DRAFT October 30, 2009

4th Bi-annual Cross-Border Post-Keynesian Conference
Buffalo State College, Buffalo, New York
October 9-10, 2009
and
New Marxism Times: The 7th International Conference
Rethinking Marxism, University of Massachusetts, Amherst
November 5-8, 2009

A Marxist Modeling of Capitalism, Suggesting Theoretical Over-emphasis on Accumulation of Capital

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Abstract: In Volume I of *Capital*, Marx offers actual data from a Manchester spinning factory describing that business. In Volume II, he offers schemes of reproduction to help understand accumulation of capital while mentioning numbers which actually suggest correlation to the spinning factory data. Nevertheless, Marx seems to slide over the costs of new machinery when analyzing accumulation, instead focusing on wear and tear (depreciation). In this paper, we offer a modeling of accumulation that takes account of modern estimates of the composition of capital, i.e., the relation of labor time invested in constant capital compared to the labor time employed with that constant capital, relying principally upon U.S. and Canadian estimates.

We find empirically that the composition of capital fluctuates but does not show much trend. We also consider levels of the rate of exploitation and of utilization of surplus value required for achieving actual historical levels of accumulation of capital, and include consideration of the turnover of capital. We find that only a small portion of surplus value, perhaps ten percent, is required for actually achieved accumulation. This suggests that a focus on the utilization of surplus value for the accumulation of capital misses vast other terrains for the utilization of surplus value.

Our result is suggestive of an over-emphasis within Marxist political economy on accumulation of capital.

I. Marx Estimating Constant and Variable Capital Consumption in Cotton Spinning

There has not been a lot of attention to empirical observations of Marx, but in *Capital, Volume I*, Chapter 9, he offers actual data from a Manchester spinning factory which is directly relevant to his discussion of accumulation of capital and to his schemes of reproduction. From his data, Marx reports a consumption of constant capital of £378 weekly, compared to variable capital of £52 weekly, which implies a ratio of 7.3 (Marx, 1867, p. 211).[1] Most of the constant capital consumed in his textile example is for cotton, i.e., £342 out of £378. Marx lists an additional £20 for wear and tear (depreciation) of spindles, £6 for building rental, and £10 for auxiliary materials. Marx suggests £10,000 as the outlay for the fixed constant capital in the 10,000 spindle factory for which he is providing data; therefore, his weekly depreciation of £20 corresponds to £1000 annually, i.e, a depreciation rate of 10%. Surplus value is £80 so that the rate of surplus value is 80/52 = 1.54.

In Chapter 24, as he begins his well-known discussion of converting surplus value into capital, Marx suggests for cotton spinning a money advance of constant capital equal to £8000 for "cotton, machinery, &c." and of variable capital equal to £2000 for wages paid (Marx, 1867, p. 543). The ratio of the consumption of constant capital to variable capital is 4, less than the 7.3 empirical ratio implied in Chapter 9. (Did Marx perhaps believe his particular spinning manufacturer to be unrepresentative?). In any case, in neither case does Marx label the ratio of consumed constant capital to variable as a composition of capital, perhaps on the reasonable grounds that the constant capital here refers to its **consumption**, not its level, while a composition of capital (yet undefined by him) should refer to the level, the **stock**, of constant capital being utilized by workers. As we shall see shortly, this distinction is born out by Engels when he does discuss composition of capital. Nevertheless, the focus of Marx's Chapter 24 is upon expanding the business by converting surplus value into capital,; thus, there must be investment in **new** machinery. It would be costly.

In his next chapter (p. 574), Marx defines a *technical composition of capital* as the "relation between the mass of the means of production employed, on the one hand, and the mass of labor necessary for their employment on the other". The *value composition* is determined, however, by the ratio of "constant capital or value of the means of production, and variable capital, or value of labor-power". He goes on to claim a "strict correlation" between these two and defines the *organic composition of capital* as "the value composition of capital, insofar as it is determined by its technical composition and mirrors

[1]Wages for a spinner were less than £1 per week, according to Marx's 1865 lecture (Marx, 1865, p. 21), a spinner being a rather skilled occupation, although here it could be averaging the spinner with an assistant. A very comprehensive study of British wages indicates 160 (old) pence or only £2/3 weekly for cotton factory operatives in 1871 (Wood, 1910, p. 587), which would imply 78 operatives earning £52 total on the 10,000 spindles. Robson (1957, p. 342) suggests about 150 spindles per operative around 1871, implying 67 operatives on 10,000 spindles. Incidentally, Marx indicates in the footnote on the following page that he assumes prices=values for this calculation. He calculates the rate of surplus value as 1.54.

the changes of the latter". That claim of "strick correlation" is rather unfortunate as the value of the constant capital can change with technological improvements in the production of means of production and/or with changes in the value of labor power.

In *Volume* 2, Marx suggests levels of 2, 4 or 5 for the ratio of consumed constant capital to variable capital in his well-known schemes of reproduction. For spinning specifically, and much earlier in this volume, he notes a consumption of constant capital of £372 and a variable capital of £50 (Marx, 1885, pp. 27 and 38ff), very close to the *Volume 1* data in Chapter 9 mentioned above.

Volume 3 refers to the same spinning manufacturer's data that is presented in *Volume 1*, but the text (Marx, 1894, pp. 75-76) is by Engels, drafted when editing Marx's manuscript in the context of discussing the turnover of capital. Engels repeats the data Marx reported in *Volume 1*, including the installation cost for machinery consisting of 10,000 spindles at an "assumed" £1 for each spindle, a total cost of £10,000. Wear and tear is at £20 weekly (implying £1040 yearly, or about 10%). Building rent is £6 weekly (£312 yearly), along with £10 auxilary materials costs weekly (£520 yearly). Engels offers his own assumption that the unreported yearly level of circulating capital (constant and variable) is one-quarter of the level of £10,000 for the spindle machinery, i.e., £2500. He calculates £12,182 in constant capital: £10,000 for the stock of fixed capital, as well as £2182 circulating, i.e., £2500 yearly total circulating capital, variable included, less £318 as the portion of the circulating which is for wages (£318 obtained by using the same proportion of circulating capital which variable capital represents in Marx's data, while applying it to Engels' own total circulating capital of £2500). Note that the £52 weekly wage cost Marx provided and the £318 annual outlay for wages implies a turnover -- a recirculation of wages costs -- of 8.5 times in the year (52 x £52 / £318 = 8.5). **Referring explicitly to "composition of capital", Engels obtains a remarkably high level of £12,182/£318 = 38.3** with the £10,000 in fixed constant capital being much larger than the £2182 for circulating constant capital (Marx, 1894, p. 76). While the assumed installation cost of £10,000 for the 10,000 spindle factory, as well as Engels' assumed £2500 level for total circulating capital, would need confirmation for accuracy (Engels, however, did know the textile industry personally), still, modern estimates, as we shall see, are not remotely close to such a number.

