Aggregate profit: A comparison between Kalecki's theory and a Hayekian approach

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Abstract. Kalecki's theory of profits (1942, 1954) is contrasted with the theory deduced from a Hayekian model of the structure of production (Hayek 1935 [1931]). This study reviews the conceptual, theoretical, and methodological characteristics of the two theories, finding some unexpected similarities between them, but also (as expected) many points of deep disagreement.

Kalecki's theory of profit (1942, 1954) is still to this day a major reference in the Post-Keynesian School (Lavoie 2007). It is however very rarely mentioned by economists of the Austrian School, except for a few comments by Reisman (1996) and more recently by Machaj (2017). This paper offers an in-depth comparison between, on the one hand Kalecki's theory, and on the other the theory that can be deduced from Hayek's (1935 [1931]) model of the structure of production. Hayek's graphical model remains to this day the main macroeconomic construct of the Austrian School (Rothbard 1962, Garrison 1978, 2001, Skousen 1990, Fillieule 2007, Hülsmann 2010, Machaj 2017, Granot 2019). This representation of the economic system as a triangle was developed by Hayek in order to analyze the process of capital accumulation and the business cycle. Since his original model does not take profits into account, a more elaborated version of the Hayekian "triangle" will be used here, which displays capitalists' profits at each stage of production. With the help of this improved illustration of the structure of production, a full comparison can be carried out between the frameworks of our two authors. This study shows, perhaps surprisingly, that there is a *fundamental similarity* between Kalecki's theory of profit and the conception of profit drawn from the Hayekian structure of production, but also, less surprisingly, that there are significant conceptual, theoretical, and methodological differences between them.

In the present paper, only the most basic version of the theory of profit will be discussed. Taxes and international trade will be entirely left aside in order to focus on the phenomenon of profit in its simplest and purest form. In this "simplified model," as Kalecki calls it, the system considered is "a closed economy in which both government expenditure and taxation are negligible" (1954, p. 45). Section 1 presents Kalecki's theory. Section 2 develops the improved version of the Hayekian "triangle" that integrates profits. Section 3 shows that the core concepts of "capital goods," "investment," and "profit," have different meanings in the respective frameworks of Kalecki and of the Hayekian structure. Section 4 addresses the conceptions of nominal aggregate profit and Section 5 the determination of real aggregate profit. Finally, Section 6 contrasts the methodological foundations of the two theories. Even though the author of this paper is a member of the Austrian School, the aim here is not to push for one side against the other, but rather to highlight the similarities and differences between the two frameworks on a key topic.

1. Kalecki's theory of profit

Kalecki's theory rests upon the categories of national accounting and is straightforward. In his "simplified model," there are two economic classes participating in production, capitalists and workers. The "gross national product," when considered from the viewpoint of income, is equal to "gross profits" plus "wages and salaries." When considered from the viewpoint of expenditure, the same "gross national product" is the sum of "gross investment," "capitalists' consumption," and "workers' consumption."

Gross national product (income) = gross profits + wages and salaries

Gross national product (expenditure) = gross investment + capitalists' consumption + workers' consumption

If workers do not save, i.e. if wages and salaries are entirely spent on workers' consumption, it follows that:

Gross profits = gross investment + capitalists' consumption

Kalecki defines *gross profits* as the sum of "depreciation and undistributed profits, dividends and withdrawals from unincorporated business, rent and interest" (1954, p. 45). In his 1942 paper, he also added "managerial salaries." These salaries, however, clearly belong to the category of wages and this may be the reason why he later removed this item from the list. He succinctly defines *gross investment* as investment "in fixed capital and inventories" (1954, p. 45) and more precisely in his earlier paper as "the value of all sales of newly produced fixed capital equipment + increase in working capital and stock" (1942, p. 258).

After finding in the last equation above that *profits are equal to the consumption and investment of capitalists*, Kalecki asks the question of whether (i) profits determine capitalists' consumption and investment or (ii) capitalists' consumption and investment determine profits. Since capitalists can choose their consumption and investment, but not their profit, he concludes that *it is the consumption and investment decisions of capitalists that determine profits and not the other way round*. As the Post-Keynesian saying goes, capitalists earn what they spend and workers spend what they earn.

2. The Hayekian linear structure of production

Even at this elementary level of analysis, there are already some similarities but also deep differences between the Austrian and the Post-Keynesian approaches. To bring them to light, we first need to develop a simple model of the core concept of the Austrian theory of capital, namely the concept of the *structure of production* first conceptualized by Menger (1976 [1971]) and Böhm-Bawerk (1959 [1889]).

Figure 1 displays an improved version of Hayek's (1935 [1931]) graphical illustration of the structure. This model offers a very simplified representation of the economic system that captures a fundamental insight: the overall production process takes time and proceeds through successive stages towards its end goal, which is to provide the economic actors with a stream of consumption goods. Time runs vertically and from top to bottom. There are in this example five

stages of production (numbered in the reverse temporal order) and each stage lasts for one year. The overall production process, therefore, takes five years. The horizontal axis measures monetary spending. The economic system is here in a *stationary equilibrium* in which the aggregate nominal values and aggregate outputs of the various stages remain the same period after period, and the rate of profit is constant and uniform across the stages. The successive stages downward are larger and larger due to the value added at each stage. On the right side, the value is added by the original factors (OF) labor and land in wages and rents (white squares). On the left side, the value is added in profits (white triangles). Each stage is therefore larger than the previous one and the structure has a *triangular shape*. Since by definition the original factors are not produced, there is nothing above the white squares. The capital goods (KG) are represented by grey rectangles and since by definition they are produced, the structure extends above them towards the higher stage that produces them.

