THE GENESIS OF THE SYSTEM OF NATIONAL ACCOUNTS IS TO BE FOUND IN VOLUME 2, DAS KAPITAL

*While many Marxists criticise the System of National Accounts **(SNA)**, the BEA is bountiful in its praise: "At the end of 1999, the Commerce Department named the invention and ongoing development of the NIPAs and its marquee measure GDP as 'its greatest achievement of the century'. Actually, it was the greatest achievement, not of the twentieth century, but the nineteenth century. And the author of this achievement was Karl Marx. It is my opinion, the failure to cite Marx, is the biggest and most consequential plagiarism of all time. This article seeks to connect Book 2 of Das Kapital to the SNA. In Book 2, Marx sets out the methodology needed to avoid the duplication on which GDP is based and he provides the means to connect inputs and outputs. (All quotes are from Lawrence and Wishart, 1977 printing of Volume 2.)*

It is of course one of the ironies of history, that the least read of Marx's famous trilogy, Book 2 of Das Kapital, has been the one which has transformed capitalist economic statistics. This article has three purposes. Firstly, to show how the SNA is descended from Das Kapital. Secondly, to verify the turnover formula. Thirdly, to show up the absurdity of many Marxists who claim that the National Accounts blinds us to the economic reality it addresses, rather than providing valuable insight.

We turn immediately to Chapter XX of Volume 2, the chapter on Simple Reproduction. Simple Reproduction is chosen because it is uncluttered allowing for a clearer extrapolation of the methods found there. The numerical example deployed by Marx is reproduced below:

Department 1. 4000c + 1000v + 1000s = 6,000 (Means of production)
Department 2. 2,000c + 500v + 500s = 3,000 (Articles of consumption)

Here is history's first input-output table as we shall see. Marx divides the economy into the two departments needed for production. In contemporary SNA language they would be described as two industries. The first industry is Department 1 producing means of production, and, Department 2 producing articles of consumption to feed, clothe and house them, together with the luxury goods for the capitalist class' own enjoyment.

To illustrate the movements and exchanges, the table above has been further elaborated by adding an additional row providing totals.

Department 1. 4,000c + 1,000v + 1,000s = 6,000
Department 2. 2,000c + 500v + 500s = 3,000
6,000c + 1,500v + 1,500s = 9,000
(Capital 7500 + profit 1,500 = 9,000)

The highlighted row informs us that in this simple economy, total constant capital produced is valued at 6,000c. This is the amount of capital needed to replace the capital used up during the period of production, meaning that the total capital does not change. In modern SNA language gross domestic investment equals deprecation. There is no additional net investment. Moving on to the renumeration of workers, the second row shows that total variable capital is 1,500 (this is the sum needed to pay wages) of which 1000 is invested in Department 1 and 500 in Department 2.

Together, the 6,000 constant-capital plus 1,500 variable-capital = total capital of 7,500. The third row shows that the total surplus or undivided profit is 1,500. This yields a rate of exploitation of 100% or 1,500/1,500. Finally, the value of the social product is 9,000 comprising 6,000c + 1,500v + 1,500s.

The first thing to point out is that the output produced in Department 2, at 3,000 is equal to the total 1,500v + 1,500s. This means there are sufficient articles of consumption and luxury goods for the workers to spend their wages on and the capitalists their profits on. When all the wages and profits are spent, the output of Department 2 will have been sold out.

Looking more closely at Department 2. Its output is measured at 3,000 but of this 3,000, 2,000 represents means of production used up producing the articles of consumption. But Department 2 does not produce means of production, it produces only articles of consumption. So how does it get its hands on these means of production.

The answer lies in the exchange between the two departments. Department 2 cannot produce articles of consumption without the means of production provided by Department 1. This means that articles of consumption valued at 2,000 will have been exchanged for means of production also valued at 2,000. What has been given up in one form is received in another. In the modern language of the SNA, Department 1 is the "make" industry, and Department 2 is the "use" industry. One third of the means of production "made" in Department 1 is "used" in Department 2.

Turning to the tables again. The social product of 9,000 is now called GDP. GDP is explained in the extract of the table below.

