APPLYING THE TURNOVER FORMULA TO THE SYSTEM OF NATIONAL ACCOUNTS TO DETERMINE BOTH THE AMOUNT OF WORKING CAPITAL AND ITS ANNUAL RATE OF TURNOVER.

The role of the turnover of capital is an important discussion that takes in both Marxian and mainstream economics, though Marx was the first to describe its importance and its effect on the mass of profits. Today most annual turnovers of working or circulating capital are obtained by analysing the balance sheets of individual corporations. Current liabilities are subtracted from current assets to obtain working capital. Working capital is then divided into the cost of annual sales to determine how often it turns over each year. This laborious process means that only the top corporations are researched by analysists who then sell these results to investors. If a method could be found to obtain turnovers using the national accounts, which comprise the most comprehensive and detailed analysis of the economy, it would provide a more thorough and fundamental analysis of the economy. The turnover formula provides that method. It is based on the inter-relation between Gross Output and Gross Value Added. It is of course a matter of conjecture why it has taken so long for this formula to emerge when the modern SNA is 70 years old.

Key words: Gross Output, Gross Value Added, System of National Accounts, circulating capital, working capital.

Introduction.

The methodological origins of the System of National Accounts (**SNA**) are shrouded in deceit. Three men, two of whom were Russian emigres, are credited as its primary architects - Leontief, Kuznets and Clark. In particular Leontief is credited with the development of the first input-output tables in the west. Nearly two decades later, in the early 1950s, the CIA tried to expunge the input-output tables from the SNA because they discovered it had been used for decades in the USSR and that it was the foundation of the planned economy. Fortunately, the CIA did not have its way.

The Soviet Union had no illusions where the methodology behind their input-output tables and national accounting came from, it came from the least read of Marx's trilogy, Volume 2 of Capital. In this volume Marx explained how to avoid counting duplicated sales in order to arrive at value added, and how to employ value added to prepare the product and income side of the National Accounts. Additionally, volume 2 contains the first elementary input output tables which are used by Marx to explain the difference between simple reproduction and expanded reproduction. It was no accident that two Russian emigres, both of whom were familiar with the earlier work done in the USSR, would be pivotal to preparing the first sets of National Accounts. Unfortunately, because of the prevailing antipathy to the USSR at the time, neither would ever credit Marx for this work.

It is precisely because the SNA follows Marx's methodology that developing the formula was made possible. Gross Value Added is the sum of net value added plus depreciation as directed by Marx. It is represented by the price of the final sales in an industry. But there are two classes of sales in all industries, final sales and intermediate sales (inputs). Together these two classes of sales make up Gross Output or the value of the total sales within an industry.

For those not familiar with the SNA a simple example will clarify the distinction between Gross Value Added (G.V.A.) and Gross Output (G.O.). A farmer sells wheat to a miller, who sells the milled wheat to the baker, who then sells bread to a restaurant for final consumption. There are thus four sales.

Three are intermediate, the farmer's sale, the miller's sale, the baker's sale, while there is one final sale, the sale of bread to hungry diners who consume it.

If the four producers each add £10 of value, the total value they add is £40. But the total value of their sales is higher, it totals £100. This is made up as follows: value of the farmer's sale = £10, value of the miller's sale = £20 (£10 for the wheat + £10 value added), value of the baker's sale = £30 (£20 for the milled wheat + £10 value added), value of the restaurateur's sale = £40 (£30 for the bread + £10 value added) £10 + £20 + £30 + £40 = £100. Both the miller, the baker and the restaurateur must sell at £20, £30 and £40 to respectively recoup what they paid for their intermediate inputs, which comprises wheat, followed by milled wheat, followed by bread. The value of G.O. must be bigger than G.V.A. because it always includes intermediate sales which in this case is £60 (£10 + £20 + £30).

If gross output represents the total number of sales in an industry, while gross value added represents only a single sale, it is possible to develop a formula which yields the total number of sales. However, that formula needs to be a two-part formula because of the dual way in which the final sale presents itself. On the one hand, it represents the total value added by the chain of producers leading to its production, while on the other hand it also adds a fraction to that value, in this case the £10 added by the restaurateur. Thus, the formula cannot simply be either,

$$\frac{GO}{GVA} = \frac{100}{50} = 2 \quad \text{or} \quad \frac{GO}{GVA} + 1 = \frac{100}{50} + 1 = 2 + 1 = 3.$$

In both cases we obtain a result different to the 4 sales registered above. Instead the correct formula can be described either as,

$$\frac{GO}{GVA} + \frac{(GO-GVA)}{GVA} \quad \text{or} \quad \frac{GO}{GVA} + \frac{IS}{GVA}$$

where IS stands for Intermediate Sales which is equal to GO minus GVA. Applying this formula yields the correct result of 4 sales in both cases.

$$\frac{100}{40} + \frac{(100-40)}{40} = 2.5 + 1.5 = 4 \quad \text{or} \quad \frac{100}{40} + \frac{60}{40} = 2.5 + 1.5 = 4$$

If an explanation as to why it has taken so long for this formula to surface is needed, it must be because the dual nature of the final sale has not been hitherto understood. Furthermore, it may be argued that the formula works only because each producer provides an equal fraction of value added. This is true but not problematic, because the SNA is based on aggregated sales not individual sales, sales that number tens of millions in each industry and whose magnitude has an averaging out effect.

In turn, the number of sales can be used to determine the turnover of capital because the circuit of capital always ends with a sale. The productive circuit of capital begins with a purchase and ends with a sale. With the purchase, the capitalist purchases the factors of production setting them to work to produce goods for sale. (To the sellers of these factors as commodities, this represents a sale.) During the first exchange, money goes out in payment for the factors of production and in the second exchange money comes back in from the sale of the goods produced. Marx presents the circuit thus: $M.C…P…C^+.M^+$ where M stands for money, C for commodities (the factors of production) …P… stands for the production period, C^+ stands for the new commodities produced ready for sale and M^+ for the new money that comes in from the sale.

The final step was to test the results yielded by the turnover formula against the results found empirically. To do this the most comprehensive data base found on the web was used - *Stock Analysis on the Net: Top 100 Leaders,* which is a private, subscription only, research database of the top 100 US corporations. Separating out all the corporations belonging to the manufacturing sector and averaging out their turnover times or annual rates of turnover, the result obtained was an annual

turnover rate of 4.8 yielding an average turnover period of 76 days (365/4.8). Car companies were excluded from the average due to issues with Ford's working capital that year though the inclusion of the car companies would have reduced the turnover period below 76 days.

The turnover formula on the other hand yielded a figure that was within 90% of that figure, but lower:

$$\frac{5829.6}{2170.3} + \frac{(5829 - 2170.3)}{2170.3} = 4.4 \text{ turnovers} \qquad \text{or in days } \frac{365}{4.4} = 83 \text{ days}$$

(All figures in millions of dollars provided by the BEA Interactive Website, GDP-by-industry, KLEMS, Composition of Gross output.)

The slower turnover rate was expected. The formula had to yield a lower rate because the BEA's figures includes the average turnovers of all corporations and non-corporations in the manufacturing sector, both small and large, and as the smaller corporations tend not to have the economies of scale of the larger corporations, they also tend to have slower turnover cycles.

Different rates of turnover prevail in different industries.

Different corporations and industries manifest different annual rates of capital turnover. Conversely this means that their turnover period, which is measured in days, differs. For the rate of profit to function as a guide to investment, these differing turnovers need to be made commensurate. What concerns every investor is the return of profit in terms of the expenditure of their capital over a predetermined time frame. This time frame is usually a calendar year. Hence despite their different periods of turnover, each will produce a quantum of profit within a year, which allows their profitability to be measured in the same time frame. By setting a universal time frame, the profitability of capitals with differing rates of turnover are made commensurate.

In 2015 the following rates of turnover took place in the following industries:

Non-durable manufacturing	4.9
Durable manufacturing	4.2
Food/beverage production	6.6
Vehicle assembly	7.5

(Source: BEA Interactive Tables, GDP-by-industry GO/GV + [GO-GV]/GV)

In the durable manufacturing sector, it took 87 days (365/4.2) for working capital to complete its circuit and for profit to be realised. In the food and beverage sector it took only 55 days (365/6.6). It follows that each lump of profit in the food and beverage sector took 32 fewer days to produce compared to durable manufacturing. Conversely, in the durable manufacturing sector, employers had to have sufficient working capital, including wages, to cover 87 days, whereas in the food and beverage sector only 55 days.

It now becomes clear why turnover period or annual rates of turnover are so crucial. Shorter periods in which working capital turns over requires less working capital, while providing more opportunities to produce profit. In the case of durable manufacturing profits are produced and realised every 87 days, or 4.2 times a year whereas in the food/beverage industry each quantum of profit is produced in only 55 days or 6.6 times a year.

Turning away from the profit side to the expenditure side, the issue of annual wages becomes critical. Just as profits are annualised so too is workers' compensation. However, it is clear that employers seldom require capital sufficient to pay a years' wages. Why should they, when within that year working capital turns over multiple times. In the durable sector workers' compensation is needed for

87 days only, less so for the food industry where only 55 days of compensation is needed. After this period, sales revenue replenishes the empty wage coffers in both industries.

Marx's understanding of variable capital, the capital spent on the employment of labour power, is thus predicated on turnover. Variable capital is never an annualised figure, it is a turnover figure. It is always smaller than annual compensation by the number of turnovers within that year. The problem with using annual employee compensation as a substitute for variable now becomes clear. Both the durable sector and the food/beverage sector will pay wages over 365 days, but here the similarity ends. In the case of the food sector it will require 37% less working capital to meet those wages than is needed in durable manufacturing (all other factors made equal) due to its faster turnover.

The formula for converting annual compensation into variable capital is:

$$\frac{\text{annual compensation}}{\text{annual number of turnovers}}$$

Using this formula, the following adjustments to annual compensation are made in the four aforementioned industries for the year 2015.