There is a significant puzzle surrounding that £10,000 cost of the spindle factory: Why does not Marx pay more attention to the cost of the machinery, the cost of fixed constant capital, the cost which he explicitly states as early as Chapter 9 of *Volume 1* in his empircal example of cotton spinning? When he discusses the conversion of surplus value into capital beginning on p. 543 of Chapter 24, Marx does include costs of wear and tear of the machinery as part of constant capital consumption, but he slides over the required investment in the machinery itself? How is it possible to convert, in this later chapter, a £2000 level of surplus value for the year into £1600 constant capital and £400 variable capital? That is, a

£400 expenditure for new variable capital would seem to require the purchase of new machinery totalling £15,320 to be able to successfully employ those workers (following Engels' calculation for the composition of capital). Where are the resources when surplus value totals only £2000 for the year?[2] (If one should slip into thinking of borrowing the money for this spinning factory, do not forget that this problem would renew on an increasing scale every year thereafter! Furthermore, truly, we are discussing the entire economy, not just the spinning example.)

Engels asserts (Marx, 1894, p. 76) that the data of April 1871 used by Marx were particularly favorable for capitalist profits as cotton prices were particularly low and yarn prices particularly high.[3] Should the market price of yarn drop to the level in which surplus value is just £52, instead of £80, surplus value would equal variable capital and the rate of surplus value becomes unity, as Marx assumes in Chapter 24. Since annual surplus value now equals £2704 instead of £4160, growth falls from 33% to 22%. Alternatively, if yarn prices had not dropped, but cotton prices had risen by enough to raise cotton costs from £342 weekly to £370, then surplus value would still drop to £52 weekly. Growth would be somewhat less than 22% as somewhat more costs are drawn toward cotton. These levels of accumulation do constrast favorably with Marx's illustration of 20% growth when converting surplus value into capital. Nevertheless, the key question to ask is what sense can we make of Marx's spinning illustration in Chapter 24 in which the substantial fixed capital costs for new spindles are not even identified, let alone

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[2]We can ask, if the composition of capital is 38.3 as reported by Engels, why did not Marx begin his Chapter 24 something like the following:

[What Marx could have written in Chapter 24:]

> Recalling our data for mule spinning of cotton presented in Chapter 9, our capitalist receives £80 of surplus value weekly, which amounts to £4160 for the year. If expanded production is desired, we need first to note the fixed capital cost of £10,000 for spindles, since our capitalist is going to need to buy more spindles. In addition, let us assume £2500 as the level of circulating capital costs for the year, divided up into the same proportion which we described in Chapter 9, i.e., 6.9 to 1 (being £358/£52, weekly, before expansion). Then, the £2500 circulating costs are £2182 for the cotton, auxiliary materials and building rent, and £318 for variable capital. The composition of capital is then (£10,000 + £2,182)/£318 = 38.3. Note that £318 of variable capital over the year actually commands £2704 wage payments -- there are £52 wages weekly for 52 weeks. Products are being sold after about six weeks in the production cycle, so that the "turnover" is 8.5 times per year (more on turnover in *Volumes 2* and *3*). Our composition of capital is thus calculated on a ratio of the fixed capital plus flow of circulating constant capital to outlay on variable capital.
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> Without any allocation for capitalist consumption and focusing only upon expanded reproduction, the sum of £4160 in surplus value can be utilized during the next year as follows: £3324 buys new spindles on January 1 for the year's expanded operations. This represents 33% more spindles. During the year £730 is invested for the additional circulating portion of constant capital consumption needed (wear and tear of fixed capital ignored for the initial year) and £106 is invested for additional variable capital needed. Note that the composition of capital for the expanded production remains at 38, i.e., (£3324 + £730)/£106. The ratio of circulating portion of constant capital consumption to variable capital remains at 6.9, i.e., £730/£106. In our calculation, the rate of surplus value remains at 1.54.
>
> Since the turnover of wages, as describe above, is 8.5 annually, the £109 yearly committed to variable capital actually represents an additional command over labor power of £901 compared to the £2704 before expansion which we have mentioned. We now have £3605 in wages paid annually. In other words, our capitalist friend has expanded the labor force also by 33%, even with the high relative cost of spindles.

[3]This would call into question whether prices=values but we leave this point aside.

numerically incorporated into his illustration? While constant capital consumption relative to variable capital is less in Chapter 24 than in Chapter 9 (four times greater, instead of seven times), still this is insufficient as an explanation for the similarity of the growth rates. The larger reason is that Chapter 24, by ignoring turnover of capital, leads the reader to understand a turnover of unity. The significantly higher, and presumably much more accurate, ratio of consumed constant capita to variable capital in Chapter 9 is 'compensated' by the high annual turnover of 8.5 for the circulating capital as compared to the illustration in Chapter 24. At best, Chapter 24 makes a theoretical point on an inadequate empirical base. More reasonably, the illustration in Chapter 24 can be considered simply misleading. While the actual illustration by Marx in his Chapter 24 is intended for theoretical understanding and not intended to duplicate the actual data provided in the earlier chapter, still, it is too far off the marker of his empirical work.

II. Modern Estimates of the Composition of Capital

Now that we have explored Marx's empirical representations, we can turn to modern estimates of the composition of capital. These are typically undertaken as part of a project to determine the behavior of the rate of profit, rather than for a purpose such as ours of comprehending the level of accumulation of capital. The level of the composition of capital is necessary in order to ascertain how much of the surplus value used for accumulation must go into constant capital as compared to variable capital. Major lines of demarkation for such empirical work include the conceptualization of constant capital in its fixed as well as its circulating component, turnover, the relation of values to prices, and whether unproductive labor needs to be distinguished from productive labor in the overall calculations leading up to the organic composition. Although turnover of capital is important for accurate discussion of the accumulation of capital, some modern authors ignore turnover altogether. Webber and Rigby (1986, pp. 37-38) offer the clearest exposition of turnover we have seen and include calculations of the level involved.

As a first step, note that it is rather easy to confuse the consumption of constant capital, which is a **flow** of used up constant capital, with its level, which is a stock and reflective of the labor time required for producing means of production. Only if the stock is turned over once a year would the two magnitudes be the same. In order to keep the distinction clear, we distinguish the flow from the level by referring to the level as the **outlay**. For example, an annual flow of circulating constant capital totaling four million dollars, with a turnover of circulating constant capital equal to four, would require an outlay of one million dollars -- once each quarter the products are sold and receipts used to renew that capital. In order to avoid confusion, from here on we will denote the stock of constant capital as C. Retaining c for the annual flow of constant capital consumed, the organic composition is represented by C/v.