6,000c + 1,500v + 1,500s = 9,000 GDP

The green 6,000c represents means of production used up and replaced while the lilac colour equal to 3,000, is the additional labour newly added in the current cycle of production of which half is paid (v) and half unpaid (s). In the language of the SNA, this 3,000 is described as National Income or Net Output in this closed system. This is similar to the term used by Marx: "annual value product" (page 429) In turn this 3,000 of national income is divided into 1,500 employee compensation and 1,500 undivided profit. Other terms used are Gross Value Added equal to 9,000 and Net Value Added equal to 3,000. We can therefore see how modern this simple table is.

The real science lies hidden in the table. How to account for all the sales found in the table. Here it is necessary to introduce the modern concepts of "Gross Output", "Intermediate Sales" and "Final Sales". Gross Output is the sum of intermediate sales and final sales. An intermediate sale is an input, a use value, which still needs to be worked up or assembled into its final form. Examples are raw materials, components, power and so on. A final sale is the sale of the finished goods on which no more productive labour needs to be expended.

In our table in its modern setting, as far as Department 1 goes, total sales are no longer 6,000 but 8,000 comprising a final sale of 6,000 and an intermediate sale of 2,000. Immediately a concern is raised, if total sales in Department 1 is 8,000, this 8,000 when added to the 3,000 produced in Department 2 raises the social product or GDP to 11,000 from 9,000. This cannot be correct.

The solution was provided by Marx and is used by modern statisticians. The 2,000 in intermediate sales is deducted at source (the make industry) because it is added in the use industry, in this case Department 2. The result is that GDP or the social product remains at 9,000. The 2,000c therefore appears only once. Statistically this is presented as: Gross Output - Intermediate Sales = Final Sales or

11,000 less 2,000 = 9,000. The converse works just as well: Final Sales + Intermediate Sales = Gross Output (total sales).

Hence in Book 2 Marx sets out the rules to avoid duplication. And by showing how to avoid duplication Marx for the first time shows the difference between an intermediate sale and a final sale and how to account for both. In the language of the SNA, final sales amount to 9,000 and intermediate sales to 2,000.

There was a final proof provided by Marx. He showed that the value of the final sale, in the absence of duplication, was always equal to the labour used up in its production. Turning to Department 2, the value of the final sales there amounted to 3,000. However, of this 3,000, 2,000 originated in Department 1. No problem. Because this 2,000 is only counted in Department 2, there is no duplication. Therefore, the Gross Value Added of 3,000 in Department 1 when added to the 6,000 in Department 2 is equal to the GDP of 9,000.

Assumption 1.

We are now going to examine the relation between gross output and gross value added (value of the final sales). Our purpose is to examine how we arrive at the turnover of circulating capital and how we are able to measure the amount of circulating (working) capital using the national accounts. Circulating capital is physical capital used up within a calendar year or financial year whichever is applicable. It is distinct from fixed capital whose durability and longevity are measured in multiple years.

In this assumption, which admittedly is at variance with the behaviour found in a typical capitalist economy, we assume that all the exchanges take place at the end of the production period which is set by the slowest producer. In Department 1, there is to be found, a company which produces a vital and irreplaceable component necessary for all the other means of production to function, and, this component takes 90 days to produce. Although this production period of 90 days is above the average production period for all the other capitalist producers, convention holds that all exchanges takes place only on day 90 once these components are ready for sale. On this day all sales take place simultaneously, including the 2,000 between Department 1 and Department 2.

This creates a situation analogous to that described by Marx on page 300. *"We assume furthermore that at the end of the year the product is paid for on the same day it is finished so that the money-capital returns on the same day. The circulation period is then 0."* Under this assumption, there are no intermediate-sales only final sales. On day 90 the entire commodity product exits production in formation and is sold to its end users who convert it immediately into money which returns to the individual producers. Under this circumstance the following formula holds true:

Gross Output = Gross Value Added = 9,000

This simplifies the calculation of circulating-capital, whose formula is as follows:

Gross Output less surplus = circulating capital/turnover.

We know that Gross Output is 9,000 and we know that the surplus is 1,500. By deducting the 1,500 from the 9,000 we obtain the cost of this gross output which is equal to the capital expended of 7,500. Finally, we know that the rate of turnover is 1 when measured by 90 days.

9,000 – 1,500 = 7500/1 = 7500

To further illustrate the above formula let us extend it over a calendar year. A ninety-day cycle will repeat itself four time over the course of a year. All commodities produced are sold on day 90, day 191, day 273 and day 364. The annual rate of turnover is now 4. In order to annualise the figures everything is multiplied by 4.