Table 1.

INDUSTRY	YEAR	Annual comp.	Rate of turnover	Variable Capital
Non-durable	2015	342,577 million	4.9	69,914 million
Durable	2015	660,040 million	4.2	157,152 million
Food/beverage	2015	102,705 million	6.6	15,561 million
Motor vehicle	2015	69,332 million	7.5	9,244 million

(Source: BEA table 6.2D for annual compensation.)

The difference between annual compensation and variable capital is a function of the number of turnovers. In turn, the magnitude of the error by the theorists who used to, and continue to, substitute compensation for variable capital, is given by the number of turnovers. The more turnovers, the greater the difference between the two rates and, consequently, their error.

In terms of ratios, the share of annual compensation by the non-durable manufacturing sector relative to the durable sector is 52% but in terms of variable capital it falls to only 44% because of its faster turnover. Hence the incentive on the part of the capitalist class to accelerate the rate of turnover of circulating capital, both in terms of the production period …P… and the circulating period on both ends: M.C. and C$^+$.M$^+$. All accelerations reduce the money capital expended in terms of output.

Using the SNA to determine the magnitude of working capital.

Variable capital forms only one component of working capital. Generally, working capital exceeds variable capital due to its additional components. As Engels outlined in Volume 3, Chapter 4, working capital consists of cash on hand, inventory, credit given less credit taken - and a few additional items. Variable capital takes the form of cash on hand to pay wages in arrears and it is embodied in the worked-up inventory but not in the raw inventory. In the language of capitalist accountancy, working capital is generally described as current assets less current liabilities, where these assets and liabilities are defined as having a life less than the life of the financial year. To determine working capital using the SNA the following formula is used:

$$\frac{\text{gross output for the industry } \textbf{less} \text{ undivided profit}}{\text{number of annual turnovers}}$$

Gross output is the value of total sales in an industry and it is comprised of undivided profit plus employee compensation. Undivided profit in turn is equal to the sum of enterprise profit, plus interest paid, plus taxes paid.

Total sales include its paid component equal to total cost price, and its unpaid component equal to undivided profit (surplus). Total circulating or working capital only ever covers the paid component of sales - not the unpaid. At first this appears contradictory. If capitalist A sells to capitalist B, then the treatment of unpaid labour is different. Capitalist A does not pay his workers for all the labour they expend. But when he sells his output to capitalist B he is paid for all the labour of his workers (presuming that the output is sold at its value.) The cost price of capitalist B thus includes both paid and unpaid labour or, what is the same thing, the profit pocketed by capitalist A.

The strength of the turnover formula is that it avoids this contradiction between selling prices and cost prices at an individual level, because it deals with aggregated sales or, in other words, industry-wide sales that total millions of individual transactions in any period. This being so, it is possible to separate out the profit component from this aggregate to arrive at the "cost-of-gross-output" which circulating capital pays for and which is equal to the aggregate working capital. (1) This is done by using the industry wide surplus figure (= to undivided profit) provided by the BEA in its series on value added.

It should be noted that the surplus figure being used in this section has not been adjusted for taxation as it is impossible to separate out sales tax - which is paid out of circulating capital - and corporation tax which is not. Nor is compensation for workers adjusted for the top 1% as the bulk of that payment is paid out of working capital. The net result is a marginal overstating of working capital.

In the table below, the relation between gross output and working capital is laid out. The greater the rate of turnover, the greater the reduction in working capital. Numerically, in the non-durable sector, it takes $594.5 billion of working capital to circulate $2,912.9 billion worth of sales, because turnovers amounted to 4.9 in 2015. In addition, given the importance of the inventory cycle as a marker of the health of the capitalist economy, the table measures inventory relative to total working capital.

Table 2. (all figures in millions of dollars)

(a) Industry	(b) Gross Output	(c) Undivided Profits	(d) Turnovers	(e) Working Capital	(f) Inventories	(g) f/e
Non-durable	2912.9	223.9	4.9	548.8	283.1	52%
Durable	3027.4	265.3	4.2	657.6	411.7	63%
Food/bev.	964	126.5	6.6	126.9	82.7	65%
Motor vehicle	662.5	55.6	7.5	80.9	35.5	44%

(Sources: BEA Table 1BUC, 3.4ESI for Food/beverages & Motor Vehicles. Table 5.8.5B for durable and non-durable, 29th June 2017 release.)

Alongside inventory, another major element of working capital is credit. Marx recognised that the total turnover time of capital was the sum of its production period and its two circulation periods. (2) The cut-off points at the inception of the circuit and its termination, are the monetary payments which extinguish the credit given or taken. "…*the turnover of capital which always begins with the advance of capital-value, whether in the form of money or commodities, and which always necessitates the return of the rotating capital value in the form in which it was advanced."* (3) The BEA's method of compiling purchases and sales essentially records moments of payment. This is the correct outcome.

Credit given to customers generally exceeds credit taken from suppliers because the value of output post-production, always exceeds the value of the inputs that went into its production. Hence as, under normal conditions, the value of sales always exceeds the value of purchases, credit given must exceed credit taken (if they are of similar duration). Therefore, the giving of credit must, on balance, increase the mass of working capital. Altogether, this explains why working capital, with few exceptions, must exceed inventory capital. In addition, this relatively higher provision of credit by the seller, explains the basis for the fragility found in the chain of credit.

The business cycle, fluctuations in the rate of turnover, and their effect on working capital.

Marx originally referred to circulating capital as "fluid capital" referring to the incessant reflux of commodities and money. (4). The use of the term 'fluid' implies that the circulation of capital can become less fluid, more viscous. This implies that turnover times can reverse.

In the long-run, the rate of turnover accelerates. This is confirmed in a subsequent section by reference to the international rate of turnover of capital. This acceleration is a product of the improvement in the technical conditions of production and circulation. Commodities are produced more efficiently and arrive at their destination more quickly due to more modern and complex machinery, equipment and computers. The friction that decelerates turnover times must therefore arise from a non-technical cause - except in the case of natural disasters. This friction can only be a function of changing market conditions resulting from the phasing of the business cycle.

The individual capitalist experiences this elongation in the circulation of capital or, which is the same thing, the slow-down in the velocity of the rate of turnover, as a build-up of inventory. What used to take 100 days to buy in, produce and sell, now takes 120 days. The sales-to-inventory ratio falls. It now appears that the same amount of inventory is surplus to requirements, because 100 days' worth of inventory has now become 120 days' worth. This stockpiling of inventory is the trip-wire triggering the fall in production.

But it is not only inventories that impact on working capital. Working capital, which initially covered 100 days, must now be extended to cover 120. If workers are not fired, the amount of compensation must be increased by 20% to cover 120 days instead of 100 days. The same applies to credit. If it is assumed that this fall in demand is generalised, resulting from the twilight phase of the business cycle, it affects customers as much as it does sellers/producers. They are stuck with additional stock which is taking longer to sell despite lowered prices - and accordingly they seek more credit to tide them over. Under these circumstances credit stretches to breaking point and the issue of solvency arises.

The elongation of the circuit of capital or, to put it another way, the deceleration in the annual rate of turnover of capital, has not one but two effects. Not only does the same value of output require more capital, but on the other side, less profit is produced. The same amount of profit which took 100 days to produce and be realised, now takes 120 days. This impacts the annual rate of profit. A 100-day circuit produce 3.65 turnovers each calendar year. A 120-day circuits produces only 3 circuits or turnovers per annum. If, by way of example, each turnover generates $1 billion in profit, then the initial rate of turnover will produce $3.65 billion annual profit and the subsequent rate only $3 billion - a loss of $650 million, amounting to a reduction in the mass of profits of 18%.

In terms of measuring the profit returned against the amount of working capital advanced, there is a sudden and significant deterioration in profitability. In inverse proportion to rising working capital, profits decline, a decline accelerated by falling prices. To remain solvent, the corporation has no option but to trim its working capital through firing some of its workers, curtailing production and selling down its overlarge inventory. In the words of Marx, the employer acts as the personification of the

needs of capital. In fact, if inventories are to be reduced, production must fall below the level of sales to reduce stocks. In the past, before the computerisation of stocks and the supply chain, what is now called "just in time inventory", inventory corrections could be convulsive. Today they are less so as inventory build-ups are spotted earlier and orders corrected more expeditiously. Nevertheless, an inventory correction, no matter how well managed, will always impact on production.

The effect on working capital turnover of changing market conditions has been well researched, albeit superficially. The capitalists are more focused on its superficial expression: the inventory cycle. *"Alan Blinder, a former Governor of the Federal Reserve System, famously remarked that 'the business cycle, to a surprisingly large degree, is an inventory cycle'."* (5) What has been missing is the more fundamental observation of the working capital cycle. This missing element can now be reconstructed using the turnover formula which enables gross output to be reduced to working capital.

Graph 1 below, covering a 20-year period between 1995 and 2015, encompasses two business cycles including their recessions in 2000/1 and 2008/9. Two sectors are chosen: durable and non-durable manufacturing. Statisticians divide manufacturing into its durable and non-durable components based on how long its output lasts. Durable goods are defined as having a life span in use exceeding a year. However, it is also true that the production of durable goods tends to be more complex, takes longer and embodies more parts from suppliers than that found in the non-durable sector. It is this technical variation which underlies the difference in the fluctuations of their respective working capitals. In the case of durable goods production, this complexity makes it more prone to oscillations during the business cycle. Conversely it can be said that, as production becomes more complex, it requires more stable market conditions - a state of affairs that capitalism cannot provide.

