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The New Economy Business Model and Sustainable Prosperity

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The Rise of the New Economy Business Model

The Internet boom of the last half of the 1990s seemed to herald the arrival of a "New Economy" with its promise that, after the stagnation of the early 1990s, innovation in information and communication technologies (ICT) would regenerate economic prosperity. The subsequent collapse of the Internet boom at the beginning of the 2000s called into question the New Economy's ability to deliver on this promise – and even raised questions about whether there had really been anything "new" about the economy of the late 1990s after all. Perhaps the journalist John Cassidy (2002) was correct to entitle his well-documented book on the Internet boom "dot.con: the greatest story ever sold". If the "New Economy" was just all smoke and mirrors, one would expect that, once the debris left behind by the storm of speculation and corruption had been cleared away, economic life would return to what it had been before the boom took place.

It is now clear that there was plenty of e-con in the New Economy. At the same time, however, there was something new, important, and permanent about the New Economy that transformed the economic lives of many from those they had led before. The core of that something new, important, and permanent is what I call the "New Economy business model" (NEBM), a mode of organizing business enterprises that has changed, perhaps dramatically, the ways in which, and terms on which, people in the United States are employed.

NEBM emanated from Silicon Valley and spread to other regions of the United States. NEBM also affected employment relations in other areas of the world, especially Europe and Asia, as US-based ICT companies extended their global reach and as high-tech companies based outside the United States sought to adopt elements of the new business model. With well-educated high-tech labor flowing into the United States from abroad, especially from India and China, and with US-based ICT companies offshoring various types of business activities to other countries, again especially to India and China, the ICT labor force had become by the 2000s vastly more globalized than it had been prior to the Internet revolution.

While the Internet boom of the late 1990s made the "New Economy" a household phrase, the end of the boom did not result in the demise of NEBM. To the contrary, its characteristic features have become more widespread and entrenched in the US ICT industries in the 2000s. With its startup firms, vertical specialists, venture capital, and highly mobile labor, NEBM is a business model that remains dominant in the United States, and it is one that many national policy-makers and corporate executives around the world seek to emulate. At the same time, within the United States, it is a business model that has been associated with volatile stock markets, unequal incomes, and unstable employment, including the insecurity associated with the offshoring of high-skill ICT jobs. If we define "sustainable prosperity" as a state of economic affairs in which growth results in stable employment and an equitable distribution of income, then the prosperity of the US economy would appear to be unsustainable. There is a need to understand the organizational and industrial dynamics of NEBM if only to determine how the tapping of its innovative capability might be rendered compatible with more socially desirable outcomes.

The "Old Economy business model" (OEBM) that dominated the US corporate economy in the decades after World War II and into the 1980s offered employment that was far more stable and earnings that were far more equitable than employment and earnings in the era of NEBM. The sociological foundation of OEBM was the "organization man". Popularized in the United States in the 1950s (Whyte 1956), the stereotypical "organization man" was a White, Anglo-Saxon, Protestant male who had obtained a college education right after high school, secured a well-paying job with an established company early in his career, and then worked his way up and around the corporate hierarchy over three or four decades of employment, with a substantial "defined benefit" pension, complemented by highly subsidized medical coverage, awaiting him on retirement.[1] The employment stability offered by an established corporation was highly valued, while interfirm labor mobility was shunned.

The "organization man" could trace his origins back to the early decades of the 20th century, and in the immediate post-World War II decades he was ubiquitous in the offices of the US corporate enterprises that were the dominant employers in the US economy. Somewhat ironically, when in the 1980s formidable Japanese competitors confronted US-based Old Economy companies, many US observers of Japan's "lifetime employment" system viewed it as a mode of organization that was quite alien to the American way of life. In the post-World War II decades US business corporations had their own versions of lifetime employment, complete with what the Japanese call "salarymen". US corporations had over the course of the 20th century transformed the salaried professional, technical, and administrative employees who peopled the managerial structure into organization men. By the 1950s and 1960s, moreover, even unionized production workers, ostensibly paid on an "hourly" rather than salaried basis, found that collective bargaining protected their positions of seniority, so that they too experienced, and in a growing economy came to expect, lifetime employment as well as defined-benefit pensions and comprehensive health benefits, just like the salaried managers of the companies for which they worked.

