at the third quarter are the same original ones, since they will have already returned by then; therefore, no money reserve will be needed to cover them. At the same time, no portion of circulating capital will be found to be advanced as productive capital at the zero point in time, since both circuits are closed by then. Consequently, the circulating advanced capital will be 100.

Let us move now each complete circuit one quarter to the right (which is equivalent to moving the calendar one quarter to the left). The circuit that now goes on to the following year is equivalent to the circuit coming from the previous one, in the infinite reproduction of the process of valorization represented by the single-year model. Therefore:

	quarter			
	1	2	3	4
return *a*-1	100			
advance *b*		100		
return *b*			100	
advance *a*				100

The cash flow will detect that there is no need of money reserves at the beginning of the year, since the first advance that will occur in the second quarter will be covered by the return of the capital already in action at the beginning of the year. At the same time, the advance that will take place in the fourth quarter will be covered by the return of the capital advanced in the second quarter; obviously, the latter capital will not appear as an advancement under a form apt to function in the production or circulation processes at the end of the year. On the contrary, the capital advanced in the fourth quarter will appear at the year end and, therefore, at the beginning of the year, under that sort of material form. The circulating advanced capital will be again 100.

Let us return to the original position of the circuits, assuming that each of them does no longer have a six month length, but an 18 months length. Notice that the indefinite reproduction of the annual movement corresponds to the starting of a new circuit each quarter, while the equivalent circuit opened in the previous year has not been closed yet. Now, the cash flow in the year will remain unchanged:

	quarter			
	1	2	3	4
advance *a*	100			
return *a*-1		100		
advance *b*			100	
return *b*-1				100

A capital of 100 is needed as a money reserve. But the capital advanced in quarter 1 will not have completed its turnover at the end of the year, so it will appear then under the material form that corresponds to its use in production or circulation. Therefore, it will appear under the same form at the beginning of the year. The same will happen with the capital advanced in the third quarter. The total capital advanced for the processes of production and circulation will be 200, and the total circulating capital 300.

If each turnover takes another additional year to be completed, each of the portions advanced for the processes of production and circulation will appear going through the end/beginning of the year under that form for two times. The corresponding advanced capital will be 400, and the total circulating capital 500. And so on, whichever the complexity followed by the succession of the circuits and their length.

The criteria that correspond to the multiyear model are similar to those of the accounting of individual industrial capital.

d) The computation of the advanced fixed and circulating capital that begins its turnover in a production process that provides the means for another production process inside the same specific industrial capital

This is the case of the production by a specific industrial capital of some of its own means, and typically of its own instruments, of production. Two different production processes are thus involved in the turnover of the same portion of advanced capital. The essence of the problem corresponds to portions of capital that enter a first process where their material form is completely consumed in each circuit, that thus appear at first sight as corresponding to the circulating capital, but that complete their turnover only as instruments in the production aimed at being sold and, therefore, as fixed capital. Since this form of turnover only comes to its end with the closing of its second step, only at that moment the profit that corresponds to the capital advanced along the complete double production process becomes realized and, consequently, computed as such.

The effect of this production on the advanced circulating capital and the annual rate of profit is directly reflected in the single-year model on the same basis on which any turnover fits in it to represent the process of capital accumulation as a process of simple reproduction of the annual valorization: the indefinite annual repetition of the self-production of instruments and of the incorporation of these instruments to the production of the products to be sold. Only a specificity that concerns the mechanics of the computational procedure itself (that in this case has to cut the circuit and reclassify each portion of the capital advanced) mediates here vis-à-vis the ordinary case.

Many processes of production of the own instruments of production have in reality the normal form of a continual gradual renewal that directly corresponds to the required by its representation through a single-year model. Agricultural production is the typical case where the production of the own instruments of production takes place. And this production has typically that form; for instance, the continual gradual renewal of fruit plantations, the production of the milk or breeding cows, etc. Furthermore, this form of renewal is also common in the production of the own instruments of production in industrial production in general, when the production of instruments is aimed at constantly replacing a given proportion of the total stock of a certain instrument; for instance, the constant gradual renewal of tanks in the chemistry or food industry.