Graph 1.
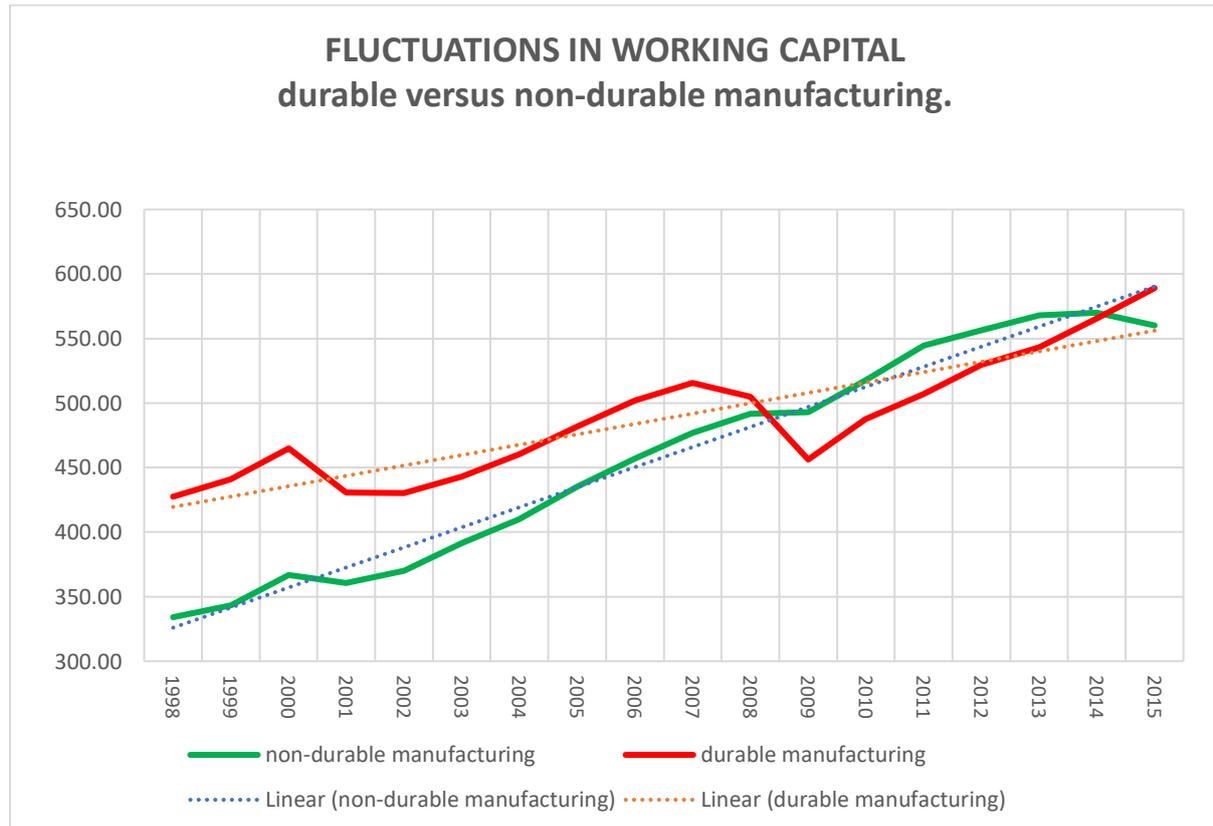
(Source: BEA Interactive Tables: GDP-by-Industry, Value Added & Gross Output.)

The business cycle is described by the undulations in the movement of working capital. During the up-phase of the business cycle when both production and circulation are expanding, more working capital is employed. As expected, durable production, with its higher technical composition of capital, increases fastest. Durable production takes longer to execute and requires a higher quantum of inventory. Large jet planes typically require, for example, three million parts provided by hundreds of contractors.

The opposite occurs during the down-phase. Now the working capital in the durable sector contracts faster. In the durable sector, the mass of working capital fell 10% from its 2000 peak to its 2001 trough and in 2009 by 13% from its 2007 peak. This compares to the non-durable sector whose falls were limited to 2%. This is due to the turnover of capital being more fluid in the non-durable sector where inventory is lower and production simpler, so that destocking can be done earlier and more gradually. In the case of the durable sector where the production period is longer and more complex, the cancellation of orders provokes a deeper contraction to maintain solvency.

The addition of trend lines highlights the oscillations. Despite working capital rising relatively faster in the durable sector in the up-phase, this is balanced by the relatively faster falls during the down-phase. The longer-term trends in investment is of little concern. They are simply a function of the greater weight of investment that has gone into non-durable production compared to durable production.

Until the turnover formula enabled an estimation of working capital, the movement of working capital within the business cycle could not be monitored. Nor could the differential response between industries and sectors be seen. In addition, the emphasis hitherto, between profitability and investment, has focused primarily on the impact of falling profitability on fixed investment. However, unlike working capital, which is fluid and responsive to changing market conditions, fixed capital is sticky and has greater inertia. Changes to fixed capital often take years, whereas changes to circulating capital take only months to effect. The missing link between profitability and investment has been circulating capital. Before investment decisions relating to fixed capital are taken, circulating capital has already contracted or expanded. Indeed, unless and until changes to circulating capital take place, fixed investment tends to be unaffected. The need to reduce stocks as the rate of turnover falls, together with movements in the overall rate of profit, are the switches affecting future investment. (More attention will be given to the interaction of turnover and the rate of profit later.)

A final emphasise is required. The division of labour into its paid and unpaid parts is one of the most contentious aspects of political economy and its most obscured relationship. If, where circulating capital can be derived from the national accounts - as is the case; and it equates to manually extracted versions of working capital - which it does; then this is one of the most powerful confirmations of unpaid labour. Circulating capital does not pay for the entire gross output (which includes depreciation), but only for part of it. What remains unpaid is the surplus lodged within gross output. Deducting this surplus or undivided profit from gross output, yields the cost-of-gross-output, or aggregated cost price, or the industry-wide sum of circulating capital. Here then is confirmation that the capitalist throws capital into circulation and extracts a sum greater than this capital value. If this sum was simply the product of the addition of a profit margin, it would mean one capitalist (the seller) profiting from this margin at the expense of another capitalist (the buyer). Instead all the capitalists profit. This can only happen under one condition: their workers must be underpaid - they have to be producing unpaid labour which makes up the surplus by which gross output exceeds the cost-of-gross-output. The national accounts, like a gigantic pond where the ripples and waves cancel each other out as they cross, therefore minimises the illusions and inversions thrown up by competition, providing one of the most powerful proofs that the source of profits originates from unpaid labour.

**Understanding the relative and absolute fall in the mass of profits through the prism of turnover.**

This section examines the transition from the relative fall in the mass of profits compared to investment, to its absolute fall. This analysis is confined to working capital only. This article avoids examining fixed capital and therefore does not introduce the rate of profit based on the formula below. Suffice to say, that is only now, with the advent of the turnover formula, possible to prepare an accurate rate of profit because hitherto it was not possible to distil variable capital from annual compensation.

$$\frac{\text{Undivided profits}}{\text{Fixed capital + variable capital}}$$

Just as annual compensation has been confused with variable capital, so too the rate of exploitation with the rate of surplus value. The rate of exploitation is the ratio of surplus to compensation while the rate of surplus value is the ratio of surplus to variable capital. The question that arises is this: does the mass of profits respond more closely to the rate of exploitation or to the rate of surplus value? It turns out it responds to the rate of surplus value for it alone contains the turnovers that effect the production of profits.

