CHIEF-EXEC.COM

Working Paper

Calculation of Consumptivity

This paper describes the methods used in: Analysis: an Apple that just keeps on rising published on *Chief-Exec.com* on August 28, 2017

By Dr John Egan

Version 1: August 2017

Introduction

On the back of the British £20 banknote, alongside a profile of the Scottish classical economist Adan Smith, is an image and articulation of his principle of the division of labour. By dividing the operations needed to manufacture a pin and allocating these to different workers, the efficiencies of production can be increased hugely.

In the first pages of his *An Inquiry into the Nature and Causes of the Wealth of Nations*, Smith notes:

> "I have seen several boys, under twenty years of age, who had never exercised any other trade but that of making nails, and who, when they exerted themselves, could make, each of them, upwards of two thousand three hundred nails in a day".

Productivity, which is typically measured as the monetary value of the output per hour produced by a worker, is greatly enhanced by industrialisation. This led Smith to a Labour Theory of Value, which associates value with the labour time required for its creation.

Chief-Exec.com have introduced an alternative to productivity, which we refer to as consumptivity, for which the time in question applies not to the labour of production, but to the time to create favourable consumer product interactions and consequent sales of their related manufactured goods or services.

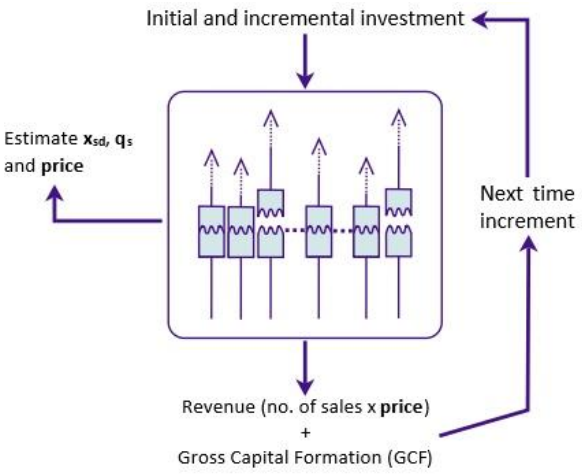
We have taken a look at a marketplace in which consumer product interactions, along with their consequent sale events occur, through the prism of a physical system that is elsewhere used in the analysis of energy dissipative systems – such as the shock absorbing soles of your shoes. In an energy dissipative enterprise, the energy that is input as investment increases value perceptions in a consumer population to then be "dissipated" at points when perceived value exceed a sale price. Revenue from these sales is then reimbursed to the supplier to fund further cycles of investment.

In this energy dissipative enterprise, the cycle time from investment to sale can be shortened, which brings about a proportional reduction in the price that is estimated for the traded product in an expression of the labour theory of value. It is this proportionality, that is the slope of reduction in **price** with the enterprise investment-to-sale cycle time ($\mathbf{t_r}$), that we can estimate as the consumptivity of the enterprise.

This principle can be applied to economic agents operating at different scales, from individuals and small companies, to large companies and their component business units, through to national economies. In the latter case, a representative product is used to epitomise the productive endeavours of a nation. As the nation increases its consumptivity, the effect on the price of its representative product appears in the exchange value of its national currency.

This paper takes a step down in scale to explore what the energy dissipative enterprise simulation can say about the commercial performance of Apple Inc. in *Analysis: an Apple that just keeps on rising* for which this paper provides the background methodology and results.

Method for consumptivity calculation



The energy disspiative simulation of a commercial enterprise steps through time as incremental investments are added to enhance value perceptions in a population of consumers, some of whom will make a decision to purchase the company products. The sales **price** set by the company will then determine their income based on the number of sales.

The shorter the cycle time $\mathbf{t_r}$ between investment and sale, the greater is the income made during a trading period.

Conversely, fitting the enterprise model to reproduce as closely as possible a known set of investment and income data provides an estimate of the **price** of the company representative product for a set increment time $\mathbf{t_r}$ [1]. An example of such a best-fit scenario is shown in figure (1) below.