From this historical perspective, NEBM can best be described as "the end of organization man". It is not that New Economy companies have ceased to build complex and durable organizations. To attain and sustain competitive advantage, companies such as Intel, Microsoft, and Cisco – the gold-plated enterprises of the New Economy -- need to integrate the labor services of tens of thousands of individuals who participate in complex hierarchical and functional divisions of labor. In an innovative enterprise, the role of an integrated division of labor is to develop and utilize new technologies. Indeed, one might

[1] In the early 1950s the sociologist C. Wright Mills (1951) had written an influential academic treatise on the significance of the "white collar" employee. William H. Whyte (1956), who wrote his best-selling The Organization Man while an editor of Fortune, later became a prominent urban sociologist. It is also worth noting that John Kenneth Galbraith (1967), an agricultural economist by training, gained many of his insights into what he eventually called the "technostructure" of The New Industrial State while an editor of Fortune in the late 1940s.

argue that, given heightened technological complexity and intensified market competition in the "open systems" world of ICT, the building of unique organizational capabilities has become more, not less, critical to the success of the enterprise than before.

Nor is it necessarily the case that employees who spend their entire careers with one company have become an endangered species. The leading industrial corporations still have low levels of employee turnover. Rather what is new is the lack of a *commitment.*, explicit or implicit, on the part of US high-tech companies to provide their employees with stable employment, skill formation, and rewarding careers. When an employee begins to work for a company in the New Economy, he or she has no expectation of a career with that particular enterprise. Nor does a person with ICT capabilities necessarily want to work for one company for years and decades on end. Interfirm labor mobility can bring benefits to an employee, including working for a smaller company, choice of geographical location in which to work, a step increase in salary, access to employee stock options as a potential source of income in addition to a salary, and new learning experiences. The New Economy business model represents dramatically diminished organizational commitment on both sides of the employment relation compared with its Old Economy predecessor.

A corollary of this diminution in organizational commitment in NEBM has been an increased globalization of the types of labor that US-based ICT firms employ. This globalization of labor has occurred through the offshoring of high-tech work and the international mobility of high-tech labor, neither of which is a new phenomenon but both of which have intensified over the past decade or so. The employment relations of major US-based ICT companies have become thoroughly globalized, based on corporate strategies that benefit from not only lower wages but also the enhancement of ICT skill levels in non-US locations, especially in Asia and increasingly in Eastern Europe.

While the extent of these impacts of NEBM on ICT employment has become evident only since the last half of the 1990s, NEBM itself has taken a half-century to unfold. Indeed, its origins can be found in the mid-1950s at precisely the time when the Old Economy industrial corporation was at the pinnacle of its power. NEBM evolved as an integral element of the microelectronics revolution. The development of computer chips from the late 1950s provided the technological foundation for the microcomputer revolution from the late 1970s, which in turn created the technological infrastructure for the commercialization of the Internet in the 1990s. While the US government and the research laboratories of established Old Economy corporations played major, and indeed indispensable, roles in supporting these developments, each wave of innovation generated opportunities for the emergence of startup companies that were to become central to the commercialization of the new technologies.

The regional concentration of these new ventures in what would become known as Silicon Valley reinforced the emergence of a distinctive business model. From the late 1960s venture capitalists backed so many high-tech startups in the vicinity of Stanford University that they created a whole new industry for fostering the growth of young technology firms. These startups lured "talent" from established companies by offering them compensation in the form of stock options, typically as a partial substitute for salaries, with the potential payoff being the high market value of the stock after an initial public offering or the private sale of the young firm to an established corporation. As these young companies grew, annual grants of stock options to a broad base of potentially highly mobile people became an important tool for retaining existing employees as well as attracting new ones. The subsequent growth of these companies occurred, moreover, not only by investing more capital in new facilities and hiring more people but also by acquiring even newer high-tech companies, almost invariably using their own stock rather than cash as the acquisition currency. In addition, wherever and whenever possible, ICT companies that, as systems integrators, designed, tested, and marketed final products outsourced manufacturing of components so that they could focus on higher value-added work. This outsourcing strategy became both more economical and more efficient over time as contract manufacturers developed their capabilities, including global organizations and highly automated production processes, for a larger extent of the market.