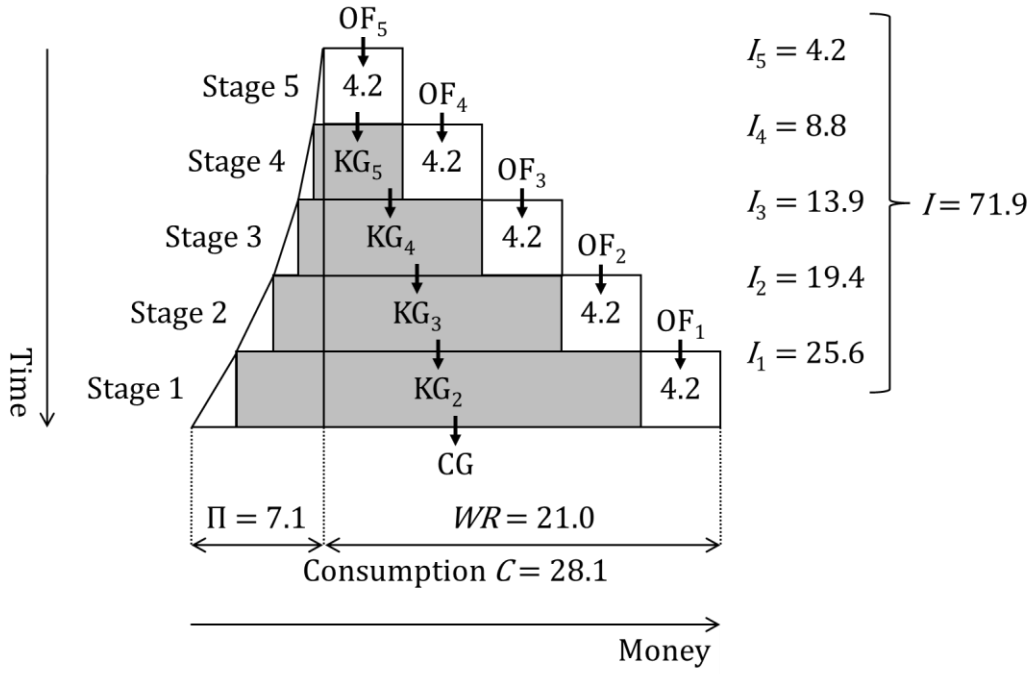

Figure 1. A 5-stage linear structure characterized by an aggregate expenditure $E = (C + I) = 100$ and a rate of profit $\pi = 10\%$. Π is the aggregate profit and *WR* is the aggregate wages and rents

The nominal value of original factors used at each stage is the same (OF: 4.2), which characterizes the structure as *linear*.[1] It can be demonstrated that a stationary linear structure is entirely determined by the number of stages N, the aggregate expenditure $E = (C + I)$, and the rate of profit π (see Appendix 1). In Figure 1, with $N = 5$, $E = 100$, and $\pi = 10\%$, the calculation finds that consumption C is 28.1 and investment I is 71.9. The distribution of consumption between capitalists and original-factor owners is easy to visualize. Aggregate profit Π is the sum of the profits earned at each stage and appears on the left: $\Pi = 7.1$. Aggregate wages and rents WR are similarly the sum of the payments to original-factor owners across stages and appear on the right: $WR = 21.0$.

Table 1. Investment and incomes of the capitalists in the 5-stage linear structure (some values are rounded to match those in Figure 1)

Stages	Investment in capital goods	Investment in orig. factors	Aggregate investment	Gross income of capitalists	Profits of capitalists
5	0.0	4.2	4.2	4.6	0.42
4	4.6	4.2	8.8	9.7	0.88
3	9.7	4.2	13.9	15.2	1.39
2	15.2	4.2	19.4	21.4	1.94
1	21.4	4.2	25.6	28.1	2.56
Total	**50.9**	**21.0**	**71.9**	**79.0**	**7.1**

Viewed *diachronically*, the process begins with stage 5 where the capitalists invest 4.2 monetary units at the beginning of year to rent or buy original factors (OF_5). At the end of stage 5, i.e. one year later, the capital goods (KG_5) are produced and sold to the capitalists of stage 4. The capitalists of stage 5 earn 10% on their 4.2 investment: their net income (profit) is 0.42 and gross income is $4.20 + 0.42 = 4.62 \approx 4.6$. The capitalists of stage 4 invest 4.6 to buy the capital goods (KG_5) produced by the previous stage, combine them with 4.2 invested in original factors (OF_4), and sell the product (KG_4) one year later with a 10% profit rate: their $(4.2 + 4.6) = 8.8$

[1] For representations of proportional and exponential structures, see Fillieule (2007) and Granot (2019).

investment brings a 0.88 profit and their gross income is (8.8 + 0.88) = 9.68 ≈ 9.7. At each successive stage, the capitalists thus buy the capital goods of the previous stage, combine them with original factors, produce capital goods, and sell them with a profit to the capitalists of the next stage. Finally, at the very first stage, capitalists do not produce capital goods but instead consumption goods that they sell with a 10% profit rate to final consumers. Table 1 shows the values of investment and incomes for all the stages.

Viewed *synchronically*, i.e. during a given year, Figure 1 displays the five processes that run simultaneously in order to produce a constant stream of consumption goods: stage five shows the new process that is currently launched and will provide the consumption goods in five years, stage four the process that has begun in the previous period and will provide the consumption in four years, etc., and stage one displays the completion of the process that began five years earlier and finally delivers the consumption goods. This synchronic view of the Hayekian model of the structure of production is the one that will be contrasted with the national accounting approach of Kalecki.

3. Conceptual clarifications

The comparison between Kalecki's and Hayek's frameworks can now be carried out, but before even addressing the theory, we need to explore and clarify the significant differences in their respective conceptions of the fundamental categories of capital goods, investment, and profit.

3.1 Capital goods

In Hayek's model of the structure of production, capital goods are represented by the grey rectangles (and original factors labor and land by the white squares). Capital goods are classically conceived here as produced factors of production.[2] Furthermore, they consist of

[2] In his later work, Hayek (1941) blurred the distinction between capital goods (understood as produced factors of production) and material original factors of production (natural resources) by defining capital goods as "the aggregate of those non-permanent resources which can be used only in this indirect manner to contribute to the permanent maintenance of the income at a particular level" (1941, p. 54). This cryptic definition is a bit unfortunate because it seems to erase a very important distinction between the produced and non-produced factors. The latter are stopping points of the structure, while the structure extends above the former.

circulating capital only (intermediate goods). The capital goods bought by the capitalists at the beginning of a given stage are combined with labor (and land) and are entirely used up in the process that produces the capital goods that will be sold to the capitalists of the next stage. The Hayekian structure of production is a "goods-in-process" structure in the sense that capital goods never outlive the stage at which they are used. Kalecki, on the other hand, only mentions one type of capital goods, namely *fixed capital*. There are 82 references to "fixed capital" in his book, and none to "circulating capital" or "intermediate goods." The two frameworks, therefore, focus on entirely different types of capital goods.