Still, the production of their instruments of production by some specific industrial capitals may correspond to a form of turnover that does not properly fit in this direct way into a single-year model. This happens when the fixed capital is produced by the same capital in block, and not in a gradual process until reaching the normal scale of production. In the first place, this case only generates a specific computational problem when the period of construction of the own instruments is long enough as to make the period after the disbursement of a capital and before it starts yielding profits through the current production significant with respect to the normal annual basis. In the second place, many of these cases can still be represented through an assumed gradual renewal. If even this is not the case, the actual fact that the circuit of the capital in question does not directly fit into a single year model since it involves the presence of non-normal periods, can only be solved through an indirect procedure. This procedure adds the computing of the capital advanced for the years of construction, which is a simple computation since it does not involve any return, to the ordinary computation of the normal year. Then, the annual profit computed through the normal procedure is compared with the weighted average of the capital advanced for the years under construction and the normal operation that corresponds to that construction.

The production of the own instruments of production does not present any specificity concerning the multiyear model, corresponding to it the same criteria as those of the accounting of individual industrial capital.

e) The computation of the capital advanced in excess of its current consumption

The normal course of capital's valorization demands the disbursement of some portions of fixed and circulating capital in excess of their current consumption. In what concerns this portion of fixed capital, even when the instruments are not used in production, their value gradually reappears in the value of the product, since they are a condition for the normal production itself and the mere passage of time and moral depreciation render them useless sooner or later. So the turnover of this portion of fixed capital is reflected in the same way as the ordinary one.

The corresponding portion of circulating capital actually gets into use, since the reserve is constantly renewed through the consumption and new purchase of its individual elements. Nevertheless, from the point of view of the single-year representation, this reserve appears as a permanent advancement of capital that remains out of the turnover process. So this portion of circulating capital has to be specifically computed and added to the summation of the money reserves and the advances for production and circulation that arise from the computation of the turnover process itself.

The criteria that correspond to the multiyear model are similar to those of the accounting of individual industrial capital.

4. Changes in the conditions of production and circulation from one period to another, and the complete scope of the single-year model

a) Changes that take place with respect to opened turnover circuits[38]

Unless they somehow compensate each other, all variations in the conditions of production and circulation manifest themselves through a twofold change in the circuit of industrial capitals. In the first place, these variations will tend to reflect themselves in changes in the quantities, prices and conditions of payment of the instruments, materials, labor power or other expenses. Changes in the opportunity the disbursements of capital on these elements

[38] For an extended analysis of this matter see Marx, Karl, *Capital*, Vol. III, "The Effect of Price Fluctuations," Moscow: Progress Publishers, 1966, pp. 105-137.

take place, belong in the same type of manifestation inherent in the opening phase of capital's circuits. In turn, the variations in the conditions of production and circulation will tend to reflect themselves in the corresponding changes concerning the close of the circuit, that is, concerning the quantity, price and conditions of collection of the commodities produced.

Nevertheless, if a change in the conditions of the processes of production and circulation completely occurs after an industrial capital has completed a circuit and before it opens a new one, that change does not appear as such concerning the former circuit of valorization itself. This circuit will be developed from the beginning to the end under the new conditions. The change in the conditions of production or circulation reflects itself in the circuit in question through the possible tying up or release of capital that results from it. In the first case, additional capital will be needed to reproduce the process of valorization; in the second, a portion of advanced capital will be freed and left available for the opening of a further new circuit. The tying up or release of capital could rise or lower the pressure in the credit market, thus rising or lowering the rate of interest, and hence the participation of interest bearing capital over the total surplus value. And a tying up or release of capital always implies from the point of view of total social capital a decrease or increase in its potentiality to valorize itself. But, since the variation in the conditions of production or circulation occurs while the industrial capital in question remains under the form of capital in potency, and not in action undergoing its valorization process, all these effects integrally belong in the next, not started yet, circuit.