36,000 – 6,000 = 30,000/4 = 7,500.

Exactly the same result is achieved. The capital spent on production is once again reduced to 7,500. However, over the course of the year, this 7500 of capital produces a value of 36,000 rather than the 9,000 in one period. As we shall see later, this confusion between a single period and an annual period is the basis of most of the mistakes many Marxists make when analysing the SNA.

Assumption 2.

In Assumption 1 convention held that all that was produced was sold collectively on day 90. This assumption is now abandoned. The company that needed 90 days to produce its vital component now finds a way to produce it in just under 30 days although in batches of one third, so that over the 90 days no more components are produced than before. In typical capitalist fashion, to save on money capital, the convention of simultaneous exchanges on day 90 is abandoned. Exchanges now take place within the original 90-day cycle. As a result, intermediate sales reappear.

In this Assumption we will return first to the exchange between the two industries of 2,000c, which is sold by Department 1 to Department 2. As this takes place within the 90-day cycle, this 2,000c forms a distinct pattern of sales whose duration is less than 90 days. For this reason, Gross Output is no longer equal to Gross Value Added, now it is 11,000 versus 9,000. (Gross Value Added of 9,000 + intermediate sales of 2,000 = Gross Output of 11,000). We restrict our observation here to between industry transactions. Assumption 3 will introduce: within industry transactions.

If we now use the formula for obtaining circulating capital, we notice an immediate problem

11,000 – 1,500 = 9,500

It is impossible for capital which was once valued at 7,500 to be revalued at 9,500 without some form of alchemy. This requires further investigation. In Assumption 1, turnover was taken as 1 because it occurred altogether on one day (day 90). But now some of the sales occur within 90 days. The average circulation period can no longer be 90 days. It must be shorter because 633c is bought on day 30 by Department 2 and another 633c is bought on day sixty and the final 633c is bought on or before day 90. The average circulation period for this 2,000c is reduced to below 60 days from 90 days.

For this reason, we can expect that the amount of circulating capital measured by money to be reduced. Originally, all the capitalists needed a combined 7,500 to tide them over for 90 days to re-purchase the next period's means of production and pay their workers. For every cycle they would have needed 90 days' worth of capital. Instead, some of them are now receiving replacement cash as early as 30 days. These capitalists in Department 1 therefore need to hold less than 90 days cash.

This is Marx's famous circulation of capital. If something circulates it must have a start point and an end point. Marx identifies this start and end point as money going out and money coming back in. *"The qualitative identity* (of this circuit – my addition) *does not come about if we take as our starting point P…. P. However, the form M….M undoubtedly yields the identity of turnover."* What Marx is saying is that the turnover of circulating capital is equal to the time that elapses between the moment the capitalist spends money buying the factors of production and the moment he or she receives money back after selling the resulting products.

The circuit of capital expresses the capitalist social relation in its productive form. It comprises the distinctive two exchanges. It begins with a purchase and ends with a sale. With money, the capitalist purchases the factors of production. By managing these factors, the capitalist sets production in motion. By selling the resulting commodities the capitalist is once more in possession of money, or should we say, more money than when they started off. The period between money going out and coming back in yields the turnover of this capital over the course of a year.

The circuit of capital is generally equal to the period of production plus the period of circulation (the time taken to sell the product and be paid for it). Only rarely does money come in before the product is produced. Here we think of the bespoke industry where something is made to order for an individual and must be paid for when ordered. Or in private education where payment has to occur at the beginning of the term or semester, not at the end. Otherwise, payment takes place only after the commodity has been produced and often with a gap.

As a result of goods being sold and payments taking place before day 90, we know that the money which forms the advanced capital, no longer needs to last 90 days. On average it needs to last less than 90 days. Some of this capital will circulate twice by day 90. This accelerates the average turnover. The average capital now circulates more than once when measured by 90 days. The question arises, by how much does the turnover of capital accelerate? We know it will be more than once every 90 days, but how much more?

The answer is provided by the turnover formula based on Gross Output and Gross Value Added.

$$\frac{\text{Gross Output}}{\text{Gross Value Added}} + \frac{(\text{Gross Output} - \text{Gross Value Added})}{\text{Gross Value Added}} \quad \text{or}$$

$$\frac{11{,}000}{9{,}000} + \frac{(11{,}000 - 9{,}000)}{9{,}000} = 1.22 + 0.22 = 1.44$$

Turnover is now 1.44 and no longer 1.0. This must be understood precisely. Over a period of 90 days circulating capital will turn over on average 1.44 times. It will now turn over in 63 days (90/1.44). Over the course of a calendar year it will now turn over 5.76 times (4 X 1.44) not 4 times.

