

THE LIGHTER SIDE OF BERNSTEIN

Fund Management Strategy: The man who created the last index

Inigo Fraser-Jenkins +44-207-170-5134 inigo.fraser-jenkins@bernstein.com

This note is a work of fiction that addresses the role of indexation and passive management in investing today. It covers the origins of indexation and how the role that an index is expected to perform has now changed. The rapid growth in the number of indices presents a problem for investors in that it becomes harder to articulate what is meant by a passive investment. This leads to a discussion of the work of Borges and Balzac and what it means for investing.

He considered the plan of attack for the day. His task was clear, albeit perhaps apparently mundane to a casual observer. To create all possible stock market indices. Yes, there are all the major indices endlessly repeated on websites and newspapers and scrolling along the bottom of television screens. But those are just the indices for major markets. Maybe a financial daily would list up to a few hundred indices for markets and sectors. It had now been decided that there was a need, a demand indeed, for something that went way beyond that. Indices were required for what the cheapest stocks had done, or the highest growth ones; indices where the weight of a company was not determined by its size, but by some other characteristics. And so it went on. In short, his task was to create far more indices than had ever been even thought of before.

He recognised that many would regard such a task as tedious and utterly pointless. He didn't mind, there would always be non-believers who did not understand. Others would come to realise how important his task was. A few might even come to appreciate its beauty.

What currently occupied his time was creating all possible stock indices weighted towards a concept of "value". He had been at it for a month now. He had created lists of stocks on all the metrics that seemed sensible, or at least plausible. This started with the obvious ones, forming indices of stocks that were cheap on multiples of earnings or book value or cash flow. He had then moved on to selecting stocks that had low multiples of every conceivable different definition of earnings. He had reweighted stocks on the same metrics. He had formed indices of stocks which had fallen the most in recent years. He had produced indices that defined value as mispricing of stocks, and thus based on companies that were cheap given their level of profitability or growth. He wondered about the need to group the definitions of value that relied on the balance sheet and those that relied on

income, or should they all be kept separate? Yesterday he had completed all the permutations of value when that was defined as things that are cheap compared to their history as a counterpoint to value defined as things that are cheap compared to their peers. Today he was going to embark on value taken from within sectors, from within industries, from within subindustries.

But how to arrange? How to go about the task? His hope each day was to find eloquent beauty in the task and his daily fear was to descend into mindless enumeration of possibilities. He could start with a plan, a kind of grid with many dimensions to it and work his way across it. But also the project must in the end have every index and therefore logically every interpolation between every index. If the interpolations have to be there too then maybe the plan did not matter? He realised that he had leeway to decide what this meant. They had, after all, engaged him to undertake this task and he was expressly allowed to judge, to consider, to decide what was required. He was entrusted with the power to decide what the final set of indices would look like.

Some said that the apparently useless indices should not be created, or if created but then subsequently regarded as superfluous then they should be ruthlessly culled. He fought back against this idea. Who was to say which was a useful one and which was a useless one? Four decades ago many of the ones that were in demand now were unimagined and no one could have conceived to what use they could have been put. An index that lowered volatility as its founding *raison d'être* would have been met with bafflement by a previous generation, had they been inclined to turn their attention to such a thought. Yet now there was a whole family of such indices. This reminded him that he had not yet planned how he would make his way through all such indices that lowered vol. Yes, he could weight by $1/\text{volatility}$, he could screen by volatility and remove the most volatile members. He could make each stock contribute equal



risk to the portfolio and hence take covariances into account as well. He could optimize by volatility, and if so he could perform that calculation alone a multitude of ways. There was then the question whether good corporate governance lowered volatility? If so there were all the interpolations between indices that were based on measures of good governance and those based on volatility. And so it continued.

There was the great hope of discovering The Index, the ultimate one, the one that had always surpassed all others and always would do. A great deal was said about the possibility of such an index. Logically it must exist, he thought, one of them must be it. Others said that it could not exist, that the "best index" was always a contingent thing. Such nay-sayers claimed that The Index could only be, at best, provisional as the self-referential nature of markets would destroy it as soon as it was known. If indeed he could discover The Index then with its discovery would come adulation from many quarters.

It had not always been thus. The idea of applying the word "index" to a thing that could be bought and sold is not that old. That is not to say an index has not always been tangible. The index itself as a list has a long heritage as something tangible long before someone applied it to the stock market. In Troilus and Cressida the index is referred to as a guide when Nestor says

"And in such indexes, although small pricks

To their subsequent volumes, there is seen

The baby figure of the giant mass "1

Our creator of indices liked the idea of the index as a guide. Indeed, the Latin usage of the word index referred to a discoverer, a catalogue or the index finger, in a sense all these denote a thing that shows the way. Shows the way, yes that was apt he thought given the origins of the stock index lie firmly in financial journalism and most definitely not in financial theory. He considered the sense of meaning as very fitting to the *zeitgeist*. In a world of free information, free computing and search boxes the idea of an index as simply a list of words on paper was out-dated. But at the same time, endless computing power made the concept so much more powerful if it referred to that data-driven amalgam of experience that could show the way. Indeed, submitting to an all-encompassing data-led guide was exactly what people were increasingly willing to do it seemed.