The opposite happens as soon as variations take place while a turnover circuit is still in course. A part of, or the whole capital involved in a process of production and circulation has been advanced, but has not closed its circuit yet, when the original conditions in which the advancement took place cease to exist. Since industrial capitals can valorize themselves as such only by being active in the process of production, and the time of circulation is a burden they cannot free themselves from, they tend to remain under their money form as little as possible. Hence, the changes in the processes of production and circulation always tend to catch them when they have already started the current circuit under conditions that do not exist any more. And if this tendency applies to circulating capital, it is the absolute norm concerning fixed capital. Since the same instruments of production remain under the form of productive capital along many circuits, and thus, years, until their use-value is exhausted, the capital materialized in them is constantly exposed to changes in the processes of production or circulation.

Now, inputs in which circulating or fixed capital have been advanced experiment changes in their value because (starting from the general necessity of constantly increasing labor's productivity) the conditions of production or circulation from where their new specimens flow out change. And those changes become immediately visible in the prices these new specimens get in the market vis-à-vis the prices originally paid for the ones currently in use. Still, the values of the elements that form the already advanced fixed capital change along time for a further specific reason. To accumulate itself, capital needs to constantly increase the productivity of the labor it puts into action. A new technology able to sustain an increased productivity becomes economically viable when the commodities produced with it can reach the market at a price of production lower than the one prevailing up to then. When this happens, the capitals materialized in the instruments able to support the formerly normal (but now insufficient) productivity lose their capacity for valorizing themselves as aliquot parts of total social capital. It does not matter whether or not the new instruments themselves are cheaper than the existing ones. In fact, often not even such comparison can be established, given the physical differences that characterize the old and the new generation of instruments. It only matters that the price of the common commodity produced by them is now ruled by the new conditions of production, and these determine a fall in that price. Whichever their cost, the old instruments do not embody their own original carrying value any more. To go on acting as ordinary industrial capitals, they have to devalue themselves until reaching the point in which the newly imposed price of production (that corresponds to the technically superior instruments) becomes the price of production of their own product. That is, it has to devalue itself until reaching the point in which it can stand on a par with the capital embodied in the superior instrument as an aliquot part of total social capital. Obviously, this devaluation includes the absorption of the portions of circulating capital needed by the old technology in excess of what the use of the new instruments requires. And as soon as the required fall in value goes beyond that which the old instruments were carrying on, their end as materializations of normal industrial capital has arrived. In any case, although the old instruments have not suffered the least physical ware because they have been technically surpassed, their obsolescence impairs their capacity for acting as an embodiment of capital. They have suffered a moral wear.

Value is the autonomous general ruler of production and consumption in commodity-producing society. As such, it is determined by the productivity of the labor needed to reproduce the commodities at the time they reach the market, whichever the productivity of the labor that actually produced them. The general rate of profit is the specific developed form taken by value as the autonomous general ruler of production and consumption in capitalist society. As such, no historical costs enter its determination, but only present-day costs of reproduction do. Hence, any variation in the conditions of production or circulation occurred during a turnover circuit enters social capital accounting as changing the history itself of that circuit. In other words, from total social capital's point of view, changes in its value caused by variations in the conditions of production within its circuits produce by themselves no gains or losses that have to be accounted for. These changes are alien to the determinants of total social capital's capacity to valorize itself. The principles of national accounting reflect this determination, inasmuch as the criterion of "current prices" is applied[39]. It even remains effective when actual prices are abstracted and replaced in the representation by prices forced to remain fixed from year to year, though in a mediated form given the specific analytical object of this abstraction. In that case, the reproduction prices for the circuits developed in the year taken as the computational basis, are extended to all the circuits. Of course, the variations in the conditions of production and circulation can embody changes in the capacity itself of total social capital for valorizing itself and, therefore, in the general annual rate of profit. These changes are precisely the ones that concern total social capital, and are reflected by its accounting. Still, currently this accounting disregards altogether the erosion of value suffered by fixed capital due to its moral ware[40].