These features of the new ICT business model were already evident to industry observers in the late 1980s. It was only in the Internet boom of the last half of the 1990s, however, that this ICT business model had a sufficient impact on product market competition and resource allocation, including interfirm labor mobility, as well as productivity to give popular definition to a "New Economy". In my book, Sustainable Prosperity in the New Economy?, I document the evolution of NEBM over the past half century as a foundation for understanding the origins of the globalization of ICT employment in the 2000s, and its current implications for ICT employment opportunities in the United States.

My central argument is that NEBM has definitively replaced OEBM as the dominant mode of business organization in the ICT industries of the United States. NEBM has been, and continues to be, an important engine of innovation in the US economy, and hence an important source of economic growth. The performance of an economy, however, is not measured by growth alone. Economists give high marks to an economy that not only generates growth but does so in a way that provides stable employment and an equitable income distribution -- what I call "sustainable prosperity". Yet over the past decade or so, NEBM has been an engine of innovation that has contributed to instability and inequity. ICT continues to help make the United States the richest economy in the world, in terms of both absolute and per capita income. The increased dominance of NEBM in the organization of the ICT industries, however, has meant increasingly insecure employment and incomes for most workers in the US ICT industries, and has become an important factor in the trend toward greater employment instability and income inequality in the US economy as a whole.

Following the Internet boom and bust, what is particularly novel about the employment situation of the 2000s thus far has been the extent to which the most highly educated members of the US ICT labor force have experienced this insecurity as many of the well-paid jobs that they used to hold have been offshored. In terms of their education and qualifications, these are the people who in another era would have been the prototypical organization men, although they are no longer so uniformly White, Anglo-Saxon, Protestant or male, as the organization men of the 1950s were apt to be. The public outcry against the "export of American jobs" in this first decade of the twenty-first century in effect laments the demise of organization man.

For whom does America compete?

Driven by the microelectronics revolution, the United States has been highly innovative economy over the past three decades. The resultant economic growth, however, has been unstable, while the distribution of income in the US economy has become significantly more unequal. In my forthcoming book, Sustainable Prosperity in the New Economy?, I show that the transition from OEBM to NEBM in the ICT industries has contributed to this instability and inequity. Gone is the collective security that the corporatist Old Economy business model once offered its employees. In its place is a far more individualized relation between employer and employee. The employment and incomes of even the most highly educated members of the US labor force are now much more susceptible to the pressures and vagaries of "market forces" than they were a few decades ago. In particular, global labor markets and national financial markets now exert preponderant influences on the conditions of high-tech employment in the United States.

In the regulation of the employment relation, "market forces" are not a natural state of affairs. Rather the policies and decisions of corporations and governments shape how and in whose interests capital and labor markets function (Lazonick 1991 and 2003). Since the late 1970s in the United States corporate strategies and government policies have combined to define the ways in which NEBM allocates resources, employs labor, and finances investments.

When US corporate executives systematically allocate billions of dollars to stock repurchases, they will argue that the stock market requires them to do so. Yet in the 2000s the powerful corporations that have the financial resources to engage in this practice are actually using their financial might to manipulate the stock market -- to the direct benefit of those executives who make resource-allocation decisions. When US corporate executives systematically offshore as much productive activity as possible to lower-wage regions of the world, they will argue that the forces of market competition compel them to do so. Yet in making these decisions they are generally unaccountable to current US-based employees who have helped to build the organizations that are capable of globalization, and they rarely consult with these employees about alternative strategies for maintaining and extending the competitiveness of the company. Armed with the ideology of "maximizing shareholder value", US corporate executives who control the allocation of their companies' resources now simply take it as a fundamental, and self-serving, assumption that they are responsible to shareholders alone.

