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A Simple "Neoclassical" Model of Marxian Exploitation*

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A Simple "Neoclassical" Model of Marxian Exploitation

Can a neoclassical (*NC*) model be used to explain the nature of capitalist exploitation as seen in Marxian theory? This paper aims to do so.[1] Making it fit the *NC* label are the assumption of an aggregate production function with constant returns to scale (*CRS*), run by a representative agent under atomistic competition in product markets, in equilibrium. But exploitation's existence rests on two main complementary departures from the "pure" (*PNC*) model: rejection of Say's "Law" (*SL*) and addition of variable degrees of effort by workers, driven by fear of job loss (cf. Schor, 1987). A *PNC* model lacking these two deviations is the non-exploitative special case of the more general model.

"Exploitation" here refers to the receipt of positive "normal" profits merely for owning means of production (here called "machines"). This paper aims to supersede John Roemer's (1982, 1985) attempt to restate Marx's theory using *NC* theory.[2] To Roemer, exploitation arises simply due to capitalist ownership of scarce machines; profits are a technological rent garnered because machines boost the productivity of workers using them. For Marx, on the other hand, such profits arise because "the worker purchases the right to work for his own livelihood only by paying for it in surplus-value" (1867: 515). While Roemer posited an alternative source of livelihood for workers, Marx saw them as having little choice but to work for capitalists. They exert more effort than needed to pay for wages, since otherwise they would not survive as human beings.

[1] It is not surprising that utopian *NC* assumptions imply non-exploitative results. But if exploitation can exist even under such assumptions, it seems likely to exist even in the empirical world where such ideal assumptions do not apply.

[2] See Dymski and Elliott (1989), Devine and Dymski (1989, 1991), Devine (1993, 1996), and Veneziani (2000) for critiques of his work.

As in other class systems such as slavery or serfdom, workers face *institutional coercion*: their choices are limited by human-made social structures. Under capitalism, this coercion arises from two complementary social-structural traits. First, their control of accumulation and technology gives capitalists macro-level *supremacy* over labor (corresponding to workers' proletarianization). Second, the capitalists' micro-level *subjection* of workers within the production process (a.k.a. domination or subsumption) allows them to push workers to produce more than the cost of their wages, permitting the creation of profits. Supremacy leads to and is endorsed by the reserve army of labor (*involuntary unemployment*) causing a positive *cost of job loss* (*COJL*) that sustains workers' subjection.[3] These institutions mean that the relative scarcity of machines is usually reproduced over time, explaining a key element of Roemer's story. The role of workers' conscious *submission* to exploitation, though crucial to its persistence, is elided here.[4]

Rejection of *SL* means dismissal of the *NC* axiom of scarcity. That axiom has implied at best an uneasy alliance with Keynes: his unemployment equilibrium seen as only a temporary digression from the "true" full-employment equilibrium lurking in the background. In contrast, this paper aims to synthesize ideas from Marx and Keynes.

Absent *SL*, some idle capacity is normal. In *PNC* equilibrium, therefore, there are zero rents for machine-ownership. But since some labor-power is also unemployed, *PNC* equilibrium also implies zero wages. So profits and wages race to the bottom.[5] Even

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[3] Consciously-organized direct coercion such as serfdom or fascist forced-labor camps are ignored. Only the pure classical-liberal capitalist case (the *CLC*) is discussed.

[4] While the capitalist is a decision-maker, workers' choices are represented here only by mathematical functions. This treatment is akin to that of Marx's Capital (cf. Lebowitz. 1992).

[5] Real-world resistance to nominal wage cuts makes this race merely a creep.

when tied in the race, workers' urgent need to survive as humans[6] backs up capitalist subjection, typically allowing positive profits. Capitalist supremacy insures that jobs remain artificially scarce, since accumulation does not occur without positive profits.

It is not *notional* (*SL*-based) demand and supply that determine real wages and profitability. Rather, it is *effective* demand and supply: at the model's heart (*Chart II*) is equilibrium formed by two "disequilibrium" functions.[7] Effective demand (**ED**) depends on accumulation, while effective supply (**ES**) depends on class struggle. Because of assumed working-class passivity, the latter is represented by a *wage curve* (Blanchflower and Oswald, 1994), which fits some visions of Marx's reserve army of labor.

The model has both micro and macro levels.[8] Macro-behavior depends on micro-decisions of the representative capitalist (*RC*) who cannot see or control macro-effects of its actions. Unlike in typical "microfoundations" models, macro-results feed back to affect micro-level behavior. It is as if a large number of identical capitalists face the same conditions – but cannot coordinate actions. Identical conditions spur identical actions, that of *RC*. Conflict between micro-decisions and macro-rationality (a collective good problem) can arise, however, so a *PNC* zero-exploitation case can result.

The model's deviations from atomistic competition are between (rather than within) classes. But the model does not rely on monopsony (Robinson, 1969: ch. 26; Manning, 2003). It exists only as part of bilateral monopoly and can be negated by labor's bargaining power with high employment. Further, exploitation can occur even

[6] To Smith, "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" (1776: 169).

[7] Clower (1965) developed the notional/effective contrast. "Disequilibrium" is defined *relative to* the notional *SL* equilibrium.

[8] As in Levins and Lewontin (1985), parts create whole and whole creates parts. Unlike in their method, parts are homogeneous (except between classes) and the model is not truly dynamic.

without artificial depression of wages, if workers exert enough effort. The model has the notional marginal product exceeding the wage. But this result arises from the dropping of *SL*, not on micro-level limits on the mobility of workers amongst employers.

In this paper but not in Marx, profit production represents “exploitation” in the *normative* sense since it is akin to taxation without representation, i.e., the under-payment of workers without their explicit democratic consent. In response, “risk-taking” and “entrepreneurship” are often used to explain the existence of profits from machine ownership. This seems to say that the ends (innovation) justify the means (exploitation). But that is beside the point. With either concept, positive profits still need to be explained for society as a whole. Otherwise, these theories merely explain why some capitalists profit more than others. In any event, both seem part of another argument, i.e., that capitalism is superior to all alternative systems. It is not for economists to unilaterally make such assertions when working people should decide democratically.

The current paper follows Devine (1996) and Elliott (1996), to restate Marx’s vision without his controversial modes of analysis. New is the formal model. The first section explains how it connects with Marx’s project. The next two sections present microfoundations, while §**4** provides macrofoundations. §**2** presents a simple, non-exploitative, *NC* model. The potential for exploitation is found in §**3**, by bringing in variable effort and subjection. The extra effort needed arises from the existence of unemployment and supremacy, explained in §**4** by dropping *SL* and developing a simple model of accumulation and steady-state growth. §**5** summarizes and comments.

1. Was Marx NC*?*

Despite their fallacious nature,[9] the first three *NC* assumptions stressed in the first paragraph above fit with some of Marx's more abstract work, i.e., volume I of Capital (Marx, 1867).[10] Since he saw exploitation as a societal (macro) phenomenon rather than simply a micro-relation between a capitalist and workers (based in monopoly or monopsony), considering aggregate production is apt. Like Solow (1956), Marx abstracted from inter-industry and intra-class heterogeneity. *RC* is akin to his "Moneybags." The competition assumption extends his view that capitalism is unplanned: though omnipresent, Moneybags is neither omniscient nor omnipotent.

Obviously, Marx's goals differed from Solow's. He aimed to understand shared traits of capital/labor social relationships and the overall context in which individuals operate, explaining profits for the capitalists as a whole before turning to their distribution amongst disparate individuals (in volume III). This paper stays at the volume I level of abstraction, ignoring the disaggregation (or "transformation") problem.[11]

Since Marxian exploitation cannot arise in a *PNC* model, the title's "neoclassical" is in quotation marks. The model is more realistic, for example, adding an independent investment function, putty-clay technology, and path dependency. These amendments are not as central, however, as those emphasized in the first paragraph of the introduction.

Several assumptions – centered on the ubiquity of equilibrium – totally reject Marx. These include smooth technology, the absence of money and inflation, and an un-

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[9] See Harcourt (1972) on the aggregate production function, Kirman (1992) on representative agent models, and Arrow (1959) on theoretical problems of pricing under perfect competition.

[10] Textual justification of my interpretation is far beyond the scope of this article.

[11] This "problem" implies math troubles akin to those plaguing Solow's model (Bhaduri, 1969).

realistic conception of time. Most crucially, the model ignores his view that capitalism is an artificial and historically-limited institution. State coercion in creating and preserving exploitation is thus left unexamined, as are most of its other roles.

The central assertion is that exploitation exists in “normal” times (without worker rebellions and Depressions) and the conditions for its existence must be explained.

2. Production.

Start with the short run (a *week*) and later bring in long-run analysis (the *year*). Long-run results are taken as given in short-run decision-making, while short-run decisions determine the long-run results. In equilibrium, weekly decisions and yearly results are consistent.

Basics. The flow of gross output (**Q**) arises from the flow of productive *effort* or labor (**E**) using a stock of *machines* (**M**).

$$\mathbf{Q} = \mathbf{q}(\mathbf{E}, \mathbf{M});\ \mathbf{q_i} > 0;\ \mathbf{q_{ii}} < 0 \text{ for } \mathbf{i} = 1,2 \qquad (1)$$

Q, **E**, and **M** are assumed infinitely divisible and homogenous in terms of individual characteristics. The production function has the usual pleasant characteristics. Assume *CRS* above the minimum efficient scale (*MES*)[12] and that actual **Q** ≥ output at the *MES*. Thus, both **E** and **M** are positive.[13]

Marx distinguished *labor-power* (the ability to work, **L**) from *labor* (**E**). Selling **L** involves submission to an employer’s authority for a specific time-period for a wage (**w**), while labor is an activity (providing “labor services”). **E** depends on the *intensity of labor*

[12] If the *MES* = 0, workers can easily enter the capitalist class, undermining capitalist supremacy (cf. Devine and Dymski, 1991). The inability of workers to own enough liquid wealth to gain from diversification also blocks their entry (Bowles and Edwards, 1993: 130).

[13] As seen below, the assumption that **E** > 0 assumes not only that **L** > 0 but that **ε** > 0. The latter assumes that workers are not actively destructive, because they submit to *RC*’s authority.

or degree of effort ($\boldsymbol{\varepsilon} = \mathbf{E}/\mathbf{L}$, assumed positive). While **L** is measured as hours sold per week, **E** is harder to gauge. If **E** is measured by joules of energy spent per week, then **ε** is measured as joules expended per hour of **L** sold. Until §**3**, assume **ε** given.

Assume overhead supervision costs ($\mathbf{Z}_L$) are non-negative. These plus direct labor-power costs ($\mathbf{Z}_L + \mathbf{w}\cdot\mathbf{L}$) are one measure of Marx's "variable capital."

Let the replacement price of **M** equal unity (the over-all price level). When used, **M** decays at a positive constant rate **δ**. If $\mathbf{Z}_K$ is the non-negative overhead cost of maintaining all machines, the explicit cost of using **M,** a measure of Marx's "constant capital," is $\boldsymbol{\delta}\cdot\mathbf{M} + \mathbf{Z}_K$.

Because of demand constraints explained in §**4**, total machines *owned* (**K**) typically exceeds those used (**M**). The capacity utilization rate $\boldsymbol{\mu} = \mathbf{M}/\mathbf{K}$, with $1 \geq \boldsymbol{\mu} \geq 0$. In a week, **K** is given by past accumulation, and **μ** by current effective demand (**D**).[14] As seen in §§**4.B**, "factor substitution" takes place with accumulation.

In calculating the opportunity cost of holding **K**, *RC* takes the general profit rate (**r**) as given, as with textbook normal profits: $\mathbf{r}\cdot\mathbf{K}$ is income forgone by keeping **K** in an industry rather than scrapping them and/or exiting (but see below). To *RC*, the total cost of owning **K** thus equals $\mathbf{r}\cdot\mathbf{K} + \boldsymbol{\delta}\cdot\mathbf{M} + \mathbf{Z}_K$.

