

TSSI Experiments in Circulation.

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Abstract.

My paper seeks to explore Marx's value theory following a Temporal Single System Interpretation (TSSI) of Marx's determination of commodities' values by labour-time. I explore how trying to consistently follow Marx's definition of productive and unproductive labour affects our understanding of circulation/retailing. I model, trying to follow the TSSI of Marx, retailing sequentially occurring alongside production. Firstly I contrast how following Marx allows us to account for all the surplus-value extracted from labour, whereas seeing value as a market phenomenon cuts any link between exploitation of workers and profit. Then I explore how my model is affected in turn by a change to wholesale price, a change to retail price, and lastly a state of growth/technological change. Finally I conclude.

(120 words)

Introduction.

Let me put this paper into context. The Temporal Single System Interpretation (TSSI) of Marx, as best summarised and defended by Kliman (2007), has rediscovered the consistency of Marx's labour theory of value. Exploitation of workers is confirmed as the exclusive source of profit (Potts and Kliman, 2015) as to critically is Marx's tendency for the rate of profit to fall in response to labour saving technological change (disproving Okishio, 1961, see Kliman, 1996, and more recently Kliman *et al*, 2013).

The TSSI imagines a single system of labour value, with values being expressible in money or labour-time through conversion by the monetary expression of labour-time (MELT, see Ramos-Martinez, 2004) that is established at the end of production with price formation each period. Secondly the TSSI takes a sequential approach to time, assuming production takes time, so the unit values of inputs may vary from the unit value of outputs.

Up to now TSSI writers, myself included, have focused on production in their models by assuming circulation instantaneously occurs at the end of each period. I now wish to explore how allowing retailing to also take time might be best modelled following the TSSI of Marx.

Unproductive but Necessary Activities.

By 'necessary' but unproductive activities Marx (1978) means activities that do not directly produce value or surplus value, but still have to be carried out. If specialist capitalists did not exist to carry out these activities as cheaply as possible, they would have to be carried out by productive capitalists' themselves, still unproductively and through being less efficient wasting more surplus-value. Marx (1978) clearly stresses how capital consumed in unproductive activities such as retailing or banking represents a deduction from the total surplus value produced in the productive economy. Furthermore as this unproductive activity is necessary and a business in-itself it should be subject to the tendency for profit rate equalisation between all capitals productive or unproductive.

Our Simple Model of Retailing Alongside Production.

To illustrate the significance of whether we see value as produced in the productive economy or as a market, pure exchange, phenomenon (Arthur, 2001) let us employ a simple example of the economy including both production and circulation/retailing. We shall firstly interpret this example from Marx's perspective (value must first be produced in production) and then consider it from the value-form perspective (value is simply a market phenomenon). For simplicity let us assume a single identical commodity and no fixed capital. We assume a productive sector and a retail sector.

Let us assume that in one time period the retail sector sells the (previous period's) output of the productive sector (circulation time equals production time).

We leave aside questions of how much retailing represents a form of productive production, and how much it purely represents an exchange of commodities, and is thus unproductive, by assuming the retail sector is entirely unproductive. For simplicity let us assume an absence of technological change and simple reproduction (capitalists unproductively consume all their profits) so our period is infinitely identically repeatable.

Let us try to be clear on what is happening and when it happens. The key is recognising that retailing takes time in this abstract model. A period's output takes the productive capitalist a period to make, and then it takes another period, the next period, for the retail capitalists to sell it. Of course they may not sell it, if this is a large enough failure to sell then it represents the opening of crisis, but let us also leave this aside.

Workers' are paid for the current period they are working at the start of the period. We assume they entirely spend their wages before the end of the period. They buy from retailers part of last period's output. Capitalists, both productive and retail, make profit for the last period and now this period use some, as we shall initially assume all profit to support simple reproduction, of that profit for their luxury

consumption. Again, like workers, they do this by the end of the period and are consuming last period's output.

Constant capital input is a little different, as the capitalists, both productive and retailers must first obtain these inputs and then apply them to production. This is something they can not instantaneously do at the end of production/start of the next period as we are assuming retailing takes time.¹ So capitalists buy this period their inputs of constant capital for next period, with these constant capital inputs having been produced last period and retailed this period. Constant capital inputs thus have a period of being purchased and waiting as stock (of future productive capital). This raise two questions, what happens if while this is happening the produced value of these inputs changes, and how is it being paid for?

The first question we can avoid for now by our assumption of simple reproduction and an absence of technological change. The second can be seen as an opportunity for credit to be provided as a specialist activity to capitalists. If they had to advance extra capital for their stocks of constant capital input their total advanced capital would rise, depressing their profit rates. But let credit be extended for simplicity for free (0% interest) from sellers of commodities to buyers until the end of the period. If capitalists had fixed capital then depreciation reserves could 'usually' be used by capitalists to effectively grant credit to themselves, cutting down on the need to request it from others, but for simplicity we have assumed no fixed capital in our abstract example.

Let us focus on prices. This period's output is sold by productive capitalists to retail capitalists all in one go at the end of the period at what we will call its wholesale price (not producer price to avoid confusion with produced and appropriated values). This output is now retailed before the end of the next period at its retail price, before at the end of next period that periods output is sold at its wholesale price. The retail price for this period's output, that it will be retailed/sold at next period, can thus in our

¹ We are insisting that no capitalist can directly use their own output (commodity capital) as input of constant capital, or to pay their workers in kind, or to consume for their own luxury consumption. Through assuming all must buy from the retail sector, even retail capitalists, we abstractly proxy a situation of many commodities and thus very little opportunity for any capitalist to use their own output for any direct use.

abstract model be seen to be formed at the same time as its wholesale price is established at the end of the period it is produced.

So how do we calculate the MELT established at the end of each period? To come to an answer to this question let us firstly remember that following the TSSI of Marx we abstractly assume that the MELT established at the end of a period allows conversion between value expressed in labour-time and its monetary expression at the end of that period. Plus it holds at the start of the next period for inputs, and in fact continues to hold until the end of the next period when prices are again determined, ensuring MELT may change.

Next let us ask what would happen if this unproductive activity of retailing were conducted in house by productive capitalists, making them both productive and retail capitalists, or more simply capitalists. The price this period's output will be sold at next period by capitalists will be its retail price established at the end of this period. At the end of this period capitalists would hold that period's output as stocks of unsold commodities valued at their retail price (the price they will be sold at), so as any accountant knows, the capitalists would have expanded their capital by the surplus-value they had extracted from their productive workers. However, now they would face the inconveniences of retailing, wasting unproductively (through employing workers and constant capital) part of the surplus-value they had extracted last period from their productive workers. The only reason retail capitalists exist is that they simply waste less surplus-value, allowing ultimately (through the tendency to profit rate equalisation) productive capitalists to keep more of what they exploit from their workers.