The general annual rate of profit takes shape in the concrete annual rates of profit of individual industrial capitals. The simple determination of value by the conditions in which the produced commodities can be reproduced, manifests itself here through a twofold mediation. In the first place, though the reproduction prices are immediately taken into account facing any fall in value, the need to preserve the capacity of individual capitals for facing their debts, introduces a specific criterion concerning the rises in the reproduction value. Individual capitals can only record these rises in occasion of selling their commodities at their corresponding higher values. This concrete form taken by the general annual rate of profit is reflected in accounting practice through the principle of "cost or market, whichever is the lowest" (complemented by the principle of "ongoing business," that excludes any liquidation criterion) as far as a simple fall in the instrument's prices is concerned. In turn, the accounting principle of

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[39] Notice that total social capital as such is not the objet of national accounting. National accounting registers each of the particular portions of total social capital cut by the national form through which the worldwide essence of capitalist accumulation takes concrete shape. Obviously, any particular portion of social capital can profit from, or lose to another portion. Therefore, the simple exclusion of a profit or loss caused by a valorization or devaluation of existing capital concerning total social capital, can reflect itself as a genuine profit or loss in national accounting as soon as this valorization crosses the national boundaries. Bearing in mind this specificity, we will assimilate a national portion of total social capital to this capital as such, for the sake of brevity.

[40] This disregard reflects how the accounting of total social capital suffers from its subordination to the categories of Neoclassical economic theory too. Yet, it pales as a manifestation of the consequences of substituting the appearances of the production factors and their sources of revenue for the circuit of industrial capital, compared to the universal practice of putting in the same bag the value- product and the returned fixed capital, without bothering to account for such a mix beyond labeling it a "gross product."

“impairment” reflects the devaluation of existing fixed capital caused by the increased productivity of labor its new specimens are able to support[41]. Nevertheless, the USA standard principle excludes the registration of the loss in value while some profit, albeit below the normal annual rate, remains to be realized. Only when the lower price of the commodity produced starts to erode the return of fixed capital, the revaluation comes forth. And only in that case, it must consider the normal rate of profit of the capital in question to write down it to a new carrying amount that reestablishes that rate [42].

In the second place, contrary to social capital, individual capitals do gain or lose from the change in their value. As a concrete private mass of value, they have entered their turnover with a given amount, and come out from it with a different one, let aside their normal valorization as aliquot parts of total social capital. Instead of rewriting their history, individual capitals need to reflect their changes in value in the profit line of their balance sheets. In turn, their advanced capital enters at its historical value as the denominator of their rate of profit.

Specific industrial capitals stand in the middle. In what their determinations immediately correspond to the specific expression of the general annual rate of profit, their normal concrete rate of profit excludes from itself the gains or losses due to changes in values we are considering here. That is, the concrete normal capacity of specific industrial capitals for valorizing themselves is determined at each time by the conditions in which their valorization can be reproduced, and not by their historical conditions. The single-year model reflects this determination given its very basis: all its data correspond to the indefinite reproduction of the conditions prevailing in a given time. If this moment is defined as the average of a sufficient number of years, the model will reflect immediately the concrete normal capacity for valorizing itself. Besides, the determination of this capacity by the conditions of reproduction expands the single-year model scope beyond directly measuring its simplest expression. When a single-year model is defined by the conditions prevailing at a certain year, the annual rate of profit it renders does not correspond to capital’s normal capacity to valorize itself. On the contrary, it corresponds to the concrete form this capacity takes in the given year. So a succession of single-year models, each corresponding to the conditions of a singular year, allow us to follow year by year the concrete path through which the normal capacity realizes itself. The rate of profit that expresses this normal capacity as such, can be computed then as the average of the concrete ones, weighted by the relative amount of each year’s advanced capital, On this basis, accumulation itself can be represented, though in an indirect and approximate way, without scarifying the operative easiness of the single-year model. In this representation, accumulation appears as a succession of independent simple reproductions of annual processes of valorization, each of them extending itself indefinitely in time. In any case, the use of the single-year model to represent the concrete conditions prevailing in each singular year is subjected to the material possibility of its indefinite reproduction. That is, it excludes any annual process of valorization whose conditions imply that the circuits that continue in the following year cannot be identical to those that come from the previous year.