***PNC* Equilibrium**. *RC* aims to maximize its economic profit (**π**):

$$\boldsymbol{\pi} = \mathbf{q}(\boldsymbol{\varepsilon}\cdot\mathbf{L}, \mathbf{M}) - \mathbf{w}\cdot\mathbf{L} - \mathbf{r}\cdot\mathbf{K} - \boldsymbol{\delta}\cdot\mathbf{M} - \mathbf{Z}_L - \mathbf{Z}_K \qquad (2)$$

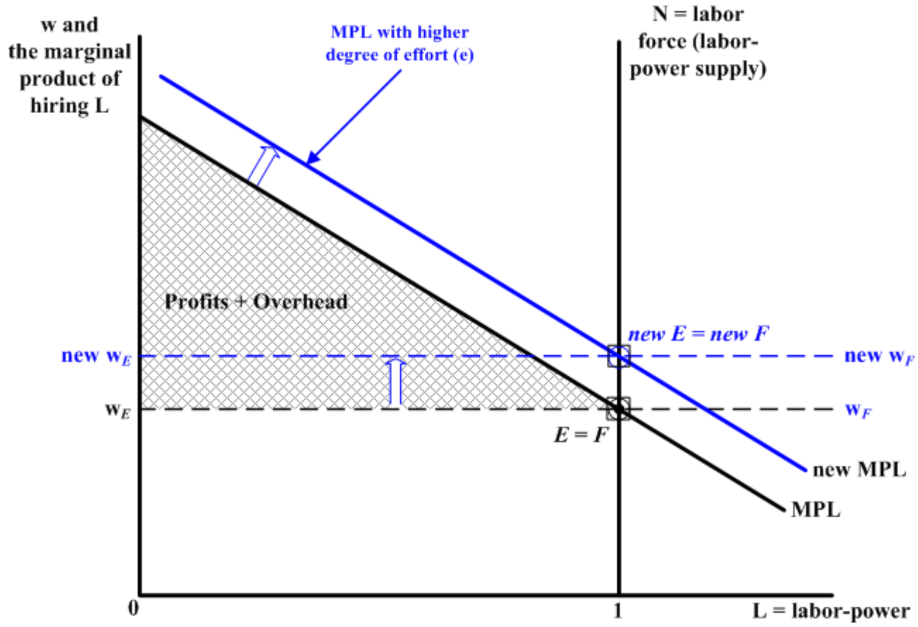
Until §**3**, assume *SL* applies, i.e., that *all output can be sold at prevailing prices* (Clower, 1965), so that $\boldsymbol{\mu} = 1$. Under competition, **w** and **r** are not decision variables. Also, let overhead $\mathbf{Z}_K$ and $\mathbf{Z}_L$ be constant (adding to **Z**). With **ε** constant, maximization gives:

[14] In the *NC* vein, ignore capitalist competition over the distribution of excess capacity.

$$\mathbf{w} = \boldsymbol{\varepsilon}\cdot\mathbf{q}_1 \equiv \mathbf{MPL} \quad (3)$$

Because $\mathbf{q}_{11} < 0$, the notional marginal private physical product arising from hiring labor-power (the **MPL**) is a downsloping demand curve for **L** for given **ε**, as in *Chart I* below.

Chart I: the Short-Run Labor-Power Market under Say's Law.



N is the labor force and the supply of labor-power curve, assumed fixed and equal to unity during a week. With no hiring delays, **w** determines **L** demanded. In the *PNC* case, **MPL** and **N** determine the equilibrium wage ($\mathbf{w}_E = \mathbf{w}_F$), while equilibrium *E* corresponds to the full employment point ***F***.[15] The area under **MPL** and above $\mathbf{w}_F$ represents normal and economic profits ($\mathbf{r}\cdot\mathbf{K} + \boldsymbol{\pi}$) plus overhead.

For an individual, economic profit arises from monopoly power, disequilibrium, or individual advantages (natural, technological, or artificial rents). These do not fit the assumption of atomistic competition and a representative agent model: economic profits of one correspond to others' losses. So let $\boldsymbol{\pi} = 0$. But what about normal profit (**r**)? To *NC* economics and to individual capitalists, this is the cost of keeping machines in an in-

[15] Ignore structural or frictional unemployment, corresponding to job vacancies at ***F***.

dustry which in turn equals the benefit of using them. But to Marx, it reflects societal exploitation. Examine this contrast further.

The model does not involve exploitation: for given marginal product of effort ($\mathbf{q_1}$), rising effort raises **MPL**. The shift to the **new MPL** line in *Chart I* thus raises $\mathbf{w}_F$ as movement to a new *PNC* equilibrium at the new $E = \boldsymbol{F}$ point compensates for extra effort. But this is a partial picture. It ignores the possibility that exploitation is an always-existing wedge between workers' effort and their reward (akin to a tax wedge) and a fact of normal capitalist life.

Further, nothing in the model determines **r**. Maximization implies $\mathbf{q_2} = \boldsymbol{\delta} + \mathbf{r}$. However, **r** could easily be zero. It was asserted above that **r** reflects profits forgone by keeping **K** in an industry. Though this makes sense to an individual, the exit argument only says that **r** will be *equalized* between sectors, not positive. In a one-sector model, only the threat of scrapping – or of cutting accumulation – is available. Positive **r**, and the credibility of the capitalist's threat to stop accumulation, must be explained by the relative scarcity of machines on the macro level.

In *Chart I*, the shaded area represents scarcity rent due to the limited **K**, the consumer surplus for consumers of labor-power. But the triangle may not be large enough, net of overhead, that $\mathbf{r} > 0$. From (2) under *CRS* and with $\boldsymbol{\pi} = 0$,

$$\mathbf{q}(\boldsymbol{\varepsilon}, \mathbf{m})\cdot\mathbf{L} = \mathbf{w}\cdot\mathbf{L} + \mathbf{r}\cdot\mathbf{K} + \boldsymbol{\delta}\cdot\mathbf{m}\cdot\mathbf{L} + \mathbf{Z} \tag{4}$$

where $\mathbf{m} = \mathbf{M}/\mathbf{L} > 0$. With $\mathbf{L} > 0$ and given **K**, this implies that:

$$\mathbf{r} > 0 \quad \text{iff} \qquad \mathbf{q}(\boldsymbol{\varepsilon}, \mathbf{m}) - \mathbf{w} > \boldsymbol{\delta}\cdot\mathbf{m} + \mathbf{Z}/\mathbf{L} \tag{5}$$

where $\mathbf{q}(\boldsymbol{\varepsilon}, \mathbf{m}) > 0$ is the average private physical product of hiring labor-power (**APL**) for **ε** and **m**. This says that for given **m**, **δ**, **Z**/**L**, and **w**, exploitation occurs only if the

APL exceeds the wage (and the **MPL**) by enough to cover depreciation and per-worker overhead. That is, $\mathbf{r} > 0$ only if workers exert enough effort, raising **APL** sufficiently.

Under *CRS*, Euler's Theorem makes positive **r** more difficult to achieve, since there is no way to pay for **Z**, except by cutting $\mathbf{r} + \boldsymbol{\delta}$ below $\mathbf{q}_2$ and/or **w** below $\boldsymbol{\varepsilon}\cdot\mathbf{q}_1$, violating competition. For simplicity, let $\mathbf{Z} = 0$.

Benchmark. Define the *PNC case* as ruling out exploitation, seeing any "profits" as a cost which corresponds to services provided by machines (measured by $\boldsymbol{\delta}$). If some profits are paid for services rendered, **r** represents profits beyond those. But **r** equals zero in this case. The *PNC* case also assumes $\mathbf{N} = \mathbf{L} = \boldsymbol{\mu} = 1$, so that:

$$\mathbf{q}(\boldsymbol{\varepsilon}_F, \mathbf{m}) = \mathbf{w}_F + \boldsymbol{\delta}\cdot\mathbf{m} \qquad (6)$$

where $\boldsymbol{\varepsilon}_F$ is a benchmark value of $\boldsymbol{\varepsilon}$ that makes (6) an equality, given $\mathbf{w}_F$, i.e., the equilibrium wage.[16] Combining equations (4) and (6) gives an accounting identity to frame the model. Total profit equals

$$\mathbf{S} = \mathbf{K}\cdot\mathbf{r} = [\mathbf{q}(\boldsymbol{\varepsilon}, \mathbf{m})\cdot\mathbf{L} - \mathbf{q}(\boldsymbol{\varepsilon}_F, \mathbf{m})] + [\mathbf{w}_F - \mathbf{w}\cdot\mathbf{L}] + \boldsymbol{\delta}\cdot\mathbf{m}\cdot(1 - \mathbf{L}) \qquad (7)$$

Thus, for given **m**, exploitation's existence depends on workers' effort beyond the *PNC* standard ($\boldsymbol{\varepsilon}_F$) and/or the reduction of wages below the *PNC* wage ($\mathbf{w}_F$). But any fall of **L** below unity (dropping *SL*) hurts profits.

Now examine determinants of $\boldsymbol{\varepsilon}$, before turning to those of **L**, **w**, and **m**. To simplify, let $\mathbf{w} = \mathbf{w}_F$ until §**4**. Thus, if $\boldsymbol{\varepsilon} = \boldsymbol{\varepsilon}_F$ then $\mathbf{r} \leq 0$.[17] As seen in (7) and §**4**, having $\mathbf{w} < \mathbf{w}_F$ is not necessary to formalize Marx's theory.[18]

[16] Assume that for given technology and **N**, the $(\mathbf{w}_F, \boldsymbol{\varepsilon}_F)$ duo is unique.[17] Allow $\mathbf{Z} \geq 0$. If $\mathbf{w}_F = \mathbf{w}$ and $\boldsymbol{\varepsilon} = \boldsymbol{\varepsilon}_F$, then $\mathbf{K}\cdot\mathbf{r} = (\mathbf{w}_F + \boldsymbol{\delta}\cdot\mathbf{m} - \mathbf{q}(\boldsymbol{\varepsilon}_F, \mathbf{m}))\cdot(1 - \mathbf{L}) = -\mathbf{Z}\cdot(1 - \mathbf{L})$. Thus, if $\mathbf{L} = 1$ or $\mathbf{Z} = 0$, then $\mathbf{r} = 0$. If $\mathbf{Z} > 0$ and $\mathbf{L} < 1$, $\mathbf{r} < 0$.

[18] Wage variations were not part of Marx's simple (static) theory of exploitation (1867: chs. 4-22). Further, in general, this paper ignores the case where $\mathbf{w} > \mathbf{w}_F$.

3. Subjection.

Since simply positing that **ε** is high enough for **r** > 0 does not truly explain exploitation's etiology, endogenize effort. The case where workers as a class enjoy effort enough to voluntarily produce a surplus for capitalists is not exploitation as defined above and is thus ignored.[19] Subjection must be introduced: capitalists use control of the labor process and management techniques – e.g., the threat of firing – to evoke effort.

Production. If workers were hired under complete contingent individual contracts agreed to with complete and certain information and zero transactions costs, Marx's distinction between labor and labor-power – and the relevance of **ε** – would evaporate. But most real-world production involves not only information problems and uncertainty but complex positive and negative externalities among individual worker efforts, implying that almost no work processes can be completely atomized and marketized.[20]

The employer's dilemma qualitatively differs from a textbook principal/agent problem: the firm's labor process is a miniature planned economy, with managers' efforts to control workers being limited by information and motivation problems stressed by the planning literature. Further, as with the old U.S.S.R., the vertical relationship between boss and employees is not democratic. Workers' collective goal can conflict with the boss' profit-seeking, so that the latter encourages worker free-riding (cf. Devine and Reich, 1981; Devine, 1993). That is, worker efforts to solve the planning problem in their interest via "voice" rather than "exit" conflict with the employer's interest, especially

[19] Thus, ignore cases (e.g., Sweden a few years ago), which some see as evoking voluntary production of a surplus.

[20] Effort-interdependency in production helps explain scale economies (cf. Marx, 1867, chs. 13–15).

when voice is expressed collectively. The results of this conflict depends on such factors as wages and unemployment.

For contrast, consider the efficiency wage hypothesis (*EWH*), i.e., that bosses raise **w** to promote **ε**. In the current context, the *EWH* runs into several snags. Higher **w** counteracts the profit-promoting effects of higher **ε**; not surprisingly, no article in Akerlof and Yellen (1986) mentions exploitation. Second, theories based on the advantages of wages that exceed those of other firms cannot apply in a *RC* model: we must focus on the absolute level of wages for capitalism as a whole.[21] Third, the *EWH* ignores the collective action problems of the previous paragraph.[22] Fourth, most *EWH* models assume *SL* (or ignore it), so unemployment cannot feed back to affect micro decisions.

Effort Extraction. This paper emphasizes the feedback. Similarly, **w** is assumed determined by macro-forces, not by individual firms. The *EWH* is replaced by the *COJL* theory, in which the cost of motivating effort is borne mostly by the unemployed.[23] The model starts with the effort extraction function:

$$\boldsymbol{\varepsilon} = \boldsymbol{\varepsilon}(\mathbf{c});\ \mathbf{e}_1 > 0;\ \mathbf{e}_{11} < 0;\ \boldsymbol{\varepsilon}(0) = \boldsymbol{\varepsilon}_F \quad (8)$$

Rising **c** (the *COJL*) induces increased effort, with diminishing returns. Other causes of rising **ε** such as "divide and conquer" management techniques are assumed to move with **c** or are ignored. The assumption that $\boldsymbol{\varepsilon}(0) = \boldsymbol{\varepsilon}_F$ (the *PNC* level) follows the premise that production of a surplus is involuntary. By (7) and $\mathbf{w} = \mathbf{w}_F$, $\mathbf{c} = 0$ implies that $\mathbf{S} = \mathbf{r} = 0$.

[21] Only some of the reasons for the *EWH* in Akerlof and Yellen (1986: 4-8) make sense in this context. The focus here is on "shirking."

[22] To Ash (2005), the *EWH* ignores collective action problems for the capitalist class as a whole.

[23] *RC* also pays a cost in the form of unused capacity. As seen below, profits are still positive.

