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Capital theory: implications for the theories of distribution, employment and growth

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• Capital theory allows discriminating between the two main competing approaches

• 1) Classical or surplus approach (Smith, Ricardo, Marx, Sraffa):
• determines income distribution without any need for tendency toward equilibrium between supply and demand for factors, without any need for factor demand functions. Wages determined by sociopolitical forces: class conflict, institutions, custom. Unemployment need not cause wage decreases. Important as possible alternative if neoclassical notion of factor demand functions and tendency toward equilibrium were to come out to be indefensible – which is indeed the case.
Profits due, not to a contribution of capitalists, but only to their superior bargaining power.

Analogy with feudalism: control of means of production by the ruling class (land in feudalism, capital in capitalism) obliges workers to accept to renounce part of what they produce in order to obtain subsistence. Exploitation

some unemployment normal; wages close to historically determined subsistence; (Marx) a strong working class causes crises. Picture of capitalism far from rosy
Difficulty with value theory (defective labour theory of value) and determination of rate of profit: surmounted by Sraffa

Given real wage rate, production technique, quantities produced ⇒ profits and rate of profit. Profits: output minus reconstitution of capital minus wages. Rate of profit: profits relative to capital advanced (interest part of profit)

For example corn-corn economy:

100(K) ⊕ 20(L)·10(w) ⇒ 360 social output (gross-gross output)

Profits 360 – (100+200) = 60

Wages advanced: r = 60 / 300 = 20%

Wages paid at end: r = 60 / 100 = 60%

Basic scheme: r = value of surplus / value of capital

But outside single-good economy, r depends on relative prices that depend on r: logical circularity? no, see below
• 2) **marginal/neoclassical approach:** wages equal marginal product of labour
  - e.g. corn-corn economy
  - if one factor earns its marginal product, residue going to the other factor corresponds to its marginal product. So capital too earns its marginal product

  ![Diagram](image.png)
  - MPL: marginal product of labour (w)
  - L: labour

• **technical substitution and substitution in consumer choice** (MCM ch3):
  - decreasing demand curve for each factor → tendency toward full employment of all factors (if competition);
  - stability of equilibrium could be argued

• apparent plausibility: decreasing demand curves for factors derived simply from existence of technical choice and consumer choice; apparently, clear step forward relative to classics, who had not realized existence of these substitution mechanisms

• no exploitation; efficiency (tendency to full utilization of resources);
  - too high rigid wages damage society because production decreases. Rather rosy picture of capitalism.
• exploitation?

• **contribution** of a unit of factor: what society loses if that factor unit withdraws from production, that is, its marginal product; **reward** received by that unit of factor: its marginal product; ➔ for each unit of each factor, contribution = reward.

• Objection: contribution of physical capital is not contribution of the capitalist. Reply: unit of capital exists because of sacrifice of capital owner who did not consume it but saved it, renouncing immediate consumption: abstinence!

• worker’s sacrifice (unpleasant labour) rewarded by wage; saver’s sacrifice (abstinence from immediate consumption) rewarded by interest; both rewarded for what they contribute
• Which approach is correct? Results of capital theory suggest the marginal/neoclassical approach is indefensible theoretically.
• (Empirics: unemployment, crises.) Theory: supply-side and demand-side problems with capital.
• **Supply-side:** equilibrium’s data: preferences, techniques, endowments. Problem with specifying endowment of capital.
• Logic of marginal approach: equilibrium centre of gravitation: its data must be sufficiently persistent for deviations to be corrected or compensated so that it can indicate averages and, with its changes, the trends.
• Most capital goods’ endowments can change quickly so must be determined endogenously by the tendency toward equilibrium, cannot be data of equilibrium.
• Traditional idea: capital single factor of variable ‘form’
• But then how measured? Necessarily quantity of exchange value.
all units of a factor tend to earn the same. thus take two lands A and B of same quality; land A earns as total rent twice as much as land B ⇒ land A has a surface twice the surface of B

two different capital goods A and B; capital good A earns as net rental (e.g. fitto netto di un trattore) twice as much as capital good B; we want to see this as due to the productive contribution of a single factor ‘capital’ embodied in them ⇒ A contains twice as much ‘capital’ as B

but net rental is interest on value of capital, and rate of interest is uniform, so value of A is twice value of B

hence quantity of capital ‘embodied’ in different capital goods is necessarily proportional to the value of those capital goods; hence value of capital measures quantity of capital; nor is there any other, physical way to specify this quantity: weight or volume of capital goods have no univocal connection with productivity or earnings.
but then endowment $K$ of an economy is the value of the capital goods present in it – logical circularity: $K$ should help determine equil. prices but cannot be known before equil. prices

