

**SHAREHOLDER VALUE MAXIMISATION, STOCK MARKET AND
NEW TECHNOLOGY: SHOULD THE US CORPORATE MODEL BE
THE UNIVERSAL STANDARD?**

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Abstract

In 1992 a blue-ribbon group of US economists led by Michael Porter concluded that the US stock market-based corporate model was misallocating resources and jeopardising US competitiveness. The faster growth of US economy since then and the supposed US lead in the spread of information technology has brought new legitimacy to the stock market and the corporate model, which is being hailed as the universal standard. Two main conclusions of the analysis presented here are: (a) there is no warrant for revising the blue-ribbon group's conclusion; and (b) even US corporations let alone developing country ones would be better off not having stock market valuation as a corporate goal.

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I. Introduction: Stock market-based U.S. corporate model and the new technology¹

A little over ten years ago, Michael Porter (1992) reported on the findings of a large research project on the US financial system sponsored by the Harvard Business School and the US Council on Competitiveness. This project comprised 18 research papers by 25 leading academic experts including Larry Summers, later to become Secretary of the US Treasury and currently President of Harvard University. The central conclusion of the overall project was summarized by Porter (page 65) as follows:

“...the change in the nature of competition and the increasing pressure of globalisation make investment the most critical determinant of competitive advantage. ...Yet the US system of allocating investment capital both within and across companies is failing. This puts American companies at a serious disadvantage in global competition and ultimately threatens the long-term growth of the US economy.”

That was 1992. Today the US model -- namely that of corporate shareholder wealth maximisation subject to the discipline of liquid stock markets -- is triumphant. Some leading policy makers and economists are unstinting in their praise of this model and the financial system in which it is embedded.² Fast US economic growth since 1995, compared with the relatively sluggish performance of Japan and the EU, seems to have changed the perception of many economists about the relative effectiveness of different national economic systems. In this new comparative evaluation, certain economists are scathing about the European financial and corporate governance systems. Kay (2003), a British economist, reported recently on a published symposium on the European economy in *American Enterprise* (December 2002). He suggested that the following statement by Mark Steyn accurately summarized the tenor of the whole debate. “I find it easier to be optimistic about the futures of Iraq and Pakistan than, say, Holland or Denmark. What’s wrong with the Islamic world is relatively straightforward. With Europe, it’s harder to foresee any happy endings.” (page 19).

Turning to the stagnating Japanese economy and to the recent Asian crisis, in these pro-Anglo-Saxon model analyses, both are blamed essentially on the Asian way of doing business.³ The latter, it is suggested, is marred by crony-capitalism, which arises from the close relationship between government, business and the financial sector. Similarly, the East Asian crisis is blamed on alleged poor corporate governance, relationship banking and lack of competition that are said to characterize these economies.⁴

In view of the supposed US success in ICT technology, which is thought to be reflected in the observed trend increase in US productivity growth over the last decade, many economists have emphasized the positive role of the stock market in promoting technological development.⁵ The huge investment in new technology firms in the US during the technology boom of the 1990s, despite their zero or negative short-term profits, is regarded as an obvious refutation of the short-termism alleged by the stock market's critics. Further, there are some theoretical models that indicate that stock markets may be better than bank-based systems at choosing technological winners (Allen, 1993; Allen et al., 2004). Other aspects of the stock market-based US financial system, namely incentives, rewards and punishments, are thought to be highly supportive of technological development. Specifically, the widespread use of stock options as a means of payment to those who work for new technology companies is said to help to align the interests of managers and employees with those of shareholders, leading both to greater rewards for innovation and greater social efficiency. These rewards derive in part from the existence of an "exit mechanism" for venture capital, provided by the US financial system in the form of IPOs and take-overs. Both avenues are thought to improve enormously the rewards for innovations, compared with other financial systems that do not have such mechanisms.⁶ Last, but not least, the takeover mechanism on the US financial market, that allows for hostile acquisitions is considered to be particularly helpful in the selection process, that is, in being able to discriminate between useful technologies which increase shareholder value and those which do not.

Larry Summers, who in the past was critical of the short-term focus of the US stock market, now suggests that "increasing pressure for performance for shareholders" has played a crucial role in the U.S. economic success. He observes: "I think our financial markets should get a lot of the credit for forcing money out of the traditional management and entrenched corporations, and preventing what would have been negative internal rates of return on investments." He goes on to point out that the pace at which companies mature has greatly increased: "On conventional estimates it used to take five years to build a business to the point at which venture capital would be entering. Now it's less than a year." Similarly, Martin Feldstein, President of the National Bureau of Economic Research, suggests that "it may be that the nature of this technology is particularly favourable for the US, there are all kinds of facilitating characteristics here – the venture capital market, incentive-based rewards for the managers."

Apart from these positive perceptions of the virtues of the stock market and the US financial system, in the adoption and diffusion of new technology, some scholars go further, positing an ‘end of history’ type assessment of US corporate model: the US system is deemed to represent the “ultimate” legal and financial system and all other national systems will need to converge towards it (Hansmann and Kraakman, 2001). Gugler et al (2004) also emphasise institutional and organisational competition between different countries in the era of globalisation and come to the view that the US system is economically more efficient than others, and will therefore tend to replace the latter. While they do not go as far as Hansmann and Kraakman, they do suggest that there will be convergence for the large multinational corporations. These will all become listed on the New York stock market, wherever the location of their headquarters, providing corporations with a cheaper external source of capital than that available to companies listed elsewhere. National stock markets will continue to exist in a number of countries, Gugler et al go on to suggest, because of path dependence but will find that such markets are only able to list small domestic companies.

