THE TELECOMS BOOM AND BUST, 1996-2002: PUZZLES, PARADOXES, AND PROCESSING

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"Soros explains something that most observers of the recent stock market bubble know intuitively, but that market fundamentalists deny: 'Financial markets, left to their own devices, are liable to go to extremes and eventually break down.' Robert Shiller, in his book *Irrational Exuberance*, has documented this tendency of markets to excess volatility."

Joseph E. Stiglitz, 'A Fair Deal for the World', *The New York Review of Books*, May 23, 2002, p.26.

NOTE: This paper draws on the author's forthcoming book, *Telecoms in the Internet Age: From Boom to Bust to …?*, Oxford University Press, September, 2002.

INTRODUCTION[1]

Why are financial markets "liable to go to extremes"? This paper examines this question within the context of the Telecoms Boom and Bust, 1996-2002. In the first part of the paper the main beliefs that drove the Telecoms Boom are re-constructed. These beliefs formed a Consensual Vision regarding the Telecoms Industry and its dynamics. There were, however, fundamental flaws in this vision that are analysed. These flaws contributed to the ensuing Telecoms Bust. The main question posed in this paper, however, is why did so many key players come to accept this Consensual Vision despite its shortcomings, many of which could have been anticipated? This question is examined through an analysis of three hypotheses which all deal with how decision-makers handle information in the attempt to derive knowledge about how their world works, what will happen to it, and what the implications are for what they should be doing. The three hypotheses are the Biased Incentive Hypothesis, the Information Processing/Bounded Rationality Hypothesis, and the Guru Hypothesis of Information Selection. It is concluded that the paradox of the 'Information Society' and the 'Knowledge Economy' is that they do not provide the information and knowledge that is necessary to eliminate the extremes. We have little option, it seems, but to live with booms and busts as best we can.

PUZZLES

According to *Business Week*, in the second half of the 1990s Jack Benjamin Grubman "may have been the most influential person in the telecom industry"[2]. Between 1998 and 2000 Grubman helped his firm, Salomon Smith Barney, to raise $53 billion for telecoms companies, more than any other firm on Wall Street. However, after the onset of the Telecoms Bust from March 2000, Grubman's influence quickly crumbled. At least ten of the major telecoms companies he strongly supported – including the most prominent such as Global Crossing – have filed for bankruptcy and some of the others, notably WorldCom, have collapsed.

What did Grubman, in retrospect, make of the Telecoms Boom and Bust? According to Grubman,

> "Everyone was culpable: the debt markets, the equity markets, the issuers, the companies. Anyone who tries to point a finger at a single group is not being fair."[3]

But Grubman's conclusion poses a puzzle. To say that everyone was culpable is to imply that they could have, and should have, known and done better. If events were beyond

[1] The author would like to acknowledge, without implicating, useful comments from Arno Penzias and Steve Klepper.

[2] *Business Week*, May 13, 2002, p.42.

[3] *Financial Times*, 7 September 2001.

their control they could not be culpable. But if they could have, and should have, known and done better, why did they not?

The Cognitive Framework: The Consensual Vision of the Telecoms Industry

To take this further, it is worth attempting to reconstruct the key beliefs that underpinned the Telecoms Boom from around 1996 to March 2002. These beliefs were widely shared amongst the debt markets, equity markets, issuers and companies that Grubman refers to, and even by regulators. Accordingly, I refer to these beliefs as comprising a Consensual Vision.

In my book I suggest that there were four key beliefs that underpinned the Consensual Vision, expressing the conventional wisdom about what would happen in the Telecoms Industry. These beliefs are shown in Exhibit 1.

Exhibit 1. The Beliefs underpinning the Consensual Vision regarding the Telecoms Industry

Belief 1	The Internet will drive an explosive demand for bandwidth.
Belief 2	New telecoms operators will out-compete the incumbents in providing this bandwidth.
Belief 3	Financial markets will support the fittest new operators.
Belief 4	Technical change will further reinforce the processes referred to in the first three beliefs.

Source: M. Fransman, *Telecoms in the Internet Age*, (2002)

These beliefs together provided the building-blocks for the cognitive framework[4] that shaped thinking about what would happen to the Telecoms Industry and its companies and, by inference, how decision-makers should play their cards. Most visibly, this cognitive framework drove share prices. More specifically, the cognitive framework was responsible for the rapid rise in the price of the shares of the main telecoms companies (operators as well as equipment suppliers) and for the rise in the share price of the major

[4] For recent writing on cognitive frameworks in economics see Loasby, B. (2001). 'Cognition, Imagination and Institutions in Demand Creation'. *Journal of Evolutionary Economics*, 11(1): 7-22; Witt, U. (2000). 'Changing Cognitive Frames – Changing Organizational Forms: An Entrepreneurial Theory of Organizational Development'. *Industrial and Corporate Change*, 9(4): 733-56.

new entrant telecoms operators (such as WorldCom, Qwest, Level 3, Global Crossing and Colt) relative to the incumbent operators (like AT&T, BT, etc).[5]

The rise in the share price of the telecoms operators (and also the telecoms equipment companies who supplied them) continued until about March 2000. At this time the generalised bull stock market ended and the decline began. Simultaneously, doubts emerged regarding the validity of the beliefs underlying the Consensual Vision that had reigned. These doubts may be summarised in the form of three questions regarding the Consensual Vision. These questions are presented in Exhibit 2[6].