So the MELT established at the end of this period, that holds until new prices are established at the end of next period, will equal the total monetary expression (appropriated value) of this period's newly produced output priced at its retail price divided by the total produced value in labour-time of this newly produced output.²

² Note we are following Andrew Kliman's approach of calculating MELT by just considering the appropriated and produced value of newly produced output (see Potts, 2011a and 2016a). If we were to follow Alan Freeman's approach then the stocks of constant capital waiting to be applied next period would have to be included in this total capital concept of the determination of MELT. Andrew

Let us assume prices are such as to ensure the monetary expression of labour time (MELT) is constant at unitary i.e. so that all variables are identical in monetary expression and expression in hours of labour-time. With no technological change, and no change to prices, all values, in both monetary expression and labour-time, and use-value magnitudes will be unchanged as the period repeats. So all figures shown in Table 1 are in money and hours of labour-time as MELT = 1. By also assuming for simplicity that 220 units of use-value of the commodity are produced the figures in Table 1 also represent the quantities of use-values of C and V.

Table 1 – Marx’s Perspective.

	C Constant & Commodity Capital	V Variable Capital	S Surplus Value	CP Cost Price	M' Total Revenue	M'-CP Realised Profit	Profit Rate %	Exploitation %
P	140	20	60	160	176	16	10	300
R	6, 176	18	0	200	220	20	10	?
O	322	38	60	360	396			

In the productive sector total living labour of 80 hours is combined with 140 hours of constant capital to produce an output by the end of the period with a produced value of 220 hours. We have assumed a 300% rate of exploitation of productive workers, variable capital equals 20 hours and total surplus-value extracted from productive workers equals 60 hours. Productive capitalist only realise £176, equal to 176 hours of value, by selling their output for £176 to the retail sector at the end of the period. Productive capitalists earn a 10% profit rate $(M'-CP)/CP$, realising in profit only 16 $(M'-CP)$ hours of the surplus-value their workers create. Retailers thus buy all of the productive sector’s output this period for £176, to sell by the end of next period for £220, once the ‘business’ of retailing is complete.

In our identically reproducing economy retailers at the end of the previous period would have bought the productive sector’s entire output for £176. Last period’s productive output thus represents £176 of commodity capital input to the retail sector

Kliman’s approach would thus appear simpler to model here, but of course that is no guide to its relative theoretical merit over Alan Freeman’s approach.

this period. Let retailers also apply £6 of constant capital input and £18 of variable capital input.

Note we are not double counting, by the end of last period retailers purchased £6 of constant capital for this period (produced the period before the last period) and at the start of this period advance £18 in wages for workers this period (who will use their wages to buy £18 of last period's output).

Retailers 'cost-price' (C+V) is now equal to $£176+£6+£18 = £200$. Assuming they also earn a 10% profit rate ensures they will realise £220 by the end of the period, by selling for £220 the output (including selling £6 of constant capital for next period to themselves) that cost them £176 at the end of last period.

Let us be clear about what is happening. At the end of each period the productive sector sells its entire output to the retail sector for £176. We assume all agents must buy from the retail sector i.e. productive capitalists can not directly use their output as constant or variable capital and cannot directly consume it. Productive capitalists use their total revenue of £176 to, first pay for the constant capital they bought last period for this new period (£140), and to advance variable capital for this period (£20, paid to workers who entirely spend this in the retail sector this period), and finally they consume the remaining £16 for their luxury consumption (in total £176). They also contract to buy constant capital from the retail sector (£140), to apply next period, but do not pay for it until the end of this period.

We assume retailers, in addition to their purchase of the productive sector's entire output at the end of the last period, and their payment to each other for constant capital to apply this period (£6), advance variable capital for this period (£18) and also buy luxury consumption goods, equal to their realised profit last period, of £20, from the retail sector. They also contract to buy £6 of constant capital for the next period, not paying for it until the end of the period.

Total retail demand thus equals £176 from the productive sector and £44 from the retail sector itself (because we assume retailers also cannot directly use their 'output' as C or V input or for their own consumption). Total demand for the 'output' of the

retail sector thus equals £220. Demand, between both sectors, and overall, balances, the economy can continue to simply reproduce.

Note as input of commodity capital in retail, the value of last period's output this period is simply defined by what was actually paid for it, the wholesale price, at the end of last period (dividing by MELT at the end of the last period, which in this case simply equals one).

In our example profit rates equalise at 10%. Productive workers suffer a 300% (S/V) rate of exploitation. We cannot calculate the rate of exploitation of unproductive retail workers by dividing the surplus-value the retail sector captures, and does not waste on C or V, in total £20, by the £18 of variable capital the retail sector applies. These workers do not produce this surplus-value, so this calculation would be meaningless. To calculate retail sector workers' 'rate of exploitation' we would need to know how long they work in total for £18 of variable capital (equal to 18 hours of value as MELT=1), information we do not have in our table. Unproductive workers are just as exploitable as productive workers, but no matter how much you exploit them they can not produce value or surplus-value. Clearly if retail sector workers are exploited more less variable capital needs to be applied in retail, reducing this waste of surplus-value produced in the productive economy, but not directly creating any new surplus-value.

Note, as we shall explore below, the surplus value extracted in production this period is partially realised by productive capitalists in profit at the end of this period, with the rest being consumed unproductively in retail and being realised as profit by retail in the following period. So in Table 1 productive capitalists profit of 16 hours is part of the total 60 hours of surplus-value extracted in production this period, whereas the waste of 24 in retail (C+V) and 20 profit in retail this period is from the 60 hours of surplus-value extracted in production last period. Simple reproduction and constant prices obscure this, as all variables remain constant.

Following Marx's clear distinction between what is productive and unproductive allows us to see that the processes of production and retailing are very different. We

can see where all the value and surplus-value is produced and where it ‘necessarily’ has to end up.

Marx v Value-Form.

Let us consider the same scenario from the point of view that value is simply a market phenomenon, see Arthur (2001) i.e. value is defined by having a price; retailing is thus ‘productive’ by selling its ‘output’ at a price, see Table 2.