International financial institutions (IFIs) – the World Bank and the IMF – routinely recommend to developing countries (DCs) the US system of corporate governance as well as a stock–market based financial system.⁷ Denying any ideological bias the IFI suggest that it is the perceived benefits of the US system in terms of efficient risk-sharing, allocation of resources and technological development, which leads them to this prescription.

In this paper we critically examine the implications of these prognostications. We shall start with the question, whether the experience of the US economy and its financial system during the last ten years should lead to the complete reversal of the conclusions reached by Michael Porter and his colleagues in 1992. Does the so-called post-1995 “new” US economy constitute a conclusive proof of the superiority of the country’s financial system over all others? What precisely is the nature of the relationship between the “new” economy, adoption of ICT technologies and the financial system? Is there adequate analysis and empirical evidence to indicate that the Anglo-Saxon model of corporate governance outlined above is the one which all countries, including developing ones, should adopt?

A main objective of this paper is to ask in the light of the answers to the above question, what kinds of corporate governance, and financial system in general are most likely to promote technological change, industrial and economic development in emerging countries. At an analytical level the paper focuses on two market processes which are central to stock market efficiency and

effectiveness, namely (a) the pricing process; and (b) the takeover mechanism. Relevant theory and available empirical evidence on (a) and (b) will be reviewed with emphasis on the experience of the last decade.

It may be useful to note that for reasons of space only a few, crucial aspects of the financial system are being considered here, namely the incentives the financial system provides for those who manage the corporations to pursue particular objectives, and what constraints are they subject to; how efficient is the system in allocating resources, in promoting technological progress and developing new industries and firms. The question of the effects of the financial system on economic stability is touched upon but not fully explored here; other features of the financial system such as meeting consumer demand for credit, for household mortgages at least cost or issues related to the banking system lie outside the scope of this paper (Allen et al 2004; Allen and Gale 2000).

The paper is organised as follows. Section 2 examines the relationship between the financial system, adoption of ICT technology and the aggregate performance of the US economy, reviewing specifically the experience of the last 10 years. Section 3 broadens the research to other countries and considers the experience of 63 developed and developing countries, some with financial systems similar to those of the US and others with distinctly different ones, specifically its focuses on the hypothesis that stock market-based economies are particularly conducive to the adoption of ICT technology. Section 4 considers alternative analyses of mispricing on the stock market – the role of the analyst vs that of the managers and examines the significance of the agency problem, irrational exuberance and other relevant factors. Section 5 examines the implications of the analyses for developing country corporations and provides a brief conclusion.

Although it is giving away the plot it may nevertheless be helpful to the reader to know the main conclusions towards which the analyses of this paper will lead:

- The experience of the 1990s and 2000s on the US capital market provides little justification for revising Michael Porter's unfavourable verdict of 1992 on resource allocation by these markets, although the reasons for this are not necessarily the same now as were then.
- Secondly, the analyses of this paper suggests that instead of maximising shareholder wealth developing country corporations should pay no attention at all to their market valuations.
- Thirdly, these corporations would be better off pursuing their traditional objective of increasing market share or corporate growth within the overall framework of the country's industrial policy.

- Thus, fourthly the stock market-based model of shareholder wealth maximization does not represent the ‘end of history’. In the first decade of the 21st century this system has been subject to substantial corrective regulation but is far from certain that these regulations would greatly improve the efficiency of the pricing system or the take-over mechanism.

II. The U.S. financial system and ICT: the case of the critics

In the introductory section we have outlined what are regarded as the strengths of the U.S. financial system in fostering technological development, and specifically its role in relation to the adoption and spread of ICT. At the macroeconomic level, as noted earlier, the U.S. has achieved a trend increase in productivity growth since 1995 which leading students of the subject attribute to the widespread usage of the new technology. Initially there was some controversy whether the observed productivity increase was a cyclical or long-term phenomenon. With the passage of time this issue has been resolved and there is a broad consensus that the ‘new’ economy does have a faster long-term rate of productivity growth⁸.

However, the debate about the financial system is far from being over. This is because the precise links between the stock market and ICT diffusion are not obvious, particularly in view of the boom and bust of technology stocks, both of which characterise the last 10 years or so of stock market history. At an elementary analytical level, it may be observed that the merits of the stock market system in relation to technological development outlined in section I depend crucially on the nature of the stock market pricing process and the actual prices which emerge from this process. If share prices always accurately and exclusively reflected the true long term expected profitability of firms (including the effects of new technology), the case for the virtues of the stock market system will have a more solid basis. Orthodox financial economists believe this would indeed be the end result of a postulated pricing process based on rational expectations of investors who have similar beliefs about the future prospects of companies. Actual prices generated by such a process of buying and selling of shares on the stock market, it is thought, will generate prices which obey the so-called efficient market hypothesis.

On the other hand, the prices may well be generated by an altogether different processes where investors base their decisions on irrational exuberance and are motivated by speculative profits and other psychological factors.⁹ The basic mechanism of such an alternative pricing process is neatly described by Keynes’s famous beauty contest analogy. Keynes (1936) observed in Chapter 12 of the *General Theory* that

professional investment may be likened to those newspaper competitions in which the competitors have to pick out the six prettiest faces from a hundred photographs, the prize being awarded to the competitor whose choice most nearly corresponds to the average preferences of the competitors as a whole; so that each competitor has to pick, not those faces which he himself finds prettiest, but those which he thinks likeliest to catch the fancy of the other competitors, all of whom are looking at the problem from the same point of view. It is not the case of choosing those which, to the best of one's judgement, are really the prettiest, nor even those which average opinion genuinely thinks the prettiest. We have reached the third degree where we devote our intelligence to anticipating what average opinion expects the average opinion to be. And there are some I believe who practise the fourth, fifth and higher degrees. (Keynes, p.156)