3.2 Investment

An much more significant difference between the two theories lies in the way they conceive investment. Kalecki's theory uses the concept of investment only in the context of what he calls *gross investment*. Since government spending is neglected in this paper, this "gross investment" is private investment and it essentially covers (i) the repair or replacement of used (wear and tear), damaged (accidents), or aging fixed capital and (ii) the new additions to fixed capital. In other words, nominal "gross investment" comprises the payments made in order to maintain and increase the stock of fixed capital (through repairment, identical replacement, and additions).

Kalecki: *gross investment* = depreciation (repairment and replacement) of fixed capital
+ net investment in fixed capital

In the Hayekian framework, investment is an entirely different magnitude. The reason is simple. Since there is no fixed capital in Hayek's structure and only circulating capital, the "gross investment" in Kalecki's sense equals *zero*. The Hayekian investment is nonetheless a much larger amount and we call it the *aggregate investment* in order to avoid any confusion with Kalecki's "gross investment."

Figure 1 shows that in the Hayekian structure, nominal investment is carried out at the beginning of each stage and all along the stage. In this example, the aggregate investment I (= 71.9) is the sum of investment at stage 1 (I_1 = 25.6) plus investment at stage 2 (I_2 = 19.4) plus investment at stage 3 (I_3 = 13.9) plus investment at stage 4 (I_4 = 8.8) plus investment at stage 5

(I_5 = 4.2). This Hayekian investment covers, not only the price of capital goods bought by capitalists but also the price of the original factors labor and land rented by the capitalists to the original-factor owners. Capitalists need to buy both capital goods *and* original factors when they invest in order to carry out the production processes. Since circulating capital is entirely destroyed and replaced each year, the formula is:

Hayekian structure: *aggregate investment* = replacement of 100% of circulating capital + purchase of original factors labor and land + net investment in circulating capital

Since it takes into account *all* the factors and the *entirety* of the annual stream of circulating capital, "aggregate investment" is by far the largest form of spending in the structure of production. In the example of Figure 1, aggregate investment amounts to almost three-quarters of the economic system (71.9 out of a total expenditure of 100). Aggregate investment (= 71.9) is roughly 2.5 times consumption (= 28.1). The "gross investment" of Kalecki, on the other hand, is much smaller (roughly one-fourth) than consumption.[3] From a Hayekian viewpoint, the term "gross" in the Kaleckian "gross investment" is improper because it leaves out the major components of investment in circulating capital and in original factors.

3.3 Profits

Hayek's model is purely theoretical and offers a stylized view of an economic system in stationary equilibrium. The categories of gross and net incomes in such a model are crystal clear. There are three types of economic agents and three corresponding categories of *net* incomes, workers and wages, land owners and rents, capitalists and profits. Capitalists get their gross income by selling capital goods and consumption goods. Their profit is calculated by subtracting from their gross income their productive expenses, i.e. their investment in capital goods and original factors. In the structure depicted in Figure 1 and Table 1, the gross income of capitalists is 79.0 (prices of capital goods + consumption goods), their investment is 71.9 (prices of capital

[3] Kalecki uses data collected by Kuznets for the national product of United States between 1869 and 1913. In his Table 15 (Kalecki 1954, p. 69), "gross investment" roughly amounts to 20% of the "gross national income." The latter is final consumption plus gross investment, which implies that nominal "gross investment' is approximately 25% of the value of final consumption.

goods + original factors), and since one year elapses between investment and sales, their profit or net income of (79.0 – 71.9) = 7.1 represents a 10% annual profit rate. In stationary equilibrium, this rate is the same across all stages.

Kalecki, as we have seen, uses the concept of "gross profit" defined as the sum of "depreciation and undistributed profits, dividends and withdrawals from unincorporated business, rent and interest" (1954, p. 45). This definition is very wide, as it includes his "gross investment" ("depreciation and undistributed profits") and only seems to subtract wages and the payments of intermediate goods from the gross income of capitalists. However, a theory of profit cannot rest upon such an encompassing definition of profit, simply because profit is the income of capitalists *net* of all of their payments. "Gross investment" represents expenses incurred by capitalists and should not be counted as part of their profit, properly conceived. Depreciation is clearly a cost of production intended to maintain the productive capacities of the economic system. In Hayek's framework, depreciation (specifically understood here as the annual replacement of the entirety of circulating capital) is indeed the main cost of production and is not at all counted as a component of profit.

As far as rent is concerned, it is properly categorized in Hayek's structure as an income of original-factor owners (white squares), and not as part of the profit. What Kalecki calls "rent" and includes in his "gross profits" is a composite income that is for one part the pure rent, so to speak, paid for the use of land (standing room) and for the other a profit on the capital invested to build and maintain the residential and nonresidential structures. Those two kinds of incomes can be separated in a theoretical model but they are intermingled in a reasoning based upon the categories of national accounting such as Kalecki's.

From the Hayekian viewpoint, the concept of "gross profit" is too large for a theory of profit, as it includes productive expenditures paid by capitalists such as depreciation, net investment, and (pure) rent. Kalecki's concept encompasses three different types of monetary flows–(net) profit, investment in fixed capital goods, and (pure) rent–that should be strictly separated in theoretical reasoning. It is a bit surprising that Kalecki (1942, 1954) never defines or even uses the concept of "net profits," i.e. profits as net incomes.

In order once again to avoid any misunderstanding, "gross profit" will be used to refer to Kalecki's concept, and "net profit" to refer to the Hayekian (and usual) concept of profit.

Kalecki: *gross profit* = maintenance investment (repairment and replacement) + rent + *net profit*

Hayek: *net profit* = (sales of consumption goods + sales of capital goods)
– (buying of capital goods + wages + pure rents)

Hayek: *net profit* = sales of consumption goods – (wages + pure rents)

4. National accounting and nominal aggregate profit

Let us now deal with our main topic, the theory of profit. As far as nominal aggregate profit is concerned, the conceptions found in the Kaleckian and the Hayekian frameworks are to a large extent similar. The two main components of aggregate profit, namely capitalists' consumption and net investment, are going to be reviewed in turn.