The index was that which showed us what has happened, or is happening. A convenient tool for concisely describing the activity in the market. Yet the importance of his project was more than this. He was not restricted to describing what had happened, the goal of his task would necessarily lead to something that would influence the future. The index had become that which determines what investments are made. The index was now the channel by which capital flowed into the market. Thus, the index no longer represented an act of journalism, it had become the process of investment itself. But also in the number of indices

that he had to create, his task would no longer be a "small prick to [the] subsequent volume" as Shakespeare defined the index. With many more indices than stocks the scale was inverted.

Was this inversion a process of temporal confusion? Was the index that directed investments and thus determined what will happen in future, a different thing to the index which merely reported on what has happened? Some said that such a step was too far and bound to failure in a circle of logical contradiction. He tended not to be moved by such sentiments, though he did recognise that his task was something that the early founders of indexing would not have recognised.

Charles Dow arrived in Leadville Colorado in 1879 on a train full of eminent bankers, investors, geologists and Mr Brayton Ives the president of the New York Stock Exchange amid a silver rush. The journey from New York took 6 days in a "hotel" car for most of the way followed by stage coach. In Dow's regular letters for The Providence Journal their outbound journey takes the form of a wonderful piece of descriptive journalism, but by the end of the short stay his letters for publication in the Journal take an air decidedly more leaning toward financial journalism.² Apart from staring out of the windows and a brief breakfast at the Palmer House in Chicago the playing of cards passed the time, despite their initial misgivings that it might not be proper. A Mr Dam kept launching into songs from HMS Pinafore driving the party to despair, while Captain Crowell "has a passion for rising at unnaturally early hours, such as 7am, after which he promenades through the car and admonishes those who are enjoying their beauty sleep". We are told that dinner was served on the train at 5 o'clock while cigars were handed around "every hour or oftener". One of the party was a lawyer, travelling with the task of foreclosing on one of the railway companies which they were to pass over. At Abilene cases of rifles were put on board as the Kansas Pacific Railroad was much subject to train robberies. Every few miles they passed emigrant wagons toiling Westward.

From Dow's letters for the Providence Journal when he got to Leadville we learn that the two great causes of death in the town are exposure and alcohol. Sleeping on the sidewalks after a night of gambling and drinking leads to pneumonia and death. In the evenings gambling is the principal activity in the town. A great deal is said about the games of cards played and their rules. We are told that the leading game here in the West is the same as the East and is Faro. A little way from the Faro table there is usually a table for "chuck-a-luck", where the dealers in the latter game are "less aristocratic". Other games are Lansquinette, high ball poker, Short Faro ("for boys"), Rouge-et-noir and "the nut shell game" which, we learn, is played with three half walnut shells and a rubber ball the size of a pea. The trappings of civilisation were arriving in fits and starts. Dow tells us that "if a man shoots another in cold blood, he is obliged to procure \$1500 or \$2000 bail, or he will be kept shut up". Dow opines that "this is a great step. When a community gets to the place where murderers are arrested, it is approaching the time when murderers will be

¹ Troilus and Cressida, Act I

² Letters from Leadville reproduced in Bishop, G (1960)

punished", though clearly that latter state of enlightened justice had yet to arrive at the time.

By the end of the sojourn in Leadville, Dow is increasingly inclined to furnish his readers with financial information that presumably has a bearing on the decisions of those in the East who may have felt the inclination to invest. One of the last letters from Leadville (which appeared in the Providence Journal on July 28th 1879) is entitled "The extent of the carbonate field" and includes lists of mines and a consideration of the current thinking of eminent geologists. We are told in detail the process for assaying silver output and provided with some forecasts "My opinion is that the silver production of Leadville for 1879 will not exceed \$10,000,000". While the last letter, published two days later, tells us that "A comparison of the stock list with that of a year ago shows a marked increase in the business in mining stocks". "Stock list". There it is. Not "index" or "average", those terms were to come later. It is just a list, but it makes its appearance. The letter itself ends with a tabulation (the only table of numbers in the letters) of the "Eastern investment" in the mines of Leadville and a brief discussion of the dividends paid. The tabulation is important. It is after all the first step to forming an index as it is understood today, and indeed the stepping stone in the very meaning of the word "index", allowing it to jump from index-as-a-list to index as a measure of the market

Back from Leadville and editing his daily news sheets that eventually were transformed into the Wall Street Journal, Dow wanted a way to concisely describe the movement of the market. Thus, the Dow Jones Average appeared in the 1880s. He used the simple expedient of adding up the closing prices of the 12 companies which he chose for the index and taking an average. This methodological choice may now cause much frustration, but is also revealing in a number of ways. First it reflects the brute difficulty in creating anything else. Yes, a weighted average of returns for 12 stocks could be worked out on paper, but once the number grew so did the complexity, not to mention the problem if such a calculation had to be quickly performed for different points in history to make a comparison.