Which of the above two views of the stock market pricing process accords more with the prices observed in the real world is a crucial question. Not surprisingly, it is also a controversial one. In interpreting empirical evidence on this issue, Tobin (1984) makes a useful distinction between 'fundamental valuation efficiency' and 'information arbitrage efficiency'. When financial economists claim that stock prices are 'efficient', this claim can only normally be sustained with respect to the latter concept of efficiency. This simply refers to the fact that all information is rapidly circulated in the market, any new information is more or less immediately discounted by market players so that no gains are to be made from any publicly available information. There is however no necessary correspondence between this information arbitrage efficiency and fundamental valuation efficiency. The latter refers to the extent to which relative share prices of firms reflect their relative long-term expected profits. It is the fundamental efficiency which is salient if stock prices are to perform their task of efficiently allocating resources in the economy as a whole. There are a number of theoretical models as well as empirical evidence which suggest that share prices often depart from fundamentals for prolonged period, being influenced by whims, fads, fashions and irrational pessimism or exuberance.¹⁰

In the eyes of the critics of the stock market, the relationship between the new economy and the stock market, rather than being regarded as a virtue of the American financial system in facilitating the infusion of new technology, becomes, instead, a cause for concern. There is a wide range of evidence which suggest that during this last decade US share prices have not been efficient in the fundamental valuation sense. This is particularly so with technology stocks. Consider NASDAQ which has been the main market for technology company shares. In 1995 the NASDAQ index stood at 1052.1 and by 1998 the index had doubled in value to 2192.7. In the next 12 months, it nearly doubled again to

4069.3 (31 December 1999). At its peak in March 2000, the index stood at 5060.3 (10/03/00). Over the next 3 years NASDAQ crashed to 1335.5, less than a fourth of its value at its peak. NASDAQ index stood at 2175.4 on 31 December 2004, still less than half of its peak value, more than five years ago.

This pattern of share price movement on NASDAQ looks *prima facie* like a classic share price bubble, followed by a bust. These prices could not be efficient in the fundamental valuation sense, simultaneously both at the top of the boom and in the trough. This is because there was ample evidence that there was no change of the required magnitude in the economic fundamentals during this period. True, the US economy had a small trend increase in long-term productivity growth rate, but there were no dramatic changes in the growth of corporate earnings and dividends. While the share prices soared, the latter continued to expand at their normal far slower pace (Shiller, 2000).

According to the Federal Reserve Bank of San Francisco, technology companies in the U.S. accounted for only 7% of total stock market value in 1990 but by March 2000 this share had risen to 36%, a fivefold increase. However, the share of employment accounted for by the technology companies rose from 6% in 1990 to only 9% in March 2000, while their share of sales increased from 6% to 10% in the same period.¹¹ Even though technology companies had faster sales growth than old economy companies, the latter had faster earnings growth. This again suggests the bubble nature of the technology stocks during the 1990s boom.

There is further important evidence which points in the same direction. Shiller (2000) carefully constructed data on real price-earnings ratios in the U.S. economy over a long time period, from 1881 to 2000. During the 1990s stock market boom that began in 1992 and gathered pace during the late 1990s, the average real price-earnings ratio reached a value of 44.3 in January 2000. This compares with a peak value of 32.6, the highest ever recorded before, reached in September 1929 on the eve of the Great Depression. After this earlier peak, the S&P index fell by 80 per cent in the next three years and did not regain its 1929 value until 1958.

Most, but by no means all, economists regarded such valuations of technology stocks in the boom period to be unrealistic and as representing a stock market bubble. This is perhaps brought home more clearly by taking a closer look at some of the individual stocks rather than the market averages. The data for 1995-2000 on share prices and profits of the foremost icon of the new economy, Amazon.com, indicate that while the share price of the company was rising rapidly during this period, it was making increasing losses in each successive

year. Another case that depicts even more vividly the irrational exuberance and speculative character of stock market prices for technology companies is that of a recent British IPO, in 2002. The *Financial Times* (September 22, 2000) observed:

It is often an amusing, if futile, exercise to read the ‘investment considerations’ section of a prospectus. In the case of Arc International, the customisable chip designer, this ran to nine pages and advised investors that the company had never made, and might never make, a profit; that if it did that profit might not be sustainable; that revenues were likely to be volatile, unpredictable and subject to factors outside the company’s control; that all manner of dreadful things could happen that would have a material adverse effect on the company and its share price; and that anyone buying the shares would ‘experience substantial and immediate dilution in the net tangible book value of their investment.

Investors in technology stocks are made of stern enough stuff to set aside such dire warnings, and the falls in the sector since the bookbuilding exercise began two weeks earlier. Knowing what happened to other chip company floatations, they were not going to miss this one. The issue was a great success and yesterday the shares more than doubled in first dealings.

Shiller (2000) considered a wide range of structural factors that could justify the high price-earning ratios in the 1990s boom in terms of fundamentals. He specifically examined the role of the internet, the baby boom and other factors such as the decline of inflation and the growth of mutual funds and found that none of them individually or collectively provided a satisfactory explanation for the observed rise in the average price-earnings ratio.

The prices of technological stocks, apart from being speculative, are also highly volatile. If NASDAQ companies are regarded as the ‘new economy’ and the Dow Jones corporations as the ‘old economy’, the NASDAQ indices are considerably more volatile than Dow Jones or S&P 500. Share price volatility is however a negative feature of stock markets for several reasons. First, it reduces the efficiency of the price signals in allocating investment resources. Secondly, it increases the riskiness of investments and may discourage risk-averse corporations from financing their growth by equity issues and indeed from seeking a stock market listing at all. Thirdly, at the macroeconomic level, a highly volatile stock market may lead to financial fragility for the whole economy (Singh 1999, 2000).