Table 2 – Value Form Perspective.

	C Constant Capital	V Variable Capital	CP Cost Price	M' Total Revenue	M'-CP Realised Profit = Surplus Value, S	Profit Rate %	Exploitation %
P	140	20	160	176	16	10	80
R	176+6	18	200	220	20	10	111.1
O	322	38	360	396	36		

In the productive economy $M' = £176 = 176$ hours and in retailing $M' = £220 = 220$ hours. It looks like both sectors are productive of value and surplus-value, with surplus-value defined by realised profit = $M' - CP$. It seems that both sectors produce in total 36 hours of surplus-value from each exploiting their workers that period. Without the concept of value being produced in the productive sector alone any notion of a waste or capture of value by the retail sector is lost.

With ‘unproductive’ workers apparently producing value and surplus-value it would seem but a simply step to assume all capital advanced, including constant capital, is productive of surplus-value (Arthur, 2001). If for example the retail sector became entirely automated it would still appear to produce surplus-value.

To illustrate this assume in our example retail variable capital input drops from £18 to 0, as constant capital input rises from £6 to £12, with no other change so total retail

profit rises to £32 (which to maintain simple reproduction we assume retail capitalists entirely consume on luxury consumption) delivering a 17.02% profit rate in retailing.

We must note, as so far our model does not include stocks, that it is balanced on a knife-edge (like nearly all economic models), which we must carefully, yet unrealistically, preserve. Remember in our state of simple reproduction retail sector purchases from itself each period must equal £44 (up to now $C = £6$, $V = £18$, realised profit spent on luxury consumption = £20). Consequently to make the change this period, last period retail capitalists must have foregone £6 luxury consumption to buy £12 constant capital for this period instead of £6. Furthermore to ensure retail demand is still at £44 this period, given retail only contract to buy constant capital of £12 for the following period, and now pay no wages, they must consume £32 on luxury consumption, as if their increased profits had arrived early! The following period, when all is ‘settled down’, the period we illustrate in Tables 3 and 4, retail capitalists will simply contract to buy £12 of constant capital, for the period after, and consume their £32 profit from the previous period. Clearly with retail stocks all that would occur is the use of some of these stocks to buy more constant capital, and an increase in retail stocks next period when wages are not advanced, with stock levels stabilising next period (£6 higher than before) when capitalists consume their now larger profit.

Table 3 – Value Form Perspective.

	C Constant Capital	V Variable Capital	CP Cost Price	M' Total Revenue	M'-CP Realised Profit = Surplus Value, S	Profit Rate %	Exploitation %
P	140	20	160	176	16	10	80
R	176+12	0	188	220	32	17.02	Infinite!
O	328	20	348	396	48		

Table 3 shows us from the value-form perspective how total surplus-value grows to 48 hours (still 16 in the productive sector, but now 32 in the retail sector); but we have lost any meaningful link between labour-time and value, as less, in fact no labour input in retailing, of to the value-form approach productive labour, leads to higher

surplus-value! We may calculate the exploitation of labour for both sectors, but not as defined in production, but as defined by price formation in the market. However as no labour is employed in retailing, yet price formation ensures this sector ‘produces’ 32 hours of surplus-value, its rate of exploitation is infinite!

Table 4 – Marx’s Perspective.

	C Constant Capital	V Variable Capital	S Surplus Value	CP Cost Price	M' Total Revenue	M'-CP Realised Profit	Profit Rate %	Exploitation %
P	140	20	60	160	176	16	10	300
R	176+12	0	0	188	220	32	17.02	
O	328	20	60	348	396			

Alternatively in Table 4 from Marx’s perspective we know total surplus-value produced in the productive economy is 60 hours. If now only 12 hours are applied/wasted unproductively in retail (on C), as opposed to 24 (on C+V), it is of no surprise that total remaining surplus-value captured by retail should rise from 36 hours to 48 hours.

To properly understand the distribution of surplus-value we must understand its source, only then is the link between labour-time and value clear, Marx (1976), pages 261-262,

‘Hence we see that behind all attempts to represent the circulation of commodities as a source of surplus-value, there lurks an inadvertent substitution, a confusion of use-value and exchange-value. In Condillac, for instance: ... Still, Condillac’s argument is frequently repeated by modern economists, especially when the point is to show that the exchange of commodities in its developed form, commerce, is productive of surplus-value. ... We might therefore just as well say that the buyer performs what is ‘strictly’ an ‘act of production’ by converting stockings, for example, into money.’

Exploring Our Model – A Change to Wholesale Price.

Clearly despite much simplification my model is already very complex. To explore it further, by first changing prices and then introducing growth/technological change, will involve considerably more complexity and will also raise a number of issues concerning how we model circulation/retailing alongside production while attempting to follow the TSSI of Marx. So let me be clear, this is a preliminary exploration, and I do not claim to have definitive solutions to any of the methodological questions I shall relate below or for that matter have already related above, such as how to calculate MELT. Hopefully my efforts will inspire others to take up and engage with these issues themselves.

Let me explain the additional notation I use in Table 5 below and in all our other tables from now on. I shall use U to denote stocks held by retail capitalists, and for simplicity still assume productive capitalists hold no stocks themselves. P_w stands for wholesale price and P_r stands for retail price. $PC C$ is productive capitalists' constant capital purchases this period to apply next period (paid for at the end of the period), while $RC C$ is retail capitalists' constant capital purchases this period to apply next period (likewise paid for at the end of the period). $PC L$ is productive capitalists' purchases this period for their own 'luxury' consumption (funded by their profit last period), while $RC L$ is retail capitalists' purchases this period for their own 'luxury' consumption (likewise funded by their profit last period).

MELT, established with price formation at the end of the period, and holding next period until prices are established again at the end of period, is calculated by dividing the monetary expression of this period's output (P_r , established at the end of the period, times Q) by the total produced value of this output in hours of labour-time (C in monetary expression divided by last period's MELT, plus living labour added this period). Note we shall consider the appropriate retail price to use to calculate the monetary expression of C further when we next explore changing retail price, but in this example retail price simply stays constant at £1. Also for simplicity we hold living labour applied by productive capitalists constant at 80 hours in this example and in all our subsequent examples.

Table 5 - Exploring Our Model – A Change to Wholesale Price.