Exhibit 2. Questions regarding the Consensual Vision

Question 1	At what rate will the demand for bandwidth increase?
Question 2	What will happen to the supply of bandwidth and how will demand and supply interact?
Question 3	How many competitors will there be in the market for telecoms services?

Source: M. Fransman, *Telecoms in the Internet Age*, (2002)

The Rocks on which the Consensual Vision Foundered[7]

In retrospect, it is clear that the implicit assumptions on which Belief 1 were based were overly optimistic. Although, as a result of the rapid global diffusion of the Internet, there was an 'explosive demand for bandwidth' – as the new operators and their supporting financial analysts put it in their publicity material – it was not explicitly acknowledged that this rate of increase in demand could not continue indefinitely. Telecoms operators – just as their counterparts producing PCs and mobile phones – would soon be forced to live with this fact.

Even more surprising was the under-emphasis in the Consensual Vision of the supply side (Question 2). As the Nineteenth Century economist – Alfred Marshall – noted, price is determined by both blades of the scissors, a fact recognised by any first-year economics student. Curiously, however, in their eagerness to address the new demand opportunities opened up by the Internet, the proponents of the Consensual Vision neglected the supply side.

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[5] See M. Fransman, *Telecoms in the Internet Age*, for an elaboration on the rationale behind the four beliefs and for empirical evidence on the share price movements of the incumbents and their main new operator competitors in the US and UK.

[6] For a more detailed examination of these three questions see M. Fransman, *Telecoms in the Internet Age.*

[7] The arguments in this section are elaborated upon in M. Fransman, *Telecoms in the Internet Age.*

But crucial changes were taking place on the supply side. In 2000 it was announced, for example, that Lucent Technologies' Bell Labs had pushed 1.6 trillion bits, or terabits, of information through a single optical fibre by using the dense wavelength division multiplexing technique (DWDM)[8]. This is enough for 25 million conversations or 200,000 video signals simultaneously and one cable may contain a dozen such fibres. The effects of such technical change were dramatic. In September 2001 it was estimated that "only 1 or 2 percent of the fibre optic cable buried under Europe and North America has even been turned on or 'lit'…. A similar overcapacity exists in undersea links, where each new Atlantic cable adds as much bandwidth as all the previous infrastructure put together."[9]

However, it was not only technical change per se that was rocking the foundations of the Consensual Vision. The evolving structure and organisation of the entire Telecoms Industry constituted a fundamental challenge to this Vision. The problem was that very few of the participants in this industry understood how the Telecoms Industry worked and how it was changing.[10]

As had happened in the Computer Industry, processes of vertical specialisation were radically transforming the Telecoms Industry. Until the 1980s, the engine of change in the Telecoms Industry lay in the central research laboratories of the incumbent telecoms operators – famous institutions such as AT&T's Bell Labs, BT's Martlesham Laboratories, France Telecom's CNET laboratories, and NTT's Electrical Communications Laboratories. The research and advanced development that took place in these laboratories created the new generations of technology and equipment that drove the Telecoms Industry. The equipment itself, however, was manufactured by a group of specialist telecoms equipment suppliers – such as Lucent (then an integrated part of AT&T) and Nortel in North America; Siemens, Alcatel, Ericsson and Nokia in Europe; and NEC, Fujitsu and Hitachi in Japan. Closed markets and long-term obligational relationships bound the incumbent telecoms operators closely to their equipment suppliers.

By the 1990s, however, this pattern of industrial organisation had changed dramatically. The forces of vertical specialisation that had, at first un-noticed, begun to transform the Telecoms Industry decades earlier were given legal vent from the mid-1980s when government liberalisation introduced the first elements of competition in telecoms services markets in Japan, the UK and US. In the US, MCI and Sprint emerged to challenge AT&T; in the UK, Mercury took on BT; and in Japan, DDI, Japan Telecom, and Teleway Japan fought with NTT.

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[8] DWDM is an optical technology that uses different coloured light waves as communications channels in a single optical fibre, thereby increasing significantly the carrying-capacity of that fibre.

[9] *Financial Times*, 4 September 2001.

[10] A detailed analysis of the evolution of the Telecoms Industry is contained in chapters 1 and 2 of M. Fransman, *Telecoms in the Internet Age*.