But the "average" also signifies what the index was *for*. Dow was firm in his view that the compiling of a stock market average was merely a tool to aid the description of what was happening, not as a thing to invest in in its own right. The stock market average in this sense is definitely in the camp of journalism and not in the camp of investing. This is why it is totally acceptable for the "index" to be an average of prices with none of the contemporary complications of weighting methodology. The first edition of the Wall Street Journal on 8th July 1889 included his average of "12 active stocks". Was this the best index to use though? In an editorial in the Wall Street Journal in September 1889 Dow noted "[the 12 stock average] has occasionally been attacked as not including stocks enough to fairly represent the market, and we often have inquiries as to what stocks are made the basis of the calculation. As a matter of fact the 12 stocks taken represent the movement of the market as well as a greater number. Twenty stocks reach in their averages the turning point on nearly or quite

the same days as 12 stocks". Nevertheless, Dow added a 20 stock average and an average of 60 stocks.

The language had not fully adapted to its modern sense however. In all the editorials by Charles Dow he never once uses the word "index" to refer to the stock market. The word "index" is used solely to refer to the "commodity index" maintained by the newspaper *The Economist*. This usage is informative. Clearly the word index existed, it even existed in a narrow financial context for tracking the price of something (in this case coal), in a way that was relevant to stocks. However, the stock market average and the index were not equated.

Indeed, the idea of buying the whole market seems utterly antithetical to his writings. His editorials for the Wall Street Journal are dense with methods that investors can use to go long or short individual companies. The whole market is never something that is meant to be bought. However, armed with a concise description of market movements in the form of his average, Dow tried to take this tool further by making it the centrepiece of a body of work that tried to be specific about general rules on how to go about the process of investing.

In an editorial of December 14th 1900 Dow asks whether there can be a Scientific approach to investing? Dow realised correctly that, strictly speaking, a science of investing is not possible. But he did think that a greater use of methodology could be applied through the use of maxims. These maxims were based on looking at charts, observing swings in prices and analysing the history of dividend payments. There is no valuation in the modern sense, but this was still three decades before Benjamin Graham and anyway modern valuation and accounting standards had to evolve in parallel. Without accepted accounting standards, a focus on the study of dividends would seem eminently sensible. To the modern reader, the feature of the maxims of "Dow Theory" that shocks is how many of them are still quoted frequently today.

But how could one actually perform the operations required to calculate an index? The Dow 12 stock average could be calculated on paper if need be, but he was also reporting on 20 and 60 stock averages. There were averages for Industrials overall and averages for Railroad companies. Quickly the calculations become cumbersome, especially if one wants to calculate and compare indices at many points in time.

The Genesis of one solution to this lay earlier in the nineteenth century on the French Iberian military campaigns under Marshal Sault, one of Napoleon's marshals. Charles-Xavier Thomas de Colmar, while on the staff of the eminent marshal needed to perform a huge number of calculations for the correct angle at which to fire guns or the logistical problems of moving vast armies across Europe. This led him to consider the need for a mechanical solution to such operations. With conflict over he was appointed General Manager of the Phoenix insurance company, the need for a mechanical solution to large numbers of calculations again became more pressing.

He named his invention the Arithometer and was first granted a patent in 1820. Thomas worked on numerous improvements to it, but owing to the time he had to devote to running a large insurance business the Arithometer was not widely accepted until the 1870's, around the time of his death. However, at that time it could claim to be the first multiplication machine made generally available for sale.³

It was, however, cumbersome to use. In order to perform a calculation the operator first set numbers to be inputted on a series of sliders. The operator then turned a handle which mechanically transferred the numbers to a movable carriage which in turn was connected to dials that showed the results. In most versions one had to keep track of the number of turns of the handle as the number of turns determined what the input number was multiplied by. Via the expedient of a reversing switch the machine could be made to perform division as well. The Arithometer was usually constructed in a wooden box with folding lid that could comfortably sit on a desk.⁴ Although larger presentation versions were also made with greater calculating ability and encased in elegant cabinet work, making them look similar to a fine upright piano or harpsichord and approximately of the same dimensions as well. Such versions were presented at international exhibitions such as the Great Exhibition of 1851 (it won second prize for calculating machines, behind the Russian entry designed by Israel Abraham Staffel) and also no doubt featured in several gentlemen's "cabinet of curiosities".

From the beginning in 1820 Thomas envisaged that the primary commercial use of the invention would be insurance companies and banks. Indeed, by 1877 the offices of Prudential in London had 24 Arithometers at work and Henry Harben the chairman of Prudential noted at the time that "without them our work would have been impossible".⁵

The closest inheritor to the earliest indices are those for countries. Within the context of his current task, he regarded these as the most mundane and least interesting. Yet he had to make sure that all such indices needed to be created. He had done this last month and it was with a sense of quiet satisfaction that he could tick off that whole section of the project. It had been relatively easy. There was the obvious question of how many stocks needed to be included in each county. Then which countries? At the moment he was only concerned with assets that were listed and so if a country did not have a public market it would naturally be excluded. He realised that when he came back to consider private assets then some more countries might have to join the list.