Only the multiyear model represents the concrete path followed by the realization of the normal specific annual rate of profit, by taking it as such. In the first place, it has to reflect the determinations of the concrete annual rate of profit for each year as it is determined by the costs of reproducing the corresponding circuits. Still, at the same time,

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[41] Only last year, and pushed by the current acceleration of technical change, the criterion of “impairment” has been standardized in the USA: Financial Accounting Standards Board of the Financial Accounting Foundation, *Statements of Financial Accounting Standards No. 121, Accounting for the Impairment of Long-Lived Assets and for Long-Lived Assets to Be Disposed Of*, Connecticut, March 1995. The standard accounting principles of other countries still exclude the “impairment” criterion.

[42] This standard includes the use of the present net value at a given rate of interest among the reasonable procedures to adjust the value of the impaired fixed capital. We have already seen how such a procedure lacks the ability for unequivocally measuring the profitability of industrial capitals. Its inclusion in the present case shows once more how accounting practice suffers from its subordination to mainstream economic theory. Here too, only the direct measure of the concrete normal annual rate of profit, and therefore, the open acknowledgment of capital’s metamorphosis along its turnover circuits, can render a legitimate result.

the path followed by specific industrial capitals towards realizing their concrete normal capacity for valorizing themselves is paved with the gains and losses produced by the variations in their conditions of production and circulation. Therefore, this model has to be spliced into two types of model according to their specific object inside the representation of the concrete path through which the general rate of profit realizes itself determining the normal annual rate of profit of specific industrial capitals: the second type of multiyear model needs to reflect the historical evolution in the value of capital. Therefore, it follows a set of criteria that resembles those of business accounting concerning the valuation of advanced capital. To three specific analytical objects correspond three differently defined models.

The general annual rate of profit necessarily takes concrete shape through individual annual rates of profit that tend to it in a constantly fluctuating movement from year to year, and from individual capital to individual capital. The different basis on which individual and total social capitals incorporate the changes in values occurred during their corresponding circuits, introduces a further mediation. Insofar as the changes in value are determined to follow cyclical patterns, the general annual rate of profit will tend to realize itself through individual annual rates of profit that diverge with additional intensity from it. Yet, these added divergences will follow cyclical patterns themselves, thus tending to compensate themselves along time. That is not the case concerning changes in value that follow a tendency. An increase in values with a given tendency, will result in a general annual rate of profit that takes concrete shape through individual rates constantly higher than itself. The equivalent decrease in values will quantitatively place the general rate of profit above its concrete individual forms. Now, capitalism carries in itself the general necessity of constantly increasing labor’s productivity. Only provided this necessity realizes itself in the production of commodities in general in the same proportion as in the production of the commodity that is determined as the general representative of value (money under its simplest form), the amount of the general annual rate of profit will be immediately identifiable in the average of the individual rates of profit of normal capitals. The volatility of this convergence stresses the importance of a model that measures the profitability of specific industrial capitals providing, at the same time, a broad analytical scope.

b) Changes in the unitary capacity of the currency to represent value

As we have seen, no specific variation in the conditions of production or circulation can affect the value of industrial capitals while they remain in their turnover under the form of money (that is, under the form of the objectified general representation of value). Yet, they are certainly affected by a variation in the unitary capacity of each sign of value (the concrete form money takes in circulation as the currency) for representing value; i.e., inflation or deflation in the strict sense. Given its nature, this variation appears as a general movement in prices or terms of circulation. Money’s very capacity to act as the general equivalent in exchange has varied, while capital remained under that form. A certain amount of money that represented a certain amount of value, represents now a different one. Industrial capital has valorized or devalued itself not because it was undergoing its turnover inside the working process, not even because it was undergoing whatever moment of its turnover, but because it was in a latent form outside its turnover.

The gains or losses in question are immediately such from the point of view of any capital whose circuit is basically defined by the departure from and the return to the money form. Hence, they are such for the individual industrial capitals, and for industrial capitals defined by a specificity of any kind. As the extremes of the circuits of industrial capital develop their concrete form with the development of the functions of money into credit, those gains or losses occur insofar as industrial capital remains congealed as a net amount of credits and debts named in the currency. And they extend further, as money develops its function as an ideal measure of value. This happens through the fixation of prices with the contractual closing of the circuit prior of its actual closing, when the commodity involved is delivered and its price collected under any of money’s concrete forms.