4.1 Stationary economy: aggregate net profit as capitalists' consumption

According to Kalecki's theory, the first component of profits is the consumption of capitalists, and their decision of consumption determines these profits.

Kalecki: gross profits = gross investment + capitalists' consumption

In the stationary Hayekian structure of production, as clearly appears in Figure 1, *net profits are indeed the consumption of capitalists*. The structure of Figure 1 can be formulated with national accounting equations like those used by Kalecki.

Hayek: gross consumption output (income) = net profits + wages + rents

Hayek: gross consumption output (expenditure) = capitalists' consumption
+ original-factor owners' consumption

It is assumed in the Hayekian stationary structure, just as in Kalecki's basic theory of profit, that workers (and land owners) consume the whole of their incomes. It then follows from the equations above that:

Net Profits = capitalists' consumption

A similar conclusion is therefore reached in both frameworks. The Hayekian model formalizes a stationary equilibrium in which there is a strict equality between aggregate *net* profit and the consumption of capitalists. Furthermore, Kalecki is right to say that *it is capitalists' consumption that determines profits* and not the other way around. It is true that capitalists decide their level of spending on consumption, and therefore the level of aggregate nominal profit, so Kalecki's causality is undeniable.

4.2 Growing economy: net investment as a component of aggregate net profit

The second component of Kalecki's gross profit is the "gross investment" spent to repair, replace, and increase fixed capital (and changes in inventories). In Hayek's model, there is no fixed capital (and no remaining inventories at the end of the year: everything is sold within a year) and therefore no such investment, but there can nonetheless be a net investment if capitalists decide to curtail their consumption, build a net saving, and invest it in a more capitalistic stream of intermediate goods. Now, this net investment is indeed a part of the aggregate profit during the period in which it takes place. This result is demonstrated in the following way and does not depend on the distinction between fixed and circulating capital (see Reisman 1996 for the original analysis).

If a net investment takes place during a given period, it means that the initial structure (C, I, Π) shifts to a new structure characterized by a larger nominal investment $I' > I$ and a correspondingly smaller consumption $C' < C$. Net investment is $(I' - I)$.

For the initial structure, the aggregate annual net profit Π is calculated by subtracting from the total earning of capitalists their total expenditure on factors of production. Since they sell all the consumption goods and the capital goods, their total earning is equal to the annual nominal consumption C plus the total price of capital goods KG: total earning = $(C + KG)$. They buy all

the factors of production, capital goods, labor, and land, so their total annual expenditure is the sum of the price of all the capital goods *KG* plus all the wages and rents *WR*: total expenditure = (*KG* + *WR*). The aggregate net profit Π of a stationary economic system is therefore:

$$\Pi = (C + KG) - (KG + WR) = C - WR$$

Net profit Π is what remains out of total consumption when the consumption of workers and landowners is subtracted, and what is left is of course the consumption of capitalists. This formula is simply another way of saying that aggregate net profit is capitalists' consumption.

After the net investment, a new and more capital-intensive structure appears (*C′*, *I′*, Π′), and its aggregate profit Π′ is calculated with the new values:

$$\Pi' = (C' + KG') - (KG' + WR') = C' - WR'$$

The problem, however, is to calculate the aggregate profit *during the transition period (i.e. year)* from the initial to the final structure. In the span of this one-year transition, the nominal values shift from those of the old structure (*C*, *I*, *WR*, *KG*) to those of the new one (*C′*, *I′*, *WR′*, *KG′*). *The aggregate net profit during the transitional year is therefore calculated with the incomes of the final structure and the costs of the initial one*. The net profit of the transition period is noted Π_T. It is equal to the total income of capitalists in the new structure (*C′* + *KG′*) less their costs of production in the old one (*KG* + *WR*):

$$\Pi_T = (C' + KG') - (KG + WR)$$

Aggregate investment *I* in the initial structure is the expenditure on all capital goods, all labor, and all land: *I* = (*KG* + *WR*). In the new structure, aggregate investment is *I′* = (*KG′* + *WR′*). Net investment is:

$$(I' - I) = (KG' + WR') - (KG + WR)$$

The transitional profit can be written as:

$$\Pi_T = C' + (KG' - KG - WR)$$

Net investment can in turn be written as:

$$(I' - I) = WR' + (KG' - KG - WR)$$

It follows that:

$$(KG' - KG - WR) = (I' - I) - WR'$$

Replacing this term in the transitional profit leads to:

$$\Pi_T = (C' - WR') + (I' - I) = \Pi' + (I' - I)$$

The nominal aggregate net profit during the change in structure is the consumption of capitalists $\Pi' = (C' - WR')$ in the *new* structure *plus the net investment* $(I' - I)$ applied to get from the old to the new structure. Once the transition is completed, assuming that no further net investment takes place and a new stationary equilibrium sets in, in the following periods the aggregate net profit Π' will once again simply be the consumption of capitalists in the final structure: $\Pi' = (C' - WR')$.

The conclusion is straightforward and on the side of the Austrian School it was first noticed by Reisman (1996). *The conceptions of profit found in Kalecki and in the Hayekian structure of production are similar: aggregate profit is capitalists' consumption plus investment, and capitalists as a whole determine it through their decision to either consume more or invest more*. This difference is that this principle is expressed in terms of gross values in Kalecki's national accounting approach and in net values in the Hayekian structure of production.

5. The determination of real aggregate profit

While the conception of nominal profit is similar in the Kaleckian and Hayekian frameworks, their respective analyses of the determination of real aggregate profit are totally different. The comparison will be carried out after a presentation of the two approaches

5.1 Kalecki on real gross profits

In his chapter on "The Determinants of Profits," Kalecki (1954) only briefly alludes to "real gross profits" and states that "in a given short period [they] are *determined* by decisions of capitalists with respect to their consumption and investment shaped in the past, subject to correction for unexpected changes in the volume of stocks" (1954, p. 46, our emphasis). He addresses the topic of determination in the following chapter titled "Profits and Investment." His starting point is this equation (1954, p. 53):

$$C_t = qP_{t-\lambda} + A$$

C_t is "'real' capitalists' consumption" in a given year t,[4] A is a "stable part" of capitalists' consumption ("constant in the short run although subject to long-run changes"), λ is "the delay of the reaction of capitalists' consumption to the change in their current income," and q is the "part of the increment in income" that capitalists consume ("q is probably considerably less than 1"). The basic idea is that consumption comprises a fixed amount A (maybe a level of consumption to which capitalists are accustomed?) and a variable part related to profits made in the past (because it takes time to adapt one's pattern of consumption to a change in income).