The rate of surplus value can increase even if the rate of exploitation decreases, provided the rate of turnover increases, and it can fall even if the rate of exploitation rises, provided the rate of turnover falls sufficiently. The best way to deconstruct the rate of surplus value to describe the role of turnover within it, is to cast it in the role of multiplier. It multiplies any changes in the underlying rate of exploitation. Any acceleration in the rate of turnover increases its multiplier effect, while any deceleration in the rate decreases it. This effect can be seen in Graph 2 below.
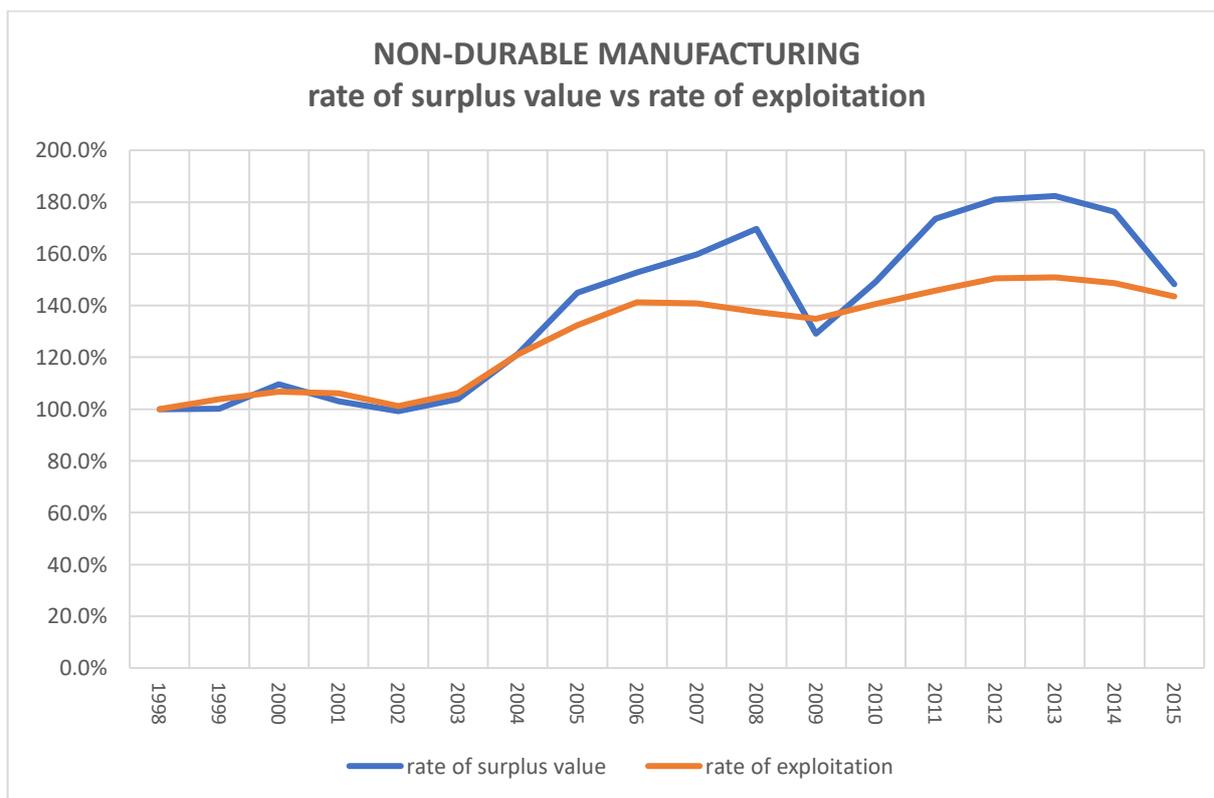
Graph 2.
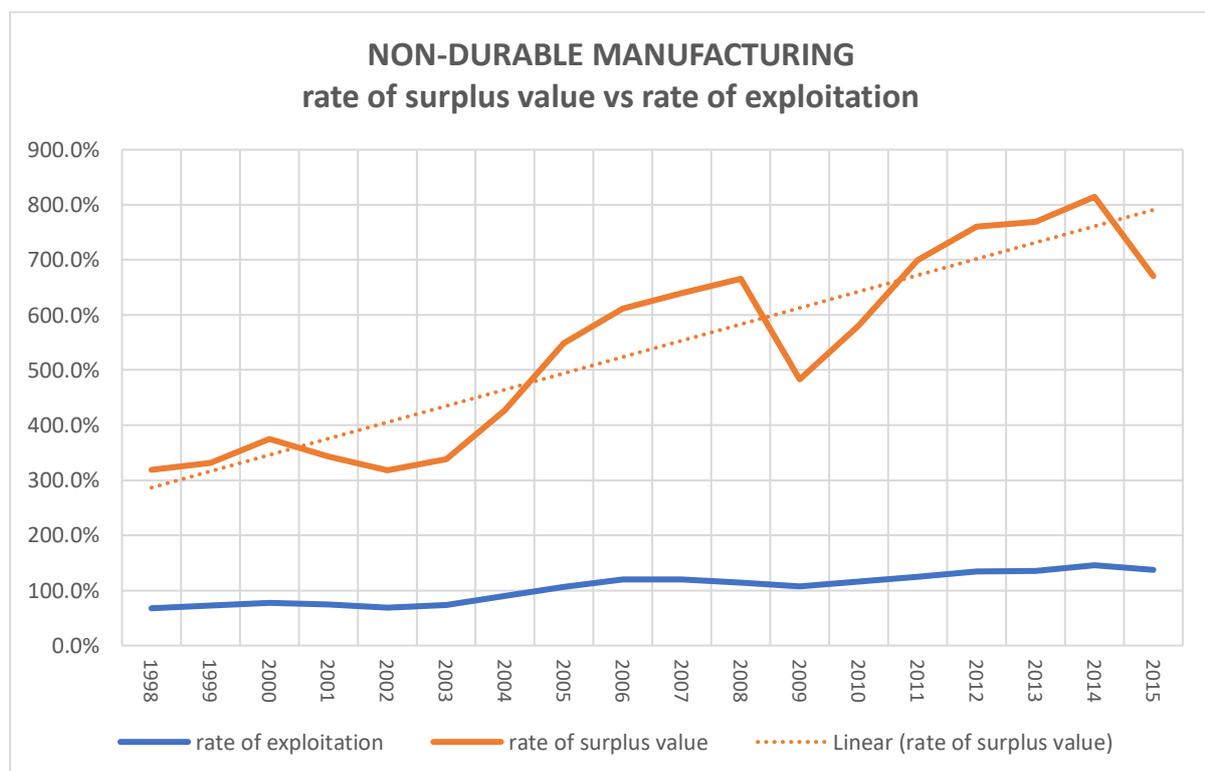
(Sources: BEA Table 6.1D for value added. Table 6.2D for compensation. For wage adjustment: Saez-Zucman 2014 Appendix Data, Table B28 up to 2012. Thereafter *Office of the Chief Actuary,* Annual Wage Statistics issued 17 May 2017.)

Non-durable manufacturing has been chosen because, unencumbered by industries heavily dependent on Intellectual Property (I.P.), and because it is less prone to the vagaries of foreign trade, it has shown resilient long-term increases in turnover times. The multiplier effect is clearly visible. Whereas the rate of exploitation has increased by 45% over 17 years, the rate of surplus value (as indicated by the trend line) has increased by 78% over the same period. This difference is due to turnovers increasing from 4.6 to 5.6 over this period.

There is another important effect that needs further elaboration. The rate of surplus value is more volatile than the rate of exploitation. During recessions, the rate of surplus value decelerates much more rapidly than does the rate of exploitation. This is due to the deceleration of the rate of turnover as the movement of circulating capital stalls at the end of the business cycle. Between 2008 and 2009 the number of annual turnovers declined from 5.82 to 4.52. This represented a loss of over one turnover over the period. The result was a much deeper comparative fall in the rate of surplus value.

Graph 3 below brings out in sharper relief the effect of changing rates of turnover. In this graph both the rate of exploitation and of surplus value are indexed at 100 in 1998. This converts absolute rates into relative rates demonstrating the degree by which both rates accelerate and decelerate relative to each other. Both rates accelerate during the up-phase of the business cycle and both decelerate during the down-phase of the business cycle. Whereas the oscillation for the rate of exploitation is 4% in 2009 for the rate of exploitation, it rises to 26% for surplus value. The degree of oscillation therefore differs by a factor of 6. It is the depth of this fall, this multiplier effect, that converts a relative into an absolute fall in the rate of profit.

Graph 3.

(Sources: BEA Table 6.1D for value added. Table 6.2D for compensation. For wage adjustment: Saez-Zucman 2014 Appendix Data, Table B28 up to 2012. Thereafter *Office of the Chief Actuary,* Annual Wage Statistics issued 17 May 2017.)

This has direct consequences for the movement in the mass of profits. Either the movement in the mass of profits will correspond to the slighter movement in the rate of exploitation or it will correspond to the much greater movement in the rate of surplus value. This represents the acid test for Marx's observation that the mass of profits is dependent on the rate of surplus value which in turn is dependent on the rate of turnover of capital. To confirm this link, and to vindicate Marx's hypothesis for the first time in the aggregate, the correlation of the respective rates of exploitation or surplus value with the movement of pre-tax profit (enterprise profit) plus net interest, is investigated. Net interest is included as the rate of interest pre-2008 and post-2009 differed significantly and this affected the amount of enterprise profit. Net interest plus enterprise profit thus provides a stronger correlation to the rates of exploitation and surplus value than would enterprise profit alone.

GRAPH 4.
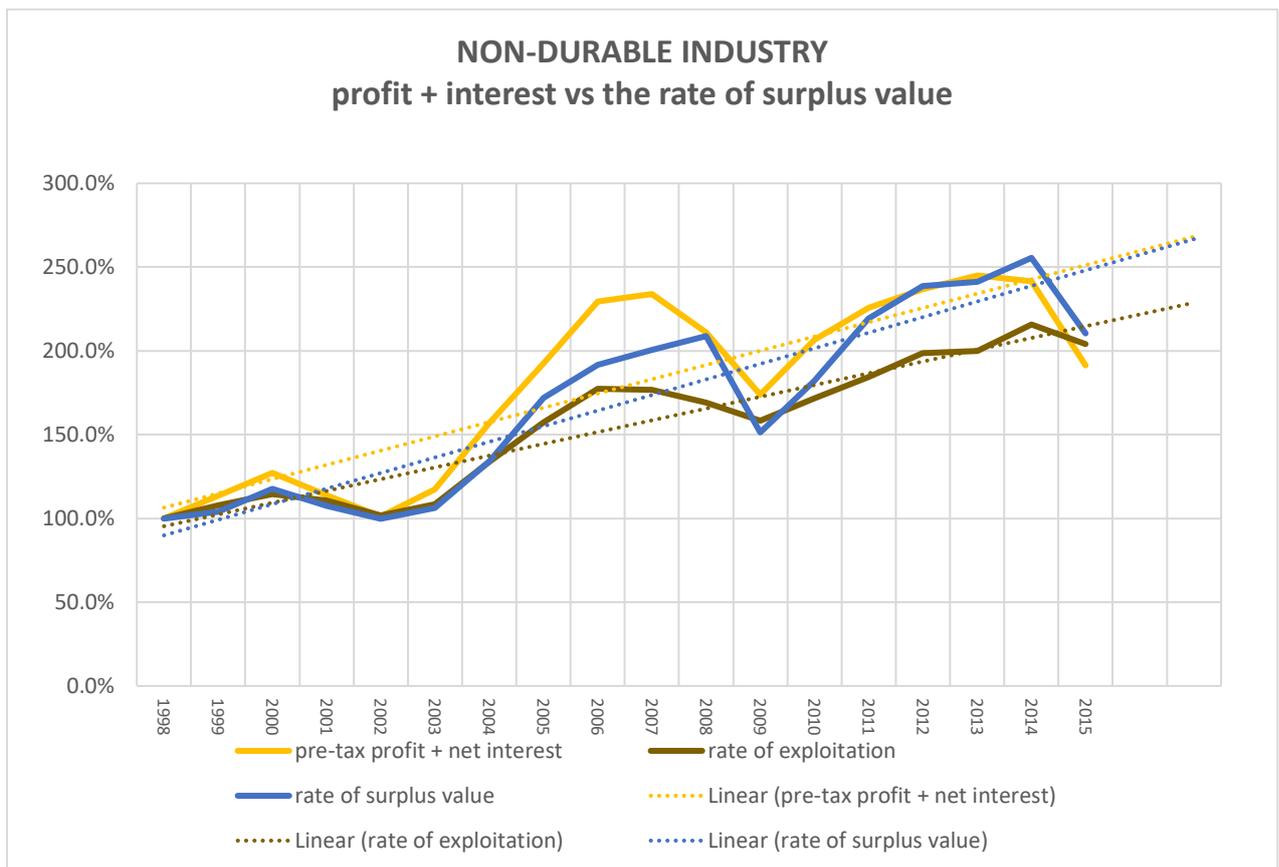
(Source: BEA Tables 6.15D for net interest, and 6.17D for pre-tax profits.)