It goes without saying that interest bearing capitals are exposed to that kind of gain or loss all along their circuit. Considered in themselves, they appear as excluding any departure from the money form, M ... M'. On the contrary, the circuit of total social capital is defined by the circuit of commodity-capital. That is:

$$C' - M' - C \left\langle \begin{matrix} L \\ Mp \end{matrix} \right. \ldots P \ldots C'$$

The signs of money unitary gain or lose capacity for representing value (that is, their face value starts to diverge form the value they actually represent) when they are thrown into circulation in defect or excess of the crystallized value needed for the realization of the commodities that reach that process. Regardless the form of capital considered, profits appear as the difference between the amount of capital that opens a circuit, and the amount capital reaches on closing its return to its original form. Money itself does not participate in the extremes of total social capital's circuits (as it is obviously reflected in national accounting, though it registers still nationally limited portions of total social capital and not it itself). Money only appears at those extremes as the necessary ideal (i.e., accounting) expression of this capital's value.

Whichever specific differentiation could arise inside total social capital, it does not valorize or devalue itself because the signs of money change their unitary capacity to represent value. From this capital's point of view, it all comes down to the unit of computation itself embodying a distortion that (necessarily inverted as a general change in the prices of the commodities that form the social capital) appears as a change in the value of total social capital from a given stage of its circuit to another. Hence, it all comes down to computing total social capital's profitability on an homogeneous basis. And this homogeneous basis is a currency whose unitary capacity to represent value remains unchanged, however much the value itself of all commodities, including the one that is determined as the materialized form of value itself, and therefore as money in person, changes.

The same purely computational adjustment must be performed concerning individual and specific industrial capitals, when the change in the unitary capacity of the currency to represent value takes place while those capitals are undergoing their turnover in any non-monetary material form. *Ceteris paribus*, to reestablish an homogeneous unit of accounting implies reestablishing its computation on the basis of the conditions that correspond to the current reproduction of its circuit. Of course, the actual effect on profitability involved here, appears with its determinations inverted. The monetary portion of capital is the source of the gains or losses, but it remains with its amount designated in the currency and, therefore, unchanged. The non-monetary portions are alien to that gains or losses, but they see their value adjusted to reflect the change in the capacity of currency to represent value. Hence, it appears as if the gains or losses arise from this nominal adjustment in value, while the monetary portion remains untouched. The single-year model reflects the effect in question in what it tends to determine the concrete normal profitability of specific industrial capitals. The multiyear model follows it from year to year.

5. Consolidated basic formula of the total advanced capital

The single-year model computes the total advanced capital by aggregating the elements:

$$K(\bar{x}) = Kf_{(\bar{x}),p} + Kf_{(\bar{x}),sp} + Kc_m + Kc_{pa} + Kc_{pr}$$

where the subscripts stand for:

p: purchased instruments
sp: self-produced instruments
m: money reserves
pa: production and circulation advancement
pr: permanent advances

The multiyear model computes the total advanced capital for the year *i* as:

$$K(i) = Kf_{(i),p} + Kf_{(i),sp} + Kc(i)_{,m} + Kc(i)_{,c-d} + Kc(i)_{,pa}$$

where the additional subscript stand for:

c-d: credits minus debts

and, obviously, all the elements are defined according to the specific criteria of this model.

6. Computational structure of the models of specific industrial capitals

Based on the defined criteria, the author has designed the computational structure for the single-year and the multiyear models. This structure has been developed into an application software, by María F. Calvín (a previous version of the software corresponding to the single-year model was developed by Eduardo Mayo Huergo).