The turnover figure of 1.44 is now used to complete the formula for working capital.

$$11{,}000 - 1{,}500 = 9{,}500/1.44 = 6{,}600$$

This is the expected answer, a figure below 7500 reflects the fact that the capitalists in Department 1 need to advance less capital over the period of 90 days because they sell some of their completed product before day 90, converting it back into money.

Assumption 3.

In Assumption 2 we investigated the intermediate sales between Department 1 and Department 2. Now it is time to investigate intermediate sales within Department 1. For argument sake let us assume there are four companies in Department 1 and two in Department 2. The four companies in Department 1 do not make all their own components. So, in order to replace their constant capital, they have to buy components and materials from each other to replace the worn out means of production. Let us assume that company A buys 1000 components and materials from B, who buys 1000 from C, who in turn buys 1000 from D, who finally buys 1000 from A. Let us further assume that most of these purchases take place before 90 days because they are now based on production periods.

Under these assumptions, there are now an additional 4000 of intermediate sales within this industry styled Department 1 to add to the 2,000 already taken as a result of the purchases from Department 2. This will raise gross output further because it is the sum of intermediate and final sales. Gross output which stood at 11,000 now rises to 15,000. Once again this will affect the turnover of circulating capital because there are more sales with an average duration of less than 90 days.

$$\frac{15{,}000}{9{,}000} + \frac{(15{,}000 - 9{,}000)}{9{,}000} = 1.66 + 0.66 = 2.32$$

If we then apply this to our formula for circulating capital we arrive at:

15,000 G.O. – 1,500 S =13,500/2.32 = 5,800

There is a further reduction in circulating capital because of these additional shorter duration sales. The more intermediate sales there are, the more frequently money is changing hands, the less of it is needed. We have now moved a long way from our original state where 7,500 was needed to recapitalise production because all the transaction occurred simultaneously on day 90. Now the advanced capital is reduced by 30% to 5,800.

Put another way, it is no longer necessary for 7500 in cash to be held in order to recapitalise production. A smaller sum of cash will do because the average period between cash going out and cash coming in, is a smaller fraction of 90 days. The typical circulation period now is 39 days or 90/2.32. Goods are being sold and cash is being received back on average every 39 days.

The fact that the value of the circulating capital has fallen by a smaller percentage, only 23%, is due to the fact that the larger the number intermediate sales, the more capital that is changing hands. That is why the total circulating capital has risen to 13,500 from 7500 (a rise of 80%) while its time of circulation has fallen by 232%. This change is due to the transition from one simultaneous exchange on day 90 to multiple exchanges occurring more frequently within that period.

It is this prima facia paradox that has led many to reject the turnover formula. Perhaps an analogy will clarify the matter. A politician is working the crowd shaking hands. The bigger the crowd the more hands that can be shaken. But the bigger the crowd the denser it is and the more difficult it is for the politician to push past those whose hands he has already shaken. But if his entourage (centralised credit) regiments the crowd into serried ranks so that he or she can walk easily between the rows, he or she is able to shake more hands in less time. Of course, their gate is regulated by the production period, or in this case, the time it takes to extend his/her hand, shake and prepare for the next encounter. And so, it is with circulating capital. The more exchange grows between capitalists, the greater the annual weight of circulating capital, the quicker it must turnover in a year for a given value, the more the actual circulating sum is reduced. Hence the single period mass of circulating capital is never to be confused with the annualised mass of circulating capital

Finally, the fact that working capital has not fallen further has to do with variable capital. The exchange between worker and capitalist is not the same as the exchange between capitalists. The payments to workers out of capital are never treated as an intermediate sale despite an actual sale taking place. Hence wage payments do not increase the sum of intermediate sales thus boosting gross output. This is the correct procedure and was first pointed out by Marx. What workers sell is not capital, but their capacity to work which then goes on to form the substance of capital when appropriated by the capitalist class.