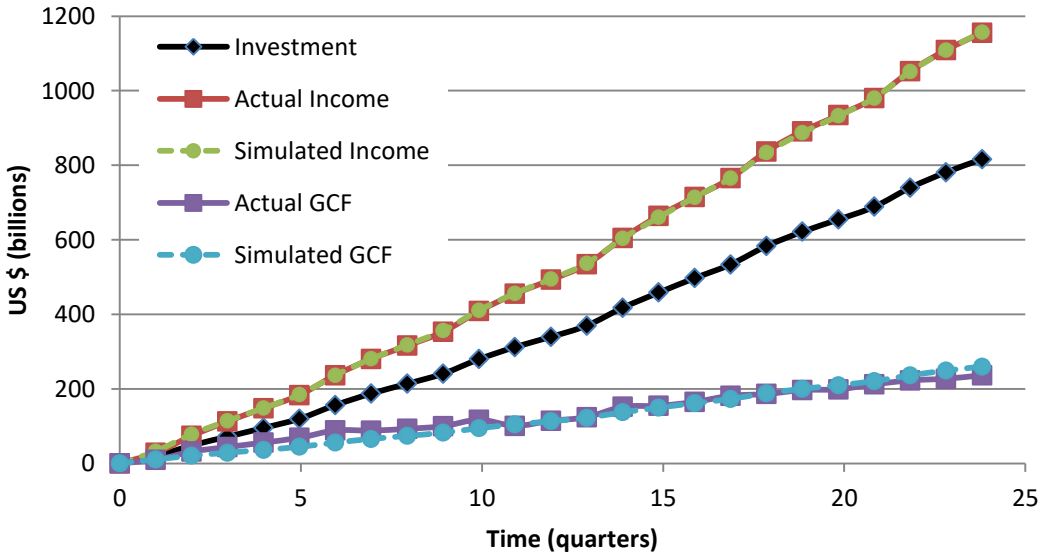


Figure 1: When real investment data is used the best fit enterprise can simulate the actual income data very well. However, the fit to the gross capital formation (GCF) data is less accurate. The modest divergence between simulated and real GCF behaviour significantly increases the overall error in the simulation. Data from Apple 2011-2017

[1] A least squares method is used to estimate values of the enterprise model parameters, including the **price** of the representative product, which provides the best fit of the enterprise simulation to actual company financial data.

For any particular set of commercial data comprising investment (input) together with gross capital formation (GCF) and revenue outputs, as $\mathbf{t_r}$ is shortened the estimated **price** decreases in a proportionate manner.

The rate of decline of price with $\mathbf{t_r}$ is referred to here as consumptivity and this is shown in figure (2) for seven companies using financial data appearing in their financial statements to the U.S. Securities and Exchange Commission (SEC) between 2007 and 2014[2].

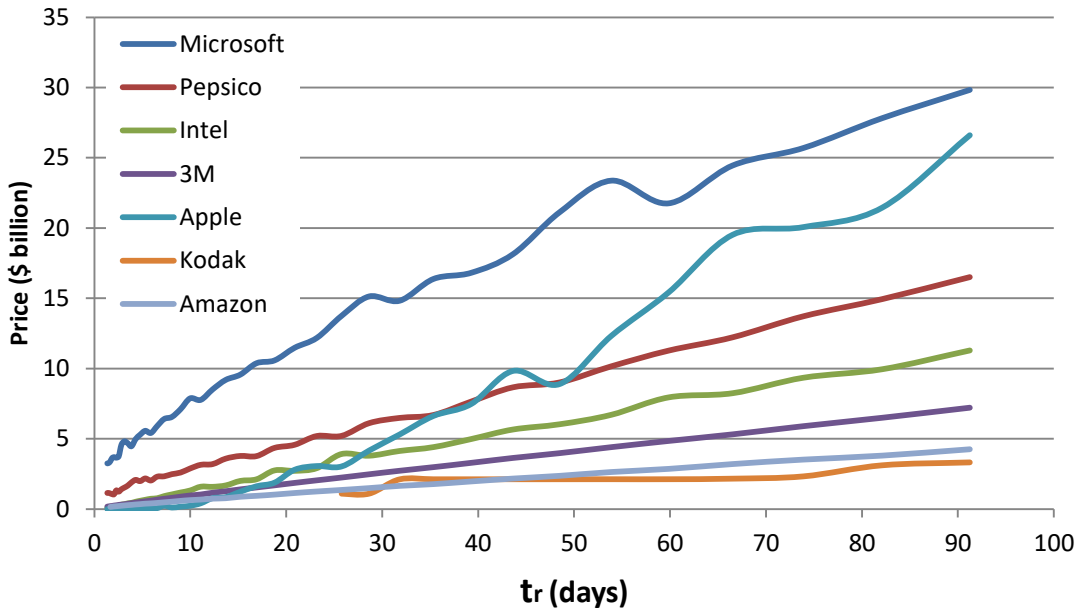


Figure 2: Reduction of the **price** estimated for the representative product of seven companies with the simulation cycle time $\mathbf{t_r}$. Company data taken quarterly between 2007-2014.

Two observations are immediately apparent from the above chart. The **price** vs $\mathbf{t_r}$ trends are irregular and while five descend towards zero, Microsoft and Pepsico do not, intersecting the vertical axis at a positive price value.

This irregular behaviour is in part due to a difficulty the enterprise model has in following the GCF behaviour of a company over time. Compared with the GCF trends for a national economy, company GCF data is noisy and at an incremental level rather arbitrary. This results in complex error surfaces that must be navigated to reach the best fit simulation together with an elevated minimum error value as the model can at best provide an approximate interpolation to the GCF data as shown in figure (1).

All of the above increases the uncertainty in the energy dissipative simulation of the real enterprise behaviour and the insight it provides into the real world becomes more tentative.