Secondly, recall that the organic composition confounds two factors -- technological requirements and the portion of the working day returned to workers captured in the rate of surplus value. That is, technology could remain unchanged, but the organic composition *c/v* rises as *v* falls when capital achieves a higher *s/v*. Clarity is therefore aided if we reformulate our empirical question in terms of the ratio of labor time invested in constant capital to the total labor time of workers working that constant capital (not simply the paid portion of the working day), i.e., $C/(v+s)$. Shaikh (1987, p. 304) labels this ratio the **materialized composition of capital** and we will follow that language below. As such, the organic composition $C/v = (1+s/v)\ C/(v+s)$, and is of course greater in magnitude than the materialized composition.

Alberro-Semerena and Nieto-Ituarte's (1986) work on Mexico illustrates the importance of the distinction between the organic composition and the materialized composition of capital. They calculate an organic composition *c/v* of 5.40 in 1970, rising to 7.02 in 1976 (p. 37). However, with their calculated rate of surplus value rising from 2.17 to 2.92 in the same period, the materialized composition $c/(v+s)$ is almost unchanged, moving only from 1.70 to 1.79. A focus on the organic composition would lead to discussion of the rise, while a focus on the materialized composition would not! We will focus on the materialized composition since it abstracts from the rate of surplus value.

Thirdly, constant capital includes two basic components, fixed capital, lasting more than one year and representing the stock of equipment and buildings required for the production process, and circulating capital, representing the needs for raw materials, energy requirements and maintenance/depreciation requirements of fixed capital. Fixed capital can last for decades, maintenance being undertaken and included in the consumption of constant capital. Circulating constant capital, however, can turn over much more quickly than one year, meaning that the outlay on it would be much less than the annual needed flow of circulating constant capital.[4]

There is quite a number of estimates of the composition of capital, often for the United States, but also for other countries. In Table B , we then report three U.S. estimates and one Canadian. To help investigate the differing estimates, in Table A we report the manner by which these authors we cite differ in incorporating fixed and circulating capital in the calculation of constant capital. Shaikh and Tonak (pp. 120-121) do have a separate calculation of the flow of circulating capital relative to variable capital, but it is not included in the values along with their calculations for fixed capital. If we were to divide their circulating capital flows (which moves from 2.35 in 1948 to 2.89 in 1989) by a measure of turnover , we could get an a measure of outlay on circulating capital which could be added to their measure of fixed capital. Moseley, as we shall discuss, does provide an estimate of the ratio of the outlay of circulating

[4]When calculating a composition of capital, an issue could arise as to whether the flow of circulating capital over the year or the outlay (a stock variable) should be considered.

constant capital to fixed capital over the time period and the results suggest an economizing process on the outlay on circulating constant capital and so suggesting more stability in the compostions of capital than Shaikh and Tonak suggest.

Since inclusion or exclusion of the level of unproductive labor is a basic distinction in undertaking these estimates, it is so indicated. Please note that Simon Mohun (2005) has offered a correction and updating of Shaikh and Tonak's work suggesting a faster rise in s/v and suggesting, with an appropirate calculation, virtually no change in the materialized composition of capital between 1967 and 1989 (the only overlapping years of data).

Table A: Methodologies used for Estimates of Constant Capital

	Constant Capital	***Fixed Capital***	***Circulating Capital***
Wolff	= fixed + circulating	"total capital stock owned by each input-output sector"	"intermediate inputs in the input-output tables"
Moseley	= fixed + circulating	"net stock of fixed non-residential private capital" - "net stock of unproductive fixed capital" + "net stock of fixed capital of government enterprises"	"value of total business inventories (current cost)"
Shaikh and Tonak	= fixed only (adjusted for utilization)	"fixed nonresidential gross private capital"	(absent – see text)
Webber and Rigby	= fixed + circulating	"midyear net capital stock"	"constant capital share of the owned inventory"

Sources: Wolff (1986, p. 105, fn. 6, and 1987, pp. 186-188, utilizing Bureau of Labor Statistics, Bulletin 2034, *Capital Stock Estimates for Input-Output Industries: Methods and Data*, 1979), Moseley (1991, pp. 175-176, utilizing Department of Commerce, *Fixed Reproducible Tangible Weatlh in the United States, 1929-85*, 1987), Shaikh and Tonak (1994, p. 125, same data source as Moseley) and Webber and Rigby (1986, pp. 43 and 54, who note: "the measure of owned inventory includes both variable capital and circulating portion of constant capital").

Table B: Estimates of Organic and Materialized Compositions of Capital, ***C/v*** **and** ***C/(v+s)***

Note: As indicated, circulating constant capital is either the annual flow or the outlay; except *C/v* for Canada, variable capital is always the annual flow. Depreciation costs are not included.

	Unproductive labor absent				*Unproductive labor incorporated*				S&T + Moseley
	C/v	Turn-over	*s/v*	*C/(v+s)*	*C/v*	Turn-over	*s/v*	*C/(v+s)*	*C/(v+s)* Moseley table C(2) added to S&T
U.S. (Wolff)	circ. as flow			circ. as flow	circ. as flow (or as outlay[a])			circ. as flow (or as outlay[a])	
1947	5.61		0.96	2.86	8.30 (5.88)		2.11	2.67 (1.89)	
1958	5.98		1.01	2.98			2.60		
1967	5.38		1.08	2.58			2.72		
1976	5.16		0.75	2.95	9.22 (6.94)		2.27	2.82 (2.06)	
U.S. (Moseley)					circ. as outlay			circ. as outlay	
1947					3.58	3.27	1.40	1.49	
1958					4.33	4.14	1.59	1.67	
1967					4.03	4.29	1.72	1.48	
1976					5.15	4.32	1.66	1.94	
1981					5.76		1.81	2.05	
1985					5.47		2.15	1.74	
1989					5.03		2.28	1.53	
1994					4.61		2.33	1.38	
U.S. (S&T)					no circ.; adj.[b] (or no adj.)			no circ.; adj.[b] (or no adj.)	cir. from Moseley adj.[b] (or no adj.)
1948					3.27 (4.36)		1.70	1.21 (1.61)	
1958					4.27 (5.55)		2.01	1.42 (1.84)	1.70 (2.13)
1967					5.00 (5.05)		2.10	1.61 (1.62)	1.91 (1.92)
1976					5.27 (6.35)		2.11	1.70 (2.05)	1.96 (2.30)
1981					5.95 (7.08)		2.16	1.88 (2.24)	2.11 (2.46)
1985					6.19 (6.96)		2.33	1.86 (2.09)	2.06 (2.29)
1989					6.20 (6.97)		2.44	1.80 (2.02)	
Canada -- mfg. only (W&R)	circ. as outlay; *v* as outlay		*v* as flow	circ. as outlay; *v* as flow					
1950	14	3.9	1.7	1.3					
1958	18	4.1	1.8	1.6					
1967	20	4.4	1.6	1.7					
1976	22	4.7	1.4	1.9					
1981	26	4.8	1.6	2.1					