The entry path of these 'original new entrant operators' was smoothed by the decades of learning and knowledge accumulation undertaken by the specialist equipment suppliers who in most cases had cut their teeth through manufacturing equipment for their national incumbent telecoms operator. Rapidly the knowledge of these specialist suppliers had deepened with the result that by the late-1990s they were collectively some four times as R&D-intensive as the incumbent operators who hitherto had powered the engine of technical change in the Telecoms Industry. By the end of the 1990s, however, the incumbent operators had handed over a large part of their R&D requirements, in addition to their equipment requirements, to the specialist suppliers. With falling R&D-intensities, the incumbent operators became less research and development intensive than the average in industries normally not considered to be 'high-tech', industries such as automobiles, personal care products, and media and photography, and about as R&D-intensive as the beverages industry.[11]

In this way, the R&D engine of the Telecoms Industry moved decisively from the central research laboratories of the incumbent operators to the specialist equipment suppliers. But this would have crucial consequences for the evolving structure and dynamics of the entire industry.

One of the most important consequences was that technological entry barriers into the network operator layer of the Telecoms Industry were dramatically lowered. The reason, simply, was that telecoms equipment suppliers such as Nortel and Lucent were willing to supply state-of-the-art equipment to any company that wanted to enter the telecoms operator market, provided they were able to pay. And financial markets, enthused by the Consensual Vision, were willing to provide the funds that enabled the new entrant operators to pay. Furthermore, labour markets, oiled by the granting of generous stock options to newly recruited top managers, provided the new operators with the knowledgeable staff they needed, often head-hunted from the incumbent operators. Between 1996 and 1999 in the US alone 144 new telecoms companies went public, raising more than $25 billion.

These events seemed to represent a vibrant market response to the major new business opportunities opened up by the Internet. They seemed to provide empirical support for the assumptions made in the Consensual Vision (summarised in Exhibit 1). Even regulators were delighted, arguing that the market forces which their deregulation measures had unleashed were creating the competitive pressures and incentives that, in marked contrast to the earlier telecoms monopoly era, would stimulate innovation and improve services.

Unfortunately, however, things did not turn out so happily. The problems arose largely from Question 3 in Exhibit 2. The substantial number of new entrant operators – together with the great increase in investment in new network capacity embodying much improved technology – undermined prices and profitability. This was particularly the

[11] This remarkable fact is documented in Table 8.2, p. 218, and is analysed in chapters 2 and 8 of M. Fransman, *Telecoms in the Internet Age.*

case in long-distance and international voice and data services.[12] Only local services and mobile services provided relief from this trend. (In the US the Telecommunications Act of 1996 had attempted, unsuccessfully, to dislodge the market dominance of the local phone companies such as Verizon and SBC. Particularly in Europe, mobile services remained profitable into 2002 but in the US strong competition between the mobile operators soon put an end to above-average rates of profitability.)

The collapse in prices meant that both the revenue and the earnings of incumbents and new operators alike were significantly below what investors had expected. The problem in this high fixed-cost industry was that large sums of money had to be spent on rolling out networks well in advance of the compensating revenues that would eventually pay for these investments. During the Telecoms Boom the exuberant expectations of investors (shaped by the Consensual Vision) plugged the gap between investment costs and the anticipated revenue streams that would cover them. The collapse in prices, however, meant that these future revenue streams were unlikely to be forthcoming. Financial markets that were exuberant quickly became disenchanted.

The collision between Consensual Vision-shaped expectations and the reality of falling prices and profitability put enormous pressure on telecoms operators. It was this pressure that explains the transgressions of WorldCom – accused of fraudulently reporting an excess of $3.8 billion in earnings - and the somewhat lesser misdemeanours by companies such as Qwest and Global Crossing. Caught in the web of false expectations that they themselves had created, these companies did everything they could to avoid disappointing the markets that fed them and kept them alive.

In short, the bonanza foreseen by the Consensual Vision proved illusory. The rest is history.

PARADOXES

> "Investors took everything at face value, which was understandable. There wasn't a lot of information, and it was of varying quality."
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> Michael E. Kenneally, co-chairman and chief investment officer, Bank of America Capital Management Inc. quoted in *Business Week* special report, How Corrupt is Wall Street?, May 13, 2002, p.37.

This statement is remarkable, implying as it does the existence of a significant paradox. In the so-called Information Society, when supposedly a greater proportion of the workforce are 'knowledge workers' than ever before, there is not enough information and the information that does exist is of 'varied quality'! Jack Grubman, the telecoms guru,

[12] This was the general picture although some sub-areas were profitable, such as private lines (data networks for businesses) and frame relay services (switched data access). However, Internet transmission provided little profit. (I am grateful to Arno Penzias for pointing this out to me.)

alone was paid about $20 million annually[13] while the compensation of his colleague, Henry Blodget, the "Superstar Internet Analyst", increased from $3 million in 1999 to $12 million in 2001.[14] And there were many, though less well-compensated, Grubmans and Blodgets. Why then, collectively, did they produce so little information and of such varied quality?

THE REMAINING BIG QUESTION: WHY WAS THE CONSENSUAL VISION BELIEVED IN THE FIRST PLACE?