Kalecki then combines his initial equation with the equation giving the aggregate profit of year t as the sum of capitalists' consumption and gross investment, $P_t = (I_t + C_t)$, and he gets:

$$P_t = I_t + qP_{t-\lambda} + A$$

[4] Kalecki (1954) generally puts the term "real" between quotation marks, for instance in "real" demand, "real" wage, "real" consumption, and "real" profits. We have to admit that we do not know why he does this. Also, he never uses the terms "nominal" and "monetary" in his book.

He infers that "'real' profits at time t are determined by current investment and profits at the time $t - \lambda$" (1954, p. 53). $P_{t-\lambda}$ can in turn be replaced by ($I_{t-\lambda} + qP_{t-2\lambda} + A$), then $P_{t-2\lambda}$ by ($I_{t-2\lambda} + qP_{t-3\lambda} + A$), and so on and so forth. Real aggregate profit of year t can therefore be written:

$$P_t = (I_t + qI_{t-\lambda} + q^2 I_{t-2\lambda} + q^3 I_{t-3\lambda} + \ldots) + (A + qA + q^2 A + q^3 A + \ldots)$$

Kalecki infers that "profits follow investment with a time lag," so that they are approximately a function of $I_{t-\omega}$, ω being "the time lag involved." If investment is approximated by $I_{t-\omega}$ at each period, then the equation above becomes:

$$P_t = I_{t-\omega}(1 + q + q^2 + q^3 + \ldots) + A(1 + q + q^2 + q^3 + \ldots)$$

Since q is quite small ("considerably less than 1"), then the sum $(1 + q + q^2 + q^3 + \ldots)$ is approximately equal to $[1/(1 - q)]$ that is the mathematical limit of this infinite sum, and the final formula[5] is:

$$P_t = (I_{t-\omega} + A)/(1 - q)$$

Kalecki concludes that "Profits according to [the above] equation are determined fully by investment with a certain time lag being involved. Moreover, investment depends on investment decisions still farther back in time. It follows that profits are determined by past investment decisions" (1954, p. 54-55). He then points out that, contrary to the idea that capitalists save because they make profits, the causality goes the other way around and in fact, they get profits because they save (and invest). In his own words, "capitalists' savings 'lead' profits."

Finally, Kalecki applies this equation to the data of the U.S. economy between 1929 and 1940 (gross profits after taxes, gross private investment). By correlating ΔP and ΔI, he finds that the best fit with the data is for ω = 3 months = ¼ year. He then calculates the regression equation

[5] Kalecki derives this equation in a different and a bit more convoluted way, but what matters here is just the result.

between P_t and $I_{t-1/4}$. He finds that $P_t = (1.34I_{t-1/4} + 13.4 - 0.13t)$, from which he deduces that $q = 0.25$.[6]

5.2 Real aggregate profit in the Hayekian framework

In the Hayekian approach, the first problem is to study the determination of the real aggregate profit in a stationary equilibrium, and the second to explain why capital is accumulated and the effect of this accumulation on the real profits of capitalists. To this aim, the Hayekian structure must be complemented with a production function. Even though Hayek himself did not follow this path (he was addressing another topic), his model easily lends itself to this development. Here is a very simple example of a theoretical production function for the *annual real output of consumption goods*:

$$Q_C = 100\sqrt{\theta}$$

Q_C is the amount of consumption goods produced in a year. The arbitrary number "100" encompasses the (constant) amounts of labor and land, and the given level of technology. θ is the *average length of the structure*, i.e. the average time it takes for the economic system as a whole to deliver the consumption goods (Böhm-Bawerk 1959 [1889]). In the Austrian paradigm, θ represents the capital accumulated: capital accumulation proceeds through a lengthening of the structure, i.e. through an extension of the overall period of production of the economic system. The square root of θ means that (i) the final output increases with the average length (with the accumulation of capital) and (ii) the returns are diminishing. Since technology does not improve and labor and land are fixed factors, the output Q increases in smaller and smaller increments as the structure lengthens.

For a linear structure with N stages, the average length θ is equal to $(N + 1)/2$ (see Appendix 2). In the example of the structure of Figure 1, since $N = 5$ the average length θ is $(5 + 1)/2 = 3$ years and the final output is: $Q_C = 100\sqrt{3} = 173.2$. The real aggregate profit is the capitalists' part

[6] As appears in the regression equation, the "stable part" A changes quite a lot during the 1929-1940 period. This is not at all surprising during a long recession that hits capitalists' incomes. As we have seen, Kalecki recognizes that the parameter A is "subject to long-run changes." Over such a long period of time, it is indeed time-dependent and should be written A_t. The parameter q is also considered as a constant through time and this is questionable.

of this amount. Since capitalists consume Π out of the total consumption C, their share α in the final output is (Π/C) and the real profit is $(\Pi/C)Q_C$. In this example, with $\alpha = (\Pi/C) = (7.1/28.1) = 25.3\%$ and $Q_C = 173.2$, the real aggregate profit is $(0.253 \times 173.2) = 43.8$.

The determinants of this real profit are: (i) the amounts of original factors of production, (ii) the level of technology, (iii) the quantity of capital accumulated, (iv) the production function relating the previous elements to the final output, and (v) the share of capitalists in the final output. With larger amounts of–or higher quality–original factors, an improved technology, a greater quantity of accumulated capital, or a bigger share for capitalists, the real aggregate profit will increase.

Since original factors and technology are here considered as given, the problem is then to explain (i) why economic agents accumulate capital, and (ii) what is the effect of this accumulation upon the share of capitalists in the final output. In Hayek's (1941) theory of the interest rate, inspired by Fisher (1930), capital is accumulated through an intertemporal choice by the economic agents: more capital implies more output (productivity of capital) but on the other hand requires to sacrifice present goods and to wait for the result (which has a disutility due to the preference for the present).