The US federal government has played a significant role in aiding and abetting the modes of resource allocation that prevail under NEBM. It continues to devote tax revenues to fund the nation's high-tech knowledge base, but demands little if any accountability from so-called "private" enterprises about how or for whose benefit this knowledge base is used. If the top executives of US corporations that have benefited from government largesse in the past now say they have to offshore to remain competitive, then the US government will not stand in the way or demand a quid pro quo. Through its immigration legislation, the US government has accommodated, until recently at least, the demands of the high-tech lobby for more non-immigrant work visas, while providing little in the way of effective oversight over the use, and abuse, of these visas. Through its tax policies, for the past three decades, the US government has basically taken the approach that whatever those who exercise strategic control over the allocation of corporate resources say they need to be competitive is what they need to get. In failing to intervene to regulate the remuneration of corporate executives, the US government has been a party to the apparently never-ending explosion in top executive pay that the United States has witnessed over the past three decades.

US corporate executives claim that they have a fiduciary responsibility to maximize shareholder value. Yet, as I have shown elsewhere (Lazonick and O'Sullivan 2000; Lazonick 2007c), it is a perspective that fails to address the conditions under which business enterprises are in fact innovative. In particular, the ideology of "maximizing shareholder value" ignores the role of workers, communities, and governments in making investments in the innovation process without any guarantee of a return. Indeed, even as corporate executives spout this ideology, and enrich themselves in the process, they are far from shy in appealing to the US government for increased spending on knowledge creation and lower burdens of taxation in order to keep the "United States" competitive. As a prime example, on March 16, 2005 the Semiconductor Industry Association (SIA), accompanied by Dale Jorgenson, a neoclassical Harvard economist, organized a Washington, DC press conference in which it exhorted the US government to step up support for research in the physical sciences, including nanotechnology, to assure the continued technological leadership of the United States. Intel CEO Craig Barrett was there as a SIA spokesperson to warn that "U.S. leadership in technology is under assault."[2]

> The challenge we face is global in nature and broader in scope than any we have faced in the past. The initial step in responding to this challenge is that America must decide to compete. If we don't compete and win, there will be very serious consequences for our standard of living and national security in the future….U.S. leadership in the nanoelectronics era is not guaranteed. It will take a massive, coordinated U.S. research effort involving academia, industry, and state and federal governments to ensure that America continues to be the world leader in information technology.

Why, one might ask, should *America* "decide to compete" in ICT if a powerful company like Intel will be able to commercialize the new technologies that emerge from such "a massive, coordinated U.S. research effort" without any consideration of the extent to which *Americans* will benefit? Barrett is also on record as saying: "Companies like Intel can do perfectly well in the global marketplace without hiring a single US employee."[3] To echo a question that former US Labor Secretary Robert Reich (1990) in a well-known

[2] "US could lose race for nanotech leadership, SIA panel says," Electronic News, March 16, 2005.
[3] Craig Barrett, Interviewed by Tom Ashbrook, On Point, WBUR, February 11, 2006.

Harvard Business Review article in 1990, written before the transition to NEBM had become apparent: "Who is Us"?[4]

In a world of global competition, a nation does need innovation to generate economic growth. When, however, corporate executives use stock-based compensation to skew the distribution of income in their favor, and when they decide to terminate the employment of qualified people even as the company is reaping the returns on its past investments in innovation in which these very people participated, then it may well be that many US citizens will lose even as the companies for which they work, or used to work, remain profitable. In the New Economy, "competitiveness" is, like "shareholder value", a highly loaded ideological term. To quote Harris Miller, from 1995 to 2006 president of the Information Technology Association of America, when he was a key lobbyist for the Immigration Act of 1990: "We were successful because we refashioned the debate from the jobs displacement issue, where we always lost, to the competitive issue" (Lee 1991).

Earning a living in the United States has never been easy for those who are poorly educated and lack work experience. In the 2000s, however, even well-educated Americans with substantial work experience face far greater employment insecurity than they did in the past. In documenting the instability and inequity inherent in NEBM, I am not advocating a return to OEBM. There is a need, however, to recognize the *collective functions* that OEBM performed in providing security in employment and retirement to a significant proportion of the US labor force. The fact that, in the Old Economy, US business corporations performed these functions greatly reduced the need for the government to be directly involved in ensuring stable and equitable growth. I would even argue that because by the 1960s business corporations performed these collective functions for such a substantial portion of the population, the US government could contemplate launching a "War on Poverty" to upgrade the employment prospects of those segments of the US population for whom business corporations did not provide employment security. In a variety of ways, OEBM provided a foundation, including a consensus among an economic elite, for the government to intervene in the economy to deal with problems of instability and inequity. With the decline of OEBM, and its replacement by NEBM, from where will such a new consensus come?