Wicksell (Lectures, 1902-1928):  
“But it would clearly be meaningless – if not altogether inconceivable – to maintain that the amount of capital is already fixed before equilibrium between production and consumption has been achieved. Whether expressed in terms of one or the other, a change in the relative exchange value of two commodities would give rise to a change in the value of capital” (Wicksell 1934, p. 202),

a few lines later Wicksell admits that this implies an “indeterminateness” of the endowment of capital
• in 1930s, Lindahl, Hayek, Hicks attempt to surmount this problem by taking as given the endowment of each capital good: shift to very-short-period modern GE models, intertemporal or temporary. New problems thus created:

• Impermanence problem: since adjustments take time, data change during disequilibrium: endowments of capital goods; expectations. Equilibrium altered by disequilibrium we do not know where the economy goes. Attempt to surmount it: instantaneous adjustment (auctioneer) – nonsense (e.g. time for wage adjustments).

• expectations problem: indeterminate how they change. Attempt to surmount it: correct foresight – nonsense (novelties?)

• (substitutability problem: no time)

• implication: these equilibria tell us nothing at all about economies without instantaneous adjustment and perfect foresight. Reference to these equilibria as rigorous microfoundation is smokescreen, still faith in old adjustments
supply-side problem illustrated for labour demand curve:
Demand curve for a factor requires full employment of other factors. Labour demand curve requires full employment (= endowment) of capital: how specified?
given value impossible, as admitted by Wicksell, it changes with wage and prices;
given vector of capital goods impossible, it changes during adjustments caused by changed wage, that take a long time.
Conclusion: labour demand curve indeterminable.
• So no equilibrium real wage. Different theory of wages indispensable.
• if labour demand curve does not exist, one cannot argue that it is decreasing; thus thesis that, in order to increase employment, real wages must decrease loses its foundation.
• then what determines labour employment? aggregate demand. that is, autonomous demand plus the Keynesian multiplier (back on this later)
• Now demand-side problem: demand for capital not ‘well behaved’, with implications for investment theory and macroeconomics
• neoclassical theory in order to argue tendency toward full employment must argue investment adjusts to full-employment savings
• otherwise decreasing demand curves for factors don’t work
• e.g. assume labour unemployment; wages decrease; suppose firms then hire more workers. Production increases, incomes increase, savings increase; in order to sell the increased production without losses, investment must increase. The increase of labour demand caused – according to the neoclassical approach – by lower wages needs that investment increases, or it will come out to have been a mistake and will be undone.
• neoclassical argument: increased savings (or lower money wages) will cause a decrease of the rate of interest, and this will cause an increase of investment.

• reason: investment is the value of purchases of capital goods by firms aiming to reach the desired stock of capital. When the rate of interest decreases, the desired stock of capital increases because the desired capital-labour ratio K/L rises, so investment rises.
• Many problems with this argument, here I illustrate only one, connected with capital theory.

• Investment is motivated by long-period evaluations – expected returns over many years. The study of long-period technical choices by firms, made possible by Sraffa, has shown that it is not true that a lower rate of interest always causes a rise of the value of capital per unit of labour; that is, there is no guarantee that the desired $K/L$ ratio rises when the rate of interest decreases, which undermines neoclassical investment theory.

• long-period technical choices: the cost-minimizing choices of production methods in the several industries, when prices are given time to tend toward minimum average cost

• product price tends to minimum average cost: well-known Marshallian notion, but insufficient in its standard partial-equilibrium textbook presentation: input prices of a good cannot be all given independently of the good’s price: e.g. steel
• solution: simultaneous determination of all normal prices
• e.g. two goods (circ. capital) \( w \)
  \[
  p_1 = (1+r)(a_{11}p_1+a_{21}p_2)+a_{L1}w
  \]
  \[
  p_2 = (1+r)(a_{12}p_1+a_{22}p_2)+a_{L2}w
  \]
• \( p_1 = 1 \)
• \( w(r) \) curve for given technique
• classical difficulty overcome!
• no problem generalizing to more goods
• assume many goods, and ask how price of a good relative to good 1 can vary with changes in income distribution, if technical coefficients are given

• if capital behaved in the same way as labour, once the production methods are given then as capital becomes more expensive, the good produced with the higher K/L ratio must become relatively more expensive.