Production in period 0						Prices and Melt established end production period 0								
	C	V	S	M	Q	Pw	Pr	Melt	M'	M'-M	Prof %			
£	140	20		160		0.8	1	1	176	16	10.0			
H	140	20	60	160	220				176	16	10.0			
O	140	20		160	220									
Retail in period 1		From period 0			Sold plus period 1 Retail V and Productive V							At period 0 Pr and Melt		
	C	V	U	Q	M	PC C	RC C	PC L	RC L	Sold	U	M'	M'-M	Prof %
£	6	18	20	176	220	140	6	16	20	220	20	240	20	9.091
H	6	18	20	176	220	140	6	16	20	220	20	240	20	9.091
O	6	18	20	220		140	6	16	20	220	20			
Period 0 S = (P0 PC M'-M) + (P1 RC C) + (P1 Retail V) + (P1 RC M'-M) 60 = 16 + 6 + 18 + 20 = 60														
Production in period 1						Prices and Melt established end production period 1								
	C	V	S	M	Q	Pw	Pr	Melt	M'	M'-M	Prof %			
£	140	20		160		0.85	1	1	187	27	16.85			
H	140	20	60	160	220				187	27	16.85			
O	140	20		160	220									
Retail in period 2		From period 1			Sold plus period 2 Retail V and Productive V							At period 1 Pr and Melt		
	C	V	U	Q	M	PC C	RC C	PC L	RC L	Sold	U	M'	M'-M	Prof %
£	6	18	20	187	231	140	6	27	20	231	9	240	9	3.896
H	6	18	20	187	231	140	6	27	20	231	9	240	9	3.896
O	6	18	20	220		140	6	27	20	231	9			
Period 1 S = (P1 PC M'-M) + (P2 RC C) + (P2 Retail V) + (P2 RC M'-M) 60 = 27 + 6 + 18 + 9 = 60														
Production in period 2						Prices and Melt established end production period 2								
	C	V	S	M	Q	Pw	Pr	Melt	M'	M'-M	Prof %			
£	140	20		160		0.85	1	1	187	27	16.85			
H	140	20	60	160	220				187	27	16.85			
O	140	20		160	220									
Retail in period 3		From period 2			Sold plus period 3 Retail V and Productive V							At period 2 Pr and Melt		
	C	V	U	Q	M	PC C	RC C	PC L	RC L	Sold	U	M'	M'-M	Prof %
£	6	18	9	187	220	140	6	27	9	220	9	229	9	4.091
H	6	18	9	187	220	140	6	27	9	220	9	229	9	4.091
O	6	18	9	220		140	6	27	9	220	9			
Period 2 S = (P2 PC M'-M) + (P3 RC C) + (P3 Retail V) + (P3 RC M'-M) 60 = 27 + 6 + 18 + 9 = 60														
Production in period 3						Prices and Melt established end production period 3								
	C	V	S	M	Q	Pw	Pr	Melt	M'	M'-M	Prof %			
£	140	20		160		0.85	1	1	187	27	16.85			
H	140	20	60	160	220				187	27	16.85			
O	140	20		160	220									

In this wholesale price change example, and our following retail price change example, we will maintain simple reproduction in use-value terms i.e. keep constant the physical quantities of C and V for both sectors and Q produced by productive capitalists.

I present production first then retailing for the following period, not because they happen at the same time, they don't, but to track the surplus-value created in production each period. So period 0 $S = 60$ is first partially consumed by productive capitalists in profit at the end of period 0 (16 hours), then unproductively consumed in period 1 retail as C (6), V (18) and retail profit (20).

Period 0 is the same for productive capitalists as in our example in Table 1. Retailing is the same as in Table 1 with the one change that retailers hold 20 units of stocks of our one commodity to sell. This increases M advanced and M' realised by the value of these stocks ensuring retail profit is now 9.091%. I do not illustrate retail for period 0 as it is identical to retail in period 1. Because we assume simple reproduction with no technological change, and we hold retail price constant, MELT stays constant at £1 throughout our example; P_r times Q remains unchanged as productive capitalists' C plus L also remains unchanged. So we do not yet need to explore the issue of which MELT(s) we should use to calculate retail profit in hours of labour-time.

At the end of period 1 I increase wholesale price to £0.85. This does not affect MELT as that is calculated using retail price. Productive capitalists now receive £187 for their output, with all else unchanged for them, increasing their profit to £27 (27 hours as $MELT = £1$), a rate of 16.85%.

As this occurs at the end of period 1 retailing for period 1 is already complete, at the retail price established at the end of period 0, so retailing is unaffected this period, with retail capitalists realising profit of £20, a rate of 9.091%. They will consume these profits in period 2, as productive capitalists consume their higher profit from period 1 of £27. Given both retail and productive capitalists apply the same V and order the same C for the following period as before period 2 retail sales exceed period 1's output, so retail stocks fall by 11 units. If we assumed retail capitalists dropped their luxury consumption in period 2 by 11 units stocks would remain unchanged.

So in period 2 retail capitalists Q of 220 to retail now costs them £187, increasing their M to £231, while, as retail price remains unchanged, they sell it for the same

revenue (plus 11 units of stock). M' equal to output sold plus remaining stocks thus remains unchanged at £240, reducing retail profit to £9, rate of 3.896%.

Production continues in all respects unchanged in periods 2 and 3.

Retailing in period 3 begins with a lower stock level, reducing M to £220. Period 2's lower retail profit ensures retail capitalists' luxury consumption falls to £9, so output retailed again equals the previous period's output produced. Stocks remain unchanged, with retail now continuing unchanged in period 4 and so on as long as nothing else changes. The fall in M slightly increases the retail profit rate to 4.091%.

In summary a wholesale price change is straightforward in our simply reproducing model; productive capitalists simply gain at the expense of retail capitalists.

Exploring Our Model – A Change to Retail Price.

I increase retail price to £1.05 at the end of period 1. As period 1 retail is already complete I do not illustrate it in Table 6A, it is identical to period 1 retail in Table 5. Changing retail price will change MELT [$MELT1 = Pr1Q1/(\text{£}C/MELT0 + L)$]. End period 1 MELT rises to £1.05. This reduces the value in terms of labour-time of productive capitalists' M' . So although productive capitalists' profitability in nominal money terms does not drop from 10%, in labour-time it falls to 4.762%. Note how we cannot calculate the labour-time value of total profit by dividing nominal total profit by MELT, as all of M' is devalued in terms of labour-time as MELT rises, not just the nominal surplus. In hours of labour-time productive capitalists' profit rate = $(M'/MELT1 - M/MELT0) / (M/MELT0)$.