Sources: Wolff (1986, p. 95; 1987, p.133, Table 6.6, line 4--to calculate s/v required for *C/v = (1+s/v) C/(v+s)*; and

1988, p. 306), Moseley (1991, p. 74 for turnover, and 1997, pp. 25 and 33, for other data), Shaikh and Tonak (1994, pp. 125-127 and commentary on 200-202), and Webber and Rigby (1986, pp. 45--in which s/v = (1-value of labor power) ÷ (value of labor power), 47, 50; in which $C/(v+s) = C/v \div \text{turnover} \div (1+s/v)$). Conceptually, Moseley's *C/v*, the traditional concept utilized also by Wolff and Shaikh and Tonak, is Webber and Rigby's *C/v* ÷ turnover, itself a measure of the ratio of constant capital to variable capital advanced (turned over enough times to imply a substantially lower measure than for variable capital costs).

[a]Wolff (1988, p. 306) reports that the materialized compositions *C/(v+s)*, when only fixed capital are included, were 1.54 for 1947 and 1.83 for 1976. Noting his circulating constant capital flows as 1.13 and 0.99, respectively, and dividing the resulting numbers by Moseley's (1991, p. 74) calculated turnovers for those years, i.e., 3.27 and 4.32, then the outlays on the circulating constant capital are obtained as 0.35 for 1947 and 0.23 for 1976. These are added to the fixed capital figures and provide the 1.89 and 2.06 figures in the table. The numbers for the organic composition *C/v* were similarly obtained.

[b]Shaikh and Tonak adjust for the utlization levels of equipment to obtain operating fixed constant capital. They multiply capital stock figures by the following utilization figures: 1948--0.75, 1958--0.77, 1967--0.99, 1976--0.83, 1981--0.84, 1985--0.89, and 1989--0.89. For comparability to the other estimates, the parenthetical figures remove this adjustment for utilization.

First, it is important to acknowledge turnover of circulating constant capital because, as we have indicated, the invested outlay is distinct from the total annual costs; the outlay is much less. As displayed in Table B, Webber and Rigby (1986, p. 50) calculate turnover for Canadian manufacturing at approximately four times annually between 1950 and 1981, trending upward, calculated as the ratio of annual costs of circulating constant capital to inventories of such capital.[5] For the U.S. economy as a whole, Moseley used some own data and some from Wolff to calculate turnover rates rising from 3.27 in 1947 to 4.32 in 1976. In his work with such data, Wolff (1988, p. 305) defers to Moseley's calculations as "preferable" to his own. Wolff notes that, compared to his use of inter-industry flows for estimating such flow costs, only if turnover were one year would his estimates for circulating constant capital be "identical" with Moseley's; otherwise, he defers to Moseley's.[6] As described methodologically in Table B's footnote a, we adjusted Wolff's figures on materialized composition reported in the table with

[5]Webber and Rigby are studying Canadian manufacturing only, not the entire economy, and calculate turnover of circulating capital -- both its variable and constant components. In the process, they explains turnover quite well, including how wage payments and circulating constant capital payments stretched out over time implies higher turnover.

[6]A year earlier, Wolff (1987, p. 82-83, fn. 21) had focused on the issue, and had estimated turnover rates to average just about one year from 1947 to 1976, i.e., 1.08, based the economywide estimate of the **sales**-to-inventory ratio. However, rather than annual costs of only circulating capital, Wolff's attempted use of sales in the numeraire included also fixed capital costs, wage costs, and profits, implying considerable overestimation [???]. He reports a ratio moving from 0.89 in 1947 to 1.19 in 1972, back to 1.04 in 1976, basing his numbers upon the inverse of the average yearly level of inventories (averaged from end of quarter data) to what he thought was annual sales. However, when he added the four quarterly numbers to obtain sales, he thought these were quarterly sales when in fact they were at "monthly rate" (same citation as his, p. 226, fn. 3). Thus, Wolff's calculated figures must be multiplied by a factor of three and become thereby not dissimilar to Moseley's or Webber and Rigby's.

We might add that the inverse of the "nonfarm inventories to final sales of goods and structures" data provided may be a better representation of turnover, of course corrected from the monthly rate to the annual. This inverse ratio is fairly stable from 1947 to 1997 as can be determined from *National Income and Product Accounts of the United States, 1929-97*, Volume 1, U.S. Department of Commerce, 2001, Tables 5.12 and 5.13, pp. 309-320. That inverse ratio, using current dollar data, trends only somewhat downward from 3.52 for the first quarter of 1947 to 3.26 for the last quarter of 1997 (jumping down as far as 2.59 in the second quarter of 1980).

calculations by Moseley regarding turnover. This correction suggests 1.89 as the composition for 1947 and 2.06 for 1976, with unproductive labor included.

Webber and Rigby (p. 42) state that the fixed capital costs are about three times greater than outlay on circulating constant capital costs, but they do not display the behavior over time. Moseley does and Table C displays two calculations based upon estimates he has made, one based upon current dollars and the other adjusted for price changes (price changes for fixed capital are growing more rapidly than for circulating constant capital). Note the increasing relative importance of fixed capital for this period in the United States. But also note that if we multiply the outlay on circulating constant capital costs by the turnover to obtain the flow, fixed capital costs are, in fact, similar to annual circulating constant capital costs, i.e., $C \sim c$.

Table C also indicates the relation of the outlay on circulating constant capital costs to the flow of $v+s$, citing data from Moseley. However, none of our cited authors include depreciation within their calculations of circulating constant capital costs. If depreciation were roughly 10%, as in Marx's own example, its annual flow would be $0.1C$, so that for a $C/(v+s) = 2$, the required flow for depreciation would be 0.2 $(v+s)$. A turnover of four would thus imply an outlay of $0.05(v+s)$ for depreciation. In other words, the last column ratio in Table C would be increased somewhat to account for depreciation.

Table C: Cost Ratios

	Fixed capital relative to outlay on circulating constant capital		**Outlay on circulating constant capital relative to the flow of v+s**
	(1) Current dollars	**(2) 1972 dollars**	**(3) Current dollars**
1947	2.07	3.14	0.49
1958	3.06	3.47	0.41
1967	3.08	3.28	0.36
1976	3.51	3.91	0.43
1981	3.72	4.37	
1985	4.15	4.89	
1987	4.18	4.88	

Source: Derived from Moseley (1991, pp. 51 and 163-164, noting that his FC for 1976 in Table A.3 has a typo and should be 1662, not 662).