The biggest puzzle is why the Consensual Vision became the conventional wisdom in the first place. If the argument in this paper is correct, it was the Consensual Vision that drove the Telecoms Boom. But why were the beliefs that underlay the Consensual Vision (shown in Exhibit 1) so readily accepted? This question is puzzling because, as shown in the last subsection, there were many reasons – some of which were summarised in the three questions raised in Exhibit 2 – to be sceptical of the Consensual Vision. And some of these reasons could have, and should have, been anticipated before the Telecoms Boom turned into the Telecoms Bust. Neither was the history of the Telecoms Industry, between 1996 and 2002, so very different from that of other industries, such as the railway and electricity industries in earlier periods. In short, why is it that the 'Information Society' and 'Knowledge Economy' of the late 1990s failed to provide the information and knowledge that might have led to the avoidance of the excesses of the Telecoms Boom and Bust?

THREE HYPOTHESES

In attempting to answer this intriguing question, three hypotheses will be examined. They are The Biased Incentive Hypothesis, The Information Processing/Bounded Rationality Hypothesis, and what will be called The Guru Hypothesis of Information Selection.

The Biased Incentive Hypothesis

One answer that has been given to this question is that the incentive system governing the provision of information and the creation of knowledge about how industries, markets and companies were working and performing was responsible for the production of biased 'information and knowledge'. One version of this biased incentive hypothesis is provided in the following quotation from *Business Week* in a special report titled 'How Corrupt is Wall Street?':

> "Wall Street has always struggled with conflicts of interest. Indeed, an investment bank is a business built on them. The same institution serves two

[13] *Business Week*, May 13, 2002, p. 42.
[14] *Business Week*, May 13, 2002, p. 39.

> masters: the companies for which it sells stock, issues bonds, or executes mergers; and the investors whom it advises. While companies want high prices for their newly issued stocks and low interest rates on their bonds, investors want low prices and high rates. In between, the bank gets fees from both and trades stocks and bonds on its own behalf as well, potentially putting its own interests at odds with those of all its customers. But in recent years, those inherent conflicts have grown worse…."[15]

More generally, the argument is that the analysts working for an investment bank might bias the recommendations they make in order to suit the interests of the corporate clients of the bank. It is this biased incentive hypothesis that supposedly explains the remarkable fact discovered by New York Attorney General, Eliot Spitzer, in an investigation into the stock market boom and bust. In *Business Week's* words, "In some of the e-mail turned up by Spizer, analysts disparage stocks as 'crap' and 'junk' that they were pushing at the time."[16]

Another variant of the biased incentive hypothesis applies the argument to the incentive regime governing the behaviour of managers. According to Robert J. Shiller, author of *Irrational Exuberance*, "It's finally dawning on people that this incentive system we've given managers based on the value of stock options has encouraged management to puff up their companies a lot."[17]

Strengths

The main strength of the Biased Incentive Hypothesis is that it goes a long way towards explaining the behaviour of some of the individuals governed by these incentive regimes and the 'information and knowledge' they created. The power of the hypothesis lies in the causal link that it postulates between incentive, behaviour, and the 'information and knowledge' that is created.

Weaknesses

However, the Biased Incentive Hypothesis also has several weaknesses. To begin with, the causal link that it postulates does not always operate. For example, in his book, *dot.con*, John Cassidy discusses the bears whose views contradicted those of the dot.com bulls who were sometimes in the same financial organisation. In some cases, as Cassidy shows, the bears remained bears even when the tide of consensual opinion was flowing decisively in favour of the bulls (although in other cases the bears eventually succumbed and conformed). There were, however, instances where recalcitrant bears, refusing to conform to the incentive regime, were "shunted aside" by their financial institution

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[15] *Business Week*, May 13, 2002, p. 36.
[16] Ibid, p. 37.
[17] Quoted in *Business Week*, May 13, 2002, p. 39.

determined to impose the desired answer.[18] As these examples show, the causal link – incentive-behaviour-'information and knowledge' – is not a deterministic one.

The second problem with the Biased Incentive Hypothesis is that it fails to take account of all the other players in the economic system who were subject to different incentive regimes that, arguably, encouraged them to tell the 'truth' (or at least – to the extent that it is impossible to create 'true' information and knowledge that is uninfluenced by the incentive regime - to create 'information' with different biases). Examples include independent financial analysts, independent consultants, large institutional investors, academics and regulators.

Of these, possibly the most problematical are the large institutional investors such as the mutual funds that controlled many billions of dollars. Are we to believe that they were unaware of the biases in the information provided by analysts tied to investment banks? Even if they were unaware, these analysts would frequently have come up with contradictory advice amongst themselves, raising the question of the resources that the institutional investors put into attempts to get an independent view of what was happening. If it was all a matter of incentives, surely the institutional investors had an equally strong incentive to attempt to 'get at the truth'. The subsequent losses that they and their clients took seem to provide grounds for this suggestion. However, if there were different incentive regimes in the economic system, and if 'information and knowledge' is caused by the incentive regime, then there must have been different, perhaps contradictory, sets of 'information and knowledge'. This raises the question of how selection was made between these sets.