Let us move on to the following period 2 when the new retail price comes into operation. We reach the question of which retail price to use to value inputs of constant capital? These actual inputs were produced in period 0 and sold in period 1 at the retail price established at the end of period 0, £1, not the just established at the end of period 1 new retail price of £1.05. Now if these inputs could be bought and applied instantly at the end of period 1/start of period 2 we would price them at £1.05.

Table 6A - Exploring Our Model – A Change to Retail Price.

Production in period 1						Prices and Melt established end production period 1								
	C	V	S	M	Q	Pw	Pr	Melt	M'	M'-M	Prof %			
£	140	20		160		0.8	1.05	1.05	176	16	10.0			
H	140	20	60	160	220				167.62	7.619	4.762			
O	140	20		160	220									
Retail in period 2		From period 1			Sold plus period 2 Retail V and Productive V							At period 1 Pr and Melt		
	C	V	U	Q	M	PC C	RC C	PC L	RC L	Sold	U	M'	M'-M	Prof %
£	6	18.9	21	176	221.9	147	6.3	16	20	229.2	22.8	252	30.1	13.565
H	5.714	18	20	167.6	211.3	140	6	15.24	19.05	218.3	21.71	240	28.67	13.565
O	6	18	20	220		140	6	15.24	19.05	218.3	21.71			
Period 1 S = (P1 PC M'-M) + (P2 RC C) + (P2 Retail V) + (P2 RC M'-M) 60 = 7.619 + 5.714 + 18 + 28.667 = 60														
Production in period 2						Prices and Melt established end production period 2								
	C	V	S	M	Q	Pw	Pr	Melt	M'	M'-M	Prof %			
£	140	21		161		0.8	1.05	1.08281	176	15	9.317			
H	133.33	20	60	153.33	213.33				162.54	9.206	6.004			
O	140	20		160	220									
Retail in period 3		From period 2			Sold plus period 3 Retail V and Productive V							At period 2 Pr and Melt		
	C	V	U	Q	M	PC C	RC C	PC L	RC L	Sold	U	M'	M'-M	Prof %
£	6.3	18.9	22.8	176	224	147	6.3	15	30.1	238.3	15.5	253.8	29.8	13.304
H	5.818	17.45	21.06	162.5	206.9	135.8	5.818	13.85	27.80	220.1	14.31	234.4	27.52	13.304
O	6	18	21.71	220		140	6	14.29	28.67	227.0	14.76			
Period 2 S = (P2 PC M'-M) + (P3 RC C) + (P3 Retail V) + (P3 RC M'-M) 60 = 9.20635 + 5.818 + 17.4545 + 27.5209 = 60														
Production in period 3						Prices and Melt established end production period 3								
	C	V	S	M	Q	Pw	Pr	Melt	M'	M'-M	Prof %			
£	147	21		168		0.8	1.05	1.07065	176	8	4.762			
H	135.758	19.394	60.6061	155.152	215.758				164.387	9.235	5.952			
O	140	20		160	220									
Retail in period 4		From period 3			Sold plus period 4 Retail V and Productive V							At period 3 Pr and Melt		
	C	V	U	Q	M	PC C	RC C	PC L	RC L	Sold	U	M'	M'-M	Prof %
£	6.3	18.9	15.5	176	216.7	147	6.3	8	29.8	231	15.5	246.5	29.8	13.752
H	5.884	17.65	14.47	164.4	202.4	137.3	5.884	7.472	27.83	215.8	14.47	230.2	27.83	13.752
O	6	18	14.76	220		140	6	7.619	28.38	220	14.76			
Period 3 S = (P3 PC M'-M) + (P4 RC C) + (P4 Retail V) + (P4 RC M'-M) 60.6061 = 9.235 + 5.884 + 17.653 + 27.837 = 60.6061														
Production in period 4						Prices and Melt established end production period 4								
	C	V	S	M	Q	Pw	Pr	Melt	M'	M'-M	Prof %			
£	147	21		168					176	8	4.762			
H	137.3	19.614	60386	156.915	217.3	0.8	1.05	1.06305	165.562	8.64751	5.511			
O	140	20		160	220									

But they cannot be so instantaneously bought and applied, by our assumption that retailing takes time. £1 was charged for each unit in the previous period 1. Now if we thus say inputs of constant capital in period 2 should be priced at £1, the price actually paid for them, then the change in MELT at the end of period 1, now holding

until MELT is re-established at the end of period 2, will revalue these inputs in terms of hours of labour-time at the start of period 2, as in Table 6A.

So taking this approach ensures constant capital inputs are revalued in labour-time due to a nominal price change that changes MELT but by our approach does not change their monetary expression! This seems odd, so after seeing the result of this approach we shall explore the alternative of valuing constant capital inputs at the current retail price as established at the end of the last period (in Table 6B below).

Returning to period 2 in Table 6A, the devaluation of constant capital most effects productive capitalists in period 2, as it is they who apply most C input, reducing their M in hours of labour-time. In labour-time productive capitalists' profit rate increases to 6.004%. Nominally M only grows by £1 due to higher wages (V is kept constant in use-value terms for simple reproduction), while they realise £176 delivering £15 of profit in nominal money terms. The lower labour-time value of constant capital reduces the produced value of period 2 output, further increasing MELT at the end of the period.

Period 2 M falls in labour-time for retailers, mainly due to last period's output's wholesale value falling in labour-time as MELT rises. Last period's nominal profit, now retail price has risen, buys fewer units of our commodity for luxury consumption, causing stocks to slightly rise. Most significantly for retailers they now sell at the higher retail price, boosting their profit and profit rate to 13.565%.

We should now note a further question of modelling now comes into focus, with MELT changing how do we calculate retail profit in hours of labour-time? By the end of the period retailing is complete at the retail price established at the end of last period. It is only now at the end of the period that prices are re-established, with the wholesale price affecting productive capitalists' M' for this period, but the retail price only affecting M and M' for retail next period. So we shall use the MELT holding through the period, established with the retail price holding this period at the end of the last period, to both value retail capitalists' M and M'. Unlike our assumption as to how to value the monetary expression of constant capital inputs we will not be

investigating any alternative assumption as to how to value retail capitalists' M' in labour-time.