The current version runs on DOS, with the following general characteristics:

a- Input data

The input data are the different concrete forms through which the circuit of industrial capital develops itself. Each of these inputs is collected on the basis of statistical or direct sources, or estimated by following some specific criterion. The computing structure operates with the extremes of the turnover movements of each element of fixed and circulating capital. Therefore, it records the disbursement of each portion of capital and its return, closing its circuit as valorized capital. This recording is done on a monthly basis, and according to the following general criteria:

1- Valuation:

Each transaction is placed in the month that corresponds to it according to a criterion analog to the accounting "principle of accrual." The model accepts the input of price and quantity for each movement, or computes it as a percentage of another element. An entry can correspond to a single month, or be automatically repeated for all. Prices are expressed in any money sign with an homogeneous capacity to represent value, and the model can automatically compute the effect of the exposition to inflation of the monetary components of advanced capital.

The models automatically compute the capital advanced in self-produced instruments of production, on the basis of the original inputs to produce these instruments. Therefore, the inputs needed for this production and not the commercial price of the finished instruments enter the models. Nevertheless, the models alternatively accept the entry of the latter values, with the current turnover implied by their reproduction accordingly reflected.

2- Financing

The financial conditions are defined for each transaction as the difference in months between each entry and each of its payments or collections. The financing of the elements of fixed capital enters the single-year model in the conditions defined above in the corresponding item.

3- Imputation

Each portion in which the advanced fixed and circulating capital are fragmented along their turnover is related with the movement of the valorized capital whit which it closes its circuit. This relationship can be specified through technical coefficients or on the basis of the return's amount.

b- Output

The models calculate the following annual data:

- Advanced capital (fixed, circulating, total)
- Valorized capital (sales)
- Used capital (cost) (fixed, circulating, total)
- Turnover rate of advanced capital (fixed, circulating, total)
- Profit
- Rate of profit

The models allow the processing of simulations by changing any of the entry data, and can save the resulting cases as a new basic ones.

7. Practical application

The single-year model has been used as the main analytical tool in the following concrete studies:

- Iñigo Carrera, Juan y Edmundo Szterenlitch, *Diagnóstico del financiamiento y cambio tecnológico en la explotación tambera*, Consejo Federal de Inversiones, Buenos Aires, 1976. (Preliminary version presented at the II Annual Meeting of the Asociación Argentina de Economía Agraria, Resistencia, Chaco, October, 1975).
- Iñigo Carrera, Juan y Juan C. Tardioli, *Estudio de las trabas específicas al desarrollo técnico que resultan de los procesos de gestión y crecimiento de los establecimientos tamberos de la cuenca de abasto de Buenos Aires*, Franklin Consult, Buenos Aires, 1980.
- Iñigo Carrera, Juan, *Estudio de la relación entre integración vertical e incorporación de técnicas avanzadas en la cuenca de abasto de Buenos Aires*, Franklin Consult, Buenos Aires, 1980.
- Bas, Carlos y Néstor Carllinni, *Rentabilidad de las explotaciones agrícola-ganaderas de la región pampeana*, Consejo Federal de Inversiones, Buenos Aires, 1987.
- Rey, Ricardo, *Comercialización de granos*, Consejo Federal de Inversiones, Buenos Aires, 1988.
- Bas, Carlos, *La actividad azucarera: evolución en la última década y sus perspectivas futuras. Provincia de Tucumán*, Consejo Federal de Inversiones, Buenos Aires, 1989.
- Iñigo Carrera, Juan y Sergio Levín, *Modalidades técnicas y condiciones de circulación del capital agrario en la región maicera. Análisis de la capacidad de acumulación y de generación de renta*, Secretaría de Agricultura, Ganadería y Pesca, Buenos Aires, 1989.
- Sangiácomo, Raúl, *Actividad pesquera: captura, industria y comercio*, Consejo Federal de Inversiones, Buenos Aires, 1989.