A third problem with the Biased Information Hypothesis is that it fails to distinguish between short run and long run incentives, confining attention to the former. Implicit in the hypothesis, therefore, is the tacit assumption of short-sightedness on the part of those supposedly driven by the incentive regime. While the creation of 'information and knowledge' that conforms with the incentive regime may benefit the individual analyst in the short term, their incorrectness may produce problems for the individual in the longer term. It is not at all clear that Jack Grubman, for example, would have given the same advice if he could rewind the video of Time. Although it is possible that even now, threatened with public investigation and social stigma, he might feel that the short term gains (which ran into many millions of dollars) outweigh the longer-term ill-effects, it is by no means obvious that the same calculation would be made by all the others involved.

In the event, however, there seems to have been little discussion and debate around different analyses, views and opinions – based on different sets of information and knowledge - regarding how the Telecoms Industry works and what would happen to it and its companies. Rather, as argued earlier in this paper, it seems that a Consensual Vision emerged, took root, and held sway, shaping beliefs about the Telecoms Industry until early 2000 when boom turned to bust. If this account of events is correct, it is the

[18] According to Cassidy, "One by one, most of the bears either changed their views or found themselves shunted aside." (p. 120).

rise to dominance of the Consensual Vision that needs to be explained.[19] The biased incentive hypothesis, it would appear, is insufficient by itself to provide the explanation.

Conclusion

It may be concluded, therefore, that although incentives certainly were an important part of the story, they are not sufficient to explain the Telecoms Boom and Bust.

The Information Processing/Bounded Rationality Hypothesis

Another view of how individuals and organisations work is contained in the Information Processing/Bounded Rationality Hypothesis, originally put forward by Nobel Prize-winning economist, Herbert Simon. Until his death in February 2001, Herbert Simon held the view of "human beings…as information processors". Furthermore, he believed that "human beings are serial information processors: we can attend to at most one thing at a time" and that this was a "fundamental axiom underlying the principle of scarcity of attention". [20] Simon argued that "bounded rationality" was one of the major consequences of the scarcity of attention. In his view human beings are competent calculators who are attempting to make informed decisions and choices but who are inevitably constrained by the scarcity of attention.

Strengths

The principal strength of the Information Processing Hypothesis lies in its axiomatic deduction of the principle of scarcity of attention. While this principle is deduced from the assumption of human beings as serial information processors, we all, though our own experiences (painful and otherwise) are made aware of the fact of scarcity of attention. Indeed, it seems difficult to imagine the truth of an alternative, contradicting, hypothesis. Accordingly, it seems necessary to incorporate the principle of scarcity of attention in any explanation of the Telecoms Boom and Bust.

Weaknesses

However, it does not necessarily follow from the assumption that human beings are serial information processors, and from the derived principle of scarcity of attention, that human beings are essentially or primarily information processors. Indeed, Simon's own

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[19] If, however, this account is incorrect then we need to, first, clarify why it is incorrect, secondly, replace it with a more accurate account of events driving the Telecoms Boom and Bust, and, third, explain why the boom emerged to begin with and why it turned into a bust. In short, we need an alternative explanation of why markets in this case 'went to extremes', to use Stiglitz's phrase used at the outset of this article.

[20] H. A. Simon, 2002, 'Organizing and coordinating talk and silence in organizations', *Industrial and Corporate Change*, Vol. 11, No. 3, June, p. 616-617, published posthumously.

views can be used to suggest that human beings cannot be essentially or primarily information processors.

This emerges if we examine the implications of the Information Processing Hypothesis for understanding the Telecoms Boom and Bust. The Simonian hypothesis suggests that the key decision-makers in the debt markets, the equity markets, the issuers and the companies – i.e. the organisations that Jack Grubman suggested were all to blame for the Telecoms Boom and Bust – were competent calculators (the 'rational' in bounded rationality) limited by the scarcity of their attention. At the time of the Telecoms Boom, between 1996 and the end of 1999, they had, in order to calculate competently, to access relevant information 'out there' to make their respective decisions. Essentially, to decide where to put their money, they had to establish where they could make above-average rates of return. To do this they had to process as much information as they could.

But how were they to find 'relevant information' given that, by assumption, the scarcity of their attention prevented them from accessing and processing *all* the information so as to establish the relevant set of information? The Simonian hypothesis suggests that as information processors they tried to collect as much information as their scarce attention would allow and, on the basis of this information set, they made optimal (boundedly rational) decisions.

However, problems quickly emerge if we follow this line of reasoning. The problems follow from the sheer quantity and complexity of the information that a person can access and process *within* the constraints of their scarce attention. In circumstances of complexity there will be significant costs associated with collecting and processing information. These costs create an incentive to *not* process information, rather relying on mechanisms that bypass the need to process information or reduce the amount of information that must be processed. This will allow an economising of the costs of information processing.