Wolff's work for the United States, based upon input-output techniques, show only a small increase over time in the materialized composition, but does report higher estimates for the materialized compositions than do Moseley or Shaikh and Tonak. Moseley's work, based upon national accounts, does not exhibit a trend. Shaikh and Tonak's work, based also upon national accounts, does show a trend upward.[7] Shaikh and Tonak adjust for utilization levels which lowers the calculation of *C* for all the years listed except 1967; without that adjustment Shaikh and Tonak's estimates of the materialized composition of capital would be 1.61 in 1948 and rising to 2.02 in 1989, thus, uniformly exceeding Moseley's. This is all the more surprising in that Shaikh and Tonak exclude circulating constant capital altogether, while Moseley includes circulating constant capital, representing as much as 33% of his measure of constant capital in 1947, albeit down to 19% in 1985 (1991, p. 163). The origin of the significantly higher estimates by Shaikh and Tonak must be that Moseley utilizes net stock data while Shaikh and Tonak utilize gross stock.[8] If Moseley is correct that circulating capital becomes less important over time as a proportion, its inclusion in calculations similar to Shaikh and Tonak would imply that the reported rise of the materialized composition of capital in Shaikh and Tonak would be less than above and would likely disappear altogther by the end of Moseley's data in 1994.

Our empirical conclusion from analyzing Wolff's, Moseley's, and Shaikh and Tonak's work for the U.S. economy is the absence of much support for a rising materialized composition of capital. A rising rate of surplus value, on the other hand, does seem supportable and would suggest some rise in the organic composition of capital.

Webber and Rigby use net stock and do report a rising materialized composition of capital for Canadian manufacturing in the post-war period, at least up to 1981. If the U.S. economy is indicative and represented well enough by Moseley's work for which the composition peaked around that year, we would expect a falling off after 1981. In any case, we note that Webber and Rigby's calculation of constant capital relative to the outlay on variable capital represents a similar form of calculation to Engels' calculation of 38 for the composition of capital in cotton spinning, examined in Section I above.

III. An Improved Model of Capital Accumulation, correcting Marx's

We have seen how the **stock** of fixed constant capital is quite distinct from the **consumption** of constant capital used in Marx's schemes of reproduction. Marx himself had been quite explicit at the beginning of his discussion of schemes of simple reproduction regarding how he delimits his study:

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[7]Curiously, Shaikh and Tonak (1994) discuss the book by Wolff (1987), but not the follow-up article by Wolff (1988). Discussion of the latter would have given them an opportunity to explain the differing estimates for the materialized compositions of capital provided by Wolff in his 1988 article. Shaikh and Tonak do cite earlier work of Moseley (1986) in which Moseley had used the same methodology as for his estimates reported in the table. However, the lack of a trend was not yet apparent in those estimates by Moseley, in that article going only to 1977.

[8]Wolff refers to "capital coefficient matrix", yet, unclear as to meaning.

> *Constant Capital*. This is the value of all the means of production employed for productive purposes in this branch. These, again, are divided into *fixed* capital, such as machines, instruments of labour, buildings, labouring animals, etc., and *circulating* constant capital, such as materials of production: raw and auxiliary materials, semi-finished products, etc....
>
> Portion *c* of the value, representing the constant capital *consumed* in production, does not coincide with the value of the constant capital *employed* in production. True, the materials of production are entirely consumed and their values completely transferred to the product. But only a portion of the employed *fixed* capital is wholly consumed and its value thus transferred to the product. Another part of the fixed capital, such as machines, buildings, etc., continues to exist and function the same as before, though depreciated to the extent of the annual wear and tear.... At this point in the study of the total social product and of its value, however, we are compelled, at least for the present, to leave out of account that portion of value which is transferred from the fixed capital to the annual product by wear and tear, unless fixed capital is replaced in kind during the year. (Marx, 1885, p. 400)

In other words, he side-stepped depreciation. As he goes on into his discussion of simple reproduction he does have an extended discussion of the "Replacement of the Fixed Capital" (pp. 453-473). But when he gets to his schemes of extended reproduction in the next chapter, he ignores the outlay for **additional** fixed capital needed for accumulation represented by machinery and equipment.

We now develop a model which does incorporate the need for the production of new fixed constant capital in order to implement an accumulation of capital. This model will follow the long-run nature of Marx's exposition and will follow Marx's schemes of reproduction insofar as they suggest a stable composition of capital that our empirical survey suggests is approximately the case. We depart, however, from Marx's modeling by taking the **materialized** composition as stable, rather than the **organic** composition; as we have mentioned, the later would be influenced by the behavior of the rate of surplus value.[9]

After an introductory discussion, Marx (1885) had developed two arithmetical "illustrations" for schemes of extended reproduction. Both have the rate of surplus value as having a unit value. Both have one-half of surplus value in Department I used for accumulation of capital (additional labor power as well as additional constant capital), with the other half used for consumption of capitalists. Both keep the ratio

[9]Although fixed capital has been included in the calculations of constant capital, the problems of identifying it are rarely described in the conceptual detail that is in the work of Swanson (1986). Shaikh and Tonak, for example, devote little attention to the problem. In any case, we will overlook Swanson in this discussion.

of consumed constant capital *c* to variable capital *v* in each department as unchanging as extended reproduction takes place. The First Illustration (pp. 514-517) takes that ratio in means-of-production Department I to be 4:1, while in consumption-goods Department II it is taken to be 2:1. In the Second Illustration (pp. 518-523) both departments have the ratio of 5:1. Marx's two illustrations begin from the following numerical examples:

Marx's First Illustration

Department I: 4000 *c* + 1000 *v* + 1000 *s* = 6000

Department II: 1500 *c* + 750 *v* + 750 *s* = 3000

Marx's Second Illustration

Department I: 5000 *c* + 1000 *v* + 1000 *s* = 7000

Department II: 1430 *c* + 285 *v* + 285 *s* = 2000

Pannekoek's (1934, pp. 63-64) work is useful in this regard. He was interested in Marx's second illustration, the one with the same ratios of *c* to *v* in the two departments, but used different numerical values which are easier to deal with. Taking the ratio as 4:1 in both departments, with *k* indicating consumption by capitalists at one half of surplus value in each department -- the other half being used for accumulation, Pannekoek's illustration for the first period is