Define the *COJL* as $\mathbf{w} - \mathbf{y}$, where $\mathbf{y}$ is what workers expect to earn if they quit or are fired. To Schor (1987: 176), $\mathbf{y}$ is a weighted average of the alternative wage available ($\mathbf{a}$) and unemployment benefits ($\mathbf{b}$). For example, $\mathbf{y} = \mathbf{a}\cdot(1 - \mathbf{U}) + \mathbf{b}\cdot\mathbf{U}$; $\mathbf{a}, \mathbf{b} \geq 0$, where $\mathbf{U}$ is the open and involuntary unemployment rate $(0 \leq \mathbf{U} = (1 - \mathbf{L}) \leq 1)$.[24]

In this model, $\mathbf{a}$ must be replaced by two different wages. First, for those getting jobs from *RC* after a spell of unemployment, the alternative wage is $\mathbf{w}$ (since workers are homogeneous). Second, some can survive (earning $\mathbf{z}$) via self-employment or work in non-capitalist and household-labor sectors (the *farm* in Roemer's (1985) variant of the Lewis (1954) model). Also, moving costs exist so that not all the unemployed can quickly exit the capitalist sector.

The story can be recast as involving currently-employed workers judging the expected cost of losing their jobs based on the situation of the entire workforce. There are three mutually-exclusive and exhaustive alternatives: working for capitalists (fraction $1 - \mathbf{U} - \boldsymbol{\varphi}$, receiving $\mathbf{w}$), unemployment (fraction $\mathbf{U}$, receiving $\mathbf{b}$), and farm jobs (fraction $\boldsymbol{\varphi}$, receiving $\mathbf{z}$). The expected fallback position is thus

$$\mathbf{y} = \mathbf{b}\cdot\mathbf{U} + \boldsymbol{\varphi}\cdot\mathbf{z} + \mathbf{w}\cdot(1 - \mathbf{U} - \boldsymbol{\varphi}) \text{ with } 0 \leq (\mathbf{U} + \boldsymbol{\varphi}) \leq 1 \text{ and } 0 \leq \boldsymbol{\varphi} \leq 1 \tag{9}$$

Thus, the expected average *COJL* for workers in the capitalist sector equals:

$$\mathbf{c} = \mathbf{w} - \mathbf{y} = (\mathbf{w} - \mathbf{z})\cdot\boldsymbol{\varphi} + (\mathbf{w} - \mathbf{b})\cdot\mathbf{U} \tag{10}$$

Thus, $\mathbf{c}$ combines the *wage gap* ($\mathbf{w} - \mathbf{z}$) and the *benefit gap* ($\mathbf{w} - \mathbf{b}$), both assumed non-negative.[25] In a week, $\boldsymbol{\varphi}$, $\mathbf{b}$, and $\mathbf{z}$ are constant.

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[24] *Open* unemployment refers to the jobless actively seeking jobs. *Involuntary* unemployment exists if the number of unemployed exceeds that of vacancies, so that no currently unemployed worker can get a job without one of the employed losing one. With zero vacancies, all open unemployment is involuntary.

[25] If either gap is negative, an exploitative capitalist sector would likely not exist, since so many workers would flee. Capitalists use political clout to avoid this fate. Assume that they succeed.

In the Lewis-Roemer model, the wage gap equals zero. Also, $\mathbf{U} = 0$, since Roemer saw unemployment's existence as unnecessary to exploitation. In another story (1982: 11) $\mathbf{U} > 0$ was allowed, but he assumed $\mathbf{w} = \mathbf{b}$. In either case, $\mathbf{c} = 0$. With $\mathbf{w} = \mathbf{w}_F$, this leaves no way to explain $\mathbf{r} > 0$ in the current model.

Instead, assume an anti-Roemerian case or *classical liberal capitalism* (*CLC*). Assume away both the social safety net and the farm rather than modeling them.[26] This simplifies the math without obvious loss of generality. With $\mathbf{b} = \boldsymbol{\varphi} = 0$, (10) becomes:

$$\mathbf{c} = \mathbf{U}\cdot\mathbf{w} = (1 - \mathbf{L})\cdot\mathbf{w} \tag{11}$$

Workers are totally proletarianized, with ultimately no way to survive except by selling labor-power to capitalists. In the short run, they can borrow, run down savings, sell consumer durables (such as houses), live off of relatives and friends, or steal. These allow temporary survival,[27] but they deplete personal nest-eggs, families, friendships, reputations, and the like, creating barriers to later prosperity. If unemployment is transitory, the burden is distributed across the working class as a whole. This is assumed, fitting the assumption of worker homogeneity.

4. Supremacy.

CLC helps to explain exploitation, but is insufficient: the fact that $\mathbf{L} < 1$ must be explained, along with the values of $\mathbf{w}$, $\boldsymbol{\varepsilon}$, and $\mathbf{L}$. Notably, dropping *SL* means that some surplus-product is not realized as profits. Central to the story is the *collective capitalist optimum* (*CCO*) where production and realization problems balance.

[26] This explains the assumed vertical **N** curve: on top of the canceling-out of substitution effects by income effects of wages for individuals, it reflects the lack of a farm or welfare state from which to attract workers.

[27] Wolff (1998: 144) estimates that in 1995 in the U.S., families with adults aged 25-45 in the middle income quintile could sustain their current consumption for 1.2 months based only on their financial reserves. Lower quintiles had more difficulty.

Though *NC* in style due to its equilibrium focus, the model resembles Robinson's Keynesian one (1962: 48ff) in the way that effective demand plays a role. There is more of a supply side than in her model, like that of Goodwin (1967). The model is Marxian in that aggregate demand follows accumulation and thus profitability (rather than wages and consumption). New to this kind of model are expectational adjustment and the potential gap between the micro-rationality of capitalists and macro-results for their class (non-attainment of *CCO*), as in collective goods models.[28]

§§**A** describes short-run determination of **r** with given **m**. Thus, **r** responds to changes in effective demand, measured by **L**. §§**B** introduces long-run considerations: **L** is determined by *expected* profit rate ($\mathbf{r^{ex}}$) during a year, while **m** varies. In §§***C***, mutual interaction between **L** and **r** implies possible macro-equilibria with $\mathbf{r} = \mathbf{r^{ex}}$.

A. Macro-Structure. To Marx, the profit rate does not arise simply from micro decisions; it also depends on the economy's structure. **ED** determines **w**, **ε**, **L**, and **μ** – and thus **r** and the *CCO*. Discuss each in turn.

Wages. Wage determination reflects the *effective supply* (**ES**) curve. This empirical regularity is not a *NC* supply of labor-power curve. Rather, it describes disequilibrium real wage determination absent *SL*: instead of scarcity alone determining them, wages and prices are established by the bargaining power of the two classes (Diamond, 1982; Soskice, 1983; Blanchflower and Oswald, 1994: 83-93). In the real world, for given **q** and relative to prices, workers resist nominal wage cuts, while *RC* tries to cut nominal

[28] While Ash (2005) points to the need for elite control to approach the CCO, the here emphasis is on the "automatic" adjustment of accumulation. Both apply, in complex combinations.

wages.[29] In this zero-inflation model, the two sides bargain over real wages. Either way, **ES** violates pure competition assumptions.[30]

For given **L** with $0 \leq \mathbf{L} \leq 1$, the **ES** is:

$$\mathbf{w} = \overline{\mathbf{w}} - \boldsymbol{\omega}(1 - \mathbf{L});\ \boldsymbol{\omega}(0) = 0;\ \boldsymbol{\omega}_1 \geq 0;\ \boldsymbol{\omega}_{11} \leq 0 \quad (12)$$

When $\mathbf{L} = 1$, $\mathbf{w} = \overline{\mathbf{w}}$, a benchmark wage.[31] To make the *PNC* case fit the general model, initially assume $\overline{\mathbf{w}} = \mathbf{w}_F$ (with $\boldsymbol{\varepsilon} = \boldsymbol{\varepsilon}_F$). Section **3** assumed a *horizontal effective supply* (*HES*) with $\boldsymbol{\omega}_1 = \boldsymbol{\omega}() = 0$ and $\mathbf{w} = \overline{\mathbf{w}}$. This fits one post-Keynesian theory,[32] one interpretation of Marx,[33] and the empirical weakness of a up-sloping **ES** at the macro level in Blanchflower and Oswald.[34] As seen below, *HES* does not undermine the model.

Effort. In fact, *HES* is more consistent than an extremely steep **ES** with the Marxian view of the reserve army of labor. From equations (8), (11), and (12),

$$\partial\boldsymbol{\varepsilon}/\partial\mathbf{L} = \mathbf{e}_1\cdot\{\boldsymbol{\omega}_1\cdot(1 - \mathbf{L}) - \mathbf{w}\} \quad (13)$$

This implies the possibility of a non-Marxian case ($\partial\boldsymbol{\varepsilon}/\partial\mathbf{L} > 0$): high $\boldsymbol{\omega}_1$ may mean that rising **L** can boost **w** and thus the cost of job loss so much that it boosts effort, swamping the $\mathbf{e}_1\cdot\mathbf{w}$ term (reflecting the "normal" impact of unemployment on effort). Thus, assume that **ES** is relatively flat, i.e.,

$$\text{assume that } \boldsymbol{\omega}_1\cdot(1 - \mathbf{L}) < \mathbf{w} \quad (14)$$

Thus, $\partial\boldsymbol{\varepsilon}/\partial\mathbf{L} < 0$. Further,

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[29] I use Soskice's (1983) vision of the **L** market, combining WRW and PRW curves in the **ES**.

[30] Similarly, dropping *SL* rules out pure competition by barring pure price-taking behavior.

[31] In Blanchflower and Oswald (1994: 5), $\ln(\mathbf{w}) = -0.1\cdot\ln(1 - \mathbf{L})$ + other terms. Thus, $\overline{\mathbf{w}}$ summarizes "other terms." Note that the $\boldsymbol{\varepsilon}()$ and the **ES** are assumed independent of each other.

[32] In the simplest Kalecki-Weintraub model, if the price mark-up over unit wage costs (**APL**/**w**) and the **APL** are constant, so is **w**.

[33] Marx (1867) assumes constant real wages, except in chapter 25.

[34] Data also reject the classical view (initially accepted by Keynes, 1936) that **w** falls as **L** rises.

$$\text{assume that } \partial^2\mathbf{e}/\partial\mathbf{L}^2 \geq 0 \tag{15}$$

It is reasonable for falling employment during a week to have decreasing returns in evoking effort. Sustained low employment would have a larger effect, ignored until below.[35]

<u>Employment</u>. Without *SL*, **L** depends on macro conditions: the aggregate quantity of output demanded (**D**) implies a *sales constraint* (**SC**) on **L** that is profitable to hire (Patinkin, 1965: ch. 13). *Effective demand* (**ED**) for **L** is less than or equal to *notional demand* for it (as implied by eq. 3).[36]

To specify the **SC**, assume putty-clay technology with **m** constant during a week.[37] Thus, $\mathbf{D} = \mathbf{q}(\boldsymbol{\varepsilon}\cdot\mathbf{L}, \mathbf{m}\cdot\mathbf{L})$, so that with *CRS*, the **SC** for **L** is:

$$\mathbf{L}^{\mathbf{d}} = \mathbf{D}/\mathbf{q}(\boldsymbol{\varepsilon}, \mathbf{m}) \tag{16}$$

The quantity of **L** demanded not does vary directly with **w**.[38] This constraint applies iff

$$\boldsymbol{\varepsilon}\cdot\mathbf{q}_1 \geq \mathbf{w} \tag{17}$$

Here $\mathbf{w}_N \equiv \boldsymbol{\varepsilon}\cdot\mathbf{q}_1$ is the notional wage for any given **L**, **m**, and **ε**. While (3) applies for $\mathbf{w} \geq \mathbf{w}_N$, otherwise **D** and the **APL** (= $\mathbf{q}(\boldsymbol{\varepsilon}, \mathbf{m})$) determine hiring.

To understand this, again assume **ε** given.[39] *Chart II* shows that the **ED** for **L** is the **MPL** curve left of point *N* and to the **SC** to the right, forming the angle *ANL*. To simplify, assume <u>SC is the only relevant constraint</u> and $\mathbf{L} = \mathbf{L}^{\mathbf{d}}$. That is,

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[35] The sign of $\boldsymbol{\omega}_{11}$ also assumes away increasing returns to falling **L** in depressing wages. In §4, it is assumed that *persistently high* unemployment reduces **w** and increases **ε**.

[36] Cf. Lavoie (2003). His "short run" has **K** and **μ** constant, but mine has **k** constant and **μ** not.

[37] This is used to formalize Sraffa's (1925: 327f) argument that instead of using all of a fixed input, it can be more efficient to utilize part of it more intensively when demand for output is low.

[38] Effective demand might slope upward as wages provide demand (cf. Lavoie, 2003) – or slope down because hiring decisions are based on *expected* wages which reflect current wages. But the point is that shifts in effective demand dominate movements along that curve.