The amount of wages needed does not determine the circulation period but is determined by it. The longer something takes to produce and to circulate, the greater the sum of wages needed. If the

circulation period in one industry is twenty weeks because of the technical nature of production there, while it is ten weeks in another, and average wages are the same, then clearly the amount of variable capital in the first industry needs to be double that of the second everything else being equal. In our example of 39 days or about five and a half weeks, each capitalist will need wages amounting to five and a half weeks' worth of variable capital to pay their workers. It is immaterial from this side of the equation whether wages are paid weekly or monthly.

Strictly speaking wages do form part of turnover, but indirectly. When workers arrive at their factory in the morning they do so empty handed. When they depart in the evening, they do so also empty handed, leaving behind what they have produced during the day. This is the quantum of stocks or inventory, goods not yet sold, perhaps complete or incomplete, but commodities with value that belong to their employer and not to them. This inventory forms part of the circulating capital and its turnover mimics that of the entire circulating capital.

More often than not, this inventory has a value much higher than the money set aside to pay outstanding wages. Therefore, by not classing wages as intermediate sales, but locating them within the framework of the final sale, duplication is avoided. Together, inventories, plus cash on hand, credit-taken and credit-given make up the bulk of the circulating (working) capital.

The consequences of ignoring the annual rate of turnover is at its starkest, when discussing the difference between the rate of exploitation and the rate of surplus value. The rate of exploitation is the annual surplus divided by annual employee compensation. Variable capital on the other hand is annual compensation/turnover. In only one case as Marx points out, will the rate of exploitation and the rate of surplus value coincide and that is when the annual rate of turnover is 1 or twelve months. This can happen episodically in industries like construction or shipbuilding where typical production periods are measured in fractions of a year, but they are exceptional. *"…the annual rate of surplus-value coincides only in one single case with the real rate of surplus-value which expresses the degree of exploitation of labour; namely in the case when the advanced capital is turned over only once in a year…"* (page 308)

By the real rate of surplus value, Marx means a single period rate of surplus value. In terms of figures let us assume an annual rate of turnover of 5. Annual compensation is $1 million, and, the annual surplus is $1 million as well. This yields a rate of exploitation of 100%. (An equivalent of six months is paid, and, six months is unpaid.) If we convert it to a single period rate of surplus value by dividing by 5 then 200,000/200,000 also yields a rate of 100%. But if a single period repeats itself 5 times a year then over the course of that year, the rate of surplus value must be 100% + 100% + 100% +100% + 100% or 500%. Marxists who describe the annual rate of surplus value as 100% or $1 billion/$1 billion are therefore confusing the annual rate of exploitation with the annual rate of surplus value because they are ignoring the turnover of capital. They are ignoring the fact that capitalists only need wages sufficient for 73 days or 200,000, because every 73 days cash returns from sales to replenish the cash going out in wages.

The System of National Accounts.

Whatever objections there are to this understanding of the foreshortening of the circuit falls away when we come to the actual SNA. The figures in the SNA are aggregated figures composed of tens and tens of millions of sales both final and intermediate. Their very magnitude averages out the value of individual sales and has a blending effect. The general law is that the greater the value of intermediate sales relative to final sales, the faster the turnover of capital in any industry. The converse is equally true: the larger the gap between gross output and gross value added, the faster the turnover of capital.

The turnover formula is real because Gross Output is the value of all the duplicated sales. By factoring how much of this value each of these sales add on average, the total number of sales is detected. This is possible because of the mathematical relation between the value of gross output and the value of the final sale.

Therefore, if Gross Output is four times larger than Gross Value Added (the value of the final sale), we know that there have been more intermediate sales than if Gross Output is only twice as big. The formula tells us that within a given year, there were 6 intermediate sales in the first instance, while in the second only 2. Therefore, capital circulated three times as fast in the first instance than in the second. This tells us that the average period of circulation was only one third the time in the first instance.

But it could be argued what the turnover formula does not reveal is how many times final sales turn over each year, only the average sale. For example, are there five or ten final sales? This question is appropriate. After all, it is the turnover of final sales that determines the actual turnover for an industry.

Earlier we recognised that the circulation period is not set arbitrarily. It is primarily set by the production period plus the circulation period. What the turnover formula reveals is the average length of the production plus circulation period for the industry. It is the average for **both** intermediate sales and final sales which is why it is a two-part formula. This being so, if the average annual circulation is 4, or what is the same thing, the rate of turnover is four times per annum, this applies not only to intermediate sales but to final sales as well. Final sales will be turning over 4 times a year as well. This is the power of aggregated figures across the whole economy, comprising tens upon tens of millions of sales.