There was then the question of how to group countries? The current fad was for the naming of regions with an endless enumeration of abbreviations which he felt was ugly and so tried to avoid. Regions did actually have names, after all, and over the sweep of human history regions had been thought of in so many

different ways he felt that he did not need to stoop to ugly abbreviations.

The task of building indices for countries was not entirely without upset. He was worried by Denmark. It vexed him greatly. Actually, Israel too. At times a single stock had dominated the weight of these indices. How dominated by one company could any index be allowed to be? If one stock was most of an index would that even count as an index? If he stumbled across such an occurrence when creating a factor screened within a sector he would conclude he had gone too far and halt the process. But a country was a country and that could not really be argued with.

He would face the same question more frequently when he got around to sector indices. He was putting this off and he realised it. He thought of these as akin to country indices in offering little by way of intellectual challenges, but at the same time being a minefield of competing classifications. He had lost track of the number of times classifications had come and gone. To be true to his project, his response to this would be nothing but brazenly pragmatic. He would build all possible classifications. This would be the only sure way to capture the multiplication of taxonomies.

THE INDEX AS A WORK OF ART

He had finished his "value indices" the previous evening, today he was starting a new chapter in the work. He was now creating indices not bounded by any constraints of asset classes. For too long, he felt, people had assumed that indices had to be either for stocks, or for bonds or for other assets such as real estate or commodities. Why were there these constraints? He felt it could only be intellectual or institutional inertia that imposed such limits. He was going to show them how much more powerful his indices could be. This was the path to making everything passive, to being able to remove active investment decision making, and was likely the path to The Index. He was convinced that such a creation could be a thing of beauty as well.

Can the index-as-a-list be a thing of beauty in its own right? The artist Richard Long revealed a list to be a work of art by annotating long walks either with found objects in the landscape that he passed or a series of interactions or events of the walk. The walks themselves tend to take several days and nights and are often across remote and rugged ground. In this way the work of art is an index of the walk. A typical example would be a list of different time intervals encountered on a continuous walk of 24 hours on Dartmoor entitled *Dartmoor Time*. The viewer encounters the work as simply a list in large format black text in an unadorned font:

1 1/2 HOURS OF EARLY MORNING MIST
THE SPLIT SECOND CHIRRUP OF A SKYLARK
FORDING THE WEST DART RIVER IN TWO MINUTES

³ Johnston, S (1997)

⁴ Russo (2001)

⁵ Johnston (1997)

PASSING A PILE OF STONES PLACED SIXTEEN YEARS AGO
 HOLDING A BUTTERFLY WITH A LIFESPAN OF ONE MONTH
 CLIMBING OVER GRANITE 350 MILLION YEARS OLD ON
 GREAT MIS TOR

THINKING OF A FUTURE WALK

In another work called *Dustlines*, Long directly addresses the line traced by the walk. The viewer sees bold red text that proclaims

KICKING UP A LINE OF DUST EACH DAY ALONG THE WALKING
 LINE

A 7 DAY WALK ON THE EAST BANK OF THE RIO GRANDE

EL CAMINO REAL NEW MEXICO

There is something mesmerising about reading these descriptions of the landscape. One can quickly adopt the Long style in one's own interaction with the world each day and in so doing radically alter an assessment of what the key elements of the landscape in fact are.

Another interpretation of this activity is that Long's lists are actually landscape paintings themselves rather than a list that describes a landscape. And why not? In that case the index of stones picked up and put down, or the list of birds heard or rivers crossed itself becomes the image of the landscape from which they were drawn. In so doing it replaces the conventional scene of river in the foreground with mountains rising behind. There are different elements of the index that coexist within such "landscapes" in parallel. There is the line of the walk. The act of walking necessarily forms a line, an imaginary line, or at least a line that only exists in the memory of the space that the walker has inhabited. There is also a real line, one that is left in the temporary depression in the grass or of the displaced gravel and yet another real line where a line of ink could describe the path across a map.

There is another artistic approach that is relevant to the act of indexing, and is particularly relevant for the task of creating all possible indices. A work by Gianfranco Barucello⁶ consists of large vitrines installed in the gallery within which are created endless partitions. Unlike Long, here it is not the listing which arises the aesthetic interest, but instead the act of endless partitioning. Whereas the work of Long could be seen as the artistic embodiment of the *time series* aspect of an index, the work of Barucello represents all the possibilities of classification and subdivision that the formation of an index requires. The viewer is first struck by the number of apparently uniform neat partitions stretching across the field of view. They are constructed from card or wood and built on a minute scale. One is then drawn to the slight differences between them. Some may have minute representations of books or cylinders of printed paper or other found objects. Suddenly the eye of the viewer is moving across the partitions in search of the differences

between them. There is something deeply satisfying about the enumeration of endless partitions. Lyotard maintained that these works "formulate a provisional picture of the postmodern sublime".