[39] To ease comparison, the slope of $\partial\mathbf{Q}/\partial\mathbf{L}$ in *Charts II* and *III* is drawn equal to that in *Chart I*.

$$\text{assume that } \mathbf{w}_N > \mathbf{w} \geq 0 \tag{18}$$

This is likely if $\overline{\mathbf{w}}$ equals $\mathbf{w}_\mathbf{F}$, as assumed. The equilibrium wage $\mathbf{w}_\mathbf{E}$ is thus determined by **ES** and **ED** in *unemployment equilibrium*.[40] Unlike in *Chart I*, equilibrium *E* need not correspond to full-employment ***F***. Equilibrium varies with both **D** and **APL**.[41]

Chart II: **Short-Run Labor-Power Market, without Say's Law and with given ε**

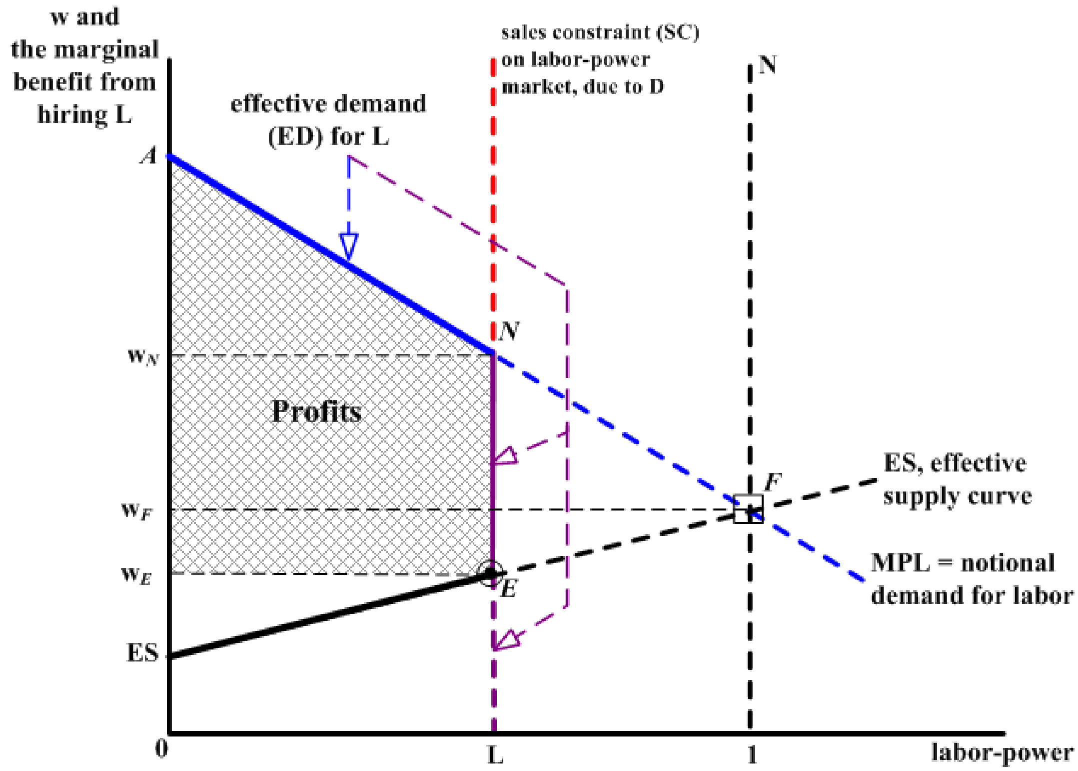

Chart III shows the exaggerated effects of an autonomous rise of **ε**. This [1] involves greater **MPL** at any **L**, boosting profit per worker. But [2] with given **D**, **L** falls

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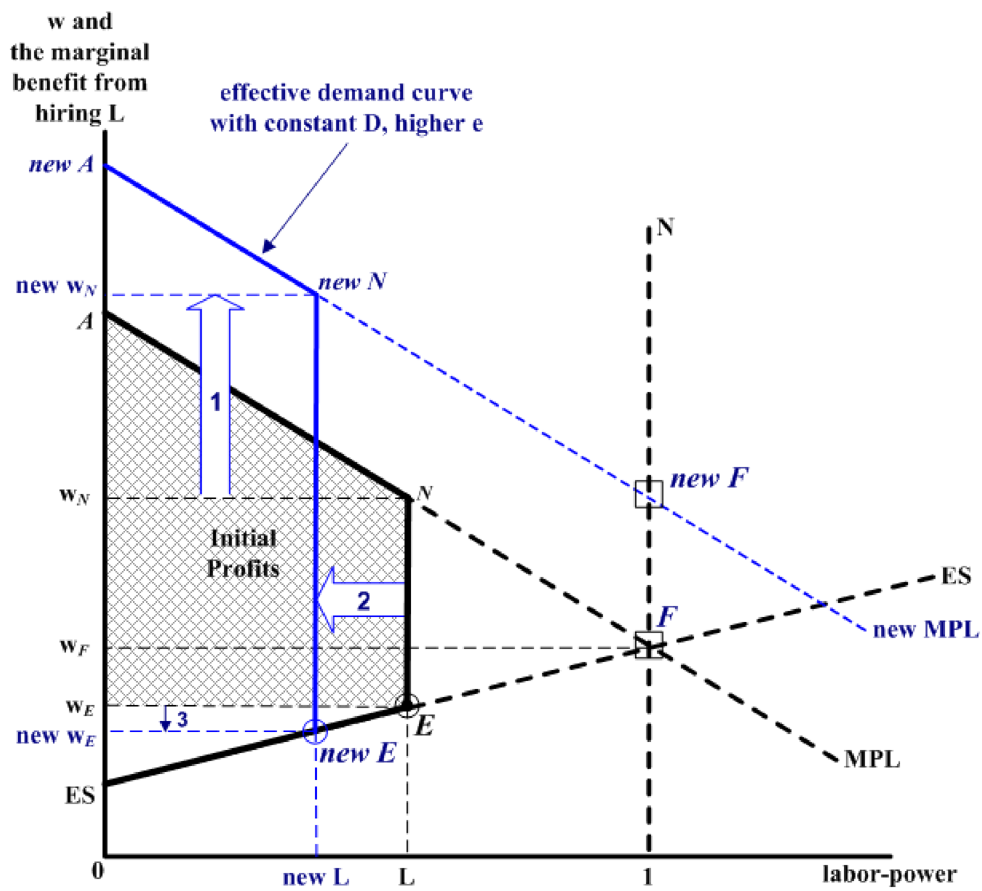
[40] In *NC* macroeconomics, **L** < 1 causes falling prices (not allowed by the model) and the real balance effect, shifting **SC** right even when spending is blocked by unused capacity, debt, pessimistic expectations, and the like, so that *E* is not truly an equilibrium (cf. Patinkin, 1965). The present model lacks nominal assets, so that this does not apply. In the real world, such outside money is relatively unimportant, while the negative effects of deflation can easily overwhelm the real balance effect (cf. Tobin, 1975).

[41] For the **SC** to be the only relevant constraint, the notional **MPL** curve (for given **ε**) and the **ES** must not intersect to the left of point *B* or fail to intersect completely. With $\overline{\mathbf{w}} = \mathbf{w}_F$ the slope of the **ES** must be less than that of the notional **MPL** curve (with given **ε**), so that $\boldsymbol{\omega}_1 > \boldsymbol{\varepsilon} \cdot \mathbf{q}_{11}$.

and cuts total profit. Falling **L** also [3] depresses $\mathbf{w}_E$ due to movement along **ES** and helps profit per worker. Finally, but not shown, following *NC* logic **ES** shifts up to keep $\overline{\mathbf{w}}$ equal to the new $\mathbf{w}_F$. This view is rejected here, so that $\overline{\mathbf{w}}$ is held constant during a week: by the principle of path dependency, short-run results (here, involuntary unemployment) help determine longer-run processes, so this kind of shift in the short run seems very unlikely, especially as an automatic economic process.[42] The actual result depends on the historical era, the specific institutions of labor relations, and the details of class struggle.

Chart III: Variable Effort and Changing ε, without Say's Law



[42] Table B-28 of the 2006 Economic Report of the President suggests that though the employee compensation share in income generally rose from the 1960s to the 1970s, it fell thereafter.

Chart III omits the endogenous impact of changing **L** on **ε**, which alters the link between **L** input and output. From (16), with **D** = **Q** (the binding **SC**),

$$\partial\mathbf{Q}/\partial\mathbf{L} = \mathbf{q}(\boldsymbol{\varepsilon}, \mathbf{m}) + \mathbf{L}\cdot\mathbf{q}_1\cdot\{\partial\boldsymbol{\varepsilon}/\partial\mathbf{L}\} \quad (19)$$

This marginal material benefit of hiring labor-power is positive if the **APL** exceeds the magnitude of the second term (which is negative by 14). In an *extreme Marxian case*, $\partial\mathbf{Q}/\partial\mathbf{L} < 0$ because falling **L** boost **c** so much that it actually raises output by raising **ε** drastically.[43] However, Okun's empirical "law" tells us to

$$\text{assume } \mathbf{q}(\boldsymbol{\varepsilon}, \mathbf{m}) > -\mathbf{L}\cdot\mathbf{q}_1\cdot\{\partial\boldsymbol{\varepsilon}/\partial\mathbf{L}\} \text{ for } 1 \geq \mathbf{L} \geq 0 \quad (20)$$

This allows the use of **L** as a proxy for **D** and **Q** below.

Utilization. Now consider capacity utilization. From the definitions of **μ** and **m**,

$$\boldsymbol{\mu} = \mathbf{m}\cdot\mathbf{L}/\mathbf{K} \quad (21)$$

Given the fixity of **K** and **m** during a week, **μ** moves in proportion to **L**. Thus, until **L** = 1, where bottlenecks hit, there are no diminishing returns to rising **L**: the **APL** is *constant* unless **ε** or **m** changes.[44] Equation (19) means that the $\partial\mathbf{Q}/\partial\mathbf{L}$ curve with given **ε** in *Charts II* and *III* should have been drawn as horizontal up to **L** = 1. In fact, if $\partial\mathbf{Q}/\partial\mathbf{L}$ is negative, it is entirely due to the fall in **ε** as **L** rises, i.e., the effects of falling **U** on **ε**.[45]

Profit rate. The macro-structure can be summarized by the determination of **r** by changes in **ED** for labor-power with given **m**. First, this profit rate is

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[43] The negative part of (19) involves small and second-order terms, so $\partial\mathbf{Q}/\partial\mathbf{L}$ is likely positive.

[44] This mirrors Sraffa's (1925) and Kalecki's (1939: 50) finding that the average and marginal cost curves are flat for $\boldsymbol{\mu} < 1$. Here, this also results from the *RC* assumption: with heterogeneous production processes, as **Q** rises, bottlenecks hit more and more firms, so that on aggregate, $\partial\mathbf{Q}/\partial\mathbf{L}$ falls and ∂(total costs)/$\partial\mathbf{Q}$ rises.

[45] $\partial^2\mathbf{Q}/\partial\mathbf{L}^2 = 2\cdot\mathbf{q}_1\cdot\{\partial\boldsymbol{\varepsilon}/\partial\mathbf{L}\} + \mathbf{L}\cdot[\mathbf{q}_{11}\cdot\{\partial\boldsymbol{\varepsilon}/\partial\mathbf{L}\} + \mathbf{q}_1\cdot(\partial^2\mathbf{e}/\partial\mathbf{L}^2)]$. $\{\partial\boldsymbol{\varepsilon}/\partial\mathbf{L}\}$ is negative, while $\mathbf{q}_1$ and the term in square brackets is positive (because $\mathbf{q}_{11} < 0$ and equation 14). For $\partial^2\mathbf{Q}/\partial\mathbf{L}^2$ to be negative, the first term must be larger in magnitude than the second.

$$\left.\begin{aligned}\mathbf{r} &= (\mathbf{D} - \mathbf{w}\cdot\mathbf{L} - \boldsymbol{\delta}\cdot\mathbf{m}\cdot\mathbf{L})/\mathbf{K} \\ &= \boldsymbol{\mu}\cdot(\mathbf{q}(\boldsymbol{\varepsilon}, \mathbf{m}) - \mathbf{w} - \boldsymbol{\delta}\cdot\mathbf{m})/\mathbf{m}\end{aligned}\right\} \quad (22)$$

where the second equation is restated per hour of labor-power hired. If $\mathbf{s}$ is profits per unit of labor-power hired, then $\mathbf{r} = \boldsymbol{\mu}\cdot\mathbf{s}/\mathbf{m}$.