Pannekoek's Illustration for Marx's Second Illustration

Department I: 4400 *c* + 1100 *v* + 1100 *s* = 6600,

with 1100 *s* = 550 *k* + (440 *c* + 110 *v*)

Department II: 1600 *c* + 400 *v* + 400 *s* = 2400,

with 400 *s* = 200 *k* + (160 *c* + 40 *v*)

Given one half of surplus value being used for accumulation -- 550 + 200 for the two departments and so totalling 750, after one period the accumulation of 750 is divided between 600 additional means of production (440+160 for the two departments) and 150 additional means of subsistence for newly hired workers (110 + 40 for the two departments). The other half of surplus value is used for capitalist consumption *k* (550 + 200 = 750). Note that Department I needs 4400 + 440 means of production to begin the next period and thus has 1760 to sell from its 6600 total production. Department II needs 400 + 200 + 40 for its own consumption needs to begin the next period and thus has 1760 to sell from its total production.[10] The relevant numbers for Pannekoek's second period now become:

Pannekoek: Second Period

Department I: 4840 *c* + 1210 *v* + 1210 *s* = 7260,

with 1210 *s* = 605 *k* + (484 *c* + 121 *v*)

Department II: 1760 *c* + 440 *v* + 440 *s* = 2640,

with 440 *s* = 220 *k* + (176 *c* + 44 *v*)

In other words, the total value of production has grown 10% from 9000 to 9900, with 10% more workers hired and 10% more means of production being used in addition to the 6000 which were originally required. Pannekoek goes on to comment that either allowing for differing organic compositions (he is

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[10]Bukharin (1924, pp. 154-159) formulated the schemes algebraically, and concluded with the same conditions for extended reproduction as had Luxemburg (1913, p. 127), albeit Luxemburg's condition refers to **increases** in constant capital in Department II equaling increases for variable capital plus increases for capitalist consumption in Department I, while Bukharin's condition refers to the **level** of the new constant capital in Department II equaling the level of the new variable capital and the capitalist consumption in Department I (p. 159).

For Pannekoek's example above, Bukharin's condition (at the end of the first period ready for use at the beginning of the second period) is that constant capital for Department II, i.e. 1760 (= 1600 + 160), must equal variable capital for Department I, i.e. 1210 (= 1100 + 110), plus the capitalist consumption during the first period, i.e. 550. In fact, this obtains, 1760 = 1210 + 550. For the following period, Bukharin's figures are 1936= 1331 +605. Luxemburg's condition, on the other hand, refers to the corresponding **changes** in each of the magnitudes. In other words, 176 (= 1936-1760) must equal the sum of 121 (= 1331-1100) + 55 (= 605-550). In the example, it does.

Although he does not mention conditions for extended reproduction, Tarbuck (1972, Appendix I, pp. 271-274) lays out Marx's second scheme showing the process step-by-step and may aid in understanding. Kuehne (1972, pp. 107-108) does lay out both Bukharin's and Luxemburg's conditions for extended reproduction and seems to prefer the greater simplicity of Luxemburg's.

Bukharin's algebraic formulation was criticized by Sweezy (1942, pp. 162-168) who thought that Bukharin had not included increasing capitalist consumption during accumulation. Sweezy added a term for that increase. Sweezy's point is difficult to understand, however, since Bukharin's condition refers to levels, not changes in levels. Furthermore, Marx had assumed that the rate of surplus value as well as the proportion of surplus value used for capitalist consumption remain fixed so that capitalist consumption does necessarily increase over time. Kuehne ignores Sweezy's criticism of Bukharin, while Tarbuck (1972, Appendix II) defends Bukharin, saying that the latter had only excluded increasing capitalist consumption in the first period, not for later periods. Tarbuck goes on to say that if changes in levels of capitalist consumption are to be included, other changes in levels should also be included and he modifies Sweezy accordingly. Such a defense of Bukharin seems unnecessary as Bukharin was discussing levels, and levels can increase over time.

With the help of a statistician H. Chester, Rosdolsky (1968, pp. 448-449) elaborates on the equilibrium condition offered by Bukharin to include the case in which the organic compositions in the two departments are distinct (although remaining unchanged). Tarbuck does not indicate that he had seen Rosdolsky's work (perhaps because the English translation was not to appear until 1977). Kuehne (1972, pp. 105-107) seems unimpressed by Rosdolsky's equilibrium condition and provides an alternative interpretation. In any case, on his following page Rosdolsky indicates that he accepts Sweezy's criticism of Bukharin even if, for Rosdolsky, the problem does not seem to involve Bukharin's basic condition for equilibrium under extended reproduction, but rather two derived conditions. To this reader the relevant passage in Bukharin (p. 158) does not in fact pose such supposedly derived conditions that Rosdolsky lists. This controversy does not seem worth further discussion.

We should note that in Appendix I to Sweezy's work, pp. 365-374, Shigeto Tsuru offers his own explanation of Marx's reproduction schemes and indicates their relationship to Keynesian categories.

referring to c/v, not our C/v) or rates of accumulation in the two departments, or allowing for organic compositions to grow, would bring the schemes closer to reality, but would not change basic results since the proportion of Department I to II could always be adjusted as needed to establish equilibrium (at least in theory, if not always in reality). Although Pannekoek doesn't write it down, the next period would be

Pannekoek: Third Period

Department I: 5324 c + 1331 v + 1331 s = 7986,
with 1331 s = 665.5 k + (532.4 c + 133.1 v)

Department II: 1936 c + 484 v + 484 s = 2904,
with 484 s = 242 k + (193.6 c + 48.4 v)

Let us return to the Pannekoek's first period, i.e.,

Department I: 4400 c + 1100 v + 1100 s = 6600,
with 1100 s = 550 k + (440 c + 110 v)

Department II: 1600 c + 400 v + 400 s = 2400,
with 400 s = 200 k + (160 c + 40 v)

Were the c above to refer to the stock of fixed constant and the outlay on circulating constant capital, the materialized composition of capital would be two -- 4400/(1100+1100) or 1600/(400+400) -- quite in line with the empirical work we have summarized. In fact, however, in Pannekoek, as in Marx, c seems to refer only to the outlay on circulating constant capital with its turnover not indicated to be anything other than unity so that its flow has the same magnitude.

Removing Marx's delimitation regarding fixed capital, we must reformulate the equations to include the need for additional fixed capital with which the laborers will work under extended reproduction (capital accumulation), along with the circulating capital to be needed. If we follow the suggestion of Shaikh and Tonak's empirical work utilizing gross, rather than net, estimates of fixed stock (see Tables A and B) and maintain materialized compositions of capital at two in both departments, with C the stock of means of production, then the portion of surplus value to be used for accumulation is allocated in the ratio of $C : (v+s) = 2$ for fixed capital in each department. The surplus value allocated for additional fixed capital can be represented by i. Additional circulating constant capital to be consumed at the higher level of production will be needed as well, and Moseley's work suggests an upper limit of one-half of newly created value, $v+s$, as its outlay. Introducing a turnover of four, then, $c : (v+s) = 2$. This, in turn, requires additional subsistence needs for additional workers to be engaged in new production.