• Refuted by Sraffa’s example in next slide, that Sraffa comments (1960 p. 38):

  • “The reversals in the direction of the movement of relative prices, in the face of unchanged methods of production, cannot be reconciled with any notion of capital as a measurable quantity independent of distribution and prices.”

• (simpler example: Samuelson 1966, see MCM ch. 2 §§ 2.33)
Fig. 3. Difference, at various rates of profits, between the prices of two commodities which are produced by equal quantities of labour equally distributed over time, with the exception that:

(1) A unit of commodity ‘a’ requires in addition 20 units of labour to be performed 8 years before its production is completed;

(2) A unit of commodity ‘b’ requires in addition 1 unit of labour 25 years before its production is completed and 19 units in the last year.

The equation of the curve is

\[ p_a - p_b = 20w(1+r)^8 - \{19w + w(1+r)^{25}\}, \]

where

\[ w = 1 - \frac{r}{25\%}. \]
So K/L ratio in production of a good not given independently of income distribution, so total K not known - confirms illegitimacy of given endowment of capital. Now look at implication for change of K/L when r rises (techn. substitution) consider economy producing a consumption good as net product; choose that good as numéraire; y quantity produced of the good, and value of net product, per unit of labour; assume labour employment 1 unit, then k=K/L capital per unit of labour net product goes either to wage w or to interest on capital rk

\[ y = w + rk \]
\[ k = \frac{(y - w)}{r} \]

k = abs. slope of line from point on w(r) curve to its vertical intercept
• having chosen a numéraire, if many alternative methods are known in each industry, for each technique (combination of methods, one per industry) we derive the \( w(r) \) curve, and put all the curves in the same diagram. Fundamental result: tendency of firms to minimize average cost will push firms to change method as long as another method reduces costs, and this causes a tendency for the economy to get to the outer envelope of the \( w(r) \) curves.

• now reinterpret Sraffa’s example as applying to the same good producible with two different techniques

• if, given a technique, at a certain \( r \) and associated \( w \) another technique allows producing the numéraire at lower cost, then its \( w(r) \) curve is above the one of the first technique (it can pay a higher wage at the given \( r \)), so Sraffa’s discovery implies that a \( w(r) \) curve may be above another one, then below, then again above as \( r \) rises
• many $w(r)$ curves and outer envelope: example

• note possible multiple intersections
• apply determination of $k$ illustrated above:
• when technique changes, $k$ determined by new $w(r)$ curve. (Note: $r$ is in ordinate in right-hand diagram)

• at switchpoints, $k$ indeterminate because both techniques may be used, in varying proportion

• at $r_2$, change of $k$ is anti-neoclassical: $r$ rises and $k$ rises
• example with more $w(r)$ curves
• “capital demand curve” not at all a regularly decreasing function of the interest rate

• hence investment too cannot be considered a regularly decreasing function of the interest rate

• (more extensive discussion of neoclassical investment theory in Petri, *General Equilibrium Capital and Macroeconomics* ch. 7, and in Petri, “Neglected Implications...” my web page)

• So no reason to believe the rate of interest can bring investment to adjust to full employment savings. Victory of monetarism in debate on Keynesian economics was based on a false theory of investment (and of capital).

• Modern GE theory and DSGE models simply assume I adapts to full-employment S, with no justification.

• We need other theory. Then turn to what empirical evidence shows: investment depends on expected growth of demand, and on innovations; savings adjust through changes of Y
• Employment will then depend on aggregate demand
• Very important: production is flexible; less production discourages production; more demand ➔ more production, made possible by fixed capital utilized more hours, and by circulating capital reproduced: initially inventories are run down, increased production reconstitutes them. Extra labour time is always available, so in order to grow faster there is no need to reduce consumption or wages: it is possible to have both more investment and more consumption; and capital is produced when required, so production techniques and K adapt to income distribution and demand, rather than the other way round. Supply-side view of growth radically wrong.
• Growth depends on the growth of the autonomous components of aggregate demand (government expenditure, investment connected with innovation, exports) that induce growth of aggregate demand and hence of desired productive capacity and hence of capacity investment
• Unemployment *can* be reduced by public policy that stimulates aggregate demand, with no need to reduce wages. If governments do not do it, the reason is political: as Marx said and Kalecki confirmed (“Political aspects of full employment”), governments **want** some unemployment, and will intervene to increase unemployment when they feel the working class is too strong, or also when they simply feel they can succeed in weakening wage labour and thus raise profits.

• There is reason to think the Euro system has been consciously conceived as a way to increase unemployment, weaken labour and reduce the welfare state.