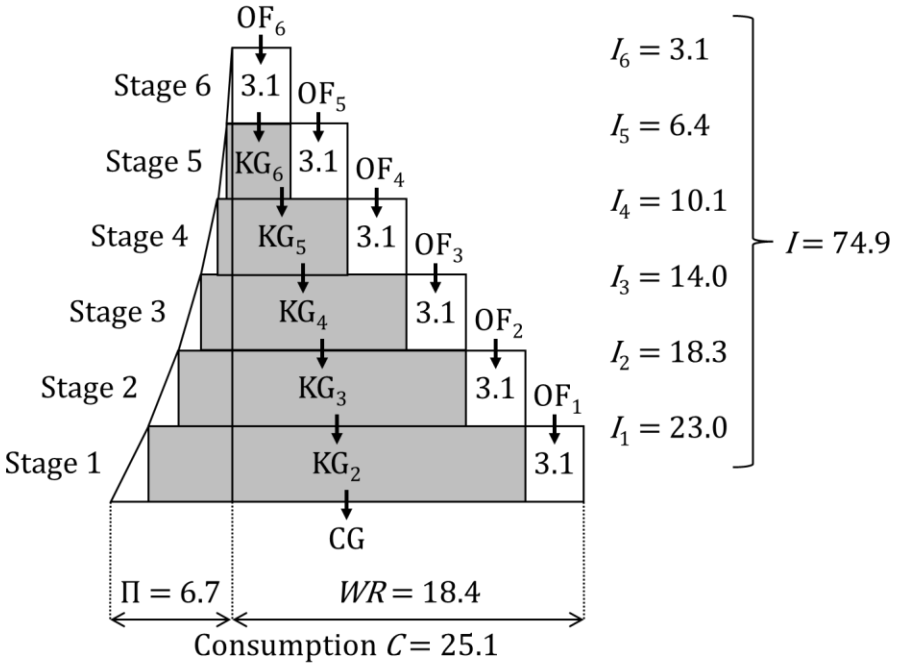

Figure 2. The 6-stage linear structure after a net investment $\Delta I = 3$

The starting point is the linear structure of Figure 1. Suppose the economic agents decide to invest more because the productivity of capital is high enough when compared to their rate of time preference. For instance, they choose to increase the nominal investment from $I = 71.9$ to $I' = 74.9$, for a net investment $\Delta I = (I' - I) = 3$. In typical Austrian fashion, this increased investment *lengthens the structure*, here from 5 to 6 stages. If the structure *remains linear* (a very simplifying and convenient assumption) and if the aggregate expenditure $E = (C + I)$ remains equal to 100 (there are no changes in the demand for and supply of money), then calculation shows that there is *only one* possible resulting 6-stage structure (see Figure 2). The characteristics of the initial 5-stage structure and final 6-stage structure are displayed side by side in Table 2. The profit rate falls from 10% to 8.95%, the share of capitalists rises from 25.3% to 26.7%, the real profits from 43.8 to 50.0 (+ 14%), and the real wages and rents from 129.4 to 137.1 (+ 6%). The original-factor owners now spend less on consumption, which implies that some of them have invested a part of their income and that as capitalists they also get a part of the profits.

Table 2. From the 5-stage to the 6-stage linear structure

Characteristics	**5 stages**	**6 stages**
Consumption C	28.1	25.1 [– 3]
Aggregate investment I	71.9	74.9 [+ 3]
Profit rate π	10%	8.95%
Nominal Π	7.1	6.7
Nominal WR	21.0	18.4
Capitalists' share α	25.3%	26.7%
Average length θ	3	3.5
Final output Q_C	173.2	187.1
Real Π	43.8	50.0
Real WR	129.4	137.1

5.3 Comparison

The main theoretical differences between the two frameworks can now be highlighted.

(1) A first and very apparent difference is the way capitalists' consumption is formalized. Kalecki's theory anchors this consumption *in the past*, with one component related to past gross profits $P_{t-\lambda}$ and the other to some kind of usual consumption *A*. He does not take anticipations of future profits into account and does not directly relate capitalists' consumption to their capital. However, since a higher real profit tends to go with a larger capital, his consumption equation indirectly links capitalists' real consumption to their capital. Hayek's (1941, Chap. 17 and 18) theory of consumption and investment is *future-oriented*. Capitalists get their real net income on January 1st and decide this instant for the whole coming year how much they will consume and how much more they will save and invest (net saving and investment). This decision takes into account the whole stream of future real incomes and is the result of the maximization of subjective utility carried out by comparing the marginal productivity of capital and the marginal time preference (*à la* Fisher).

This difference can be summarized by saying that Kalecki describes a typical behavior while the Hayekian approach analyzes an action in a very simplified setting. An action is always forward-looking and characterized by a trade-off (in this case and in real terms: more now less later or less now more later). Kalecki does take the income as a constraint on the behavior but does not explicitly evoke any arbitrage between consumption and investment.

(2) The second major difference has to do with the type of profit, net or gross, explained. Kalecki concludes that profits are "determined fully by investment with a certain time lag." His gross profits are gross investment *plus capitalists' consumption*. In his conclusion, however, he mentions investment only. He therefore ends up neglecting capitalists' consumption and by implication also neglecting a large part of the major phenomenon of net profits. Even though his starting point is capitalists' consumption C_t, at the end of his reasoning this consumption is largely disregarded and only investment is emphasized as far as gross profits are concerned.

By contrast, the Hayekian model remains centered on the relevant phenomenon of net profits. The share of the final output obtained by capitalists receives an explanation that is an integral part of the model. The "Hayekian" explanation offered above is not exempt from criticism, especially because it rests upon the very convenient assumption of the linearity of the structure.

Under this assumption, there is a strict mathematical determination between, on the one hand the net investment ($\Delta I = 3$) and the lengthening (from 5 to 6 stages), and on the other the capitalists' real profits (50.0). This theory of the rate of profit is quite convenient indeed, but may rightly be considered too simplistic. We should emphasize once more that it is not a model expounded by Hayek himself, but one that we have specifically developed for this paper in order to compare the two approaches under study.