In period 3 the £15 of period 2 profit for productive capitalists and the £30.1 of period 2 profit for retail capitalists ensures output sold exceeds period 2 output reducing stocks (remember in use-value to maintain simple reproduction V and C remain fixed in both sectors). As V is fixed in use-value at 6, and the unit value of our commodity has dropped below 1 V applied by productive capitalists falls to 19.4 hours increasing S to 60.6 hours. Period 3 retail profit is slightly lower, while productive capitalists nominal profit falls to £8 as the retail price increase catches up with their constant capital input, increasing M to £168. Productive capitalists' profit in terms of labour-time is positively affected by period 3 MELT dropping below period 2 MELT.

In period 4 our model reaches a partial 'balance' as output sold by retail equals last period's output i.e. retail stocks remain constant. However MELT is still changing at the end of the period, again slightly falling, as does S and productive capitalists' labour-time profit rate. In following periods this adjustment continues, until we reach stability in period 24/25 as illustrated in Table 6A Continued. MELT returns to £1.05 as the produced value of new output returns to 220 hours.

Table 6A Continued - Exploring Our Model – A Change to Retail Price.

Production in period 24						Prices and Melt established end production period 24								
	C	V	S	M	Q	Pw	Pr	Melt	M'	M'-M	Prof %			
£	147	21		168		0.8	1.05	1.05	176	8	4.762			
H	140	20	60	160	220				167.619	7.619	4.762			
O	140	20		160	220									
Retail in period 25			From period 24			Sold plus period 25 Retail V and Productive V					At period 24 Pr and Melt			
	C	V	U	Q	M	PC C	RC C	PC L	RC L	Sold	U	M'	M'-M	Prof %
£	6.3	18.9	15.5	176	216.7	147	6.3	8	29.8	231	15.5	246.5	29.8	13.752
H	6	18	14.76	167.6	206.4	140	6	7.619	28.38	220	14.76	234.8	28.38	13.752
O	6	18	14.76	220		140	6	7.619	28.38	220	14.76			
Period 24 S = (P24 PC M'-M) + (P25 RC C) + (P25 Retail V) + (P25 RC M'-M) 60 = 7.619 + 6 + 18 + 28.381 = 60														

Overall our scenario has shown us that increasing retail price benefits retail capitalists at productive capitalists' expense. However this one simple change has taken 25 periods to work through completely. This complexity comes from our assumption that constant capital inputs should be priced at the price they were purchased at and

not the retail price holding when they are applied as inputs. So let us now repeat our example with the one change that we value constant capital inputs at the price holding when they are applied (that is established at the end of the previous period) see Table 6B below.

Table 6B - Exploring Our Model – A Change to Retail Price.

Production in period 1						Prices and Melt established end production period 1								
	C	V	S	M	Q	Pw	Pr	Melt	M'	M'-M	Prof %			
£	140	20		160		0.8	1.05	1.05	176	16	10.0			
H	140	20	60	160	220				167.62	7.619	4.762			
O	140	20		160	220									
Retail in period 2			From period 1			Sold plus period 2 Retail V and Productive V						At period 1 Pr and Melt		
	C	V	U	Q	M	PC C	RC C	PC L	RC L	Sold	U	M'	M'-M	Prof %
£	6.3	18.9	21	176	222.2	147	6.3	16	20	229.2	22.8	252	29.8	13.411
H	6	18	20	167.6	211.6	140	6	15.24	19.05	218.3	21.71	240	28.38	13.411
O	6	18	20	220		140	6	15.24	19.05	218.3	21.71			
Period 1 S = (P1 PC M'-M) + (P2 RC C) + (P2 Retail V) + (P2 RC M'-M) 60 = 7.619 + 6 + 18 + 28.381 = 60														
Production in period 2						Prices and Melt established end production period 2								
	C	V	S	M	Q	Pw	Pr	Melt	M'	M'-M	Prof %			
£	147	21		168		0.8	1.05	1.05	176	8	4.762			
H	140	20	60	160	220				167.62	7.619	4.762			
O	140	20		160	220									
Retail in period 3			From period 2			Sold plus period 3 Retail V and Productive V						At period 2 Pr and Melt		
	C	V	U	Q	M	PC C	RC C	PC L	RC L	Sold	U	M'	M'-M	Prof %
£	6.3	18.9	22.8	176	224	147	6.3	8	29.8	231	22.8	253.8	29.8	13.304
H	6	18	21.71	167.6	213.3	140	6	7.619	28.38	220	21.71	241.7	28.38	13.304
O	6	18	21.71	220		140	6	7.619	28.38	220	21.71			
Period 2 S = (P2 PC M'-M) + (P3 RC C) + (P3 Retail V) + (P3 RC M'-M) 60 = 7.619 + 6 + 18 + 28.381 = 60														
Production in period 3						Prices and Melt established end production period 3								
	C	V	S	M	Q	Pw	Pr	Melt	M'	M'-M	Prof %			
£	147	21		168		0.8	1.05	1.05	176	8	4.762			
H	140	20	60	160	220				167.62	7.619	4.762			
O	140	20		160	220									
Retail in period 4			From period 3			Sold plus period 4 Retail V and Productive V						At period 3 Pr and Melt		
	C	V	U	Q	M	PC C	RC C	PC L	RC L	Sold	U	M'	M'-M	Prof %
£	6.3	18.9	22.8	176	224	147	6.3	8	29.8	231	22.8	253.8	29.8	13.304
H	6	18	21.71	167.6	213.3	140	6	7.619	28.38	220	21.71	241.7	28.38	13.304
O	6	18	21.71	220		140	6	7.619	28.38	220	21.71			
Period 3 S = (P3 PC M'-M) + (P4 RC C) + (P4 Retail V) + (P4 RC M'-M) 60 = 7.619 + 6 + 18 + 28.381 = 60														
Production in period 4						Prices and Melt established end production period 4								
	C	V	S	M	Q	Pw	Pr	Melt	M'	M'-M	Prof %			
£	147	21		168		0.8	1.05	1.05	176	8	4.762			
H	140	20	60	160	220				167.62	7.619	4.762			
O	140	20		160	220									

We can interpret this change to the monetary expression of constant capital inputs as akin to a tie up or release of capital to capitalists without them actually tying up or releasing any capital! For example productive capitalists bought 140 units of constant capital at £1 per unit in period 1, paying £140 at the end of that period, but as retail price at the end of period 1 rises to £1.05 they now at the start of period 2 mark up this constant capital to £147, a £7 increase in capital advanced that they did not need to advance!

Our example is now much simpler. Again productive capitalists are hit first by the fall in MELT the rise in retail price causes at the end of period 1. Then in period 2 they move to their new constant situation of 4.762% profitability in both nominal and labour-time terms, the same situation they finally reached in Table 6A Continued in period 24.