The inclusion of linear trends shows the rate of surplus value and that of pre-tax profit + interest converging and the trend between the rate of exploitation and that of enterprise profit + net interest, diverging. The former is an expression of a tight correlation while the latter is an expression of little or no correlation. The single reason for this differentiation, is the change in the number of turnovers of capital over this period. The relatively high rates of turnover found in this sector and their acceleration over time, brings this into stark relief. They prove Marx's hypothesis that it is the rate of surplus value and not exploitation which determines the annual mass of profits. It is worth repeating that it is the deceleration in turnover that converts a relative fall in profits into an absolute fall.

The importance of this proof cannot be overstated. It must end the practise of theoreticians who glibly substitute the rate of exploitation for the rate of surplus value. They are not equivalent, but different, and the rate of exploitation should never be used as a surrogate for the rate of surplus value.

Table 3 below, provides both the rate of turnover of working capital in the non-durable sector and, its growth over time. The higher the rate of turnover, the more the movement in the mass of profits and the rate of exploitation will diverge the more compensation will be reduced to variable capital.

Table 3. Annual turnovers non-durable manufacturing

1998	1999	2000	2001	2002	2003	2004	2005	2006
4.72	**4.55**	**4.85**	**4.58**	**4.63**	**4.62**	**4.73**	**5.17**	**5.11**
2007	2008	2009	2010	2011	2012	2013	2014	2015
5.35	**5.82**	**4.52**	**5.01**	**5.62**	**5.67**	**5.70**	**5.59**	**4.87**

(Source: BEA Interactive Tables, GDP-by-Industry, Gross Output and Value Added Tables)

During this period, there is an average 20% increase in turnover times - which is equal to an additional turnover period each year. During the two recessions covered, 2001 and 2009, there is a 10% and 22% deceleration in annual turnovers. As accelerations and decelerations between the two rates tend to occur simultaneously (indicated by Graph 4), it is the amplification effect caused by the change in turnovers that is responsible for the aggravated oscillations in the movement of the mass of profit + interest.

The evidence suggests that when the business cycle stalls there is a fall in prices and a fall in turnovers. The former effects the rate of exploitation because some of the surplus value is no longer realised as profits. Simultaneously there is a slowdown in the rate (velocity) of turnover. These effects can be measured as was done in Graph 3. Of the two forces acting on the rate of surplus value, the fall in the rate of turnover was greater. It follows that excluding the effect of turnover makes the absolute fall in the mass of profits over this period not only incalculable but inexplicable.

The international rate of turnover.

It has become commonplace to point out that it is problematic to develop national rates of profits because production has become internationalised. It is not so much the growth in international trade and the more complex value chains that are to blame. Rather it is the scope this trade provides for the manipulation of transfer pricing via the rerouting of paperwork. This is particularly true when multi-nationals or wholesalers (importers) use last country invoicing to set import prices rather than using export prices emanating from the country of origin (production). "*Governments need to ensure that the taxable profits of MNEs are not artificially shifted out of their jurisdiction and that the tax base reported by MNEs in their country reflects the economic activity undertaken therein and taxpayers need clear guidance on the proper application of the arm's length principle.*" (8) And according to the WTO: "*More and more products are 'Made in the World' rather than 'Made in the UK' or 'Made in France'. The statistical bias created by attributing the full commercial value to the last country of origin can pervert the political debate on the origin of the imbalances and lead to misguided, and hence counter-productive, decisions.*" (9)

Alongside the complexity thrown up by unequal exchange is the additional complexity of transfer pricing. So significant has this effect been that it has helped to boost the value of international trade above what it should be contributing to the significant gap, until recently, between the annual growth rate of trade and that of GDP. Transfer pricing anomalies not only affect national rates of profit, but the rate of turnover as well, because both are affected by inflated import prices or absent foreign inputs. In the first case, the turnover of capital is accelerated by inflated import prices should they form part of intermediate sales. Intermediate sales add to gross output but not value added. Any increase in the magnitude of gross output relative to value added will increase the annual rate of

turnover. In the second case, the exclusion of intermediate sales from foreign affiliates has the opposite effect: it decreases turnover times. Foreign affiliates are legally deemed to be resident in their country of domicile and only their exports to the parent country are classified as imports and therefore intermediate sales, whereas strictly speaking the whole of their production forms part of the overall circulation of capital within the parent company.

Transfer pricing, which is used to manipulate tax, tends to reduce export prices in the country of production, and to raise import prices in the parent country. The rate of turnover in the producer country is therefore similarly affected to that in the producer country, but inversely. We may refer to this form of "transfer of value" as 'explicit', because it is conscious manipulation.

There is another transfer of value which may be referred to as 'implicit'. This transfer arises not from manipulation but is rather a cost of doing business. This is the "hidden" discount given to commercial capital (wholesalers and retailers) by productive (industrial) capital to circulate (sell) their output. This discount is referred to as 'hidden' because it has become part of accepted practice, thus lost from memory, except when a new arrangement is struck and a discount negotiated from scratch. The output of the productive sector is always discounted to provide the margins needed to cover the costs of the retailers or wholesalers and to yield their profit. The question of deliberate underpricing occurs here only when the discount taken is so large that it yields an above average commercial rate of profit - as happens between producer and consumer countries.

Latterly, much of the growth in trade inputs to Europe, Japan and the USA, other than agricultural or energy, has originated in developing countries. These exports, part of the value chain, which go on to form intermediate sales in the consuming country, specifically semi-manufactured and often fully manufactured goods made to order, appears to have been underpriced as exports. The losses were greatest in China. China may have become the workshop of the world by the end of the 20th Century, but much of the value it produced was not realised within the country itself. Prior to the crash in 2008, 50% of their exports were produced by Foreign Invested Enterprises. Of the value produced by these corporations and agents, only half benefitted China while the other half enriched the countries in which their owners resided. (10) This would have undoubtedly affected the turnover of capital in the biggest beneficiaries - the USA, Europe, and Japan - as much as it did China.

Turnovers, to the degree that underpricing occurs, suffer a dual effect. The reduction in the price of inputs (regardless of the degree of underpricing) from these producer countries will accelerate the turnover of capital in those countries because it deflates the value of their final sales (exports). In the consuming country, the opposite occurs. Now it is the case that intermediate sales in the consuming country will be lower while final sales will be higher as the hidden value is realised.

This deflation of intermediate sales and the reflation of final sales combine to slow down the rate of turnover when calculated by the turnover formula. It also affects the calculation of working capital. This is not due so much to the change in the numerator (gross output) as it is to the denominator (the rate of turnover). The effect on gross output is minimal, because the deflation of intermediate sales and the reflation of final sales tend to be self-cancelling. It is the fall in turnovers that matters, because this fall may inflate working capital when in fact this may not be the case.

The disparity between intermediate sales and final sales can be found in the divergence between the Import Price index (IPI), the Producer Price Index (PPI) and the retail price index (RPI) of the consuming nation. In the case of the IPI, goods are generally underpriced and in the case of the PPI they are fully priced. At its height, except for the peak in the commodity super cycle, the IPI lagged behind the rise in the PPI.

All these anomalies can be avoided by using an international rate of turnover. Under this condition, where one country's imports are another country's exports, the mispricing of trade will cancel each other out. The slowdown in the rate of turnover in one area will be balanced by the speeding up of turnover in another area and in aggregate this will happen simultaneously. If a single international input-output table can be prepared, and if it is sufficiently inclusive, it will avoid the anomalies thrown up by last country invoicing or above average underpricing. Such an input-output table has become increasingly necessary as production has fragmented through being dispersed across more countries and continents. As the value chain has become more complex, so gaps in the data have increased. Furthermore, estimates based on the national economy when extended to the international economy have become increasingly outdated.

Fortunately, such an input-output table does exist for the period 1995 to 2011, a period of 16 years which covers the most important and dynamic stage of globalisation. In these tables, mispriced imports and exports cancel each other out and omissions in a single national database are compensated for by a universal database. Such a table has been funded by the EU to embrace 40 countries whose economies together produce 92.7% of world GDP (as measured by the World Bank). The results of this heroic input-output table spanning 1442 rows is presented in Graph 5 below (6, 7).