In the end of course, theoretical data needs to be measured against actual or pre-existing data. In the section at the end, titled: "The Empirical Evidence", the accuracy of the formula is established.

In our investigation thus far, we have based our turnover formula on the total number of sales in an industry. This is the correct procedure when defining the circuit of capital as M…M or in its full form, M.C…P…C^{+}.M^{+}. The gap between the cash purchase and the cash sale. In the aggregate, every purchase is attached to a sale and every sale is attached to a purchase, and this is recognised by the statistical bureaus as quoted below.

Hence sales alone provide the architecture for the turnover formula based on the circuit of money capital. But it can be argued that GDP is about production not sales. The answer is that It is, and, it isn't. There are three ways to measure GDP of which gross value added is one. It is also the most accurate and the basis for the other two measures. That is why the statistical bureaus now aggregate GDP-by-industry to obtain GDP for the economy as a whole. Gross value added is the value of final sales and it can only be determined by examining the nature and pattern of sales in order to distinguish intermediate sales from final sales. In the words of the BEA, GDP can be measured: "*as the sum of 'value added' by all industries in the economy. This measure, known as the value-added, or production, approach, is used to analyze the industrial composition of U.S. output. In the input-output (I-O) accounts, value added is defined as the difference between an industry's gross output (sales or receipts plus other operating income and inventory change) and its intermediate inputs (goods and services that are purchased for use in production). When value added is aggregated across all industries in the economy, industry sales to and purchases from each other cancel out, and the remainder is industry sales to final users.* (Source: Concepts and Methods of the U.S. National Income and Product Accounts. https://www.bea.gov/national/pdf/NIPAhandbookch1-4.pdf)

The input-output tables have to be sales based. Of course, Marx made the point earlier, that the total value realised in a calendar year was not equal to the value of production in that year. A calendar year is an arbitrary measure, one which begins on January 1st and ends on December 31st. On the morning of January, the 1st, there will be stocks unsold in warehouses produced the previous year. On December 31st, once again, there will also be stocks left over yet to be sold or worked up into their final form. The stocks found in January will be worked up and sold during the current year, while the stocks or inventory at the end of the current year will be carried forward to the following year.

If stocks are larger in value at the end of the year compared to the start, this depresses the value realised in the current year because more of current production is unsold, and if they were smaller, less would be unsold and this will raise the value realised in the current year. GDP takes this into account as the BEA expresses above ("inventory change"). Gross Output is the value of all final sales less the adjustment for inventory. Yet another star for Marx. However, statistically speaking the difference is insignificant. The difference is usually under 3% mainly composed of inflation. In other words, the value of final sales and the value of annual production tend to differ by around 2.5% p.a. (BEA National Income & Product Table 1.17.5. Gross Domestic Product, Gross Domestic Income, and Other Major NIPA Aggregates) This has no material bearing on the turnover formula under normal conditions.

In conclusion.

Only that which is understood can then be criticised. This is particularly true for the SNA. Many Marxists who have skated over the three Volumes of Kapital and consider themselves experts, dismiss the SNA out of hand. They sneer about the ability of the capitalists and their small army of statisticians to produce any analysis which is informative. Most have little inkling that Marx is the original architect of the SNA.

There is much that is wrong with the SNA, but as we shall see, there is even more wrong with most Marxists who do not appreciate its potential. To begin, the SNA is a gigantic building built on sand. By this we mean that its sources are often indirect, based on the accounts prepared by corporations themselves which are not audited by the statistical bureaus, and, from tax authorities. The former is subject to creative accounting and the latter to tax avoidance and evasion.

Secondly, the statistical bureaus do not have the budgets to examine the economy directly. As a result, they model what should be investigated. This is particularly true of PIM, (Perpetual Inventory Method) which is used to divine the value of the produced assets. Or they model international production relations using national templates which often do not coincide. Hence cost cutting takes its toll adding to the assumptions used in modelling the economy.

But the biggest problem lies in violating the cardinal rule laid down by Marx: "there must be no duplication". While the statistical bureaus seek to hold to these principles it breaks down when production for exchange is equated with production for use. This is particularly evident in the household sector where the employment of servants is treated the same way as the employment of workers engaged in the production of commodities. Even religious giving is treated as an industry, where god's work produces value. The reason this is done is that GDP needs to be expanded, otherwise wages and profits would exceed GDP. In reality the opposite should take place, wages and profits should not be counted twice. (Marx made the point originally that GDP is not the sum of rents, interest, profits, tax and wages but of the value produced before these components are accounted for.)