(3) The Hayekian explanation includes the amounts of original factors and the technological level among the determinants of real profits, while Kalecki never mentions them. They can be considered implicitly present in the data of national accounting that he uses since these data are expressed in real terms (constant dollars). It is nevertheless important to take these determinants explicitly into account, so as to investigate the effects of changes in the amounts of original factors or in technology on real profits. For instance, what is the impact of technical progress on real profits? Does this change affect the share of capitalists in the final output or only their real income? These questions immediately arise in the Hayekian framework, but they stay in the background in Kalecki's.

(4) Kalecki states that capitalists get profits because they save and invest, not the other way round ("capitalists' savings 'lead' profits"). Since, in his framework, (gross) profits are determined by (gross) investment, this is a straightforward conclusion. In the Hayekian framework, saving and investment certainly are requisites (necessary conditions) for the existence of profits: in an economy without invested saving, there could not be any profits. However, saving (and the ensuing investment) cannot explain profits because the point is to explain *net* profits, and net profits are what remains when investment has been subtracted from capitalists' gross income. Net profits, here, are explained by capitalists' consumption, i.e. by the opposite of saving. It is true that, from the viewpoint of the structure of production, net saving and investment also play a role, but it is only a minor component of profit.

6. Methodology

The two frameworks obviously belong to different epistemological universes, Kalecki being on the empirical-realistic side and the Hayekian approach on the theoretical-modeling side, but there are nonetheless some methodological similarities between them.

(1) *Validation*. Both frameworks aim at developing a theory or explanation of the phenomenon of aggregate profit, but how are these theories justified? Kalecki uses 1929-1940 statistical data from U.S. national accounting at the end of his chapter on real profits (1954, p. 57-58). However, it does not appear to us that these data are used to test or validate his theory. They help him to calculate first the delay ω and then the parameters A and q of his profit formula $P_t = (I_{t-\omega}. + A)/(1 - q)$ *in this specific time period*. These parameters would be different in another time period. His theory is therefore not corroborated but rather simply illustrated by the empirical data. While he develops his theory, Kalecki does not use any empirical data. When he concludes that profits are "determined fully by investment with a certain time lag," he has not yet introduced any statistics about profits and investment. His theory is entirely dependent on its starting point, which is the consumption formula from which his whole reasoning follows. The question then is, what is the justification of his consumption formula $C_t = (qP_{t-\lambda} + A)$? In Kalecki's own words, it is an "assumption, which is plausible as a first approximation" (1954, p. 53) and he leaves it at that. The theory is thus justified by the fact that he considers its starting point "plausible." It might be claimed that a high correlation between profits and investment would empirically support his theory. However, Kalecki does not calculate this correlation, and since he essentially defines profits as investment the correlation would likely be quite high anyway.[7]

In the Hayekian framework, it is clear from the outset that empirical data are irrelevant to the validation of the theory. The aim of the theory is to study the cause-and-effect relationships in a very simple and unrealistic setting in which the determining forces appear as clearly as possible. The starting point is also a pattern for capitalists' consumption. In the Austrian tradition,

[7] Kalecki does calculate a correlation, but it is between the profits in U.S. data and the profits obtained with his regression equation of the U.S. data. The very high correlation (0.986) that he finds between these two series (actual profits and calculated profits) simply indicates that the results of the regression equation are very close to the U.S. data. In other words, this regression equation ($P_t = 1.34I_{t-¼} + 13.4 - 0.13t$) very adequately mimics the evolution of profits in the 1929-1940 empirical data.

however, it is not just a "plausible" behavior but rather an inescapable "logic of action." The choice between consuming more or investing more is unavoidable and decided on the basis of time preference and the productivity of capital.

Both theories are validated by their starting point, namely capitalists' choices, but while Kalecki seeks realism (plausibility), the Hayekian framework pursues instead a purely theoretical relevance (logic).

(2) *Equilibrium*. The concept of equilibrium is essential to the Hayekian reasoning: the economic system is initially in equilibrium, then a change is introduced (a net investment), the system adjusts (everything else equal), and a new equilibrium prevails. In the Austrian school, this procedure is deemed necessary to disentangle the cause-and-effect relationships that are blurred in the real world where multiple changes constantly impact the system and interact with one another. In this perspective, the concept of equilibrium and the *ceteris paribus* assumption are two of the most important tools for economic theorizing. Kalecki mentions stationary equilibrium at the beginning of his theory of profits (1954, p. 46), but quickly rejects its use because profits change every year and he wants his theory to explain these changes.

(3) *Individualism vs holism*. In this methodological debate, Post-Keynesians are supposed to be on the side of holism and Austrians are definitely on the side of individualism. However, Kalecki's theory of profit is based on the typical consumption behavior of a capitalist. Even though the C_t equation is written at the macroeconomic level, it is simply the sum of the individual equations of each capitalist. This macro-level equation is founded on individual behavior and therefore resorts to an individualistic methodology. In the Hayekian framework, the starting point of the reasoning is the structure of production. This structure is considered the emergent result of individual actions and in this sense also belongs to methodological individualism. However, the linearity assumption that we have used is a purely macroeconomic constraint on the shape of the structure (constancy of wages and rents WR_n across all stages n). This assumption can of course be relaxed and is in no way required for a structure of production, but as soon as it is retained the explanation takes an undeniable holist turn. To this extent, the Hayekian model developed above is more holistic than Kalecki's reasoning.

The two frameworks differ in the way they relate to empirical data and in their use of the concept of equilibrium, but surprisingly, in this particular case, Kalecki's rests upon a more consistent individualist methodology than our Hayekian model.