Graph 5.
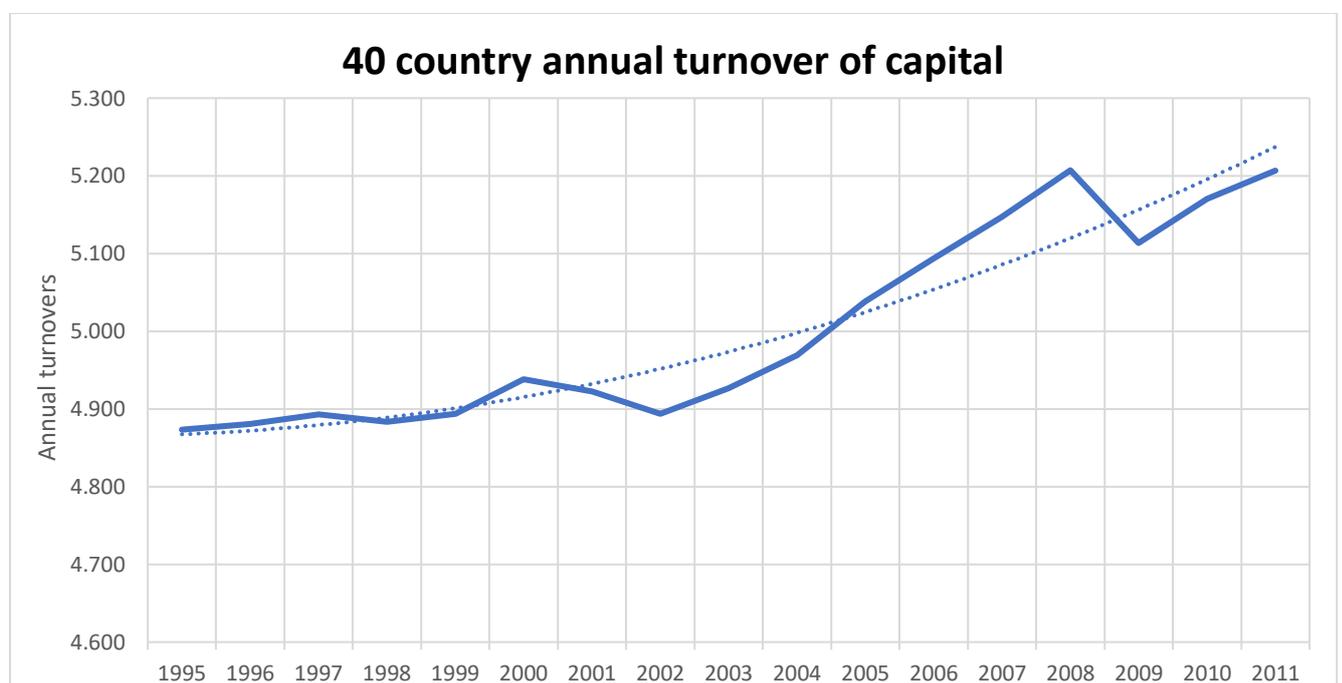
(Source: OECD Inter-Country Input-Output (ICIO) Tables, 2015 edition.)

Due to fewer omissions and discrepancies, a higher rate of turnover is present in this index than is found in many national accounts. A comparison will be provided shortly. Returning to the international trend. Its rate of turnover is faster because it is more complete than national accounts in the context of a globalized economy. The trend increases arithmetically over these sixteen years on average by half a percent per annum yielding an absolute increase over the period of 8%. It reflects the improvement in the technical conditions in the world economy that have shortened production and circulation times, if not between countries then at least within a country.

In common with national rates of turnover it is responsive to the business cycle. The synchronized global recession following the financial crash in 2008 is expressed by the nearly 2% deceleration in

2009 which took two years to reverse. This was mirrored by the collapse in international trade at the time (a proxy for inventory turnover), which shrank, not only in volume terms, but particularly in value terms as prices fell. The acceleration in the value of trade pre-2008 owed much to the commodity supercycle and its subsequent sharp fall, to the collapse of this supercycle and its impact on commodity prices.

Graph 6.

GROWTH OF INTERNATIONAL TRADE IN THE POST-WAR PERIOD.
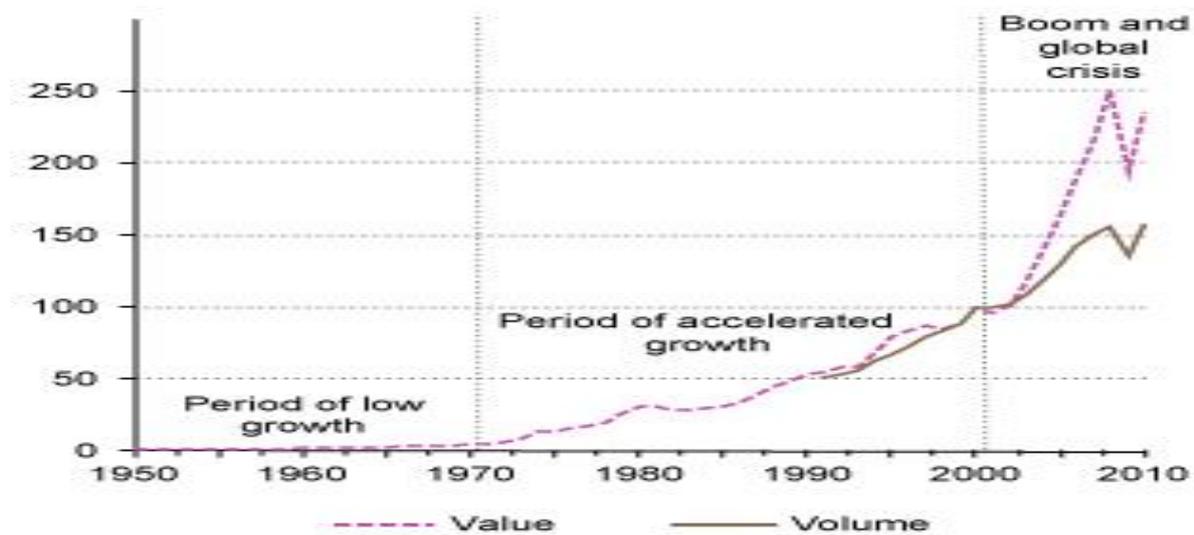
(Source: UNCTAD Development and Globalization: Facts and Figures 2012. Chapter 1.1)

It is possible to compare the same range of industries detailed in Graph 5 to that of individual countries. As the world's largest economy, measured in Dollars, the USA is most suited to this comparison. The turnover in the USA found in Total Private Industry (TPI) is chosen, because its scope is comparable to the "industries" found in the international series. Graph 7 below compares TPI turnover in the USA for the same years as found in the international series.

Graph 7.
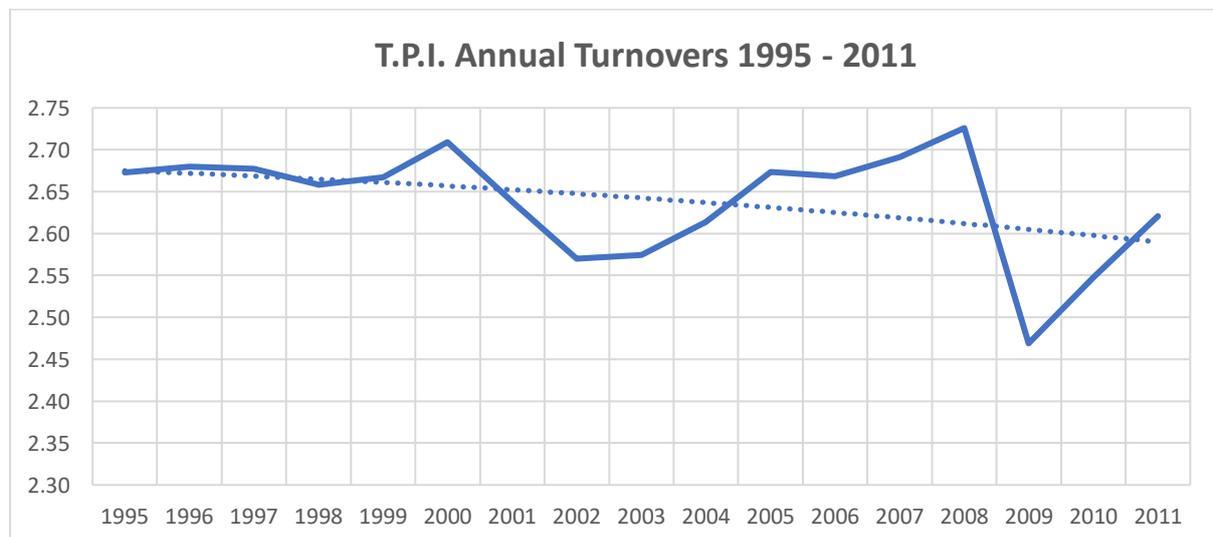
(Source: BEA Interactive Tables, GDP-by-Industry, KLEMS)

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Instead of rising, the rate of turnover in the USA declines over the period in question. As a percentage of the international rate it decelerates from 55% in 1995 to 50% in 2011. This decline has two arms. The USA benefits from the transfer of value which boosts the value of final sales thus slowing down turnover. The impact of this is relatively small, as evidenced by its effect on turnover in the productive sector. The more important of the two arms has been the effect of rising inequality. This has led to the growing weight of the non-profit and household sector within TPI, where production is mainly for use, as charities have grown to look after the poor while the rich employed more servants to look after them. Production for use does not produce value, but when it is mistakenly counted as sales producing, it has the effect of reducing turnover rates because it artificially boosts GVA. (Hence, the additional advantage to the turnover formula, its sensitivity to imputations and duplications.)

It is correct to assume that the inclusion of unproductive-industries-for-use in the international input-output tables has affected turnovers there as well. It is also correct to assume that It is possible to partially remove the tables relating to the unproductive sector, thereby improving the estimate for the rate of turnover because it minimises duplication and imputation. However, such an onerous task is beyond the scope of this article. The same result in microcosm can be obtained by selecting one of the industries where production is for sale and duplication is at a minimum. The industry chosen is labelled "Transportation Equipment". This industry has a high weight in the international economy. In the USA, the car industry alone accounts for 21% of retail sales. The transport industry is also pregnant with innovations and managerial knowhow. It is therefore ideal for evaluating changes in turnover, particularly within the "boom" phase of international trade.