Apart from this mispricing of share and share price volatility, the critics of the stock market-based US corporate system also call attention to what they regard as two other major negative features of the system. They point out first that in addition to the upsides discussed in section I, there are also important downsides to the use of stock options as a means of payment to employees in the new economy. It is now widely acknowledged that stock options in the bubble economy encouraged over-reporting of earnings by managers that resulted in consequent over-pricing of shares. In addition, stock options have also been associated with the increased income inequality in the U.S. in the last decade. Although this rising income inequality may be attributed to a number of factors (e.g. globalisation, skill biased technology), the growing use of stock options has also contributed. This is particularly so in relation to the widening income gap between the top ten per cent and the median.¹²

The other big negative feature of the stock market, in the eye of the critics, concerns the take-over mechanism. We saw in section I that the proponents of the US model regard it on the contrary as a virtue which is not available to Germany and Japan, thought to be much to the detriment of these two economies. However, critics point to both analysis and evidence to suggest that the stock market selection process (via the takeover mechanism) in the real world is far from being efficient in the sense that it does not select for survival high performing firms and punish the poor performers. Evidence suggests that the takeover selection process in the market for corporate control works only to a limited extent on the basis of profitability and stock market valuation but operates to a much greater extent on the basis of size. A large but relatively unprofitable firm has a greater chance of survival than a small profitable company (Singh 1975, 1992; Meeks 1977 and Hughes 1991; Tichy 2001).

One issue which is raised by the extremely high valuation of the New Economy relative to the Old Economy stocks is that the market has supplied far too much capital to new technology firms that they cannot use it productively in their own enterprises. To some extent it will be conspicuously consumed or fuel a take-over binge on the part of the New Economy firms, a good example being the takeover of Time Warner by America Online. Some may think that is as it should be – by this means the New Economy is able to increase the efficiency of the Old. However, it is far from certain that the managers of the New Economy firms will even know how to run Old Economy businesses, let alone enhance their efficiency. It is more than likely that the net effect of the New taking over the Old may be considerably negative for both firms and for the economy as a whole.

Similarly, Jensen (2003) drew attention to Nortel, a US corporation, to warn of the dangers of resource misallocation arising from takeovers by companies with overvalued equities. He reported that between 1997 and 2001, Nortel acquired 19 companies at a price of more than \$33 billion and paid for many of these acquisitions with Nortel stock, which had increased dramatically during that period. When the company's price fell 95 percent in the technology stocks bust, all the acquisitions were written off. Jensen observed "Nortel destroyed those companies and in doing so destroyed not only the corporate value that the acquired companies – on their own – could have generated but also the social value those companies represented in the form of jobs and products and services."

To sum up, the analytical case for a stock market economy as being particularly conducive to fostering technical change is far from being unequivocal. The analysis and evidence reviewed above suggests that the stock market based U.S. financial system has both positive and negative features in relation to promoting technological change. There is yet inadequate data to arrive at firm conclusions on this issue. However, the broad controversy over the question of the superiority of the US stock market-based corporate system over all the others cannot be resolved on the basis of the experience of the U.S. alone. It is necessary to consider other countries both with systems similar to those in the U.S. (such as the U.K., Canada, Australia, etc.) and those that possess markedly different systems (Japan, Germany, continental Europe). With respect to the policy question as to which advanced country system, if any, is more suitable for developing countries to emulate, it is also necessary to consider the actual developmental or growth records of these countries so far. Such quintessentially empirical questions are considered below in a preliminary way on the basis of data for a large group of emerging and developed country markets.

III. ICT and the Stock Market: A Preliminary Inter-country Empirical Analyses

This section will empirically investigate the relationship between stock market development and the development and usage of ICT technology on the basis of data for a large number of developed and emerging market economies. The full sample used in this survey contains observations from 63 developed and developing countries on fourteen variables. Three variables, averaged over the 1990-1995 period, relate to economic output and growth (GDP, GDP growth and GDP per capita); five variables, also averaged over the 1990-1995 period, relate to stock market development (market capitalisation, market capitalisation as a percent of GDP, value traded, the inverse of the turnover ratio, and the number of listed companies). ICT development and usage are represented by

six variables that are taken from the late 1990s: mobile phones, personal computers, and internet hosts, respectively, per 1000 people; high technology exports as a percentage of manufacturing exports, scientists and engineers in R&D, and a composite index of ICT development and usage.

The variables relating to the level of production and its growth are *a priori* important determinants of ICT development. Economic analysis would suggest for example that other things being equal, countries with higher levels of per capita GDP would have a higher degree of ICT development. Similarly, we might expect countries with a higher rate of GDP growth should have higher investment rates and thus, *ceteris paribus*, greater ICT development. We would also expect some disjuncture between the GDP per capita variable on the one hand and GDP growth on the other. Theory suggests that less developed countries further behind the technological frontier can achieve, *ceteris paribus*, higher growth rates than countries at the frontier since they can take technology “off the shelf” and dramatically improve their productivity and growth. At the frontier, countries are limited to more marginal improvements in technology that can generally be expected to have only smaller effects on the growth rate. It is quite possible that the ICT “revolution” is different and may have a greater effect on labour productivity in advanced countries but it remains to be seen how large this turns out to be.