The *Marxian Presumption* (*MP*) is that $\mathbf{r} > 0$ for some specific level of $\mathbf{L} < 1$, i.e., that exploitation exists. Given the *PNC* case with $\mathbf{r} = 0$ when $\mathbf{L} = 1$, the *MP* can only be valid if $\partial\mathbf{r}/\partial\mathbf{L} < 0$ at high levels of $\mathbf{L}$ near 1. From (22), and since $\boldsymbol{\delta}$, $\mathbf{K}$, and $\mathbf{m}$ are fixed,

$$\mathbf{K}\cdot\partial\mathbf{r}/\partial\mathbf{L} = \partial\mathbf{D}/\partial\mathbf{L} - [\mathbf{w} + \boldsymbol{\delta}\cdot\mathbf{m} + \mathbf{L}\cdot\boldsymbol{\omega}_1] \quad (23)$$

By (20), the first term is positive: as $\mathbf{L}$ falls, total profits fall (as with effect #2 in *Chart III*). But the bracketed term fits the *MP*, so that profits per worker rise as $\mathbf{L}$ falls (as with effects #1 and #3). This includes the fall of total labor costs (the $\mathbf{w}$ term) and of depreciation costs of using machines (the $\boldsymbol{\delta}\cdot\mathbf{m}$ item) that occur due to falling $\mathbf{L}$, plus the actual fall in $\mathbf{w}$ (the $\mathbf{L}\cdot\boldsymbol{\omega}_1$ item) due to the **ES** shifting. Next, use (19) to restate (23) as:

$$\mathbf{K}\cdot\partial\mathbf{r}/\partial\mathbf{L} = \mathbf{s} + \mathbf{L}\cdot\{\mathbf{q}_1\cdot(\partial\boldsymbol{\varepsilon}/\partial\mathbf{L}) - \boldsymbol{\omega}_1\} = \mathbf{s} + \mathbf{L}\cdot\mathbf{x} \quad (24)$$

At $\mathbf{L} = 1$, $\mathbf{s}$ equals 0, since $\boldsymbol{\varepsilon} = \boldsymbol{\varepsilon}_F$ and $\mathbf{w} = \mathbf{w}_F$. Since a decrease in $\mathbf{L}$ evokes a rise in $\boldsymbol{\varepsilon}$ and a fall in $\mathbf{w}$, i.e., since $\mathbf{x} = \{\mathbf{q}_1\cdot\{\partial\boldsymbol{\varepsilon}/\partial\mathbf{L}\} - \boldsymbol{\omega}_1\} < 0$, we see $\partial\mathbf{r}/\partial\mathbf{L} < 0$. This validates the *MP*.

The negative value of $\mathbf{x}$, and the *MP*'s validity, does not require that wages fall with $\mathbf{L}$ (i.e., that $\boldsymbol{\omega}_1 > 0$), as in the dynamic part of Marx's theory of exploitation (1867: ch. 25). Nor is it dependent on the inciting of effort caused by falling $\mathbf{L}$. A non-horizontal **ES** can substitute for $\mathbf{e}_1 > 0$, or *vice-versa*. But we cannot drop *both* relationships.

The *CCO*. As $\mathbf{L}$ falls, the second, negative, term in (24) becomes smaller in magnitude (directly due to falling $\mathbf{L}$, plus diminishing returns in the $\boldsymbol{\varepsilon}$ and $\boldsymbol{\omega}$ functions) while $\mathbf{s}$ gets larger, so that eventually $\partial\mathbf{r}/\partial\mathbf{L}$ becomes positive. Thus, the profit rate can be graphed as an inverted U-shaped curve, as with $\boldsymbol{\rho}$ in *Charts IV* and *V* below. The maximum profit rate ($\mathbf{r}_C$) and the *CCO* are achieved where:[46]

$$\mathbf{L}_C = -\mathbf{s}/\mathbf{x} \tag{25}$$

when the denominator is non-zero. Because $\mathbf{x} < 0$, $\mathbf{L}_C > 0$ when $\mathbf{s} > 0$. In turn, due to (22) and (16):

$$\mathbf{r}_c = -\mathbf{s}^2/\mathbf{K}\cdot\mathbf{x} \tag{26}$$

This is positive, unless $\mathbf{s} = 0$ as in the *PNC* case.

Note that if $\boldsymbol{\varepsilon}$ or $\mathbf{w}$ responds more to changes in $\mathbf{L}$, i.e., if the effort-response curve and/or the wage-curve is steeper, that implies that $\mathbf{L}_C$ is closer to 1. Similarly, a higher value of profits per unit of labor-power hired ($\mathbf{s}$) implies a higher value of $\mathbf{L}_C$. Capitalism can afford higher $\mathbf{L}$ if the reserve army is more efficient at inducing the production of profits, i.e., if any unemployment rate is associated with a higher cost of job loss or that cost is more salient.[47] This also boosts $\mathbf{r}_c$.

Simplify the determination of $\mathbf{r}$ by $\mathbf{L}$ using following functional form:

$$\mathbf{r} = \mathbf{r}_c(\mathbf{m}) + \boldsymbol{\rho}(\mathbf{L}, \mathbf{m}), \text{ where } \boldsymbol{\rho}(\mathbf{L}_C, \mathbf{m}) = 0 \tag{27}$$

In *Charts IV* and *V*, point ***C*** represents the *CCO*. The situation where $\mathbf{L} < \mathbf{L}_C$ is the *Keynesian zone* (K-zone): realization (**ED**) problems dominate so that rising $\mathbf{L}$ is associated with rising $\mathbf{r}$ ($\boldsymbol{\rho}_1 > 0$; cf. Robinson, 1962: 48ff). $\mathbf{L} > \mathbf{L}_C$ defines the *Marxian zone* (M-zone): Marx's story of wage squeezes on profits as $\mathbf{L}$ rises prevails ($\boldsymbol{\rho}_1 < 0$), with falling $\boldsymbol{\varepsilon}$

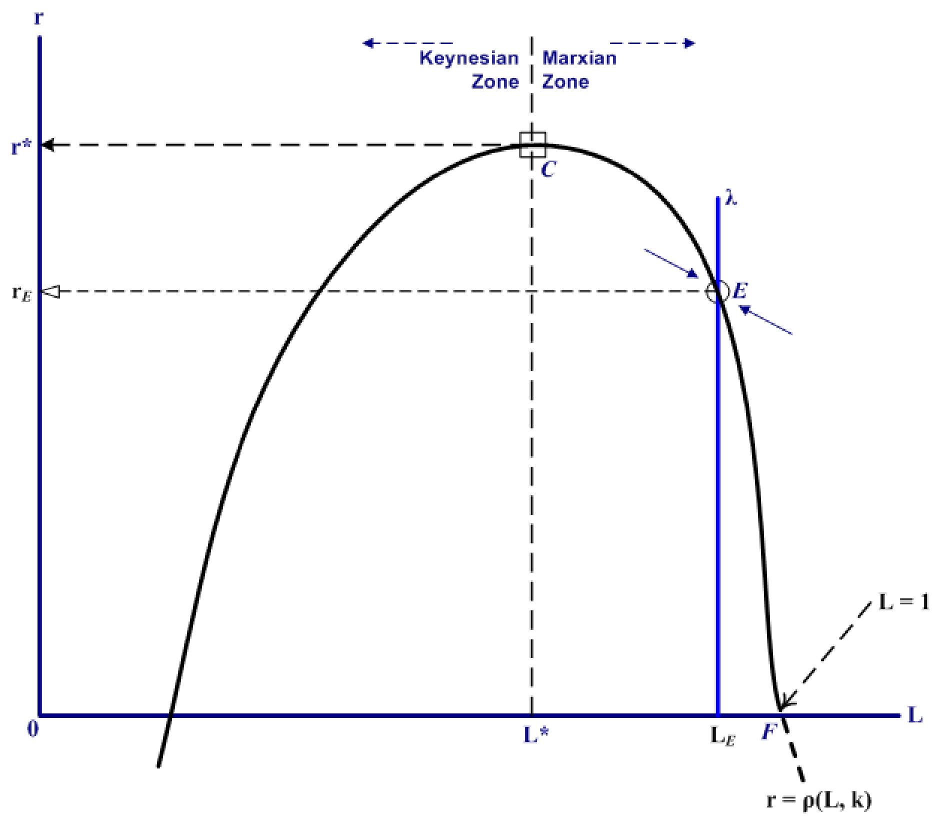
[46] This is a maximum if $\mathbf{L}_C\cdot([\mathbf{q}_{11}\cdot\{\partial\boldsymbol{\varepsilon}/\partial\mathbf{L}\}] + \mathbf{q}_1\cdot(\partial\mathbf{e}^2/\partial^2\mathbf{L}) - \boldsymbol{\omega}_{11}) > 2\cdot\{\mathbf{q}_1\cdot\partial\boldsymbol{\varepsilon}/\partial\mathbf{L} - \boldsymbol{\omega}_1\}$. This condition is met because $\mathbf{q}_{11}$, $\partial\boldsymbol{\varepsilon}/\partial\mathbf{L}$, and the RHS are negative (by equations 1, 13, and 11), $\boldsymbol{\omega}_{11}$ is non-positive (by 11), and $\mathbf{q}_1$ and $\partial\mathbf{e}^2/\partial^2\mathbf{L}$ are non-negative (by 1 and 14).

[47] All else constant, rising $\mathbf{L}_C$ implies a lower NAIRU (cf. Devine, 2000).

reinforcing the profit-squeeze effect (cf. Goodwin, 1967).[48] This is a version of Robinson's "inflation barrier" for a non-monetary, non-inflationary economy.[49]

B. Accumulation. Even though the possibility of **r** > 0 was indicated, §§**A** could not demonstrate that the *actual* **r** is positive, since it cannot be assumed *a priori* that **L** < 1. Thus, the capitalist control of **L** must be examined.

Chart IV: The Simplest Equilibrium Case.



In the simplest case, **λ** (the demand for **L**) is zero unless the profit rate is expected to be positive, in which case $\mathbf{L}^d = \lambda > 0$. Following adaptive expectations (cf. eq. 39, below), if **r** is steadily positive, $\mathbf{r}^{ex} > 0$ prevails. This case appears in *Chart IV*: given **λ** determines both the demand for labor and the profit rate at equilibrium point ***E*** ($\mathbf{L}_E$, $\mathbf{r}_E$). As

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[48] In a monetary economy, if capitalists pursue a target profit rate, the M-zone spurs inflation (as with a Phillips curve), with a fall in $\mathbf{r}_C$ encouraging stagflation, i.e., a rightward shifting Phillips curve and a falling $\mathbf{L}_C$ seen as a rising NAIRU (cf. Devine, 2000).

[49] See Backhouse (2003) for a useful sketch of Robinson's growth theory.

discussed in §§**C** below, and as indicated by the solid arrows in the diagram, *E* is stable as drawn, with $1 > \mathbf{L}_E > \mathbf{L}_C$. However, we cannot assume that $\boldsymbol{\lambda}$ is always such that $1 > \mathbf{L}_E$ and $\mathbf{r} > 0$. There is also no reason to assume that $\mathbf{L} = \mathbf{L}_C$ so that the *CCO* is attained.

To make the story more complete, explicitly introduce the determination of $\boldsymbol{\lambda}$ and role of time. During a year, **K** and **m** vary, following profit-seeking. Thus, key variables taken as given during a week are determined by longer-run decisions.

Collective Action Problem. With a simple partial-adjustment model of investment (cf. eq. 31, below), *RC* adjusts **K** to attain $\mathbf{K}^{\mathbf{d}}$, the desired machine stock. To determine $\mathbf{K}^{\mathbf{d}}$, *RC* uses data seen during a week. The macro constraints on the demand and supply sides cannot be abolished on the micro level: the firm cannot choose **ED** level or **r**. Further, **w** is parametric, while $\boldsymbol{\varepsilon}$ is not seen as changing with **L**. Without omniscience or omnipotence, *RC* cannot reach the *CCO* point except by accident.

RC takes relative input costs ($\mathbf{w}_E$ and $\boldsymbol{\delta}$), $\mathbf{e}_E$, and capacity utilization ($\boldsymbol{\mu}_E$) as determined by the short-run equilibrium described in §§**A** (given **K**, **m** and **D**). Let $\bar{\mathbf{r}}_E$ be the *standardized* profit rate in the current equilibrium, measured at a standard utilization rate ($\boldsymbol{\mu} = 1$), but with short-run equilibrium values for $\boldsymbol{\varepsilon}$ and **w**. Thus,

$$\bar{\mathbf{r}}_E = \quad (\mathbf{q}(\mathbf{e}_E, \mathbf{m}) - \mathbf{w}_E - \boldsymbol{\delta}\cdot\mathbf{m})/\mathbf{m} \quad = \quad \mathbf{s}_E/\mathbf{m} \tag{28}$$

Note that the *actual* profit rate $\mathbf{r}_E = \boldsymbol{\mu}_E \cdot \bar{\mathbf{r}}_E$. Thus, with adaptive expectations, $\bar{\mathbf{r}}_E$ and $\boldsymbol{\mu}_E$ help to determine the expected standardized profit rate ($\bar{\mathbf{r}}^{\mathbf{ex}}$), the expected capacity use rate ($\boldsymbol{\mu}^{\mathbf{ex}}$), and the expected actual profit rate $\mathbf{r}^{\mathbf{ex}}$, the main determinants of accumulation.