But how do people select the mechanisms that will allow them to avoid or minimise the processing of information? Clearly, there are many conceivable mechanisms that may serve this purpose. Once again, complexity produces problems. Complexity makes it difficult for the individual to attempt to collect information on all the possible mechanisms and on the effectiveness of all these mechanisms. It therefore seems unlikely that information processing per se yields the answer regarding which subset of mechanisms should be used in order to avoid or minimise the need to process information. But this leaves the question of how then people choose mechanisms to economise on information processing. To the extent that people rely on such mechanism, they cannot be essentially information processors, but rather the selectors of mechanisms that will allow them to avoid information processing or minimise it.

Further problems are created by the Biased Incentive Hypothesis. As we have seen, the Biased Incentive Hypothesis suggests that incentive regimes may produce biased 'information and knowledge'. This creates additional difficulties for the Simonian decision-maker. In addition to having to decide what information to process within the

constraints of his or her scarce attention, the Simonian decision-maker also (knowing about the possible effects of incentives on the accuracy of 'information and knowledge') must decide which information is accurate and which is not. This presents further problems for the pure information processor.

To make matters even worse, another problem is raised by the possible existence of Knightian uncertainty (when probability distributions cannot be determined). Under such conditions existing information may be of little use since, by definition, it cannot be used to infer what might happen.

Under conditions of Knightian uncertainty, therefore, experience, information and knowledge of past events are insufficient. The Telecoms Industry in the mid-1990s, as noted earlier in this paper, was entering a new phase in its evolution. For example, the impacts of deregulation and competition were still working themselves out, radical technical changes were transforming the industry, and, as everyone was beginning to realise, the Internet was starting to become a major catalyst, although with what precise effect no-one yet knew (and probably no-one yet knows).

Conclusion

For these reasons it may be concluded that the 'pure information processor' would not have been a creature particularly well-adapted to dealing with the circumstances of the Telecoms Industry during the period under consideration. The Information Processing Hypothesis does not appear to be sufficient in explaining the Telecoms Boom and Bust, even though scarcity of attention will have to be an important part of any explanation.

The Guru Hypothesis of Information Selection

At first sight the Guru Hypothesis seems to help in dealing with some of the weaknesses of both the Biased Incentive Hypothesis and the Information Processing Hypothesis.

The Guru Hypothesis suggests that what decision-makers do is not process as much information as their scarce attention will allow, but rather they select other human beings who they believe will provide them with appropriate answers. Indeed, there is a significant amount of evidence suggesting that such human beings – the Gurus – carried disproportionate weight in influencing the decisions of many of the key players whose decisions shaped the evolutionary path of the Telecoms Industry over the period under consideration. Jack Grubman, already referred to, was probably the most prominent of these people in the US Telecoms Industry and his counterparts in the so-called dot.com field included individuals such as Mary Meeker, Henry Blodget, and Abby Cohen.[21]

[21] See, for example, John Cassidy's *dot.con* (2002).

Strengths

One strength of the Guru Hypothesis is that it deals with some of the shortcomings of the Information Processing Hypothesis. Instead of attempting the tortuous, costly and perhaps impossible process of collecting and processing all relevant information (within the attention constraint), the decision-maker turns to one or more Gurus. A solution is similarly offered to one of the implications of the Biased Incentive Hypothesis, namely to the problem that is caused by the existence of more than one incentive regime and, correspondingly, more than one set of 'information and knowledge'. By choosing Gurus, the decision-maker sidesteps the problem of multiple sets of 'information and knowledge'. Likewise, the Guru 'solves' the problem of uncertainty by purporting, implicitly or explicitly, to know what will happen.

Empirical Evidence:
Investing Billions of Dollars in Telecoms in the latter 1990s

Mr X is a famous investor in the US. According to *Forbes* he is amongst the richest in the US. Crucial for present purposes, he is also one of the largest investors in the Telecoms Industry in the US, having made a number of major investments in new entrant telecoms operating companies. He was personally interviewed in the US by the present author in May 2002.

Significantly, Mr X made his fortune outside the Telecoms Industry. What made him interested in the Telecoms Industry and what made him decide to commit a significant proportion of his own and his company's fortune to investment in this industry? What are the implications for the three hypotheses under investigation in this paper?

Having accumulated investible funds in his core businesses, Mr X was always searching for other areas for profitable investment. He first came into contact with the profitable opportunities being opened up by telecoms deregulation in the US when one of his companies did contracting work for the original new entrants, MCI and Sprint, who competed with the incumbent, AT&T. As a result of this experience, Mr X made significant investments in a start-up telecoms operating company. However, the business of this company was not essentially Internet-driven.

In 1995 he went through what might be described as a defining moment in the construction of the cognitive framework that would shape his thinking about the changing Telecoms Industry, the impact of the Internet, and the profitable opportunities that it provided. The occasion was a private meeting of investors at which Bill Gates was the invited speaker.