Regarding the stock market data, empirical studies have shown that these indicators are the best for revealing the extent and depth of equity market development. Market capitalisation is the market value of all the companies traded on the stock exchange, while value traded is the total value of equities traded on the exchange in a given year. The turnover ratio combines both variables – it is defined as the ratio of value traded to market capitalisation – and thus provides a measure of liquidity in the market (please note that we have used the inverse turnover ratio in this paper, therefore the higher the value the lower the turnover and liquidity). It is claimed to be a more important variable than the market capitalisation to GDP ratio as a determinant of the level of development of the stock market since it measures the degree to which easy entry and exit from the market is possible. Given the greater sophistication of developed country markets and in particular their more efficient and streamlined order and payments systems, we would expect this variable to be negatively related to per capita GDP (that is, the inverse turnover ratio decreases – markets become more liquid – as per capita GDP increases). Market capitalisation as a percentage of GDP indicates the relative size of the stock market in relation to the national economy, but this variable is found to be a less reliable guide to the extent of stock market development than the turnover ratio (see Levine 1997). The number of listed companies is another indicator of stock market

development and one that is particularly important in the context of ICT development since it gives an indication of the number of IPOs.

As noted above, the development and usage of ICT technology is reflected in a set of six variables. The first three variables capture the use of mobile phones, personal computers and internet hosts per 1000 people in the population. We would expect these variables to be highly correlated with GDP per capita. High technology exports as a percentage of manufacturing exports is a rough measure of the sophistication of the country's technological base. We would expect in general a positive – though not necessarily linear – relationship between high technology exports and per capita GDP. The relationship may not be exact because multinationals from OECD countries have significantly expanded their production platforms in emerging market economies (such as, for instance, Malaysia) from which they export to developed countries. The number of scientists and engineers in research and development also provides a measure of the sophistication of the country's technological base and can be viewed as an explanatory variable that helps determine the degree of ICT development.

The final variable, the “ISI score”, is a composite index based on four broad categories measuring ICT infrastructure development and informational and social freedom compiled by the Information Society Index. Table 1 presents the 23 variables in the four main categories that comprise the index - computer, information, internet and social infrastructure. The broad scope of this composite variable make it an excellent measure of the relative standing of countries in ICT technology and thus an effective dependent variable with which to test the determinants of ICT development.

Table 1. Variables included in the ISI composite index

Computer Infrastructure	Information infrastructure	Internet Infrastructure	Social infrastructure
<ul style="list-style-type: none"> • PCs installed per capita • Home PCs shipped per household • Government and commercial PCs shipped per non-agricultural workforce • Educational PCs shipped per student and faculty • Percent of non-home networked PCs • Software vs. hardware spending 	<ul style="list-style-type: none"> • Cable subscribers per capita • Cellular phone ownership per capita • Cost for phone call • Fax ownership per capita • Radio ownership per capita • Telephone line error rates • Telephone lines per household • TV ownership per capita 	<ul style="list-style-type: none"> • Business Internet users per non-agricultural workforce • Home Internet users per household • Education Internet users per student and faculty • ECommerce spending per total Internet users 	<ul style="list-style-type: none"> • Civil liberties • Newspaper readership per capita • Press freedom • Secondary school enrolment • Tertiary school enrolment

Source: ISI website at <http://www.worldpaper.com>

Table 2 gives the median values of each of the main variables classified by per capita incomes of countries. Overall the table indicates that there is a close relationship between per capita income and most of the variables representing ICT development. There also seemed to be a generally positive relationship between per capita income and stock market variables. To supplement these informal impressions, we investigate a bit more formally the relationship between the variables measuring ICT development and those pertaining to stock market development by means of multivariate regression analysis. The latter controls for the effects of the level of the per capita GDP and that of GDP growth. The following simple linear regression model was fitted to cross-sectional data from 63 countries including both emerging markets and developed economies. The choice of countries was dictated entirely by the availability of data.

$$\begin{aligned}
 \text{ICT development indicator} &= \beta_1 \text{constant} \\
 &+ \beta_2 \text{GDP growth rate} \\
 &+ \beta_3 \text{GDP per capita} \\
 &+ \beta_4 \text{number of scientists and engineers per 10,000} \\
 &+ \beta_5 \text{stock market capitalisation ratio} \\
 &+ \beta_6 \text{reciprocal of the turnover ratio} \\
 &+ \beta_7 \text{number of listed companies} \\
 &+ U \text{ random error term}
 \end{aligned}$$

This equation was fitted successively with each of the five indicators of ICT development as a dependent variable, i.e., (i) mobile phones per 1000 population; (ii) personal computers per 1000 population; (iii) internet hosts per 1000 population; (iv) high-technology exports as a per cent of manufacturing exports; and (v) ISI scores.

For each of these dependent variables, four regression equations were fitted - one with all the independent variables listed above and the three others, each successively keeping only one of the three stock market variables as an explanatory variable and dropping the other two. The reasons for adopting this procedure is that the three variables are correlated and it may be difficult to isolate the influence of each one when they are considered together in the same equation. Therefore 20 separately specified regression equations were fitted to the data.

Table 2. Median values for quartiles for full sample

	Low income (<\$1566)	Middle income (\$1566 < x <\$4181)	Rich (\$4181 < x <\$18181)	Very Rich (\$18181 < x \$36466)
GDP (US\$m.)	34511.8	43264.8	82748.2	281994.8
GDP growth	4.20	3.55	5.60	1.45
GDP per capita	634.62	2959.79	9609.72	25379.28
Market Capitalisation (US\$m.)	0.17	0.15	0.27	0.41
Market Capitalisation/GDP (US\$m.)	3477.58	6049.75	20547.17	170494.25
World Trade Value (US\$m.)	555.10	1879.67	5057.83	63143.25
Turnover Ratio (inverse)	9.0	6.3	3.3	2.4
Number of Listed Companies	145.6	120.8	168.8	237.8

The flavour of the results is best conveyed by the estimated values of the equation, reported in Table 3. This is the preferred model from the economic point of view as the dependant variable is the composite index of ICT development - ISI scores. The table shows a good fit for the regression model with an adjusted R^2 of 0.892. However, the only statistically significant variable at 5% levels or less is the 'scientists and engineers'. GDP per capita is significant at the 10% level. None of the stock market variables are significant and one of them (number of listed companies) has the wrong sign. The successive dropping of two of the three stock market variables, in other specifications, does not alter this picture.