What would The Index look like? Surely that would be a thing of beauty and hence in a sense be an art work as well? Some said that it would represent the optimal allocation to all possible assets. He was increasingly sure that it should not and could not be confined to just the stock market. Thus it would be the amalgam of all stocks, bonds, commodities and other financial assets held with weights such that they represented human societies' needs for these different types of capital, by fulfilling this need the index at once performed a social good and also guaranteed its own success. Others doubted that this could exist, was society so self-aware that it knew what its optimal allocation to all assets should be?

Others said that it would be narrower in scope. In their view it was not all possible assets that were the important thing to hold, after all, financial assets were always being created and destroyed. No, the more important thing was to take all possible risks. If the index took all possible risks then it must, logically, be paid all possible rewards for taking those risks. Moreover, if it took all possible risks then it would naturally be diversified in a kind of holistic netting off. This type of index was different, it was not so much an index as an enumeration of all possible assets, but instead an enumeration of all possible strategies. It would represent not the passivisation of asset ownership, but the passivisation of the act of investment itself.

Such an index should not be constrained to merely taking an investment in every asset, it would have to also be able to include long-short indices as subcomponents too. Only an overly-timid interpreter of his task would conclude that the list of all possible indices would be constrained to be long-only. The early creators of indices had surely missed this point?

LISTS OF LISTS

As a child he made lists. Lists of beetles found on a hot summer's day in the garden, lists of shells picked up at the beach. When older this became lists of kings and queens, lists of emperors, lists of electors of the Holy Roman Empire. He kept his enumeration of lists private, on endless handwritten sheets of squared paper in a folder that grew evermore inadequate to its task of keeping his multiplying sheets of paper in order. It wasn't that he was ashamed of his lists *per se*, but for him the set of lists was intensely personal at some level that he found hard to explain, even as the list of items being enumerated themselves was evidently innocuous. When older this evolved to lists of songs and lists of books by which route he learned, to his great surprise, that some lists actually could be public and even play a social role. There were others who wanted to intensely argue

⁶ *La Grande Biblioteca, see Il Palazzo Enciclopedico* (2013)

about the pros and cons of why a given entry might be on one of these lists.

He thought about his task as the making of indices. What that word has represented has changed over time. For most of the time the word has meant a list of various forms. The primal index-as-list has to be the *Index Librorum Prohibitorum*. That great list of censored works the Catholic Church forbade Catholics from reading as they were deemed inimical to the moral or theological health of believers. This was really a series of distinct indices undergoing perpetual revision, The Pauline Index, The Tridentine Index etc. Although there are examples of very early versions of such an index, the need for such an index suddenly grew with the invention of printing on the fifteenth century and the resulting greater availability of books. This led to the index of prohibited books to become a major cultural influence.

There is yet another great list that has the aim of "showing us the way", and that is the exhaustive-seeming list of questions that Thomas Aquinas poses and then answers in the *Summa Theologiae* which he wrote from 1265 until his death in 1274 (he left the work unfinished). The work was intended to be the amalgam of all known learning. The work is divided into a list of 614 questions, and the list of questions and sub questions could be thought of as a categorisation of all thought, at least in terms of man's relation to God. Picking it up and opening a page one is immediately struck by the rigorous structure so loved by the scholastics. Each question is dealt with in a methodical way. For example, in the book pleasingly called "the first part of the second part", Aquinas poses the question "what is happiness?". This is then dealt with by a prologue followed by sub articles: Article 1. Whether happiness is something uncreated? Article 2: If it be something created, whether it is an operation? Article 3: Whether it is an operation of the sensitive, or only of the intellectual part? Article 4: If it be an operation of the intellectual part, whether it is an operation of the intellect, or of the will? And so on. Within each article he then lists objections to the argument, mirroring the style of scholastic debate and then we hear his opinion. The scope and structure of the great work could be a guide in this ultimate task of indexing. By posing questions that might span all possible knowledge and then methodically breaking them down and answering them it is like the intellectual equivalent of the enumeration and implementation of all possible divisions of assets and strategies upon them.

Any discussion of lists inevitably leads to lists of lists. For example, the 1881 edition of the *Encyclopaedia Britannica* has an entry on Indices which supplies a useful list of concordances, those wonderful alphabetical lists of instances of words within certain works that have now been rendered definitively obsolete by computers. There is something doubly redundant about a list of lists which no longer have any use, but each was the product of years of work. The entry on Indices tells us that the first concordance of the Bible was compiled by Hugo of St Cher in 1247; the first English concordance of the New Testament was

published in 1536, and to the whole Bible in 1550, compiled by John Marbeck. Other Biblical concordances are those of R. F. Hervey, 1579; C. Cotton, 1622 (frequently reprinted); J. Downname, 1632; R. Wickens, 1655; S. Newman, 1650. 3rd edition 1682; A. Cruden, 1737 and so on. It also furnishes us with lists of other concordances: to the Iliad, by G. L. Prendergast, 1875, to Shakespeare, by S. Ayscough, 1790, by F. Twiss 1805 and by Mrs Cowden Clarke 1845. There are concordances listed to Milton's *Paradise Lost*, to Pope's works, to Tennyson etc.⁷

Jack Lynch in his fascinating history of reference books⁸ even has a list of lists of lists. We learn that the General Catalogue of the British Library lists 38,904 titles that contain the word dictionary, the Catalogue Général of the Bibliothèque Nationale de France contains 42,162 works with *dictionnaire* in their title; the Deutsche Nationalbibliothek in Leipzig features 41,892 titles with the word *Wörterbuch*, and so on.