In Table 6B, just as in Table 6A, in period 2 retailing period 1's nominal profit now buys less units for luxury consumption so again output sold falls short of period 1 output, so as before retail stocks rise to 21.71 units at the end of the period. The retail profit rate rises to 13.411% now the rise in retail price at the end of period 1 affects retailing in period 2. In period 3 the retail sector now sells the same output as it purchased from productive capitalists at the end of period 1, 220 units, so retail stocks remain unchanged at 21.71 units. The slight rise in M extra stocks create drops the retail profit rate slightly to 13.304%. In future periods retailing will be identical to period 3, so both production and retailing have fully adjusted to the change in retail price in our example assuming simple reproduction in use-value terms.

In summary, valuing constant capital inputs at the retail price holding when they are applied, and not at the retail price they were purchased at, ensures our model settles much faster after we change retail price. For both approaches retail profit settles to £29.8, however the final situation is not identical between approaches as the new constant level of retail stock is different, in Table 6A at 14.76 units delivering a profit rate of 13.752% and in Table 6B 21.71 units, ensuring slightly lower profitability at 13.304%.

Exploring Our Model – Introducing Growth/Technological Change.

To introduce the idea of growth/accumulation with technological change I shall adjust our model so productive capitalists apply more units of constant capital each period, from period 2 10 more units each period, increasing output by 15 units each period from period 2. For simplicity I keep productive capitalists' application of living labour constant at 80 hours per period. Such technological change will each period reduce the unit produced value of our single commodity in labour-time (which must equal its unit appropriated value as we only have a single commodity). Period 0 is identical to in our other examples with the one exception that I increase retail stocks to 25 units, increasing retailers' M to £225 and M' to £245, delivering a 8.9% profit rate in retailing. In period 1 productive capitalists forgo 10 units of luxury consumption to buy 150 units of constant capital to apply in period 2.

I begin Table 7 below with production in period 2, the higher C input leads to higher output. Now the number of units of Q exceed its produced value in hours the unit produced value of our commodity falls. As I leave prices unchanged the MELT established at the end of period 2 rises because the monetary expression of Q now exceeds its produced value in hours. Selling more boosts productive capitalists' nominal profit rate to 10.586%, while their profit rate in terms of labour-time drops to 8.235%. Previously in period 1 productive capitalists had captured in profit 16 hours of the 60 hours of surplus-value they had extracted from their workers in production. Now in period 2 technological change, combined with constant prices, has increased MELT, reducing the surplus-value they now capture to 14 hours of the total 60 hours of surplus-value they extract in period 2, leaving more for retailers in period 3.

Meanwhile let us return to retailing in period 2, not shown in Table 7, which occurs before Q rises at the end of period 2. Productive capitalists again consume in luxury consumption 6 units, but now buy 160 units of constant capital to apply in period 3. As the increased period 2 output is yet to come through to be retailed, retailers have the 220 units of period 1 output to sell plus have 25 units of stock. They sell in total 230 units, reducing their stocks to 15 units by the end of period 2. Retail capitalists still earn £20 profit and earn a profit rate of 8.9%.

Table 7 - Exploring Our Model – Growth/Technological Change.

Production in period 2						Prices and Melt established end production period 2								
	C	V	S	M	Q	Pw	Pr	Melt	M'	M'-M	Prof %			
£	150	20		170		0.8	1	1.02174	188	18	10.586			
H	150	20	60	170	230				184	14	8.235			
O	150	20		170	235				235					
Retail in period 3		From period 2			Sold plus period 3 Retail V and Productive V						At period 2 Pr and Melt			
	C	V	U	Q	M	PC C	RC C	PC L	RC L	Sold	U	M'	M'-M	Prof %
£	6	18	15	188	227	170	6	8	20	242	8	250	23	10.132
H	5.872	17.62	14.68	184	222.2	166.4	5.872	7.830	19.57	236.9	7.830	244.7	22.51	10.132
O	6	18	15	235		170	6	8	20	242	8			
Period 2 S = (P2 PC M'-M) + (P3 RC C) + (P3 Retail V) + (P3 RC M'-M) 60 = 14 + 5.873 + 17.617 + 22.511 = 60														
Production in period 3						Prices and Melt established end production period 3								
	C	V	S	M	Q	Pw	Pr	Melt	M'	M'-M	Prof %			
£	160	20		180		0.8	1	1.05665	200	20	11.11			
H	156.596	19.5745	60.426	176.17	236.596				189.28	13.106	7.44			
O	160	20		180	250				250					
Retail in period 4		From period 3			Sold plus period 4 Retail V and Productive V						At period 3 Pr and Melt			
	C	V	U	Q	M	PC C	RC C	PC L	RC L	Sold	U	M'	M'-M	Prof %
£	6	18	8	200	232	180	6	10	20	254	4	258	26	11.207
H	5.678	17.03	7.571	189.3	219.6	170.3	5.678	9.464	18.93	240.4	3.786	244.2	24.61	11.207
O	6	18	8	250		180	6	10	20	254	4			
Period 3 S = (P3 PC M'-M) + (P4 RC C) + (P4 Retail V) + (P4 RC M'-M) 60.4255 = 13.1064 + 5.6783 + 17.0349 + 24.606														
Production in period 4						Prices and Melt established end production period 4								
	C	V	S	M	Q	Pw	Pr	Melt	M'	M'-M	Prof %			
£	170	20		190		0.8	1	1.10011	212	22	11.579			
H	160.885	18.928	61.072	179.813	240.885				192.71	12.895	7.172			
O	170	20		190	265				265					
Retail in period 5		From period 4			Sold plus period 5 Retail V and Productive V						At period 4 Pr and Melt			
	C	V	U	Q	M	PC C	RC C	PC L	RC L	Sold	U	M'	M'-M	Prof %
£	6	18	4	212	240	190	6	12	20	266	3	269	29	12.083
H	5.454	16.36	3.636	192.7	218.2	172.7	5.454	10.91	18.18	241.8	2.727	244.5	26.36	12.083
O	6	18	4	265		190	6	12	20	266	3			
Period 4 S = (P4 PC M'-M) + (P5 RC C) + (P5 Retail V) + (P5 RC M'-M) 60.0723 = 12.8953 + 5.454 + 16.362 + 26.361														
Production in period 5						Prices and Melt established end production period 5								
	C	V	S	M	Q	Pw	Pr	Melt	M'	M'-M	Prof %			
£	180	20		200		0.8	1	1.14933	224	24	12.0			
H	163.62	18.18	61.82	181.8	243.62				194.90	13.096	7.204			
O	180	20		200	280				280					

In period 3 retailers now have 15 units of stocks plus period 2's higher output of 235 units to sell. Capitalists, productive and retail, advance their workers the same wages to buy the same number of units of our commodity. Retail capitalists still buy 6 units to apply as constant capital in period 4, while productive capitalists now buy 170 units of constant capital to apply in period 4. Retail capitalists consume their £20 of profit

from period 2, and we assume productive capitalists consume £8 of their period 2 profit, still foregoing 10 units, to allow their C input to keep expanding. Period 3 output sold, 242 units, still exceeds last period's output, despite it being now 15 units higher at 235 units, so stocks fall further to 8 units at the end of period 3.