In a year, *RC*'s goal differs from that in §**2**. In a week, *RC* treats total profit $\mathbf{r}\cdot\mathbf{K}$ as the opportunity cost of having money tied up in a specific industry. But during a year, it treats it as determining the *benefit* of net investment: during a week *RC* gets scarcity rents, while between weeks, it seeks to acquire more. *RC* seeks to maximize the expected mass of profits achieved when *RC* attains the desired stock of machines:

$$\mathbf{S}^{\mathbf{ex}} = \boldsymbol{\mu}^{\mathbf{ex}} \cdot \bar{\mathbf{r}}^{\mathbf{ex}} \cdot \mathbf{K}^{\mathbf{d}} \tag{29}$$

Taking $\boldsymbol{\mu}^{\mathbf{ex}}$ as given by current conditions, $\bar{\mathbf{r}}^{\mathbf{ex}} > 0$ means that *RC* seeks to increase $\mathbf{K}^{\mathbf{d}}$ (and **M,** since it is expected to increase in step). *RC* enlarges **K** without limit, pulling **L** toward unity: the **λ** curve corresponds to the horizontal axis of *Chart IV* or *V*. If *RC* gets its way, **K** scarcity would evaporate, as would exploitation. This movement can be seen as an extreme case of Marx's (1896, ch. 13) tendency for the profit rate to fall.

The existence of exploitation is thus a collective good for capitalists, with simple profit-seeking being free-riding. One solution would be to create a big cartel to preserve exploitation by restricting **λ**. But assume away this empirically-unlikely solution.[50]

The incomplete use of capacity posited as normal here might discourage any new investment in machinery: if $\boldsymbol{\mu}^{\mathbf{ex}}$ is low, a large **K** is unlikely to be desired, since its benefits can largely or entirely be attained by raising **μ** instead, if **ED** allows this tactic to be applied. However, as long as $\bar{\mathbf{r}}^{\mathbf{ex}} > 0$, i.e., as long as there is a possibility of garnering profits merely for owning **K**, there will be a tendency for *RC* to invest without limit, more than balancing that discouragement. Only in Depressions with extreme idle capacity (and debt and pessimism) or during class war, would investment be totally blocked. In the *NC* spirit, ignore those cases, to focus instead on overaccumulation driving profits to zero.

Adding Realism. Realistic considerations moderate the tendency toward overaccumulation.[51] In Capital (vol. *I*, ch. 25), Marx assumed *SL* applied so falling profit rates

[50] This solution to Ash's (2005) problem would get us far beyond the *CLC* case.

[51] Over-investment is encouraged by the structural pressures arising from rivalrous competition and class antagonisms (cf. Devine, 1980, ch. 4). In the *NC* spirit, this is ignored.

automatically cause falling accumulation rates because investment was determined by saving, itself based on profits. Here, with fixed investment assumed to be determined independent of saving (à la Keynes), more complete examination is needed.

First, as investment rises, each firm sees increasing risk (Kalecki, 1937). The degree of uncertainty attached to the expected profit rate rises. Further, Pindyck sees irreversible investment projects as call option decisions. Each will be delayed until its present value exceeds its purchase and installation cost "by an amount equal to the value of keeping the investment option alive" (1991: 1112). So large increases in **K** become increasingly deterred and must be compensated for by higher $\mathbf{r^{ex}}$. Thus, $\mathbf{K^d}$ does not jump to infinity as $\mathbf{r^{ex}}$ rises above zero. Instead, it rises gradually, as with the following:

$$\mathbf{K^d} = \mathbf{h}(\bar{\mathbf{r}}^{\mathbf{ex}}, \boldsymbol{\mu}^{\mathbf{ex}}, \text{etc.});\ \mathbf{h_i} > 0;\ \mathbf{h_{ii}} < 0, \text{ for } \mathbf{i} = 1, 2 \qquad (30)$$

Here, "etc." refers to other factors such as real interest rates.

Second, even though saving does not determine investment, it sets limits. The rampant insecurity of their lives under *CLC* means that on aggregate, workers do not save (cf. Sweezy, 1942: 139-40, 140n). Without a financial system, investment cannot exceed that allowed by **r**. The only relevant cases would be those on or under the **ρ** curve. Introducing a financial system (in which borrowed money need not be paid back immediately) allows a range of relevant cases somewhat above **ρ**. The further above the curve the economy operates, however, the higher interest rates will be. This again restricts the ability to accumulate without limit but will be ignored in the formal model.

Third, based on the costs of purchase, production, installation, debugging, and the like, supply-side bottlenecks (including wage hikes) limit the expansion of **K**, becoming more important as **μ** rises. So gross investment follows a partial-adjustment process:

$$\Delta\mathbf{K} + \mathbf{I_R} = \boldsymbol{\alpha}(\mathbf{K^d} - \mathbf{K_{-1}}) + \boldsymbol{\delta}\cdot\mathbf{K_{-1}} \qquad (31)$$

where $\mathbf{K_{-1}}$ is machinery left from the previous week, $\mathbf{I_R}$ = replacement investment, and $\boldsymbol{\alpha}$ is the partial adjustment function, with $\boldsymbol{\alpha} = \boldsymbol{\alpha}(\boldsymbol{\mu})$ and $\boldsymbol{\alpha_1} < 0$. Simplify by assuming zero scrapping, so that $\mathbf{I_R} = \boldsymbol{\delta}\cdot\mathbf{K_{-1}}$. Then, equations (30) and (31) imply that

$$\mathbf{K} = \boldsymbol{\alpha}(\mathbf{h}(\bar{\mathbf{r}}^{ex}, \boldsymbol{\mu}^{\mathbf{ex}}, \text{etc.}) - \mathbf{K_{-1}}) + \mathbf{K_{-1}} \qquad (32)$$

This in turn determines the **ED** for labor-power during a week:

$$\mathbf{L} = [\boldsymbol{\alpha}\{\mathbf{h}(\bar{\mathbf{r}}^{ex}, \boldsymbol{\mu}^{\mathbf{ex}}, \text{etc.}) - \mathbf{K_{-1}}\} + \mathbf{K_{-1}}]/\mathbf{m^d} \qquad (33)$$

where $\mathbf{m^d}$ is the desired machine/labor-power ratio.

The fourth limit appears in determining $\mathbf{m^d}$. Even as it seeks rents, it minimizes costs during each week. Cost minimization determines "factor proportions" given the weekly input costs ($\mathbf{w}_E$ and $\boldsymbol{\delta} + \mathbf{r}$),[52] subject to the constraint that $\mathbf{D} = \mathbf{q}(\boldsymbol{\varepsilon}\cdot\mathbf{L}, \mathbf{M})$:

$$\mathbf{w}_E/\boldsymbol{\varepsilon}\cdot\mathbf{q_1} = (\boldsymbol{\delta} + \mathbf{r})/\mathbf{q_2} \qquad (34)$$

As in textbooks, $\mathbf{m^d}$ rises as $\mathbf{w}_E/(\boldsymbol{\delta} + \mathbf{r})$ rises for given $\boldsymbol{\varepsilon}$:

$$\mathbf{m^d} = \boldsymbol{\kappa}(\mathbf{w}_E/(\boldsymbol{\delta} + \mathbf{r})); \ \boldsymbol{\kappa_1} > 0; \ \boldsymbol{\kappa_{11}} < 0 \qquad (35)$$

Treat the profit rate **r** as constant here because Given constant $\boldsymbol{\delta} + \mathbf{r}$, the upward slope of **ES** encourages rising $\mathbf{m^d}$ with **L**. This lowers **L** demanded relative to **M** as **L** rises, moderating its infinite increase with $\mathbf{r^{ex}}$. In addition, falling $\boldsymbol{\varepsilon}$ as **L** and **w** rise encourages *RC* to raise **m** to spur effort, following Marx.[53] If $\mathbf{m^d}$ is realized, the $\boldsymbol{\rho}$ curve would be tilted a bit, with lower profit rates, *ceteris paribus*, as **L** and thus **m** rises. This does not change the basic story and will be ignored in the model.

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[52] In the short run, as before, "normal" profits are treated as an opportunity cost.

[53] If $\boldsymbol{\chi}$ is the effort-evoking benefit to *RC* of machine use, then the unit net cost of using machines is $(\boldsymbol{\delta} + \mathbf{r} - \boldsymbol{\chi})$. Assume that $\boldsymbol{\chi} < \boldsymbol{\delta} + \mathbf{r}$. Then, (33) would be $\mathbf{w}_E/\boldsymbol{\varepsilon}\cdot\mathbf{q_1} = (\boldsymbol{\delta} + \mathbf{r} - \boldsymbol{\chi})/\mathbf{q_2}$ instead. Again, $\mathbf{k^d}$ rises with **L** and **w**, *ceteris paribus*.

The generally positive connection between the expected profit rate and the demand for labor-power should survive these realistic effects. Thus,

$$\mathbf{L^d} = \lambda(\bar{\mathbf{r}}^{ex}, \boldsymbol{\mu}^{\mathbf{ex}}, \mathbf{w}, \mathbf{K_{-1}}, \text{etc.}) = \lambda(\mathbf{r^{ex}}, \text{etc.});\ \boldsymbol{\lambda}_1 \geq 0 \qquad (36)$$

This is the up-sloping **λ** curve that appears in *Chart V* below, with diminishing returns. Equilibrium with **L** = 1 can occur precisely because capitalism is not an ideal system that instantly grabs all profit opportunities. Forces exist that push toward zero profits, but "frictions" that cannot be abolished usually prevent that polar case from being realized. Nonetheless, the *PNC* zero-profit case (point ***F***) can also happen.

C. Equilibrium. Devine (1980: ch. 4) applied a model similar to that of *Chart V* with two or more equilibria and the two curves shifted for endogenous reasons. This implied cycles and the chance of lasting Depression. In the *NC* vein, focus on a model with a unique stable equilibrium (given parameters). Also, ignore issues of curve shifts except for the analysis of the possible movement to steady-state growth.

Short-Run Equilibrium. Short-run equilibrium at equilibrium ($\mathbf{r}_E$, $\mathbf{L}_E$) reflects the combination of the **λ** and **ρ** functions, equations (36) and (27):

$$\mathbf{L_E} = \lambda(\mathbf{r^{ex}}, \text{etc.}) \qquad \text{and} \qquad \mathbf{r_E} = \mathbf{r}_c + \boldsymbol{\rho}(\mathbf{L_E}) \qquad (37)$$

Uniting them is expectational equilibrium:

$$\mathbf{r^{ex}} = \mathbf{r}_E \qquad (38)$$

If conditions (37) and (38) are met, $\lambda(\mathbf{r^{ex}})$ indicates a level of employment **L** that, via the **ρ** function implies an **r** equal to that expected: *RC* expects what actually happens, so that expectations are validated and equilibrium persists. Given imperfect information, fundamental uncertainty, and a complicated economy, such an equilibrium is extremely difficult to attain. Again in the *NC* style, assume that it can be achieved.

Chart V: Profitability and Employment.

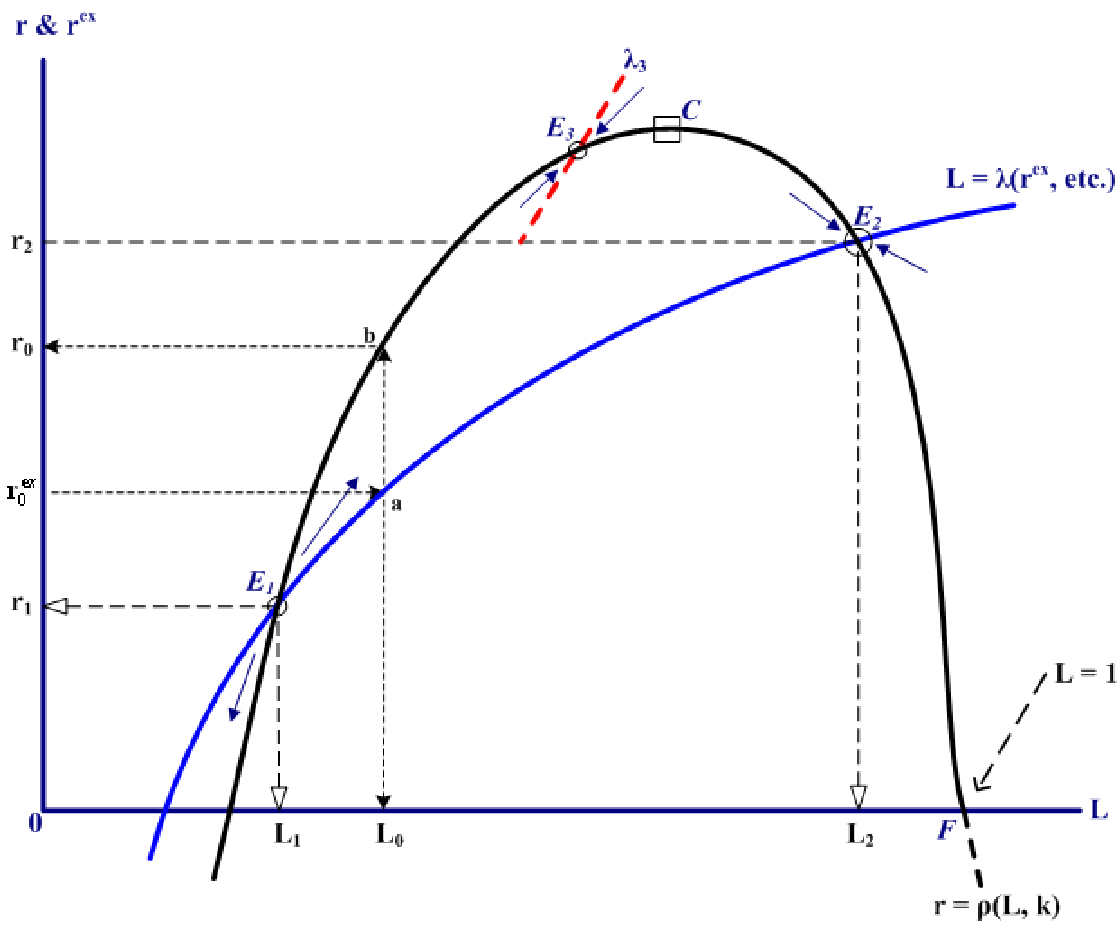

Chart V shows two short-run equilibria, $\boldsymbol{E_1}$ and $\boldsymbol{E_2}$. To understand their stability, assume that for deviations from equilibrium, adaptive expectations[54] apply:

$$\mathbf{r}^{\mathbf{ex}} = \mathbf{r}_{-1}^{ex} + \boldsymbol{\beta}(\mathbf{r} - \mathbf{r}_{-1}^{ex}) \tag{39}$$

where $\mathbf{r}$ is the profit rate this week, $\mathbf{r}_{-1}^{ex}$ is what was expected in the previous week and $\boldsymbol{\beta}$ is the partial-adjustment function between weeks ($1 > \boldsymbol{\beta}_1 > 0$).