[2] Investment and revenue data is taken from the company consolidated statements of operations at quarterly intervals. GCF data is also taken quarterly from the company consolidated balance sheets. Normally GCF did not account for depreciation of property, plant and equipment depreciation. However, in the cases of Amazon and Apple the available GFC data was the total asset value net of this depreciation.

Nevertheless, the **price** vs $\mathbf{t_r}$ trends shown above each represent a large number of best-fit simulations that are effectively aggregated in their sloping descent. Thus the inherent randomness at each point on the line is effectively smoothed out through the estimation of its gradient.

The non-zero intercept on the vertical axis presents a complication that has required an adjustment to the calculation of consumptivity to take account of this feature, based on the proportion the non-zero intercept contributes to the maximum estimated **price**[3].

While this adjustment to the calculation of consumptivity as the slope of the **price** vs $\mathbf{t_r}$ trend is in most cases small, for Apple between 2011 and 2014 the effect is significant as shown in the table below.

Dataset	**price/tr** $ million/day	**Intercept** $ billion	**Consumptivity** $ million/day	**Market Cap** $ billion
Apple 07-10	166.743	-0.838	176.123	118.734
Apple 07-14	295.189	-2.680	324.925	253.443
Apple 11-14	950.381	68.691	520.127	372.292
Apple 11-17	952.786	25.157	722.753	491.584
Apple 14-17	977.080	6.841	907.779	593.080
Microsoft 07-14	298.216	4.698	251.253	217.478
Microsoft 11-14	302.348	0.900	293.201	242.179
Pepsico 07-14	167.446	1.164	155.638	96.515
Pepsico 11-14	191.665	0.124	190.302	105.213
Intel 07-14	124.294	0.092	123.285	101.806
Intel 11-14	253.200	7.973	185.601	112.701
3M 07-14	77.744	0.189	75.711	52.772
3M 11-14	86.118	-0.041	86.574	61.313
Kodak 07-14	24.800	0.855	18.421	1.207
Amazon 07-14	45.264	0.168	43.476	80.280
Amazon 11-14	162.062	0.327	158.567	124.842

The above table shows the results from 16 simulations of the commercial behaviour of seven companies over different time durations and intervals. It reveals a close association between the calculated consumptivity and the average market capitalisation over the simulated time period.

[3] Consumptivity as calculated by the price/tr ratio is adjusted according to the formula:

Consumptivity = price/tr x (1 – intercept/max price)

This relationship is charted below and is discussed further in the companion article to this paper.

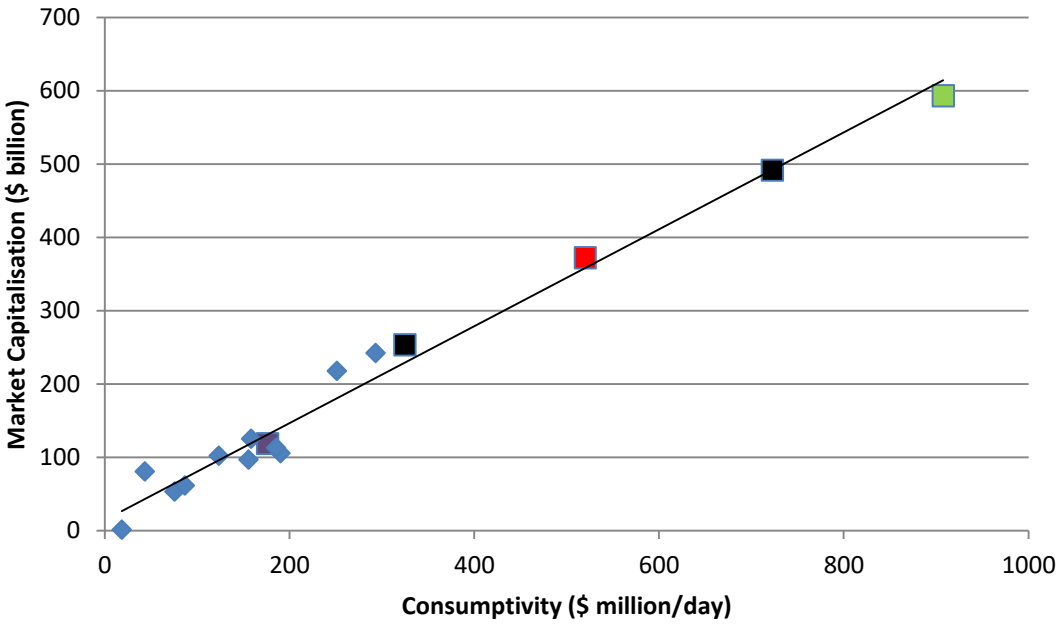


Figure 3: Simulated consumptivity vs actual average market capitalisation of Apple together with comparative companies over time intervals between 2007 and 2014

Warning: The analysis presented here should not be used to provide a basis for investment decisions and those who ignore this warning do so at their own risk.