However, the full estimated linear regression equation in Table 3, despite its high R-square, yields poor diagnostics. The latter indicate that the Cook-Weisberg test for heteroscedasticity rejects the homogeneous variance hypothesis for this data. Similarly, the RESET test indicates specification error in the fitted linear regression equation. Tests for the presence of multi-collinearity was however more satisfactory. Multi-collinearity was tested by calculating various inflation factors (VIF) for the relevant variables. The results were within the acceptable range.

Table 3. Regression Results: Dependent variable - ISI scores

Explanatory Variables							
	(Constant)	GDP growth rate	GDP per capita	Scientists and Engineers in R&D per 10,000	Market capitalisation as % of GDP	Turnover ratio (inverse)	No. of Listed Companies
B	1238.544	-28.334	3.95E-02	6.30E-01	2.66E+00	-41.175	-4.36E-03
Std. Error	280.834	34.082	0.02	0.149	1.82	30.518	0.057
T	4.41	-0.831	1.975	4.225	1.46	-1.349	-0.076
Significance	0	0.412	0.057	0	0.155	0.187	0.94
<i>R</i>	0.954						
<i>R</i> ²	0.91						
<i>Adjusted R</i> ²	0.892						
<i>Standard error</i>	473.3509						
	(Constant)	GDP growth rate	GDP per capita	Scientists and Engineers in R&D per 10,000	Market capitalisation as % of GDP	Turnover ratio (inverse)	No. of Listed Companies
B	971.037	-7.748	4.90E-02	6.06E-01	1.90E+00		
Std. Error	195.934	30.257	0.018	1.706	0.139		
T	4.956	-0.256	2.729	4.373	1.114		
Significance	0	0.8	0.01	0.274	0		
<i>R</i>	0.951						
<i>R</i> ²	0.904						
<i>Adjusted R</i> ²	0.892						
<i>Standard error</i>	472.0871						
	(Constant)	GDP growth rate	GDP per capita	Scientists and Engineers in R&D per 10,000	Market capitalisation as % of GDP	Turnover ratio (inverse)	No. of Listed Companies
B	1194.206	-9.122	4.34E-02	6.38E-01		-2.74E+01	
Std. Error	276.474	31.382	0.019	0.14		28.927	
T	4.319	-0.291	2.27	4.567		-0.949	
Significance	0	0.773	0.03	0		0.35	
<i>R</i>	0.95						
<i>R</i> ²	0.903						
<i>Adjusted R</i> ²	0.891						
<i>Standard error</i>	474.528						
	(Constant)	GDP growth rate	GDP per capita	Scientists and Engineers in R&D per 10,000	Market capitalisation as % of GDP	Turnover ratio (inverse)	No. of Listed Companies
B	1001.634	2.175	5.05E-02	6.09E-01			1.36E-02
Std. Error	198.244	29.512	0.019	0.15			0.057
T	5.053	0.074	2.675	4.068			0.239
Significance	0	0.942	0.012	0			0.812
<i>R</i>	0.949						
<i>R</i> ²	0.901						
<i>Adjusted R</i> ²	0.888						
<i>Standard error</i>	480.7237						

To remedy the specification fault, non-linear terms – squared terms for GDP per capita and for Scientists and Engineers - were added to the equation, and heteroscedasticity was tackled by suitable transformation so as to yield robust standard errors. The regression results with robust standard errors are reported in Table 4. All the diagnostic tests for this particular specification of the equation (see the bottom half of Table 4) are favourable.

The results of the estimated regression equation in Table 4, which in economic, as well as now in statistical terms, is the favoured equation, suggest that GDP per capita is in fact significant at the 2% level; GDP per capita squared is almost significant at the 5% level but has a negative sign; the variable Scientists and Engineers is now significant at the 10% level; the squared term for this variable has a negative sign but is insignificant. Importantly, none of the stock market variables are significant. Overall it may be concluded from the analysis carried out so far that inter-country data provide little evidence of any robust relationship between stock market development and ICT development and usage.

TABLE 4 - ICT Regression and Diagnostics (including both square terms)

ICT	Coef.	Robust Std. Err.	t	P> t	[95% Conf.Interval]	
gdpq	12.95908	22.61307	0.57	0.571	-33.3617	59.27986
gdp_pc	0.1225224	0.0363209	3.37	0.002	0.0481223	0.1969224
gdppc_sq	-2.32e-06	7.79e-07	-2.97	0.006	-3.91e-06	-7.20e-07
scientists	0.8680147	0.2990578	2.90	0.007	0.2554226	1.480607
scientists~q	-0.0000695	0.0000633	-1.10	0.281	-0.0001991	0.0000601
mkt_cap	-0.0001092	0.0001478	-0.74	0.466	-0.0004119	0.0001934
inv_turno	-14.70296	20.25528	-0.73	0.474	-56.19402	26.7881
num_lcomp	0.1007769	0.0900282	1.12	0.272	-0.0836375	0.2851914
_cons	616.3845	195.8228	3.15	0.004	215.2596	1017.509

DIAGNOSTICS

Regression with robust standard errors :

Number of obs = 37
 F(8, 28) = 92.54
 Prob > F = 0.0000
 R-squared = 0.9528
 Root MSE = 354.02

Ramsey RESET test using powers of the fitted values of ICT-

Ho: model has no omitted variables
 F(3, 25) = 1.72
 Prob > F = 0.1894

The Variance Inflation Factor (VIF) tests for multi-collinearity was within the acceptable range.