At the time, Gates himself was going through a defining moment when his own cognitive framework regarding the future of computing was undergoing a fundamental transformation. This was a time when computers were becoming linked in larger

networks. Hitherto, Gates had believed that Microsoft itself could both create and dominate these networks. This he made clear in a memorandum dated October 6, 1994 titled "Sea Change" which spelled out plans for networked computing by Microsoft.[22] However, by May 1995 Gates – influenced by Microsoft's technical guru, Nathan Myrhvold, a Cambridge University trained physicist, and younger staff in the company who were more in touch with the growing uses of the Internet on American campuses than Gates was – had changed his cognitive framework significantly. On May 26, 1995 Gates issued a memorandum, "The Internet Tidal Wave", which confirmed his conversion to the view that the Internet had become the dog, with Microsoft, after all, only its tail.[23]

Prior to this private meeting of investors, Mr X and his colleagues in his company had thought about the Internet. "We talked about the Internet substantially prior to that [meeting] but I don't know that we had a good understanding of it. We had a reasonable understanding but did not have, I don't think, what you'd call really a good understanding." The problem was not that they lacked the necessary technical background. "[Y, the top manager running the company's telecoms interests] is very able technically." However, Mr X himself lacked technical knowledge. "I'm not [technically able]. I tend to look at things from an economic standpoint and a business standpoint."

How did Mr X react to Bill Gates' comments at the meeting? "From my perspective, if Bill really thought the Internet was important and he needed to understand it, I thought it was important we needed to understand it. And I thought that because I have a lot of faith and confidence in Bill knowing and understanding a lot more about those things than I do. And with the interest that Bill had in it, I just came back and told [Y] that I thought it was something we now needed to do something about." Very shortly thereafter Mr X made one of the largest acquisitions in the US of a leading Internet-related telecoms company.

Discussion

As this important example makes clear, Mr X, a sophisticated investor with excellent technical information and advice at his fingertips - rather than making sure that he and his team themselves selected, collected and processed what they thought was all the relevant information regarding the Internet and the Telecoms Industry - instead selected another human being whom he trusted to come up with the right answers. The procedure provided important benefits. By selecting a Guru who, by assumption, had already obtained the relevant information and had processed it to arrive at the right answers, Mr X was bypassing the complex and costly process that would have been involved had he and his team attempted to do the same thing. The result was a significant economising on the costs of information selection and processing.

[22] This information is provided in a particularly illuminating special report on Microsoft in *Business Week*, July 15, 1996, pp. 38-44.
[23] Ibid.

The Cautionary Tale of Warren Buffet,
The Sage of Omaha

However, another investor, perhaps the most famous independent investor in the US, also turned his attention to the Telecoms Industry. He was Warren Buffet, the legendary 'Sage of Omaha' and one of the richest Americans. However, he came to a fundamentally different conclusion regarding the returns to investing in the Telecoms Industry: he avoided not only the Telecoms Industry but also the so-called tech sector generally.

Why was this? According to one of his close associates, personally interviewed by the present author[24], "Warren looked at [the Telecoms Industry] as a technology business and he's never really gotten into things that are involved in technology. His most recent purchase was Fruit of the Loom, which is underwear, and that's not what you'd call technology." But why did Buffet not want to invest in the telecoms and tech sectors, even when most others were doing so? "I'll try to repeat what he said. He said, 'I want to stay within my circle of competence. I really don't understand the technology business, therefore its out of my circle of competence'." As these quotations clearly imply, different people make different choices even when they are in the same situation. While some may decide to follow the advice of trusted Gurus, others may shun the same advice. Diversity of beliefs and expectations is the rule, even in times of consensual visions.[25]

Weaknesses of the Guru Hypothesis

If this account of the process involving Mr X's investment decisions (or at least some of them) in the Telecoms Industry is correct, and if it is generalisable beyond Mr X, then a further question becomes central. How is the decision made regarding which Guru to select? Once again, the answer does not appear to depend on collecting all the relevant information (within the constraints of the attention span) on all the possible Gurus that could be chosen, and selecting the most appropriate. Once again, a bypassing mechanism is used. This involves using "faith and confidence" (in Mr X's words) to make the selection. Faith and confidence provide the short-circuiting mechanism that allows for the economising of the costs of information selection and processing.

But if this is the case, then the question shifts to how this "faith and confidence" is established. By our assumption, faith and confidence are not the result of complex and costly processes of information selection and processing. Rather, there is a 'leap of faith',

[24] In May 2002.

[25] On July 8th 2002, when the telecoms bust was at its depths and some of the industry's main heroes had been slain – including Global Crossing and WorldCom – Warren Buffet announced that his main investment vehicle, Berkshire Hathaway, would join two other companies in a $500 million investment in Level 3 Communications, one of the main US alternative operators. According to the *Financial Times*, this marked "a dramatic departure from Mr Buffet's previous caution towards technology stocks". (July 8, 2002). As part of the deal, Berkshire Hathaway agreed to buy $100 million worth of 10-year convertible bonds.

a socio-psychological process, that allows the decision-maker to feel confident in his or her choice of Guru without having attempted to collect all the relevant information that might support this selection.