Table 4. Transport Equipment: Annual Turnovers

Country	Year	Turnovers	Year	Turnovers	% increase
Brazil	2001	9.2	2011	9.2	0%
Canada	2001	7.6	2011	8.7	14%
China	2001	6.6	2011	9.2	40%
France	2001	10.2	2011	11.2	10%
Great Britain	2001	5.6	2011	6.4	14%
Germany	2001	6.6	2011	7.6	15%
Japan	2001	6.8	2011	7.4	9%
Korea	2001	6.8	2011	8.3	22%
Mexico	2001	5.6	2011	5.6	0%
U.S.A.	2001	5.8	2011	8.8	51%
AVERAGE	2001	**7.1**	2011	**8.2**	15%

(Source: OECD Inter-Country Input-Output (ICIO) Tables, 2015 edition. (6)

The top ten manufacturing countries for vehicle production are selected. Three in the Pacific Rim, Europe and North America, and one in Latin America. In 2001 the average rate of turnover was 7.1 compared to an average 4.9 for Graph 11. The outstanding two countries to begin with were France and Brazil. Over the following 10 years, the annual rate of turnover grew 15% to 8.2. This was three times faster than the average international rate found in Graph 11. The acceleration in the rate of turnover reduced the working period from 51.4 days to 44.5 days by 2011, a reduction of two thirds of a day per annum.

Within that reduction, two countries stand out: China and the USA. From being below average, within ten years they move to being above average. This suggests that there has been significant investment within the US transport industry, contrary to the prevailing prejudice, because such a rapid increase in turnover would have required significant investment.

The unity of productive and commercial capital and their respective influences on turnover.

Up to now the investigation of turnover has been generally confined to the circuit of productive capital, viz: M.C…P…C$^+$…M$^+$. In all capitalist economies, a division of capital exists between producers and merchants, between productive capital and commercial capital. Producers (industrialists) seldom sell to end users. Instead they sell to merchants - be they wholesalers or retailers. They do so because it is cheaper for specialist or general merchants to sell their product than would be the case were they to sell these products directly themselves. Specialist wholesalers and retailers buy from many suppliers and sell to multiple customers. It represents the socialisation of the circulation process with Amazon and Alibaba occupying the apex of the process today.

The purpose of this streamlining of the circulation process proper is the reduction of the money capital needed to fund it. This is effected by the quickness of the turnovers of commodities. Marx and Engels deal with this in detail in Chapter 18 of Book 3 of 'Das Kapital' entitled: *The Turnover of Commercial Capital. Prices.* The second consideration is this. For Marx, the equalisation of the general rate of profit depends not only on productive capital but also on commercial capital. Hence the mass of capital that enters the equalisation of the rate of profit comprises both productive (industrial) and commercial (merchant) capital. (12) A reduction in commercial capital, by way of an improvement in the rate of circulation, will thus raise the rate of profit independent of changes within production itself, not because more surplus value has been produced, but because the amount of capital needed to produce and circulate it is reduced. There is thus a perpetual urgency to speed up circulation in order to minimise the money capital funding it.

In Marx and Engel's day, the circulation process was much more fragmented than it is today. Currently, large companies dominate retail and wholesale business because of the extraordinary centralisation and concentration of merchant capital over the years. They exemplify the "small profits and quick returns" which Marx mentions as the driving force of merchant capital. (13) Most producers now sell directly to them and in turn, they sell to the end users. Only in international trade is there found a chain of merchants between the producer and the consumer. If it is assumed that only a single retailer is involved in the final sale, the typical social circuit of money and commodities can be described thus:

$$M.C….P….C^+.M^+..C..M^{++}$$
< circuit one> < circuit two>

There are two circuits of capital, the first for productive capital and, the second for merchant capital. The capitalist produces a commodity and sells it to a retailer who sells it on to the final consumer. Taking this into account, the turnover formula in this section is used to investigate the total number of turnovers from production to final consumption or, in other words, the social turnover. This social turnover is the best representative of the turnover of productive and commercial capital in the economy. Its importance may explain why Leontief formulated the table "Total Business Sales" which encompasses the entirety of retail, wholesale and manufacturing.

However, before proceeding, one complication needs to be addressed regarding the formula. Marx makes clear that the selling price of the commodity as it exits the first circuit is below its value and that its price only matches its value when it exits the second circuit. "*The merchant's sale price is higher than his purchase price not because it is below the total value but rather because his purchase price is below the total value.*" (14) In short, it is the retail price and not the producer price, which reflects the value of the commodity in question. This was dealt with earlier in the sphere of foreign trade.

In effect, producers sell their product at a discount to merchants, and it is this discount that provides the merchants' margin, the difference between their buying-in price and their selling-out price. The price to the end customer does not change whether it is the producer or middleman selling a product, but the price does change if the product is first sold to a middleman. For the same product, the value of the final sale in the retail sphere is thus different to the value of the final sale in the production sphere.

The treatment of gross output or total sales in retail by the BEA is problematic. The BEA has a dogmatic or mechanical approach to the methodology set out in Book 2 of 'Das Kapital' on how to calculate value added by eliminating duplicated sales. To achieve this, the BEA divides the economy into a number of industries. To avoid duplication, it limits the sales included in an industry only to those sales used up by that industry. Once used by that industry they cannot be used or taken in another industry.

In the retail "industry" it therefore excludes all merchandise bought in for resale. The reason is that these sales have been taken elsewhere. If it is merchandise sold to a retailer by a manufacturer, that sale will have been taken in the manufacturing industry already. Hence only the purchases and sales that circulate within a given industry are included in that industry's gross output and value added.

The reason that goods for resale are not included in retail as intermediate sales affecting gross output is that they are sold on. The customer in this case is the user not the retailer. By excluding goods bought in for resale, thereby limiting gross output to the value of all the discreet purchases and sales within retail, the BEA extracts the "value added" for this industry and uses it to prepare compensation, surplus and taxes for the "industry".

Clearly as far as working capital goes this would give a wrong result. The working capital of the retailer includes not only expenses and wages, but inventory as well, which in this case is merchandise for resale.

The other question that follows is how the discounting of prices affects the turnover formula. The formula is sensitive to the value of final sales, and anything that reduces the value of final sales will appear to increase the rate of turnover within an industry. Fortunately, in the aggregate, this is not an issue of concern. The bulk of sales within each industry, circulates within that industry at commensurate prices. In the case of production, all the prices circulate at discounted prices which are self-cancelling in the aggregate. Intermediate as well as final prices are similarly affected and it is this equity which provides the basis for a robust estimate of the rate of turnover.

Neither is the formula affected once the discount has been added back as is the case in retail. In this sphere, the consistency of fully valued retail prices ensures a uniform formula. The problem lies elsewhere in the confusion by the BEA between value produced and value realised. Most of the value circulating in retail has been transferred to it through the pricing mechanism (discounts) from production, where it was originally produced. Most of the margin provided has been provided by production but claimed by retail. By localising value added, the BEA assumes the value added by retail has all actually been produced by retail. This is not the case; some has but most has not.

Hence the value added by retail is a statistical invention based on isolating those sales that relate only to retail and do not involve merchandise sales. To correct this error, the gross output of the retail sector should be composed of the full value of the commodities circulating within it, both goods for resale and those commodities needed to run the "industry" - such as power, rent, shelving, refrigeration and so on (comprising intermediate sales), rather than the BEA's gross output which deliberately excludes inventory (merchandise) for resale.

The result is that when the BEA's figures for gross output and value added are used, turnovers barely exceed two per annum. But when purchases for resale are included as intermediate sales thereby boosting gross output, the correct rate of turnover is obtained. The rate of turnover increases by a factor of 4 or more. This is detailed in graph 8 below. The modified formula for the rate of turnover in retail is now:

$$\frac{RS + IS}{GVA} = \frac{(RS+IS) - GVA}{GVA}$$

where RS stands for retail sales and IS for intermediate sales.

Graph 8.

(Source: Retail turnover FRED Table RETAILIRSA, retail sales FRED tables RRSFS, Intermediate sales BEA Interactive Table GDP by Industry KLEMS.)

In common with improvements in the rate of turnover in production, the rate of turnover also accelerates within retail. There is a 15% improvement in turnover times over this period equal to two-thirds of a percent per annum on average.

The only advantage of the BEA's limiting of gross output and intermediate sales to that used within retail itself, is that it provides an estimation of the working capital that finances retail and with that, an estimation of the level of discount needed to yield that sum of capital. It must be noted that the discount given is not arbitrary. Instead the law that governs it, as postulated by Marx, is the equalisation of the rate of profit. Competition regulates this discount, so that the rate of profit for commercial capital will tend towards the average for both productive and commercial capital.

If the discount rises to the point that commercial capital is advantaged as against productive capital, the super profits that accrue to commercial capital ensures an above average rate of profit for that sphere. This is most common in the sphere of foreign trade. Many US corporations have ceased production by outsourcing their production to a foreign country, such as China, because it is cheaper. They have thus transmuted from the realm of production to the realm of commerce (wholesaling) and substituted their productive profit with a commercial profit - which is now larger.

These super profits have improved the rate of profit in commerce and encouraged more production to be outsourced. In time, an increase in outsourcing strengthens the hand of the producer reducing the discount and once again redistributing profits back to production. This is a turbulent and cloudy process. *"As the reader will have recognized in dismay, the analysis of the real, inner connections of the capitalist production process is a very intricate thing and work of great detail…"* (14) Despite these confounding factors, the size of US retail provides a substantive relation between production and circulation, providing a robust estimate for working capital there. In 2015 the BEA's estimate of gross output in retail amounted to $1610.3 billion of which $396 billion was the surplus, while the rate of turnover was 9.1. These figures can now be used to determine the retail sector's working capital. (15)

$$\frac{\underline{\$1610 \text{ billion gross output - \$396 billion surplus}}}{9.1 \text{ turnovers}} = \$133 \text{ billion working capital for 2015.}$$

Next, this estimate of working capital can be used to obtain the margin for retail. $133 billion is the sum needed to circulate gross output for one period amounting to 40 days not 365 days (365/9.1) Therefore, to obtain the numerator the expanded gross output must be reduced from one year to single period of 40 days. Expanded gross output is the sum of retail sales plus intermediate sales.

$$\frac{\underline{\$5284.6 \text{ billion gross output}}}{9.1 \text{ turnovers}} = \$581 \text{ billion}$$

$133 billion of working capital circulates total sales of $581 billion every 40 days yielding a pre-profit margin of 23%. When the period profit (surplus) of $44 billion (396/9.1) is added back, the gross margin as a share of total sales rises to 30.5%. This is in the region of manually extracted margins, as set out by the *NYU Stern Business School,* of 30.24% - or the average of the largest 10 retailers in the USA as detailed by *Stock analysis on net* cited in section 2. (17) Whereas gross margins, the more important margin, correlates to the manually extracted series, the net margin does not. This is due to the exclusion of taxation from the net margin, whose reinstatement would bring net margin into line with the figures produced by the Stern Business School. The trend for the gross margin is set out in Graph 9 below.