(Investment of circulating constant capital -- at least represented in Moseley's calculations, pp. 161 and 163 -- is roughly equal to variable capital. If we multiple that level by the turnover, the resulting annual consumption of circulating constant capital would be some four times larger than variable capital and quite in line Marx's numbers more than a century earlier.)

With the rate of surplus value at unity and one-half of surplus value used for accumulation (the other half used for capitalist consumption *k*), the representation, although absent in Marx and in Pannekoek, must include the **surplus value used for production of new items of fixed capital**. In the following illustration, we illustrate this additional requirement *i* for additional fixed capital, in addition to requirements for additional circulating constant capital and variable capital to be in place as the next period begins. We assume a turnover of circulating constant capital of four, while the gestation for the new fixed capital is one year. Only one turnover of *c* and *v* is needed to put into place the raw materials, etc., which must be ready for the expanded reproduction of the next year, this turnover presumably in the last quarter.

Illustration 1a: Accumulation with *s/v* = 1, *k* = ½ s, *C/(v+s)* = 2, and *c/(v+s)* = 2

Department I: 4476 *c* + 1119 *v* + 1119 *s* = 6714,

with 1119 *s* = 559.5 *k* + (426.3 *i* + 106.6 *c* + 26.6 *v*)

Department II: 1524 c + 381 v + 381 s = 2286,

with 381 *s* = 190.5 *k* + (145.1 *i* + 36.3 *c* + 9.1 *v*)

: Growth of 9.5 percent has occurred. Employment represented by variable capital increases also by 9.5 percent during the expansion. The next period will then read

Department I: 4901 *c* + 1225 *v* + 1225 *s* = 7352

Department II: 1668 *c* + 417 *v* + 417 *s* = 2503

Were the process to continue, the following allocation would obtain for the use of surplus value in the next period:

Allocation of surplus value in Department I: 1225 *s* = 612.5 *k* + (466.7 *i* + 116.7 *c* + 29.2 *v*)

Allocation of surplus value in Department II: 417 *s* = 208.5 *k* + (158.9 *i* + 39.7 *c* + 9.9 *v*)

Another 9.5 percent growth would occur then.

In order to drive home the importance of the level of surplus value which is accumulated, as opposed to being consumed by capitalists, the next illustration presumes no capitalist consumption and all surplus value is used for accumulation. Note that, compared to the previous illustration, Department I expands and Department II contracts in order that the exchange between the departments balance.

Illustration 1b: Accumulation with *s/v* = 1, *k* = 0 (only accumulation), *C/(v+s)* = 2, and *c/(v+s)* = 2

Department I: 4952 c + 1238 v + 1238 s = 7428,

with 1238 s = (943.2 i + 235.8 c + 59.0 v)

Department II: 1048 c + 262 v + 262 s = 1572,

with 262 s = (199.6 i + 49.9 c + 12.5 v)

Growth of 19.1 percent has occurred. The next period will read

Department I: 5898 c + 1474 v + 1474 s = 8847,

Department II: 1248 c + 312 v + 312 s = 1872

The following illustration presumes no accumulation and all of surplus value being used for capitalist consumption. This is nothing other than simple reproduction and Department I is relatively less important compared to Department II as compared to our two preceeding cases.

Illustration 1c: Accumulation with *s/v* = 1, *k* = *s* (no accumulation), *C/(v+s)* = 2, and *c/(v+s)* = 2

Department I: 4000 c + 1000 v + 1000 s = 6000,

with 1000 s = 1000 k

Department II: 2000 c + 500 v + 500 s = 3000,

with 500 s = 500 k

No growth has occurred and the next period will read the same.

Table D displays these illustrations. They have been designed to help understand the impact of the proportion of surplus value being used for accumulation versus consumption by capitalists.

These limited presentations encourage us to develop a rather more general model. That is, we permit the rate of surplus value s/v to be other than unity. The allocation of surplus value between capitalist consumption and accumulation is also parameterized, with α representing the proportion of surplus value devoted to accumulation so that 1 - α is the proportion consumed by capitalists. We have already defined k as the level of capitalist consumption, and it is therefore $(1-\alpha)s$. In this illustration, we retain the empirical suggestion that $C/(v+s) = 2$. However, we allow circulating constant capital to be a constant fraction f of new value created, i.e., $c/(v+s) = f$. (In Marx's Chapter 9 discussed in our introduction, f would be £378/£132 = 2.86, after noting that the demoninator £132 is obtained from v =£52 plus s=£80. Table C(3) would suggest a f near to 2, if turnover is 4.) We maintain the turnover of circulating capital equal to four times yearly. Since $C/(v+s) = 2$, then the organic composition $C/v = 2(1+s/v)$ and becomes useful.

Table D: Illustrations allocating Surplus Value to Accumulation when *s/v*=1, *C/(v+s)* =2, *c/(v+s)* = 2, and turnover of annual circulating capital costs = 4

		s only for accumulation	*s=½ consumption, ½ accumulation*	*s only for consumption*
Department I				
value of output		7428	6714	6000
C and *c*		4952	4476	4000
V		1238	1119	1000
S		1238	1119	1000
k, i.e., *s* for consumption		0	559.5	1000
s for accumulation		1238	559.5	0
of which	*i* for fixed capital	943.2	426.3	
	c for circ. capital	235.8	106.6	
	v for circ. capital	59.0	26.6	
next period output value		8847	7352	6000
Department II				
value of output		1572	2286	3000
C		1048	1524	2000
V		262	381	500
S		262	381	500
k, i.e., *s* for consumption		0	190.5	500
s for accumulation		262	190.5	0
of which	*i* for fixed capital	199.6	145.1	
	c for circ. capital	49.9	36.3	
	v for circ. capital	12.5	9.1	
next period output value		1872	2503	3000
sales bet. departments		1297	1705	2000
Growth		19.1%	9.5%	0%

Accumulation α *s* requires investment in new fixed capital, new circulating constant capital, and new variable capital. We are taking the gestation of new fixed capital as the full year, i.e., it takes a year to construct and put into place the new fixed capital. However, new circulating constant capital (much of which is raw materials) and new variable capital requires only on turnover period, i.e., the last quarter, given that turnover is quarterly. Recall that variable capital *v* always represents yearly flow, as does circulating constant capital *c*. Therefore, accumulation, in each department, is

$C + c/4 + v/4$

so that, dividing by v, we obtain

$C/v + ¼\, c/v + ¼$.