• thank you for your attention
Some references

- on how to study causes of changes in income distribution:
  - Michal Kalecki, “Aspetti politici del pieno impiego” (1943), mia pag web
  - T Cavalieri, P Garegnani, M Lucii, “Il problema dell’occupazione e la sinistra” (La Rivista del Manifesto 2004), mia pag web
  - Armstrong, Glyn, Harrison, *Capitalism since 1945*
- for general non-neoclassical perspectives:
  - Noam Chomsky, lezione, mia pag web
  - Paolo Barnard, *Il più grande crimine*, scaricabile dal web
with birth of worker organizations and protests (Chartist movement, first socialists), opposition to classical approach grows. Scrope 1831 on Ricardo and his disciples:

“Surely the publication of opinions taken up hastily upon weak, narrow and imperfect evidence – opinions which, overthrowing as they did the fundamental principles of sympathy and common interest that knit society together, would not but be deeply injurious even if true – does amount to a crime ... In their theory of rent, they have insisted that landlords can thrive only at the expense of the public at large, and especially of the capitalists; in their theory of profits, they have declared that capitalists can only improve their circumstances by depressing those of the labouring and numerous class; ... In one and all of their arguments they have studiously exhibited the interests of every class in society as necessarily at perpetual variance with every other class!”
Indeed Adam Smith sounds rather Marxist when he describes wage determination as follows:

“The workmen desire to get as much, the masters to give as little as possible. The former are disposed to combine in order to raise, the latter in order to lower the wages of labour.

“It is not, however, difficult to foresee which of the two parties must, upon all ordinary occasions, have the advantage in the dispute, and force the other into a compliance with their terms. The masters, being fewer in number, can combine much more easily ... A landlord, a farmer, a master manufacturer, a merchant, though they did not employ a single workman, could generally live a year or two upon the stocks which they have already acquired. Many workmen could not subsist a week, few could subsist a month, and scarce any a year without employment. In the long-run the workman may be as necessary to his master as his master is to him; but the necessity is not so immediate. ...
“[The masters’ combinations] are frequently resisted by a contrary defensive combination of the workmen; who sometimes too, without any provocation of this kind, combine of their own accord to raise the price of their labour. ... But whether their combinations be offensive or defensive, they are always abundantly heard of. In order to bring the point to a speedy decision, they have always recourse to the loudest clamour, and sometimes to the most shocking violence and outrage. They are desperate, and act with the folly and extravagance of desperate men, who must either starve, or frighten their masters into an immediate compliance with their demands. The masters upon these occasions are just as clamorous upon the other side, and never cease to call aloud for the assistance of the civil magistrate ... The workmen, accordingly, very seldom derive any advantage from the violence of those tumultuous combinations, which, partly from the interposition of the civil magistrate, partly from the superior steadiness of the masters, partly from the necessity which the greater part of the workmen are under of submitting for the sake of present subsistence, generally end in nothing but the punishment or ruin of the ringleaders.”
• production of 1 unit of champagne requires the payment of 7 wages two periods before the sale of the product; production of whiskey requires the payment of 2 wages three periods before, and of 6 wages one period before the product is sold. Long-period prices $p_c$ of champagne and $p_w$ of whiskey:

\[ p_c = 7w(1+r)^2 \]
\[ p_w = 2w(1+r)^3 + 6w(1+r). \]

Put \( w=1 \), then \( p_c=7(1+r)^2 \), while \( p_w=2(1+r)^3+6(1+r) \). Easily checked:

\[ p_c=p_w \text{ for } r=50\% \text{ and for } r=100\%, \]
\[ p_w<p_c \text{ for } 0.5<r<1, \]
\[ p_c<p_w \text{ for } 0<r<0.5 \text{ and for } r>1. \]
The graph shows a curve on the $p_c/p_w$ axis, ranging from 0 to 1 on the $r$ axis. The curve starts at 0, rises to approximately $7/8$ at $1/2$, and then decreases to 1 at 1.
• At $r=0$ it is $p_c < p_w$ because cost consists only of wages and a unit of champagne requires the payment of 7 wages against 8 for a unit of whiskey; but the price difference decreases as $r$ increases, and is reversed as $r$ becomes greater than 50%, because interest costs initially increase faster in the production of champagne than of whiskey; however, as $r$ continues to increase, compound interest ends up by causing a greater increase of the cost of whiskey, so the price of whiskey starts approaching the price of champagne and the ratio between the two prices is reversed as $r$ becomes greater than 100%