Graph 9.

RETAIL GROSS MARGIN
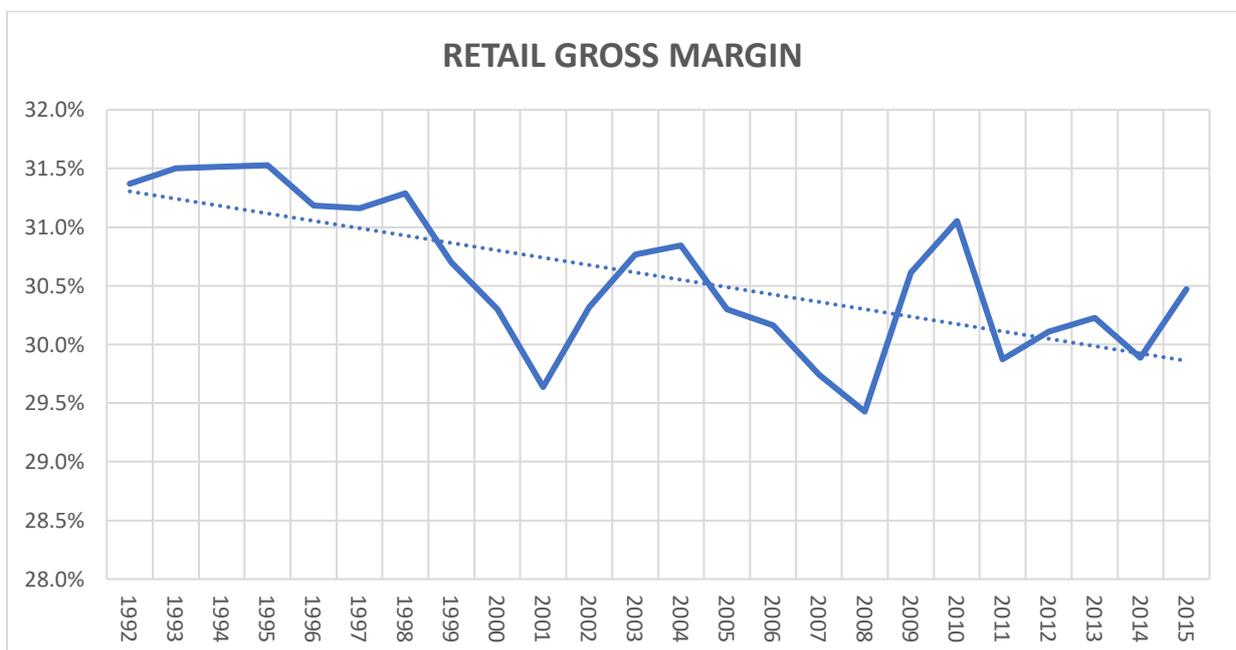
Once again, Marx and Engels' anticipation that the amount of working capital devoted to circulation in the longer term would decline in relation to total capital is born out. Since 1992, the capital specific to the costs of circulation, as a percentage of total capital, has declined by 5% on average.

There is one additional aspect relating to retail that is worthy of consideration. Previously it was stated that working capital is always larger than inventory capital, because in addition to inventory, capital is needed for net credit, wages, cash for emergencies etc. There is one exception to the rule - which in turn proves the rule. It occurs in only one specific case where the amount of credit given is significantly less than the amount of credit taken. Under this condition the amount of working capital can be depressed below the amount of inventory capital.

The only "industry" where this can occur is retail because most sales are for cash while purchases are made on credit. As retail has become more centralised (larger chains of shops), merchants have been able to prise better credit terms from their suppliers which often reach 60 days. In the mean-time, they receive cash from their customers at the time of sale and if credit is given, this is almost invariably in the form of credit cards issued by outside providers (banks, finance houses etc.).

The result of this disparity between credit taken and credit given represents a substantial saving in working capital which is sufficient to accelerate the turnover rate of working capital beyond that of inventory capital. This is demonstrated in the final graph below. In retail, the turnover rate for circulating capital is on average a cycle greater than that for inventory. In 2015 the turnover time for working capital was 40 days while the turnover time for inventory was 10% higher at 44 days.

Graph 10.
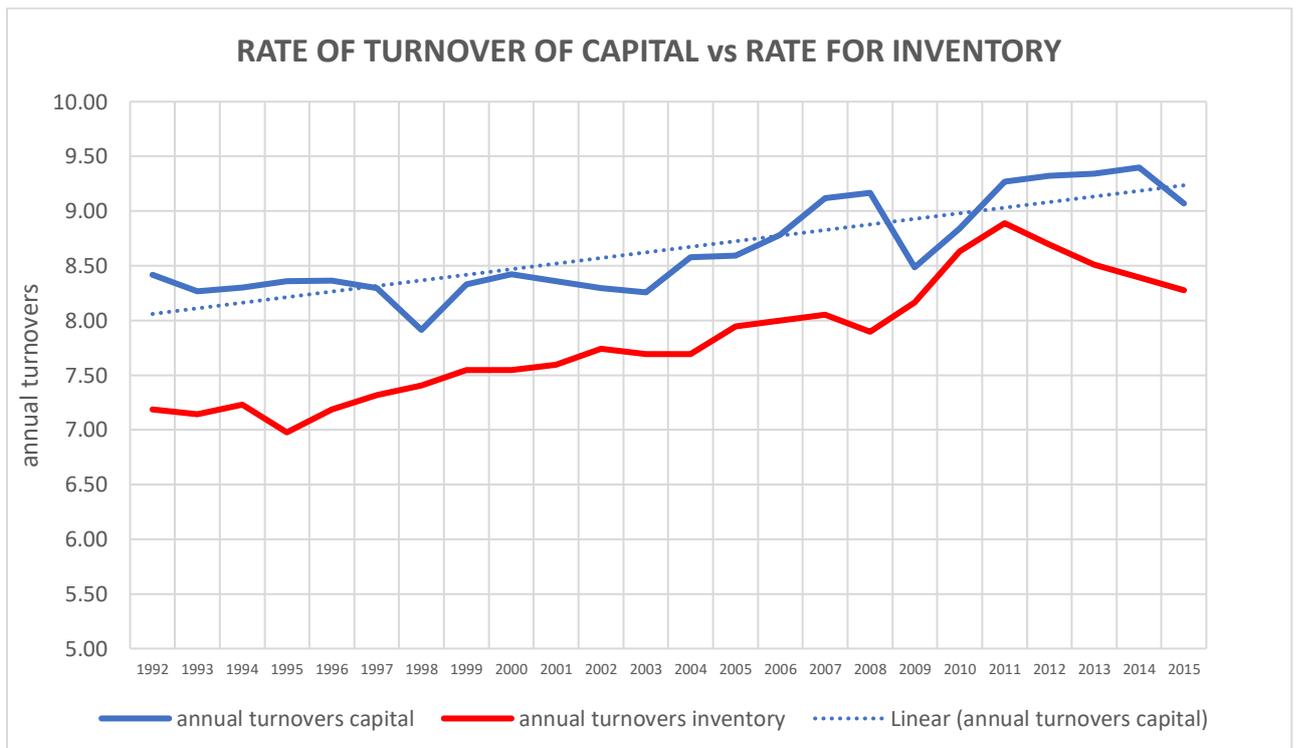
(Source: Retail turnover FRED Table RETAILIRSA, retail sales FRED tables RRSFS, Intermediate sales BEA Interactive Table GDP by Industry KLEMS.)

In conclusion.

When the turnover formula was first applied to the SNA, a number of anomalies and inconsistencies were soon detected. At first this was attributed to flaws in the formula itself. Later, it was learnt that the formula was robust, and that it was responding to errors in the data or in its compilation. It was highlighting these errors. It proved to be sensitive to any duplications, omissions and imputations.

The corollary to this is that the formula confirms Marx's hypothesis and assumptions regarding the turnover of capital. Marx set out in detail the intricacies of capital and its inner connections, but in the absence of data, was not able to offer proofs. The results provided by the turnover formula, for the first time, provides these missing proofs and substantiates the laws of motion, first identified by Marx, which govern the capitalist mode of production.

Without estimating turnover times, the analysis of the inner workings of capitalism remains crude if not vulgar. Without the rate of turnover, annual compensation cannot be reduced to variable capital. Without variable capital neither the rate of surplus value nor the rate of profit can be determined with any accuracy. Without the rate of turnover, the cost-of-gross-output cannot be reduced to working capital. Without turnover, the connection between exploitation and profitability remains hidden. Without these connections, the dynamic movements and trends within capitalist production remain obscured.

The formula has its limitations, but the results it provides once they are qualified, are real and dynamic. In a scientific sense, the development of the turnover formula completes the work begun by Kuznets and Leontief in establishing the SNA. Having presented the formula and having applied it to yield such interesting results, it would be unscientific to now disregard it. Through it new insights have been gained and new trends observed. What was inexplicable is now explicable. The formula has provided a *Rosetta Stone* allowing economists to interpret the SNA in a new and exciting way.

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