Short-run stability analysis is seen for a given $\mathbf{r}_0^{ex}$ in *Chart V*. By function $\boldsymbol{\lambda}$, this generates employment $\mathbf{L_0}$ at point ***a***. This implies an actual profit rate $\mathbf{r_0}$ at point ***b***. Since $\mathbf{r_0} > \mathbf{r}_0^{ex}$, by (38), $\mathbf{r}^{\mathbf{ex}}$ rises. So $\mathbf{L}$ and $\mathbf{r}$ rise, away from $\boldsymbol{E_1}$: the equilibrium is unstable. Ad-

[54] Assuming "rational" expectations reveals absolutely nothing about stability.

justment is shown by solid arrows. On the other hand, $\boldsymbol{E_2}$ is stable. Therefore, short-run equilibrium is stable if **ρ** cuts the **λ** curve from above, that is, iff:

$$\boldsymbol{\rho_1 > \lambda^{-1}(L)} \tag{40}$$

This assumes, of course, that the **λ** function can be inverted.

Stable equilibria are possible in both the K- and M- zones or at ***C***. The former can occur if the **λ** curve is steeper than **ρ**, as with the dashed $\boldsymbol{\lambda_3}$ line in *Chart V*. A stable short-run *PNC* equilibrium is also possible at point ***F***.

Steady States. To bring in issues of long-run growth, introduce Harrod-neutral, effort-augmenting, technical change[55] to the *CRS* production function:

$$\mathbf{Q} = \mathbf{q}(\boldsymbol{\theta}\cdot\mathbf{E}, \mathbf{M}) = \boldsymbol{\theta}\cdot\mathbf{L}\cdot\mathbf{q}(\boldsymbol{\varepsilon}, \hat{\mathbf{m}}) \quad \text{where } \boldsymbol{\theta}_\mathbf{T} = e^{\boldsymbol{\eta}\cdot\mathbf{T}} \tag{41}$$

where **θ** is the effort-augmenting factor, **η** is its growth rate and **T** is time; **θ** equals unity in the base year (**T** = 0). Here, $\hat{\mathbf{m}}$ is machines per “effective worker” (**M/θ·L**). Also assume that **N** rises at rate **n**:

$$\mathbf{N}_\mathbf{T} = e^{\mathbf{n}\cdot\mathbf{T}} \tag{42}$$

where **N** equals unity in the base year.[56] Assuming both **n** and **η** exogenously given and constant, Harrod’s “natural” rate of growth is also fixed:

$$\mathbf{G}_\mathbf{S} = \mathbf{n} + \boldsymbol{\eta} \tag{43}$$

This steady-state growth rate equals that of employment demand ($\mathbf{G}_L$) which is required to keep the employment rate ($\boldsymbol{\ell}$ = **L**/**N**) constant.

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[55] Hicks neutral technical change is not considered here. It is unlikely to change the results.

[56] All formulas above which assumed **N** = 1 must be modified.

The *NC* condition for steady-state growth with constant $\hat{\mathbf{m}}$ (Solow, 1956) sets saving (net of depreciation) per worker employed equal to the net investment per worker required to keep $\boldsymbol{\ell}$ constant:

$$\text{(net saving)}/\mathbf{L} = \hat{\mathbf{m}}\cdot\mathbf{G}_S \qquad (44)$$

Under *SL*, of course, saving determines investment.[57]

Contrary to popular assumption, steady-state growth does not imply full employment of labor-power or capacity: instead, $\boldsymbol{\ell}$ and $\boldsymbol{\mu}$ are *constant*. Thus, $\mathbf{G}_L = \mathbf{G}_S$ can correspond to the short-run equilibrium in *Chart II*, with positive involuntary unemployment, profits, and exploitation. The question, of course, is whether or not it does so.

Dropping *SL*, investment must replace saving. Steady-state equilibrium is instead:

$$\mathbf{G}_K = \mathbf{G}_S \qquad (45)$$

where, from equations (31) and (32):

$$\mathbf{G}_K = \Delta\mathbf{K}/\mathbf{K}_{-1} = \boldsymbol{\alpha}(\mathbf{h}(\bar{\mathbf{r}}^{ex}, \boldsymbol{\mu}^{ex}, \text{etc.})/\mathbf{K}_{-1} - 1) = \mathbf{g}(\mathbf{r}^{ex}, \text{etc.});\ \mathbf{g}_1 > 0 \qquad (46)$$

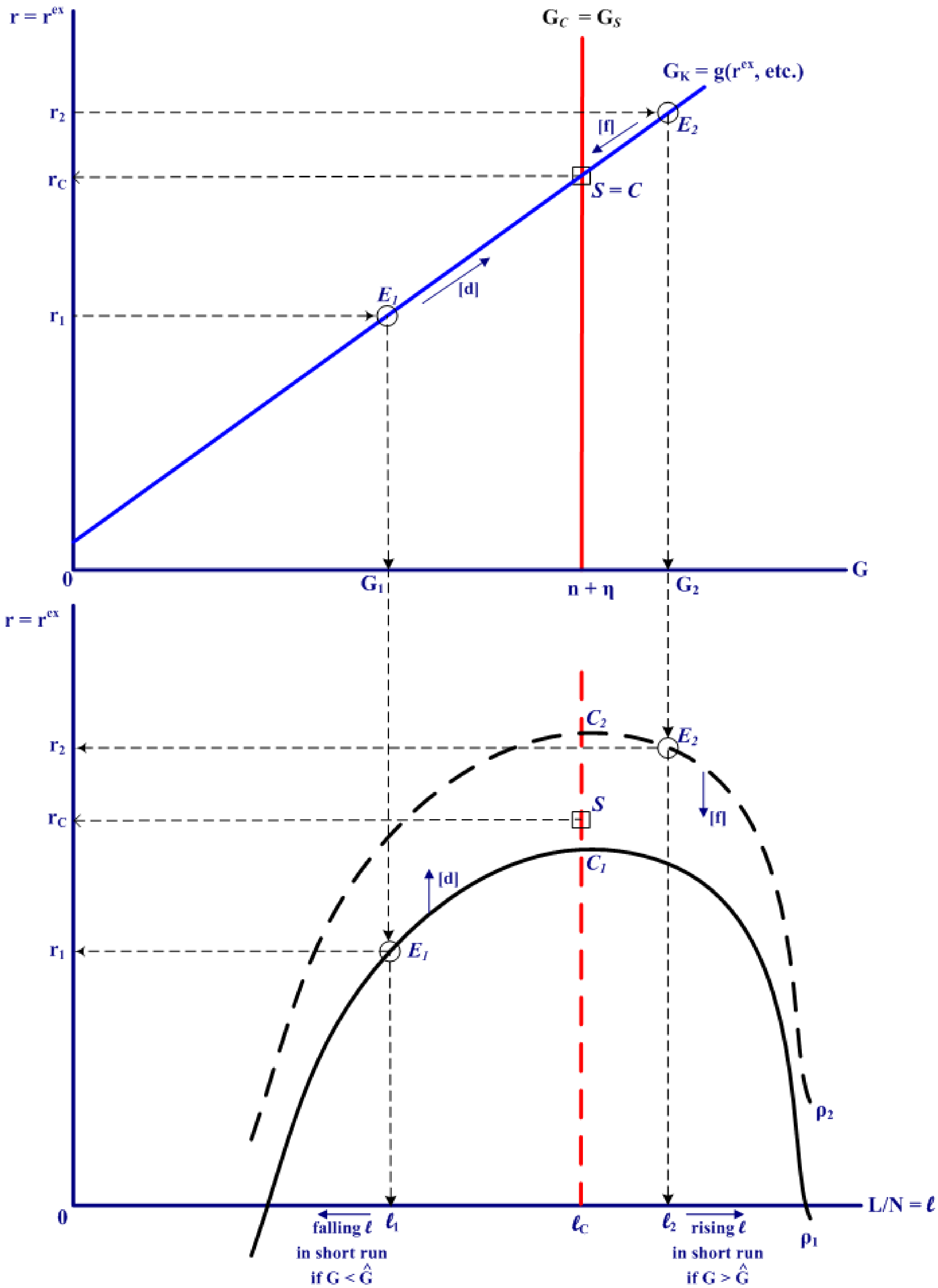
With constant $\hat{\mathbf{m}}$, this equals $\mathbf{G}_L$.

If Chart V were redrawn with $\boldsymbol{\ell}$ on the abscissa, the steady-state growth rate $\mathbf{G}_S$ would appear as a vertical line, as with the dashed line in the lower part of *Chart VI*. But actual $\boldsymbol{\ell}$ is unknown and need not coincide with ***C*** or any other specific point on $\boldsymbol{\rho}$. Thus, the chart cannot stand alone for dynamic analysis.

So use *Chart VI*. The short-run equilibrium growth rate $\mathbf{G}_E = \mathbf{G}_K = \mathbf{G}_L$ need not equal $\mathbf{G}_S$ even with constant $\hat{\mathbf{m}}$. (Drop the E subscript for simplicity.) To understand adjustment (or lack thereof) to steady-state equilibrium, assume the actual and expected profit rates are equal, as in short-run equilibria, here assumed to be stable.

[57] *CLC* rules out perfectly-executed macro-policy aimed at maintaining steady-state growth.

Chart VI: Profitability and Accumulation.



Then follow a three-step procedure, considering: *(i)* labor-market change due to $\mathbf{G} \neq \mathbf{G}_S$; *(ii)* the resulting shorter-term movement along the $\boldsymbol{\rho}$ curve, causing changes in **G**; and *(iii)* longer-term shifts in $\boldsymbol{\rho}$ due to *persistent* high or low $\boldsymbol{\ell}$, causing changes in $\mathbf{r_c}$, $\mathbf{G}_K$, $\hat{\mathbf{m}}$, and $\mathbf{G}_S$.

To start, assume that $\mathbf{G}_S = \mathbf{G}_C$, attaining the *CCO* as in *Chart VI*. In the top of *Chart VI*, at a given low profit rate, $\mathbf{r_1}$, equilibrium $\boldsymbol{E_1}$ is attained, with growth rate $\mathbf{G_1} < \mathbf{G}_S$, in the K-zone. This *(i)*means that $\boldsymbol{\ell}$ falls, away from ***C***. With $\boldsymbol{\ell}$ falling, *(ii)* equilibrium moves left along the $\boldsymbol{\rho_1}$ curve. With point $\boldsymbol{E_1}$ starting in the K-zone, **r** falls. This hurts growth, undermining hope of moving upward toward $\mathbf{G}_S$.

However, *(iii)*a longer-run adjustment mechanism can move the economy up toward $\mathbf{G}_C$. This does not follow standard *NC* price adjustment (à la Solow) but instead the kind of Marxian supply-side mechanism that Goodwin (1967) highlights, represented here by shifts of the $\boldsymbol{\rho}$ curve. Assume that falling $\boldsymbol{\mu}$ does not dishearten profit expectations in the extreme; thus the economy stays within the "normal" *NC* realm and out of Depression. Rising and persistent unemployment steadily reduces **w** and boosts $\boldsymbol{\varepsilon}$, increasing **s**. Falling wages also depress $\hat{\mathbf{m}}$ via factor substitution, so that $\bar{\mathbf{r}}$ rises. The $\boldsymbol{\rho_1}$ curve thus shifts upward so $\mathbf{r}_c$ rises. This is seen in the lower part of the graph, indicated by arrow [**d**]. For given $\boldsymbol{\mu}$, **r** rises and with it, $\mathbf{G}_K$. Equilibrium moves north-east along the **g** line, toward point *S*, the steady state, again indicated by arrow [**d**]. A summary appears in column [**d**] of *Chart VII*. For simplicity, the subscript "E" is omitted.