Then there are the imputed sales like owner occupied rent payments. These are non-existent sales. Here the owners of residential properties are treated as if they were their own landlords paying rent to themselves. Table 7.2 in the National Income and Expenditure section of the National Accounts show imputed sales amount to $3.074 trillion out of a GDP of $19.485 trillion or 16%, a considerable sum though a small proportion makes economic sense.

Finally, as long as intermediate sales are recorded correctly, which means that they are deducted at source in order to be added to the use industry, GDP will not be overstated. Hence GDP is only as accurate as the accurate recording of intermediate sales. This is the prime defence against duplication. The real problem arises when intermediate sales are deliberately mis-recorded. This is a methodological issue. One of the worst examples occurred in 2013 when R&D and in-house software were moved from an intermediate sale into a final sale. The Victorian railroad magnates, criticised by Marx, who used the same device would have been green with envy. The BEA is quite open about the fact, that as the bulk of R&D and in-house software is never sold, they had to invent a sale to move it across. The result is that while Gross Output was unaffected, because the fall in intermediate sales was offset by the rise in final sales, GDP was boosted by about 3% or the equivalent of the entire Swiss economy.

The strength of the turnover formula is that any misuse or omission of intermediate or final sales registers as an abnormal reading. Hence, over the economy as a whole, the turnover formula yields a rate much lower than the one anticipated. Anything which reduces intermediate sales or increases final sales will register as a slowdown in the annual rate of turnover. It is for this reason that the turnover formula can only be applied to those sectors of the economy where duplication is at its lowest if an accurate reading is to be recorded.

After a long period of deliberation, I have finally adopted the annual rate of turnover for the retail sector as the rate which is representative of the economy as a whole. At 9+ it is equal to the sum of the turnovers found in the goods production sector (less construction) plus utilities, plus wholesale plus parts of transport. This rate is consistent with the way the BEA compiles its accounts and GDP which is based on the sum of Industry GDPs. In future the use of this rate will form a major part of forthcoming reports.

I have always considered the turnover formula the Rosetta Stone of political economy, allowing deeper, more accurate and meaningful insights into the functioning of the capitalist economy. It remains a source of serious concern why Marxist theoreticians continue to ignore the formula and persist in the old way. This may be due to the protection of reputations, unfamiliarity or simply the insecurity associated with a Marxism which is beleaguered. Whatever the case it is unacceptable. The formula took 60 years to emerge, it should be used now, and with confidence.

Capitalism is stuttering once more. Shocks increase in severity and frequency. If Marxism is to be re-established then it needs to be substantial. The turnover formula sharpens our insights and provides weight to our arguments. It turns an axe into a scalpel. It gives precision to variable capital, the composition of capital and the rate of profit, all of which have a bearing on the direction and tempo of the capitalist economy.

EMPIRICAL DATA

Working capital

Working capital is current assets less current liabilities or the actual amount of circulating capital a corporation needs to finance current production. Engels noted that *'…the whole capital cannot be simultaneously employed in production. One part of this capital therefore always lies fallow, whether in the form of money capital, stocks of raw materials, finished but still unsold commodity capital, or outstanding debts that are not yet due for payment*.' (Engels in Marx 1991 [1894]: 163) Working capital makes up that part of the capital which is not fixed in the form of structures and equipment/machinery. It is composed of inventory (stocks of materials and product) cash, credit extended to customers less credit received from suppliers. It is assumed that 'outstanding debts' are bills payable less bills receivable (credit from suppliers and credit given to customers).

The definition of working capital is not far removed from Engels' description above. It comprises current assets less current liabilities. The accounting convention that distinguishes current capital from fixed is the somewhat arbitrary assumption that the life span of current is less than a year while that of fixed is more than a year. Accordingly, this definition of working capital includes inventory, bills payable or receivable, plus any investments or debts unconnected to production that have a maturity less than a year. After 2013 it excludes R&D expenditure, which has been moved to fixed capital. While this has speeded up the circulation of fixed capital through higher rates of depreciation, it has reduced the circulation of working capital.