- Rey, Ricardo, Pedro Castillo y Mariano Amieba, *Estudio del sector algodonero en la zona norte de Santa Fe*, Consejo Federal de Inversiones, Buenos Aires, 1989.
- Bas, Carlos, Raúl Sangiácomo y Luis Zanino, *Rendimiento económico de los agentes agroindustriales. Producción de carne bovina y frigoríficos. Actividad frutícola en el Alto Valle. Actividad algodonera en Santa Fe*, Consejo Federal de Inversiones, Buenos Aires, 1990.
- Rey, Ricardo y Luis Zanino, *Análisis de la actividad arrocera de la provincia de Santa Fe*, Consejo Federal de Inversiones, Buenos Aires, 1990.
- Zanino, Luis y Néstor Carllinni, *La actividad láctea en la provincia de Santa Fe*, Consejo Federal de Inversiones, Buenos Aires, 1990.
- Sangiácomo, Raúl, *La industria frigorífica en la provincia de Santa Fe*, Consejo Federal de Inversiones, Buenos Aires, 1991.
- Bas, Carlos y Néstor Carllinni, *La actividad yerbatera en la provincia de Misiones*, Consejo Federal de Inversiones, Buenos Aires, 1991.
- Zanino, Luis, *La actividad tealera en la provincia de Misiones*, Consejo Federal de Inversiones, Buenos Aires, 1991.
- Iñigo Carrera, Juan, *Análisis de rentabilidad de plantaciones forestales tipo: Eucalipto en la zona de Concordia y en la zona de Necochea*, IICA/SAGyP, 1992.
- Sangiácomo, Raúl, Ricardo Rey, Jorge Dominguez y Néstor Carllinni, *Análisis de los agentes productivos tabacaleros de la provincia de Misiones*, Consejo Federal de Inversiones, Buenos Aires, 1992.
- Iñigo Carrera, Juan, Patricia Lambruschini y Néstor Carllinni, *Programa de barrera sanitaria para la mosca de los frutos en la región patagónica. Estudio del efecto económico sobre los agentes de la producción frutícola*, Instituto Argentino de Sanidad y Calidad Vegetal, Buenos Aires, 1993.
- Rey, Ricardo y Jorge Dominguez, *Plan de desarrollo rural, posibilidades económicas de implantación de pomelo para consumo fresco. Formosa*, Consejo Federal de Inversiones, Buenos Aires, 1993.
- Sangiácomo, Raúl, *Bases para un plan ganadero. Plan de desarrollo rural de la provincia de Formosa*, Consejo Federal de Inversiones, Buenos Aires, 1993.
- Zanino, Luis y Néstor Carllinni, *Situación y perspectivas de los tambos-fábrica en el Partido de San Vicente*, Consejo Federal de Inversiones, Buenos Aires, 1993.
- Iñigo Carrera, Juan, Patricia Lambruschini y Néstor Carllinni, *Programa de barrera sanitaria para la cancrosis de los cítricos en la región NOA. Estudio del efecto económico sobre los agentes de la producción frutícola*, Instituto Argentino de Sanidad y Calidad Vegetal, Buenos Aires, 1994.
- Iñigo Carrera, Juan, Patricia Lambruschini y Néstor Carllinni, *Programa de prevención y erradicación del picudo mexicano del algodonero en la región NEA. Evaluación del impacto económico sobre los agentes de la producción algodonera y de su capacidad para absorber el costo del programa*, Instituto Argentino de Sanidad y Calidad Vegetal, Buenos Aires, 1995/96 (Presented at the XXIV Annual Meeting of the Asociación Argentina de Economía Agraria, San Miguel de Tucumán, September 24-26, 1997).
- Iñigo Carrera, Juan, Patricia Lambruschini y Néstor Carllinni, *Programa de control de carpocapsa en la región patagónica. Evaluación del impacto económico sobre los agentes de la producción frutícola y de su capacidad para absorber el costo del programa*, Instituto Argentino de Sanidad y Calidad Vegetal, Buenos Aires, 1996.
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- Iñigo Carrera, Juan, Patricia Lambruschini y Néstor Carllinni, *Plan nacional de control y erradicación de la brucelosis bovina. Evaluación del impacto económico sobre los agentes de la producción ganadera y de su*

capacidad para absorber el costo del programa. Evaluación respecto de la ganadería para carne en base a los capitales de tamaño medio en la principal zona de cría, SENASA, Buenos Aires, 1998.