For the M-zone, the dashed $\boldsymbol{\rho}$ curve must be used so that high **r** can coexist with high $\mathbf{G}_K$. Here, $\mathbf{r_2}$ implies equilibrium $\boldsymbol{E_2}$ and growth rate $\mathbf{G_2} > \mathbf{G}_S$ with *(i)* rising em-

Chart VII: Disequilibrium Dynamics									
	initial situations								
	$\mathbf{G_S < G_C}$			$\mathbf{G_S = G_C}$			$\mathbf{G_S > G_C}$		
resulting changes	$\mathbf{G < G_S}$ [**a**]	K zone: $\mathbf{G = G_S}$ [**b**]	$\mathbf{G_S < G}$ [**c**]	$\mathbf{G < G_S}$ [**d**]	$\mathbf{G = G_S}$ [**e**]	$\mathbf{G > G_S}$ [**f**]	$\mathbf{G < G_S}$ [**g**]	M zone**:** $\mathbf{G = G_S}$ [**h**]	$\mathbf{G > G_S}$ [**i**]
(i) labor-power market change	***ℓ*↓**	***ℓ*** constant	***ℓ*↑**	***ℓ*↓**	***ℓ*** constant	***ℓ*↑**	***ℓ*↓**	***ℓ*** constant	***ℓ*↑**
(ii) movement along **ρ**: **Δr** & **ΔG**	**r↓** & **G↓** ←←←	**r** & **G** constant	if **G** < $\mathbf{G_C}$ **r↑** & **G↑** →→→	**r↓** & **G↓** ←←←	**r** & **G** constant	**r↓ & G↓** ←←←	if **G** > $\mathbf{G_C}$ **r↑** & **G↑** →→→	**r** & **G** constant	**r↓** & **G↓** ←←←
(iii) situation persists**:** longer-term **ρ** shift & $\mathbf{\Delta G_S}$	**ρ** shifts up: **r↑** & **G↑**; **m̂↓**& $\mathbf{G_S}$**↑**			**ρ** shifts up: **r↑** & **G↑**	steady-state equilibrium	**ρ** shifts down: **r↓** & **G↓**	**ρ** shifts down: **r↓**& **G↓** **m̂↑**& $\mathbf{G_S}$**↓**		
	→→→→→→→→→→→→→→→→→→ (K-zone)				point ***C***	←←←←←←←←←←←←←←←←←←←← (M-zone)			

ployment and capacity use. With the economy in the M-zone, *(ii)* rising $\boldsymbol{\ell}$ depresses **r** – which in turn depresses $\mathbf{G}_{\boldsymbol{K}}$. If the economy does not overshoot going downward in a way that drops it in the K-zone, this causes movement back toward C_2 and $\mathbf{G}_{\boldsymbol{K}} = \mathbf{G}_{\boldsymbol{S}}$. In this case, unlike the case of $\boldsymbol{E_1}$, *(iii)* the longer-run adjustment process works *in sync with* shorter-run adjustment: persistence at point $\boldsymbol{E_2}$ would create forces that shift $\boldsymbol{\rho}_2$ downward, depressing **r** and $\mathbf{r}_c$. In the top part of the graph, the economy south-west along **g** to *S*, as indicated by arrows marked [**f**]. A summary appears in column [**f**] of *Chart VII*.

So, with $\mathbf{G}_{\boldsymbol{S}} = \mathbf{G}_{\mathrm{C}}$, if point ***C*** is attained from the M-zone without over-shooting, the steady state with $\mathbf{G}_{\boldsymbol{S}} = \mathbf{G}_{\mathrm{C}}$ persists. On the other hand, if the economy over-shoots and lands in the K-zone (or starts there), the recovery from recession is less certain: the shorter-term adjustment process and that of the longer term can, in theory, cancel out.

Similar results to column [**d**] can be seen in the case where $\mathbf{G}_{\boldsymbol{S}} < \mathbf{G}_{\mathrm{C}}$, i.e., in the K-zone (not shown in the diagram but as columns [**a**], [**b**], and [**c**] of *Chart VII*). In this case, shorter-run dynamics (*i* and *ii*) move the economy *away from* $\mathbf{G}_{\mathbf{S}}$.[58] If steady-state growth is actually attained, there would be no change in $\boldsymbol{\ell}$ and thus no movement along the $\boldsymbol{\rho}$ curve. However, persistent growth at this steady-state rate *(iii)* would cause rising $\bar{\mathbf{r}}$ and $\mathbf{r}_c$, so that the $\boldsymbol{\rho}$ curve shifts upward, encouraging movement of $\mathbf{G}_{\mathbf{K}}$ toward $\mathbf{G}_{\mathrm{C}}$. Further, factor substitution encourages $\hat{\mathbf{m}}$ to fall, so that the steady-state conditions change. This eventually can cause a steady-state growth path to be re-established, closer to $\mathbf{G}_{\mathrm{C}}$. But as in the discussion of column [**d**], there is sometimes a conflict between shorter- and longer-run dynamics. This makes K-zone dynamics more iffy, more subject to fluctuations of "animal spirits" ($\mathbf{r}^{\mathbf{ex}} \neq \mathbf{r}$) and the like.

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[58] An exception occurs when the economy overshoots point ***C***, which leads to falling **r** and **G**.

The M-zone appears in columns [**g**], [**h**], and [**i**]. Here, shorter-run dynamics encourage equilibrium to equal the steady state. However, longer-run dynamics leads to a fall in both the actual and the steady-state growth rates. Unlike the K-zone, growth in the M-zone is unequivocal, leading out of the M-zone and toward point ***C***.

In the *NC* spirit, we can assume that the *CCO* is attained. The main force that drives the economy there is the capitalist control over accumulation and the *RC*'s insistence on receiving the highest possible profit. Once point ***C*** is reached, there is nothing in the model that implies that it will persist, since it is unstable going downward, at least in the shorter-run.[59] But then forces exist pushing the economy back upward. Thus, the economy should wobble around point ***C***, with a tendency to drift to the left. Only government policies – breaking with the *CLC* assumption – would allow persistence in the M-zone, as during wars. This also encourages inflation.

As noted above, persistence of the *CCO* is a collective good. It is still possible that the rate of accumulation becomes as high as possible, so that $\boldsymbol{\ell} = 1$ and $\mathbf{r} = 0$. Wages and other costs could hit ceilings limiting their rise, so that longer-term adjustment does not save capitalists from this fate. Alternatively, point ***C*** could coincide with point ***F*** of previous Charts at $\boldsymbol{\ell} = 1$. But for a growing population and growing effort productivity (i.e., with $\mathbf{G_S} > 0$), however, there must be accumulation. With workers unable to save and not controlling the investment process, there must be a positive profit rate to finance and to motivate investment by capitalists. In the end, it is capitalist supremacy – the class control of the accumulation process – that allows exploitation to persist.

[59] This simple model ignores over-accumulation forces that push equilibrium above G_C.

5. Conclusion.

To summarize, the interaction of the accumulation process (**G_K**) with the objective conditions faced by the *RC* (i.e., the **ρ** function) determines the rate of employment and the profit rate. This usually implies a sufficient cost of job loss to provoke enough effort to imply that exploitation exists. The macroeconomic model of §**5** should assure us that under "normal" conditions, **r** > 0, even though equilibrium and steady-state growth may not exist. Abnormal conditions would include a Depression, a pre-revolutionary case, a Hobbesian civil war, or an environmental melt-down.

The above is very general and abstract, but brings in the necessary elements of a *NC* model of exploitation. In addition to the background conditions of capitalist supremacy, the subjection of workers, and their conscious submission to capitalist authority, there are two complementary elements of the model which must both be present for exploitation to exist: the cost of job loss, reflecting the existence of the reserve army of involuntarily unemployed workers and the sales-constrained labor-power market, preserving the reserve army.

Neither of these are in the standard *NC* model. Further, they do not seem to be able to stand alone in that theory. The *EWH*, like other microeconomic theories, do not seem to be sufficient explanations of the persistence of involuntary unemployment except as a transitory phenomena (see Akerlof and Yellen, 1986; Devine, 1993). Without unemployment, the cost of job loss becomes totally dependent on the existence of the "farm," an alternative to working under capital. That then disappears if the farm pays the same as capital. On the other hand, the *NC* Keynesianism of Patinkin, Clower, *et al.* disappears as an explanation of unemployment unless there exists a positive societal function of unemployment for capitalists. More importantly, there must be a mechanism allowing function to be fulfilled. This is represented by the longer-term adjustment of the $\boldsymbol{\rho}$ function and the response to its shifts by capitalist accumulation, $\mathbf{G_K}$.

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Symbols & Abbreviations Used

<u>variables and parameters</u>:

a = wage on the next best alternative job available to workers.

b = welfare-state benefit received by an unemployed worker.

c = expected average cost of job loss (COJL).

D = effective demand for output (**Q**) during each week.

E = total amount of effort or labor done during weekly hours hired (labor services provided).

g = the growth rate of the stock of machines, a function of the expected profit rate.

$\mathbf{G_L}$, $\mathbf{G_K}$ = rates of growth of labor-power demand and the stock of machines owned.

$\mathbf{G_S}$ = "natural" rate of growth, **n** + **η**.

h = demand for machinery function in the accumulation model.

$\mathbf{I_R}$ = replacement investment.

K = total amount of machines owned (constant in a week, variable in a year).

L = labor-power hired per in each week.

$\mathbf{L_C}$ = capitalist optimum level of employment, with the maximum profit rate ($\mathbf{r_C}$).

$\boldsymbol{\ell}$ = employment rate (**L**/**N**).

m = ratio of machines used to labor-power hired (**M**/**L**), constant in a week, variable in a year.

$\hat{\mathbf{m}}$ = ratio of machines used to effective labor-power hired (**M**/**θ·L**).

M = stock of means of production (machines) utilized.

n = the rate of growth of the labor force.

N = size of labor force (supply of **L**), assumed equal to unity except in the growth model.

q = aggregate production function.

Q = output per week.

r = rate of profit.

$\mathbf{r^{ex}}$ = expected rate of profit.

$\overline{\mathbf{r}}$ = standardized profit rate, measured at standard capacity utilization.

$\mathbf{r_C}$ = maximum profit rate, at **L**.

S = total profits = **r**·**K**.

s = **q**(**e**, **m**) – **w** – **δ**·**m** = profits per unit of labor-power hired.

T = time.

U = open and involuntary unemployment rate = 1 – $\boldsymbol{\ell}$ (= 1 – **L** when **N** = 1).

w = real wage rate per hour, given to the RC in a week.

$\mathbf{w}_F$, $\mathbf{w}_N$ = equilibrium real wage under Say's Law, notional real wage.

$\overline{\mathbf{w}}$ = benchmark wage in general case of ES curve.

x = $\mathbf{q_1}\cdot(\partial \mathbf{e}/\partial \mathbf{L}) - \boldsymbol{\omega}_1$ = the supply-side change in profits due to a change in **L**.

y = expected alternative source of livelihood to workers, their fall-back position.

z = wage on jobs in the farm (non-capitalist sector).

Z = total overhead costs, $\mathbf{Z}_L + \mathbf{Z}_K$.

$\mathbf{Z}_L$ = overhead labor supervision costs (constant in a week, variable in a year).

$\mathbf{Z}_K$= overhead maintenance cost of **K** (constant in a week, variable in a year).

Greek Letters:

α = partial adjustment function for investment.

β = partial adjustment function for expected profit rate.

δ = depreciation rate (assumed constant).

ε = intensity of labor or degree of effort (**E**/**L**).

$\boldsymbol{\varepsilon}_F$ = degree of effort in NC case (with **r** = 0).

η = the rate of growth of labor productivity.

θ = effort-augmenting technical factor.

κ = function determining machine/labor-power ratio.

λ = demand for labor-power function.

μ = rate of capacity utilization (**M**/**K**).

χ = effort-evoking benefit of machine use.

π = short-run economic profit (profits beyond **r**).

ρ = profit rate-determination function, determined by **L** and **L***.

φ = percent of labor force that can leave the capitalist sector and go to the "farm"

ω = **L**-sensitive part of the effective supply of labor (**ES**): how **L** affects **w**.

sub- and super-scripts:

d, ex = demanded or desired, expected (superscripts).

E, *F*, *N*, *S*, **T, C,** L, M = equilibrium, full employment, notional, steady-state, in a specific week, collective capitalist optimum, labor-power, machines (subscripts)

bar above (¯) = standardized value.

Abbreviations:

APL = **q**(**e**, **m**) = average private physical product of hiring labor-power, for given **e** and **m**.

CCO = collective capitalist optimum.

CLC = the pure classical-liberal capitalist case.

COJL = cost of job loss (**c**).

CRS = constant returns to scale.

ED = effective demand for labor-power.

ES = effective supply of labor-power (wage curve).

EWH = efficiency wage hypothesis.

HES = Horizontal effective supply, with fixed real wage.

MES = minimum efficient scale of production.

MP = Marxian Presumption (**r** > 0 for some **L** < 1).

MPL = $\mathbf{f_l \cdot e}$ = notional marginal private physical product arising from hiring labor-power, for given **ε**.

NC = neoclassical.

PNC = pure neoclassical case.

RC = representative capitalist agent.

SC = sales constraint on labor-power market.

SL = Say's Law, i.e., that all output can be sold at prevailing prices.