Some lists are so captivatingly universal in their titles that they demand attention. The Gazetteer or Newsman's Interpreter of Lawrence Eachard (1692) described itself as being a GEOGRAPHICAL INDEX of all the considerable cities, patriarchies, Bishopricks, Universities, Dukedoms, Earldoms, and such like; Imperial and Hance Towns, Ports, Forts, Castles &c in Europe : shewing in what kingdoms, provinces, and counties they are in, to what Prince they are now subject, upon or nigh what rivers, bays, seas, mountains &c. they stand, their distances (in English miles) from several other places of note, with their longitude and latitude according to the best and approved maps : of special use for the true understanding of all modern histories of Europe as well as the present affairs.

Such lists do not have to be historical. In fact, the explosion of some forms of lists recently are a nice parallel to the evolution of the role and prevalence of the index in investing. These are the lists of things to do, consume, watch or experience. 100 films to watch before you die, 100 albums to listen to, 100 holidays to take, 100 pictures to see, 1000 churches to admire. These are lists that try to point the way and hence are exactly indices in the original Latin sense of the word. One suspects that (however inadvertently) they are also attempts to passivise daily life outside investing. No need to make an active decision on the next song to listen to or holiday to take or book to read, "I am working though all 100". Indeed, this is the enunciation of a language of passive culture.

THE INDEX AS NATURAL HISTORY

Dow may be credited with the creation of the first stock market average, but the genesis of what he was trying to achieve can be traced back further. If the index is not a thing to be bought but instead a tool for recounting a financial history then there are earlier precedents. Henry Varnum Poor (as in "Standard and") published "History of the Railroads and Canals of the United States" in 1860. This is "history" in the sense of a vast enumeration of numerical facts. There are pages upon pages of

⁷ Encyclopædia Britannica (1881)

⁸ Lynch, L (2016)

tables printed across the whole page listing by year, earnings from freight, from passengers and from mail. With columns for share capital and floating debt and normally culminating in dividends paid. If one thinks of the usual meaning of the word "history", it may seem far removed from the task of indexing. However, reading the work, although it would be anachronistic to claim that is what Poor intended, the underlying sense is exactly that of following an index. Albeit it is an index articulated in a semi-prose form and presented as a book. To the modern reader it may seem too prose-like to be an index and too dense with lists of numbers to be read. But a work of indexing it is nonetheless.

The introduction to the chapter on each state is a string of paragraphs, one for each year detailing how many miles of railway were constructed with occasional observations on the success, of otherwise, of the enterprises in question. So a typical extract of the introduction for the chapter on Massachusetts reads:

In 1840, 34.33 miles were opened; the Western Railroad, 15.01 miles; the Eastern, 2.82 miles, and that part of the Norwich and Worcester, 16.50 miles...

In 1841, The Western Railroad was extended to the western boundary of the state, 40.20 miles.

In 1842, only 6 miles were opened – The Charlestown Railroad having been extended this distance

In 1843, 26.17 miles were opened, viz: the Berkshire, 21.14 miles and the Fitchburg, 5.03 miles... The Fitchburg Railroad has been a successful work, having paid dividends amounting annually to 5.8 per cent.

In 1844, 44.71 miles were opened... The Worcester Branch, designed to connect the railroads entering the city of Worcester, was opened, 0.55 miles...

In 1845, 98.33 miles were opened...⁹

And so a financial index, of sorts, is born.

In this sense the work is more like the sense of "history" in "natural history" rather than the more modern sense of the term that suggests an over-arching narrative of events. It is as if Linnaeus or Cuvier had applied their patient classification and recording of the natural world to the modern railroad, indeed the eminent French naturalist had only died 30 years before. This seems appropriate, after all, an index cannot provide a narrative. In a sense that is the real difference between an active and a passive mode of investing, one has a narrative and the other does not.

Poor tells the reader in the introduction that he is not going to speculate on reasons for success or failure as to the prospects of the companies he studies. However, that does not prevent him from sometimes allowing himself to be forthright in brief phrases interjected between the endless tables of data. In the chapter on

Vermont, for example, we learn that The Vermont Central railroad (chartered in 1843) has "proved to be one of the most disastrous enterprises ever taken in this country, having for the past six years failed to pay anything to its stockholders or bondholders". Poor tells us, for example, that the Vermont Central railroad in 1859 earned \$178,732 from carrying passengers and \$494,607 from carrying freight. However, maintenance costs were running at \$585,595 per year, it had defaulted on a rent to the Vermont and Canada railroad in 1854 and also in the same year stopped paying interest to the company's bond holders.

By contrast, there are success stories recounted in the same dry prose with two or three numerical facts per sentence. An example was the Boston and Lowell Railroad which, we are told, had returned dividends of 6.75% pa over the 20 years since its completion. We learn that the Horse Railroads within New York City are a remarkable example of adaptation to the needs of cities and that their construction has been "exercised of the entire impunity with which the grossest outrages on the public are perpetrated by the city of New York".