A further problem with the Guru Hypothesis as an explanation of the Telecoms Boom and Bust is that the hypothesis deals essentially with the mechanisms encouraging individuals to select Gurus based on the degree of faith and confidence they have in them. Less clear is why in the Telecoms Boom from 1996 to 1999 so many of the Gurus concurred with the Consensual Vision. The consensus suggests that there is also an inter-Guru process simultaneously occurring. In explaining this inter-Guru process the Biased Incentive Hypothesis may provide some illumination through an analysis of the similarity of the incentive regimes governing different Gurus. However, an explanation is still needed of why significant investors did not have faith and confidence in some potential Gurus who were operating under different incentive regimes and who refused to buy into the Consensual Vision. Where, for example, were the Guru academics who refused to go along with the Consensual Vision and its shortcomings and biases?

Further problems arise, not so much regarding the Guru hypothesis as an explanation of the Telecoms Boom and Bust, but rather as a result of the practical difficulties that may emerge from the use of a Guru. We have seen that Gurus obviate the need to process information while they provide a way (though not a rational way) of coping with uncertainty. But Gurus do not provide their followers with a way of deciding whether the 'information and knowledge' they are offering is biased or not. Indeed, precisely because their role eliminates or reduces the need of their followers to process their own information in order to arrive at their own conclusions, Gurus may be offered a screen behind which they can hide their biases. This may be referred to as Guru Hazard. There seem to be strong grounds for concluding that Guru Hazard played an important role in both the Telecoms and the Dot Com Booms and Busts.

Finally, a necessary implication of the Guru Hypothesis is that Gurus may be wrong. Unfortunately, however, their followers may have no way of knowing they are wrong until it is too late. For example, there is scant comfort for telecoms investors to read in *Business Week* that "Grubman argues that he truly believed in the stocks he recommended, even if he was wrong."[26]

COGNITIVE FRAMEWORKS

Our discussion of the three hypotheses suggests that there may be no completely reliable way for decision-makers, within the bounds of their scarce attention, to handle information in order to derive knowledge (justified true beliefs) about how their world works, what will happen in it, and what the implications are for what should be done. While there is an abundance of 'information' available (although we have also seen that

[26] *Business Week,* May 13, 2002, p. 42.

some of it may be biased) there remains a black hole with regard to the knowledge that this information implies.[27]

The selection of Gurus, it was suggested, provides one way of attempting to fill this hole. However, the unavoidable existence of Guru Hazard suggests that this way may not turn out to be particularly satisfactory.

So how do decision-makers cope with the black hole in their knowledge? The answer, it seems, is through the construction of cognitive frameworks.[28] These frameworks, based on the decision-maker's beliefs, shape the way the decision-maker understands the world and acts within it. In short, the cognitive framework fills the black hole by substituting for the information-derived knowledge (justified true belief) that, for the reasons analysed, cannot be created.

The advantage of the cognitive framework is that it allows the decision-maker to act in the world with a degree of confidence, rather than to remain inert in the face of the black hole. The disadvantage, however, is that the beliefs from which the framework is constructed are not necessarily justified by existing information and therefore are not necessarily true.[29] In short, cognitive frameworks, while serving their purpose, may be wrong. The Consensual Vision that ruled the Telecoms Industry during the crucial years of 1996 to 2000 seems to be a significant case in point.

CONCLUSION

To return to Stiglitz, why are financial markets "liable to go to extremes"? The present study of the Telecoms Boom of 1996-2002 and of the explanatory power of the three hypotheses suggests one reason (which, obviously, is not the only reason). Financial markets at times go to extremes as a result of the problems that decision-makers sometimes confront in attempting to handle information in order to derive knowledge about how their world works, what will happen in it, and what the implications are for what should be done. Some of the problems that decision-makers confront, and some of the solutions that they attempt to use, have been analysed in this paper.

All the three hypotheses imply – as the detailed discussion showed – that there is no completely satisfactory way of deriving this knowledge. However, in the absence of such knowledge the conditions are created for the possible emergence of exuberance and disillusionment. And it is this exuberance and disillusionment that can help to drive cycles of boom and bust. Accordingly, it may be concluded that the paradox of the

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[27] The philosopher, Dretske (1982), for example, argues that "information is that commodity capable of yielding knowledge" (p. 44). Knowledge, in turn, "is identified with information-produced (or sustained) belief" (p. 86). However, the three hypotheses discussed in this paper, and the Telecoms Boom and Bust more generally, deal with circumstances where the causal link between information and knowledge has been ruptured. Hence, the black hole.

[28] Elsewhere I have referred to these cognitive frameworks as visions.

[29] Of course, knowledge, in order to be 'knowledge', does not necessarily have to be justified by existing information. Karl Popper's black swans provide an example

‘Information Society’ and the ‘Knowledge Economy’ is that they do not provide the information and knowledge that is necessary to eliminate the extremes. We have little option, it seems, but to live with booms and busts as best we can.

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