7. Conclusion

In spite of some similarities in their point of departure, namely the basic idea that aggregate nominal profit is related to capitalists' consumption and to some kind of investment, the Kaleckian and Hayekian frameworks widely diverge as soon as real profits are concerned. From a Hayekian viewpoint, the Kaleckian approach largely misses the relevant phenomenon of net profits and resorts to an arbitrary behavioral assumption for capitalists' consumption instead of formalizing the fundamental trade-off between productivity of capital and time preference. From the Kaleckian viewpoint (if we dare to try and figure it out), the Hayekian framework appears totally unrealistic, trying to explain profits in a fictional universe, not only unable but unwilling to account for the data of the real world. While Kalecki seeks to stay as close as possible to the empirical reality of capitalists' behavior and of historical macroeconomic data, the Hayekian approach developed here drastically simplifies reality in order to analyze the relevant phenomenon in its theoretical purity. With such contrasting goals, not only is any kind of synthesis of the two approaches out of the question, but it would be difficult if not impossible for the supporters of one type of investigation to change the minds of those on the other side. We are dealing with two irreducible paradigms whose conflict can only be solved–if at all–in a much wider discussion questioning the very foundations and nature of economic science.

Appendix 1: The determination of a linear structure

In a (stationary) linear structure of production, the wages and rents WR_n paid at stage n are the same across all stages: WR_n is a constant for all n. This type of structure is entirely determined by the values of N (number of stages), $E = (C + I)$ (aggregate spending), and π (uniform rate of profit). Knowing these three values, it is indeed possible to deduce the nominal values of C (annual consumption), I (aggregate investment), Π (aggregate profit), and WR (aggregate wages and rents). Here is the procedure. Let us note x the value, still unknown, of original factors at any stage: $x = WR_n$ for any n. With the help of x and π, the values of spending at any stage can be calculated. When the spending on investment I and on consumption C have been calculated, their

sum E is known. Since there is one unknown (x) and one equation ($C + I = E$), the unknown can be calculated.

Let us carry out the calculation for a 5-stage structure (see Figure 1) with any rate of profit π and any aggregate expenditure E. It will then be easy to obtain the general formula for a structure with any number of stages N.

- Investment at stage 5: $I_5 = x$
- Investment $I_4 = I_5(1 + \pi) + x = x(1 + \pi) + x$
- Investment $I_3 = I_4(1 + \pi) + x = x(1 + \pi)^2 + x(1 + \pi) + x$
- Investment $I_2 = I_3(1 + \pi) + x = x(1 + \pi)^3 + x(1 + \pi)^2 + x(1 + \pi) + x$
- Investment $I_1 = I_2(1 + \pi) + x = x(1 + \pi)^4 + x(1 + \pi)^3 + x(1 + \pi)^2 + x(1 + \pi) + x$
- Consumption $C = I_1(1 + \pi) = x(1 + \pi)^5 + x(1 + \pi)^4 + x(1 + \pi)^3 + x(1 + \pi)^2 + x(1 + \pi)$

The aggregate expenditure E is the sum of all the spending above:

$$E = x(1 + \pi)^5 + 2x(1 + \pi)^4 + 3x(1 + \pi)^3 + 4x(1 + \pi)^2 + 5x(1 + \pi) + 5x$$

If we note $q = (1 + \pi)$, (E/x) can be written as the sum of $(q^5 + q^4 + \ldots + 1)$ plus $(q^4 + q^3 + \ldots + 1)$ plus $(q^3 + q^2 + q + 1)$ plus $(q^2 + q + 1)$ plus $(q + 1)$. By using the formula $(1 + q + q^2 + \ldots + q^m) = (q^{m+1} - 1)/(q - 1)$, we get:

$$\frac{E}{x} = \frac{q^6 - 1}{q - 1} + \frac{q^5 - 1}{q - 1} + \frac{q^4 - 1}{q - 1} + \frac{q^3 - 1}{q - 1} + \frac{q^2 - 1}{q - 1}$$

Since $(q - 1) = \pi$, it follows that:

$$\frac{E\pi}{x} = q^6 + q^5 + q^4 + q^3 + q^2 - 5$$

$$\frac{E\pi}{x} = q^6 + q^5 + q^4 + q^3 + q^2 + (q + 1) - (q + 1) - 5$$

$$\frac{E\pi}{x} = \frac{q^7 - 1}{q - 1} - (q + 1) - 5$$

Replacing q by $(1 + \pi)$:

$$\frac{E\pi}{x} = \frac{(1+\pi)^7 - 1}{\pi} - (1 + \pi + 1) - 5$$

$$\frac{E\pi^2}{x} = (1+\pi)^7 - 1 - \pi^2 - 7\pi$$

The value x of original factors at each stage of the 5-stage structure is therefore:

$$x = \frac{E\pi^2}{(1+\pi)^7 - 1 - \pi^2 - 7\pi}$$

For a structure with any number of stages N, the formula is:

$$OF = x = \frac{E\pi^2}{(1+\pi)^{N+2} - 1 - \pi^2 - (N+2)\pi}$$

(N, E, π) determine x, and once the latter is known, the investment at each stage can in turn be calculated, and also the final consumption C. The aggregate wages and rents WR are simply Nx, and the aggregate profit is ($C - WR$). The aggregate expenditures flowing through the structure are entirely determined. Applied to the structure of Figure 1 with (N, E, π) = (5, 100, 10%), the calculation gives x = 4.189, approximated as 4.2 in the text.

For the 6-stage structure of Figure 2, the data available at the beginning are the investment I' (= 74.9), the number of stages (= 6), and the aggregate expenditure (= 100). We can use the formula for investment I' and the formula for consumption C' (2 equations) to calculate x and π (2 unknowns). However, the algebraic solution is not very convenient, so we have resorted to a calculation by trial and error with the help of the spreadsheet (entering a value for π, calculating x with the formula above for E = 100, then calculating I', and varying π until the value found for I' matches the data I' = 74.9).

Appendix 2: the average length of a linear structure

The average length of a structure of production is calculated here with the formula of Böhm-Bawerk (1959 [1889]). For an *N*-stage structure, the average length θ is the weighted sum of the ratio of original factors WR_n at each stage *n* on the total value *WR* of original factors:

$$\theta = \sum_{n=1}^{N} n \frac{WR_n}{WR}$$

A *N*-stage *linear* structure is characterized by $WR_n = (WR/N)$ and its average length is therefore:

$$\theta = \sum_{n=1}^{N} n \frac{\left(\frac{WR}{N}\right)}{WR} = \sum_{n=1}^{N} \frac{n}{N} = \frac{1}{N} \sum_{n=1}^{N} n = \frac{1}{N} \frac{N(N+1)}{2} = \frac{N+1}{2}$$

Q.E.D.

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