Poor slipped on ice in Boston in 1905 and died but by the early 20th century Standard Statistics started maintaining a weekly index (struck at the close of each Wednesday) of 223 stocks across different sectors of the market. It subsequently calculated a daily index, but this had to be limited to 90 because of the difficulties of calculating that for a larger number of companies daily. Indeed, the sheer mass of numbers prompts the question how was the data collected and stored and manipulated.

The Arithometer of Thomas de Colmar was useful, but was expensive and slow to operate. The comptometer of Felt and Tarrant represented a big improvement in ease of use. Its great step was that the machine was activated by depressing the keys as opposed to setting keys and then cranking a handle.

The operator enters numbers by pressing as many keys as required simultaneously and this number is added or subtracted. It was the first commercially successful mechanical calculator operated in this way. Felt had started his initial prototype during the Thanksgiving holiday of 1884 using a Macaroni box, skewers and rubber bands. He was awarded the patent in 1887. Early comptometers were constructed in wooden boxes with the keys with numbers arranged horizontally across the top. Later versions were a metal construction with the keys arranged across a slanting panel, giving them a look which would later become more familiar as the style of a cash register in shops. The comptometer was widely sold to banks and accounting departments of corporations. Photographs show scores of operators employed in accounting departments performing endless calculations with these new machines. The pictures show the women (in the photographs of the comptometer in use in offices they appear to be universally staffed by women) sitting at rows of individual wooden desks, each desk equipped with a comptometer and a neat sheaf of papers. The scene looks very

⁹ Poor (1860)

much like an earlier version of what we would now call an open-plan office. Indeed, there is a familiarity in their desk-bound role alongside their peers that would be recognized by many office workers today.

THE UNKNOWN MASTERPIECE

What then was the nature of this task that he had been set? He was not a latter-day Dow or Poor because although he was engaged in the task of making indices, the purpose of the task was utterly different. Why did Dow create his index? He wanted to report on what "the market" had done in a precise and concise way that could be described on a newsheet. With the index established it could then lead him to use it for other purposes as he did in his set of editorials that came to be thought of as the Dow theory. But the index reported on the market, this is use of "index" in the sense of a catalogue of events. The creation of the index was an act of journalism. The direction of causality was clear.

Now it was different. The direction of causation was being inverted. That inversion was implicit in the grand project. The mass of indices that he was now creating were things to buy, not reporting on prices that resulted from the activity of others. They spanned all possible investments. This was not a task of journalism but instead a task of replacing all other forms of investment. In this aspect his task was beguilingly picturesque. For this reason he preferred the other sense of the word "index" as "showing the way". Yet this inversion gave a certain ambiguity to his work. What was it, exactly, that he was doing? Reporting? No clearly not that. Investing? Well not that either, in a sense he was replacing the need for such an act with something else that was all-encompassing.

He could just create all indices and present them to the world. But he felt that the impact of that might fall flat. He wanted to go beyond that, hence the hunt for The Index. The ultimate one that surpassed all others would have imitators. It was said to exist but so far not to have been discovered. There was always a danger with this hunt that what in fact he would arrive at would be another index very alike The Index in every way but so formed as it would cease to work on the day after it was discovered, and another that would be discovered to be flawed only in coming years. In fact, given the need to find all interpolations between all indices there must be incalculable numbers of ones that would be alike the True Index but in fact be false in some way. Would he be able to recognise the one true ultimate one when he saw it? Indeed would the discovery of it immediately break it?

He felt that the answer had to be to make his indices more comprehensive. If it could incorporate more assets and more strategies on more assets then it would become more robust. It would need to have private assets that are not listed on any exchange. They would not have prices that updated every day but that did not matter. This could extend across the range of real assets. He would have to include all successful long-short

strategies as well. Indeed, he would need an index for every "strategy", that used to be thought of as active investing.

He would then set to work to include all these indices too as elements of The Index. In that way The Index would include every asset and every strategy that used those assets. But what of assets that had not yet been invented? If the index was really the ultimate index then it would have to include those as well? The definitions of how it evolved and rebalanced would have to be sufficiently broad to allow future assets to be included too.

Borges tells the story of the Library of Babel.¹⁰ This was the library that held all possible books. Specifically, all possible books of a given number of pages with a set number of symbols per line and lines per page that are achievable with the Latin alphabet and simple symbols of punctuation. This library necessarily contains all knowledge in all languages. It also contains amongst its works those that give a truthful account of all future events. However, it also contains volumes that contain nothing but apparent random assortments of letters, or perhaps these volumes could be elegant prose but written in a forgotten language. Some works are meaningless jumbles of letters but with just one meaningful phrase on a single page. For librarians at work the library is their whole world. Many of them have tried to seek out those works that would tell what the future held. Yet the confidence that this library held all truth could only be based on the fact that it held all possible untruths as well.