In period 3 carrying a lower stock level from period 2 ensures retailers' M only rises to £227 from £225 in period 2. Retailers' M' now exceeds M by £23, as the extra 15 units they sell at £1, but buy at £0.80, delivers them £3 more profit. The retail profit rate rises to 10.132%. Remember productive capitalists realise as profit only 14 hours of period 2 surplus-value. Retail capitalists in period 3 waste less on C and V as they keep these inputs constant in use-value terms while the unit value of our commodity drops below 1 hour at the end of period 2 ($230/235 = 0.979$ hours). This in total allows retail capitalists to capture in profit the remaining 22.511 hours of surplus-value from period 2.

Retailers are benefiting from prices remaining the same when technology increases output in use-value faster than its produced value in labour-time. Adjusting prices appropriately (either retail or wholesale) would remove this distortion, so say productive capitalists could continue to capture 16 hours of the surplus-value they extract (and as S rises say the same proportion of S i.e. sharing, as before, with retail). Furthermore we are assuming retail needs no increase in inputs itself in-order to retail more units of our commodity. We could keep retail C and V inputs constant in labour-time, while they grow in use-value terms due to the falling unit value of our commodity. If necessary inputs of C and V grew faster than this, rising in labour-time, less surplus-value would be left for retailers to capture. So the fact that retailers benefit in this example is simply no guide to how they may fare when we are modelling the economy less abstractly.

Returning to period 3, productive capitalists' nominal profit rate rise to 11.11%, while MELT further increases to £1.05665, as Q's produced value in hours falls relative to its rising, due to constant retail price, monetary expression. Productive capitalists now only capture 13.106 hours of the surplus-value they extract, that itself has risen to 60.426 hours through our keeping V constant in use-value terms, and have in labour-time a 7.44% profit rate.

We should note how declining profitability for productive capitalists is being 'held back' due to the cheapening of our commodity ensuring increasing constant capital by 10 units of use-value each period means a lower rise in terms of hours of labour-time each period. In period 2 the 150 units of C had a value of 150 hours, now in period 3 the 160 units of C have a value of 156.6 hours. The produced value of Q only rises from 230 hours in period 2 to 236.596 hours in period 3.

In period 4 productive capitalists again apply more constant capital and produce more Q, but capture in hours less profit and have a lower profit rate 7.172%. In retail profitability is boosted by two factors, the comparatively lower stock level, and now having 30 more units of the commodity to sell than in period 2, increasing $M' - M$ to £26. Output sold still exceeds last period's output, indeed stocks would soon run dry if we do not change something. So in period 4, and thereafter until stocks have risen to 'normal' levels, I assume retail capitalists hold their luxury consumption constant at £20, 20 units, despite earning £23 profit in period 3 (and more in following periods). Stocks still fall in period 4 to 4 units, but by 4 units, not 7 units as in period 3. Next period holding retailer's luxury consumption constant at 20 units will cause stocks to only fall by 1 unit to 3 units, then in period 6 stocks would rise by 2 units to 5 units.

In period 4 productive capitalists now extract 61.072 hours of surplus-value, of which they capture 12.895 hours in profit, with retail consuming unproductively in period 5 $C = 5.45$ hours and $V = 16.36$ hours, leaving retail capitalists the remaining 26.361 hours in profit.

In value terms in period 5 accumulation slows further. Productive capitalists' M was 179.8 hours in period 4 and now only rises to 181.8 in period 5, while the produced value of output in period 4 was 240.9 hours and only rises to 243.6 hours in period 5. Exploitation is rising with surplus-value growing to 61.82 hours as V falls to 18.18 hours. Productive capitalists manage to capture sufficient surplus-value to cause their profit rate in terms of labour-time to slightly rise from 7.172% in period 4 to 7.204% in period 5.

In summary in our particular example of growth/technological change we found that holding prices constant benefits retail capitalists at productive capitalists' expense. Note if we alternatively kept MELT constant by setting retail price at the unit value of our commodity in labour-time (Q's produced value divided by its units of use-value) this would strongly benefit productive capitalists. They would capture more of the surplus-value they extract each period until in period 6 they bankrupted the retail sector completely. Clearly to create 'equality' between sectors we would have to carefully adjust both wholesale and retail prices appropriately. It should be of no surprise that these mutually dependent sectors' interests should conflict; they are simply trying to grab as much as they can from ultimately the productive workers that both fund and limit their acts of robbery and 'waste'.

Conclusion

Rather than just singling out retail I could have considered other unproductive but necessary activities. I could have experimented with the 'location' of unproductive and productive activities to try to reflect apparent changes to the global division of such activities. Quite simply the whole world of reality is out there to explain. In any case I hope my experiment in modelling retailing alongside production has alerted the reader to some of the methodological questions that arise by trying to do this. It is my sincere wish that others take up and further this research, so we can together develop how to apply Marx's theory of value to understand our world.

Finally I would not like the reader to think that those who employ the TSSI of Marx in their research are 'just' concerned with technical matters in Marx's theory of value. Rather we study Marx's value theory and defend its consistency so we can apply it to the world we live in, for example see Kliman (2012), Potts (2011b) and Freeman (2016) for explanations of the crisis, rooted in, not ignoring, Marx's theory of value. Likewise I have tried to use Marx's value theory to explore knowledge-based production (Potts, 2007), the environmental disaster we face (Potts, 2011c), and how alternative forms of land/asset ownership cannot really make capitalism 'fair' for all (Potts, 2016b). But first I needed a way to understand how value is created in our capitalist society, luckily for me Marx has a great theory.

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