Given that $c = f(v+s)$, so that $c/v = f(1+s/v)$, this expression becomes

$2(1+s/v) + ¼ f(1+s/v) + ¼ = (2 + ¼ f)(1+s/v) + ¼$.

For convenience, let

$D = (2 + ¼ f)(1+s/v) + ¼$.

Both fixed and circulating capital come from Department I. The proportion of accumulation coming from that department is therefore

$(2 + ¼ f)(1+s/v) \div D$

and the proportion of accumulation coming from Department II is

$¼ \div D$.

Thus, it can be shown[11] that

Illustration 2: Accumulation with *s/v* variable, capital accumulation = α*s* and *k* = (1-α)*s*, *C/(v+s)* = 2, and *c/(v+s)* = f.

The value of the output levels for Department II relative to Department I is

$$\{1 + s/v[1 - \alpha\,(2 + f/4)(1 + s/v)]/D\} \div \{\, f(1+s/v) + ¼\,\alpha\, s/v/D\}.$$

In other words, balance between the departments requires that the ratio Department II output to Department I output be given by the formula above.

The growth rate of the value of outputs and employment can also be shown[12] to be

$$\text{output growth rate} = \alpha\, s/v \div D\ .$$

For example, if one half of surplus value is used for accumulation so that α is one-half, the rate of surplus value is one and *f,* the ratio of flow of circulating constant capital to new value created, is two, then the growth rate is 9.5%, i.e., the value in our Illustration 1a. But if the rate of surplus value were two, i.e., the value suggested by the empirical work summarized in Table B, then the growth rate would rise to 12.9%.

Table E: Sample growth rates under differing values for α, *s/v*, and *f*

	α = 0.40		α = 0.20		α = 0.10		α = 0.05	
s/v	*f* = 2	*f* = 1	*f* = 2	*f* = 1	*f* = 2	*f* = 1	*f* = 2	*f* = 1
1	7.6%	8.4%	3.8%	4.2%	1.9%	2.1%	0.9%	1.1%
2	10.3%	11.4%	5.2%	5.7%	2.6%	2.8%	1.3%	1.4%
4	12.5%	13.9%	6.3%	7.0%	3.1%	3.5%	1.6%	1.7%

[11]To be available later.
[12]To be available later.

Table E provides growth rates in the two departments under our representation of balance between the departments being maintained. We have not introduced any discussion of technological changes, which would only increase output growth rates, but not necessarily for the labor force requirements. Indeed, since our interest is primarily on accumulation of capital as it affects the labor-power requirements, it is perhaps more useful as presented. We learn, even with only 10% of surplus value being allocated for accumulation, still the growth rates exceed the recent high levels of population growth worldwide. Such employment growth could only be sustained over a longer period by the penetration of non-capitalist modes of production and conversion of populations into wage laborers. As Rosa Luxemburg had already been aware a century ago, this potential source declines as the very result of capitalist expansion continues. **Capitalist accumulation is ever more difficult. Therefore, the rate of accumulation α must decline and alternative uses of surplus value employed.**

IV. Population Increase and Accumulation

Let us examine how much of accumulation is associated with population increase. According to United Nations figures, in 1850, of the total world population of 1,262 million, 64.1% was in Asia, 21.9% in Europe, 8.8% in Africa, 3.0% in Latin America and the Caribbean, 2.1% in Northern America, and 0.2% in Oceania (Population Division of the Department of Economic and Social Affairs of the United Nations Secretariat, "The World at Six Billion". (ESA/P/WP.154), 12 October 1999, Table 2. www.un.org/esa/population/publications/sixbillion/sixbilpart1.pdf). In that year of 1850, only Europe with its 276 million persons had a significant working class of wage-laborers.

By 1900 the world is estimated to have had 1,650 million persons, representing an annual growth rate of 0.54% since 1850. And, by 1999, the world is estimated to have arrived at 6 billion persons, an overall growth rate since 1850 of 1.05%, but 0.85% annually between 1900 and 1950, and 1.78% between 1950 and 1999. Thus, Marx was writing at a time of lower levels of world population growth, albeit above 1% in England (including net migration).[13]

If the world in 1850 had 3% of its population as working class -- i.e., 38 million -- and in 1900 had 10% its population of 1650 million as working class, the growth rate of the working class from 38 million to 165 million is 3.0% annually. This could represent accumulation of capital if all of the working class were producing value and surplus value, unproductive wage-labor not involved (the issue of unproductive labor does not seem to be a substantial phenomenon until the 20th century). We can see

[13] Based upon census data, "the population of England had more than doubled from 8.3 million in 1801 to 16.8 million in 1851 and, by 1901, had nearly doubled again to 30.5 million" (http://www.statistics.gov.uk/downloads/theme_compendia/fom2005/01_FOPM_Population.pdf) , implying 1.4% and 1.2% population growth rates, in the respective half centuries.

from our previous section that such a 3% growth rate could correspond to merely 10-15% of surplus value being utilized by capitalists for accumulation of constant and variable capital (see Table E, interpolating between 10% and 20%). The balance of surplus value at a 85-90% level being used for consumption would be much too high and higher rates of surplus value would only suggest a more severe problem for the utilization of surplus value.

The difficulty can also be illustrated by focusing upon the United States where data are available and the United States became the leading industrial power by the 20th century. The decade of 1860 to 1870 represents conversion of slaves into share croppers, tenant farmers, or wage laborers. The period thereafter includes massive immigration into the country. The U.S. census population in 1870 was 38.6 million, and was 106.0 million in 1920, a 2.0% annual rate of increase, net immigration of course included (www.census.gov/population/www/censusdata/files/table-4.pdf). As reported by Weinberg (2002, p. 185), the number of wage laborers increased from 5,600,000 to 23,300,000 from 1870 to 1920, representing a growth rate of 2.9% annually. These figures do not include 'clerical' workers which moved from 260,000 to 3,715,000. If the clerical were included, the growth rate would be somewhat higher at 3.1%. On the other hand, if reduction in hours in the workweek were included, the increase in produced value would be less and the growth rate of total workhours, and thus value produced, would be somewhat lower.

Even with a fast developing capitalist economy, represented by U. S. history, only approximately 15% of surplus value would be needed to sustain the employment rise. We are therefore compelled to ask as to the destination of a major portion of surplus, the portion neither used for capitalist consumption nor accumulation of capital. This is the third, yet very large, portion of surplus value which Marx did not focus upon. In other words, **we are drawn to ask at what level does the accumulation of capital play a role in the dynamics of the capitalist mode of production. Has it been over-played?**

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