IV. The Stock Market, the US Corporate Model and Shareholder Wealth Maximisation

As a consequence of (a) the faster long-term growth rate of output and productivity of the US economy over the last decade, and (b) the supposed US lead in ICT adoption and diffusion, the stock market has acquired a new legitimacy. However, as explained earlier, these ten years have also witnessed the boom and bust of the share prices of technology companies. This makes it extremely difficult to attribute (a) and (b) to the stock market.

Jorgensen (2001, 2003) has presented evidence to suggest that faster US productivity growth after 1995 can be attributed to a considerable extent to increased capital input and increased investment in IT. However, a faster rate of capital formation and greater investment in ICT technology could arise from factors which have little to do with the stock market. Jorgensen for example suggests that the accelerated fall in the price of semi-conductors (as a result of the shortening of the product cycle from 3 to 2 years due to greater competition) was a major factor in increased investment in IT. Similarly changes in taxation could also play a role in influencing corporate investment decisions independent of the stock market. Further it will be appreciated that the IT technology, the stock market and the venture capital funds were all there before 1995 but this did not lead to a huge increase in investment overall or in IT. The stock market bubble of 1995-2000 may have influenced investment decisions but that would be expected to be in the direction of over-investment. It could be argued however, that although such investment may not be optimal from a private individual perspective but these nevertheless may be socially useful. This argument is in principle valid but there exists little systematic empirical evidence to support or to deny it. In addition, the stock market bust in 2000 would have discouraged investment in IT.

Jorgenson's research also indicates that the US is not the only country to benefit from IT investment. Other G7 countries, including Japan have also experienced large increases in investment in IT. In Japan and a number of other countries, the stock market does not play a significant role in influencing investment decisions. To sum up, although during the period of the bubble the stock market may have played some positive role in encouraging IT investment, its net contribution is unlikely to have been positive for all the reasons (for example, the downsides of the stock options and the takeover mechanisms) examined in section 2.

Even leading finance economists including Prof. Jensen (2003) accept that in contradiction of the efficient market hypothesis, during the last decade there has been large scale mispricing of shares on the US stock market. This raises the following questions: what are the reasons for the mispricing, what are its

consequences, what are its implications for the US corporate shareholder wealth maximisation model. Jensen suggests that overvaluation during the stock market boom arose from the agency problem and the fact that the managers were generally ignorant of the overvaluation problem. He believed that the market analysts whose exaggerated expectations managers tried to fulfil during the technology boom were also a part of the problem. However, he suggests that the corporate managers should have acted as readily against overvaluation as they do in relation to the undervaluation of their shares. He believes that a dialogue between the managers and the analysts would cure the market of inefficient pricing.

An alternative Keynesian view is that mispricing of shares is inherent in the share price determination process as many stock market players base their investment decisions not on the basis of fundamentals but rather on speculative and gambling considerations. If this view is correct as extensive evidence presented or cited in this paper suggests, shareholder wealth maximisation is not a useful objective for corporate managers. With an inefficient pricing such a process could lead to perverse results favouring those who are inefficient rather than those who are efficient. Kay (2003) therefore rightly suggests that corporate managers should pay no attention to the stock market at all and indeed the creation of shareholder value should not be a corporate goal. Corporate managers should concentrate on product market competition and leave the stock market alone. He offers the following analogy for this root and branch dismissal of the US corporate model: speculation in company securities, like betting on horses is something which is impossible to prevent even if it were desirable to do so. But the horses in the race should compete against each other as best as they can with as little regard as possible to the punters outside (page 20).

V. Implications for Developing Countries

If developed country markets, which are mature, have extensive private and publicly provided information and are prudentially regulated but are still subject to such gross mispricing, emerging stock markets with greater deficits in all these areas, may be expected to do even worse. They are under-regulated, are deficient in information gathering and disseminating private or public organisations. As listed firms do not have long enough records to form reputations, it leads to arbitrary pricing of shares. The net result of all this is the observed high degree of volatility in prices. Further, the experience of the Asian crisis indicates that in a crisis the stock market is likely to interact in a negative feedback loop with the market for foreign currency generating basically a meltdown in the financial sector, if not the economy as a whole.¹³ Lest this may be regarded as an exaggeration, recall the experience of Indonesia. Between

September 1997 (the time it had received an accolade of good management from the IMF) and December 1997, the share price in the stock market fell by 80% and the value of the Indonesian currency on the foreign exchange market also fell by about 80%, making the fall of share prices in dollar terms a huge 96%. For these and other reasons, mispricing of shares on third world stock markets is likely to be even more severe than in advanced countries. In these circumstances, shareholder value maximisation is not at all a sensible objective either from a corporate or a social perspective.

At this point it may be useful to ask whether the downgrading of the stock market value as is being suggested here will lead to reduced technical progress, to the extent that venture capital markets may be regarded as essential to faster technological development. However, venture capital, although normally associated with stock markets, is not peculiar to stock-market-based systems. It is also found in bank-based systems and is at one level an age-old phenomenon: people with money providing finance to high risk businesses to gain large rewards when they back an enterprise that becomes subsequently successful.