Hunting the Library of Babel for the volume that held the key to the future is a task that in many ways is like the hunt for The Index that answers all future needs of investment. However, the tasks differ in an important way. The books in the library do not respond in any way to their discovery. Markets, unlike the physical manifestation of a book, are self-referential. Thus, The Index has, by its nature, got to be comprehensive enough to include all possible strategies that have not been discovered yet. In this way The Index is not equivalent to a volume in the Library of Babel, instead it is equivalent to the entirety of the library itself.

A flicker of worry assailed him. The comprehensive nature of the Library of Babel was what guaranteed that it contained the truth. But that very same comprehensive nature was what rendered the library ultimately useless, a futile enumeration of truths and untruths. Was it possible that by creating all possible indices he was not replacing the act of investment but simply rephrasing the problem? If that was the case maybe The Index was always unknowable and unreachable. Indeed, would the existence of all possible indices render the idea of a stock market index utterly useless and so destroy its utility. Maybe his attempt to make indices that were truly comprehensive was in fact going to be the final act that destroyed the inventions of Poor and Dow?

And so one is led, with a certain inevitability, to Balzac who recounts a story about an artist, Frenhofer.¹¹ He was so skilled as to be able, in a mere few strokes of a brush to transform another artist's work from an accomplished but lifeless form to

¹⁰ Borges (1941)

¹¹ Balzac (1831)

something that left the viewer speechless with admiration. However, Frenhofer was much more circumspect in allowing artists to view his own work. The reason was that for years he had been working on his ultimate painting. This was a painting of a woman that he had painted in a way that he insisted was so life-like that it had become his companion. But he worried that others would steal her from him if they beheld her. He would be jealous even of the gaze of others if they saw this work. So confident was he that it was so perfect that he declared it was not possible to determine where art began and life started. Indeed, he declared that the art had vanished, it was invisible so that it was the form of a living girl that was in front of the viewer.

He was tricked into showing his masterwork to two artists. They were very impatient to see the work and when they were finally allowed into the studio they approached the easel with eager curiosity. But were then left uneasy by what they saw. The work appeared to them as a “confused mass of colour and multitude of fantastical lines that go to make a dead wall of paint”. The only thing to show that this was in fact a painting of a woman was in one corner there was the image of a bare foot emerging from the chaos of the rest of the canvas. Frenhofer had undoubted skill, but the realism of the work was something that only he could see. He had carried on adding improvement after improvement to make the work more comprehensive and had been utterly incapable of stopping. The result was merely a freakish mess of colour, not a woman.

Our nameless creator of indices stopped. He looked with growing horror at his plan for creating the ultimate index. Was he destined to follow the fate of Balzac’s Frenhofer? Was the only result of his work to be a crazed superimpositioned upon superimpositioned morass of financial series? He was not ready to believe such a thing. The path to this point had been one of logical incremental steps. None of them by themselves a step too far after all. From Poor enumerating miles of railway track, to Dow averaging stock prices to indices for all markets then indices for all strategies. All these were logical steps, surely, along a path of progress.

Yet Balzac’s hero had followed a similar path. His unquestioned skill had produced what was probably at one stage a masterpiece. But there always seemed to be a way to improve it. An extra brush stroke to embellish an arm, another way to add depth or enhance a shape. Each step on each of these extra paths may have been a step that seemed correct. Yet each one of these steps toward the masterpiece had in fact been a process that was incomprehensible to others and was a slow and gradual process of destruction. So bound up was he in the details that he was unable to step back and consider.

Was his life’s task really destined to be pointless? No, he could not accept that. He would be different. All he had to do was to add one extra index...

Bibliography

Balzac (1831): *The Unknown Masterpiece*

Bishop, G (1960): *Charles H. Dow and the Dow Theory*, Appleton-Century-Crofts

Borges (1941): *Library of Babel*

Encyclopædia Britannica (1881), 9th edition

Johnston, S (1997): “*Making the Arithometer count*” Bulletin of the Scientific Instrument Society, 52

Long, R (2009): *Heaven and Earth*, Tate Publishing

Lynch, L (2016): *You Could Look it Up*, Bloomsbury Press

Il Palazzo Enciclopedico (2013), catalogue of the 55th Venice Biennale

Poor, H (1860): *History of the Railroads and Canals of the United States, Vol I*

Russo, T (2001): *Antique Office Machines*, Schiffer Publishing

Sether, L (2009): *Dow Theory Unplugged: Charles Dow's Original Editorials & Their Relevance Today*, W & A Pub

Shakespeare: *Troilus and Cressida*

DISCLAIMER: NOT A RESEARCH REPORT

This does not contain an analysis of any securities of individual companies or industries and does not provide information reasonably sufficient upon which to base an investment decision. Therefore, this opinion piece is not a Bernstein research report. Instead, the views expressed herein represent the personal opinion of the author regarding the products discussed herein. Any reliance upon any opinion, advice, statement or other information in this opinion piece is at your sole risk. To the extent there is any pricing information provided, the prices are only as of the date of the opinion piece and are not intended to represent any survey of market price. Prior to purchasing any third party product discussed in this opinion piece, you are advised to verify pricing and other information.