The numerator used by analysists in calculating their turnover of working capital is 'cost of sales' rather than sales itself, resulting in both working capital and turnover being valued at cost. Cost of sales is annual sales less annual profits, and, in aggregate is equal to the cost of gross output. Cost of sales (numerator) is the **annual** amount spent on wages for production workers, to which is added the **annual** purchases of raw materials, components, ancillary materials, power needed for production, repairs to structures and equipment and other expenses relating to production. If gross profit was added, this would yield actual sales. In order to convert the formula into days of turnover, it is divided by 365 days.

$$\frac{\text{Cost of annual sales}}{\text{Working capital}} \times \frac{1}{365} = \text{number of days for turnover of working capital}$$

This is the closest formula to Marx's and Engels' formula for the circuit of capital. As these figures are limited to the financial year, they have to be adjusted for inventory brought forward from the previous year and inventory that is unsold or not worked up on the last day of the year and which is carried over to the following year. This is achieved by adding in the inventory brought forward and deducting the inventory that is carried over to the following year. Through these two adjustments both the cost of sales and working capital consists of the commodities bought, sold and produced within a given financial year.

Empirical evidence of different turnover periods

The empirical estimation of the turnover of working capital, the operating cycle and inventory cycle for US corporations should provide confirmation of the estimate developed above, based on the formula and SNA data. The empirical data should provide a figure close to the rate of turnover of 4.8 for manufacturing (2015). This rate yields a turnover amounting to 76 days (365/4.8).

Stock Analysis on the Net: Top 100 Leaders, is a private, subscription only, research database of the top 100 US corporations. It provides detailed information on various critical aspects of corporate performance. Table 1 below, looks at the aggregated figures for a number of non-financial Sectors in the S&P 500 to obtain working capital turnover, the operating cycle and the inventory cycle. The operating cycle is the rate of turnover for inventory and the days needed for payment. The listings are in order of the operating cycle. All the figures are in days.

Table 1. The three ratios applied to industries within Manufacturing.
(Sample of the largest companies in each S&P Sector.)

Industry	Working Capital	Operating cycle	Inventory cycle
Industrial Sector*	43**	138	87
Chemicals	82	114	70
Basic materials	83	108	76
Pharmaceuticals	135	105	61
Personal Products	n/a***	103	63
Consumer Goods	22	76	48
Technology	119	67	26
Cars	13	61	36
Computer Hardware	46	56	21
Average	**71**	86.2	50.1

Source: *Stock Analysis on Net: Top 100 Leaders. 2014/5*

***** The industrial sector is classified by code 20 in international convention. It includes capital goods and transportation other than automobiles sold to consumers in code 25.
****** R&D is not included as it is now considered to be fixed capital and not part of working capital. This has shortened the operating and inventory cycles in industries where R&D is a significant expense for example the pharmaceutical and car industries. In the car industry we would need to add about 8 days to each ratio to accommodate the level of R&D.
*******n/a denotes that current liabilities exceed current assets so working capital is negative.

The industry averages lend support for the formula. The average for working capital yields 71 days compared to our formula which yields 76 days for manufacturing, the industry where most of these non-financial corporations are resident.

$$\frac{6{,}098{,}371}{2{,}111{,}498} + \frac{(6{,}098{,}371 - 2{,}111{,}498)}{2{,}111{,}498} = 4.8 = \frac{365}{4.8} = 76 \text{ days (Figures in \$ million.)}$$

The figure of 76 days is proximate to 71 days, manifesting a difference of 7%. It is to be expected that the formula, which accounts for thousands of corporations, large and small, will show a lower turnover (more days) because the average corporation does not have the economies of scale of the larger corporations found in the S&P.

In China the turnover can be confirmed by adding the inventory turnover to the payment period to approximate the production and circulation period. Using Table 13-2 in the 2017 Chinese Statistical Year Book, the inventory turnover in 2016 yields 10.8 which translates into 34 days (365/10.8) while accounts receivable equals a period of 39 days (Table 13.3). Together they yield 73 days compared to 61 days for the formula (73/61 = 120%). This is the same gap found in Table 1 between the rate of turnover of working capital and the Operating Cycle (86/71 = 121%). Further information on credit and payment terms in China can be obtained by accessing the following sites:

https://www.ceicdata.com/en/china/industrial-financial-data/industrial-enterprise-product-inventory-turnover-days

https://atradius.be/fr/rapports/payment-practices-barometer-china-2017.html#print

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