The high growth, high risk firms, which normally disproportionately consist of high technology enterprises, of the kind financed by venture capital funds, have usually been funded by governments in many developing and developed countries. The East Asian developmental states have been prime examples of providing finance for such ventures. Through an active and interventionist industrial policy, the Korean government obliged its firms to introduce new products and industrial processes through a mixture of carrots and sticks. However, it took the view that in the context of underdevelopment, such technical change is more likely to occur through the creation and expansion of large firms rather than through small start-ups. The Korean government effectively became a co-partner with these large enterprises (the *chaebol*) in financing high risk projects, effectively socialising the risks involved (see further Singh 1998). Many other governments both in rich and poor countries have directly assisted technological development and essentially acted as venture capitalists for the new technology firms. These include countries like France, Israel and India, all of which have been relatively successful in ICT development.

The government of Israel has encouraged technological development through direct aid to the venture capital industry. The state not only created the infrastructure - a high quality labour force - but also provided direct assistance for promoting technological change. In 1991 the government introduced a special program of “technological incubators” which provided prospective entrepreneurs with physical premises, financial resources, tools, professional

guidance and administrative assistance. Enterprises under this scheme could receive 85 per cent of the approved budget subject to a maximum of \$160,000. The money was, however, given for only two years after which the companies had to leave the incubator and become self-sustaining (UN, 1999, p. 214). A similar scheme was implemented in France with the government creating twelve biotechnology incubators to commercialise research produced by government scientists. Government policies, often taking the form of direct assistance, have also played a major role in encouraging ICT development in Singapore and India.

The Indian case is particularly interesting because despite very low per capita income and blanket import substitution policies, the country has managed to create a world class information technology industry. There has been very fast development of the industry and its exports during the 1990s. Indian software exports rose from \$128 million in 1991 to \$2.9 billion in 1998-99 and are estimated to be on the order of \$4 billion in 1999-2000. Some estimates project these exports to touch \$50 billion in 2008 (Patibandla *et al.*, 2000). The industry has now reached a level of development where it is able to attract venture capital funds from abroad. Indian IT companies are able to have IPOs on the London Stock Exchange and on Nasdaq. The government helped the growth, development and maturing of the industry through a variety of channels, the most important of which were: (i) creation of highly trained quality manpower at elite technological institutions that the government had established; (ii) having a selective policy to utilise multinational investment and encouraging exports; (iii) the government provided finance, infrastructure, legal regulation and marketing assistance to start-up technology firms; and (iv) the government set up software technology parks in Bangalore and other Indian cities. One of the most successful companies in India, Infosys, was set up with seed capital provided by government financial institutions. The company had been refused funding by private banks and without government assistance it may not have started at all.

To sum up, venture capital, IPOs and the stock market are not the only way of promoting ICT development. Venture capital is perfectly compatible with bank-based systems and, indeed, in the developing country context, the government itself may well be the best venture capitalist. Indeed, even in the U.S. economy the venture capital industry makes at best a marginal contribution to total annual U.S. investment of around 1.5 trillion dollars. Although venture capital expanded several fold in the 1990s, it is estimated to have contributed at its peak less than 1% to the value of total investment carried out by the American industry (Singh, Singh and Weisse, 2000). The U.S. economic historian William Lazonick (2005) has persuasively argued that the stock market may not have

played a positive role in encouraging innovation in U.S. industry. The sources of innovation and dynamism lay elsewhere, in oligopolistic competition, in social conditions and in the developmental role of the government. Lazonick observes “...in terms of investment in new knowledge with applications to industry, it is the United States that can lay claim to have been the world’s foremost developmental state. As a prime example, U.S. dominance in computers, microelectronics, software and data communications is impossible to explain without recognising the role of the government in making both seminal investments that developed new knowledge and infrastructure investments that diffused the knowledge.”

In conclusion, if there are good reasons for developed country corporations to shun the stock market the reasons are even stronger for developing country firms to do so. Thus contrary to the advice from the IFIs the latter would be better off pursuing market share or growth within the framework of overall government industrial policy as they have traditionally done. The World Bank and IMF recommendation of essentially following the US model is seriously inappropriate in the developing country context. Paradoxically, developing country corporations are in better position to ignore the stock market than those of advanced countries. This is because the latter are still subject to a market for corporate control, whereas in developing countries such markets are at best in an embryonic state and have yet to evolve.

Notes

¹ This paper draws heavily from our previous publication, particularly the working paper by Singh, Singh and Weisse (2002).

² See for example, Phelps (1999), Feldstein (1999), Summers (1999).

³ A broadly similar corporate model and financial system prevail in UK, Canada, Australia – hence the Anglo-Saxon Model. However, for differences between the US and UK models see Franks and Mayer (2004).

⁴ Greenspan (1998); Summers (1998). Glen and Singh (forthcoming) provide a critique of the Greenspan and Summers theses.

⁵ For a discussion of the U.S. investment in ICT technology and its implication for growth of productivity see Jorgensen (2003), Oliner and Sichel (2000); For the role of the stock market in encouraging investment in ICT technologies see Feldstein (1999), Summers (1999), Jensen (2003).

⁶ See Black and Gilson (1998).

⁷ See for example Iskander and Chamblou (2000), Iskander et al. (1999).

⁸ See further papers by Gordon (2000), Jorgensen et al (2001) and Jorgensen (2003).

⁹ This is essentially the view taken in the modern theory of behavioural finance. See further Shiller (2000) and Shleifer (2000).

¹⁰ See further Camerer (1989), Singh (1999), Shiller (2000), Shleifer (2000) and the *Journal of Economic Perspectives* special issue on ‘bubbles’, 1990; Kay (2003), Jensen (2003).

¹¹ Federal Reserve Bank of San Francisco (2000).

¹² See Singh and Dhumale (2000).

¹³ For a fuller discussion of these issues see Singh (1997, 1999, forthcoming)

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