An era of more stable and more equitable economic growth

An understanding of the historical context in which OEBM performed these collective functions in the post-World War II decades is critical for analyzing both the power of OEBM to provide a foundation for stable and equitable growth and its ultimate limits. The historical context was marked by:

a) government spending on World War II that resuscitated the US economy in the first half of the 1940s, thus lifting the United States out of the Great Depression that spanned the 1930s;

[4] For the debate generated by the Reich article, see Lazonick and Mass (1995).

b) the US government's enormous investment after World War II in the context of the Cold War in the high-tech knowledge base, including national research efforts and a system of higher education to disseminate this knowledge;
c) the existence of powerful corporate research labs, many of them dating back to the beginning of the twentieth century, that could absorb and further develop that knowledge; and
d) a progressive tax regime that enabled the US government to intervene both to bolster the corporate foundations of sustainable prosperity and, when pushed by social movements, to try to spread the gains of prosperity through equal opportunity to those segments of the population that the corporate economy was leaving behind.

The foundation of OEBM's contribution to stable and equitable growth in the US economy was the provision of career employment. Oligopolistic market positions and proprietary technology strategies enabled and encouraged the Old Economy corporation to offer career employment to its managerial labor force. The presence in many Old Economy companies of industrial unions with their emphasis on employment security reinforced this corporate commitment to the "organization man". For managers and workers, a clear manifestation of the expectation of career employment was the inclusion, as integral to the employment relation, of a nonportable defined-benefit pension plan that rewarded longevity.

In the New Economy, pensions, along with much else, are heavily dependent on the performance of the stock market. In historical retrospect, a major reason why OEBM was able to contribute to stable and equitable growth was the *limited* role of the stock market, in its creation, control, combination, compensation, and cash functions, in the operations of its constituent corporations. In OEBM the prime role of the stock market was to separate share ownership and managerial control, a key social condition for the managerial revolution that permitted experienced salaried employees to run established companies and rendered public shareholders powerless to intervene in the corporate allocation of resources. By facilitating the separation of ownership and control, this "non-control" function of the stock market promoted stable and equitable economic growth under OEBM in the immediate post-World War II decades. That record stands quite in contrast to the destabilizing influence of the shareholder-value driven "market for corporate control" that sought to unwind OEBM in the 1980s by "disgorging the free cash flow" (Lazonick 1992).

In the era of OEBM, it was only in the context of the "hot issues" market in the late 1950s and early 1960s that the over-the-counter (OTC) markets began to perform the "creation" function of the stock market by inducing investment in startups (O'Sullivan 2007a). In historical perspective, this speculative boom provided a glimpse into the role that new-venture IPOs would come to play in NEBM, and indeed triggered the SEC's Special Study of the Securities Markets (1963) that resulted eight years later in the formation of the National Association of Security Dealers Automated Quotation System, or NASDAQ (Ingebretsen 2002, ch. 4; O'Sullivan 2007). In the absence of NASDAQ as well as an organized venture capital industry that could take full advantage of it, a startup found it far more difficult to enter a high-tech industry and to challenge incumbents under OEBM than it would be the case under NEBM.

Under OEBM, even established companies with listed shares, did not as a rule make use of the stock market to fund new investment in productive assets. The period in which the stock market was an important source of cash under OEBM was during the speculative boom of the late 1920s when corporations sold stock at inflated prices to strengthen their balance sheets by paying off debt or building up their cash reserves – quite the opposite of what US industrial corporations did in the New Economy boom at the end of the twentieth century (Carpenter et al. 2003; O'Sullivan 2004). While the speculative stock market of the late 1920s contributed to instability and inequity in the US economy as a whole, major business corporations in effect used that speculation to solidify their financial positions in advance of the inevitable financial crash, and as a result were better placed than they otherwise would have been to weather the early years of what became the Great Depression.[5]

Although these corporations would subsequently lay off masses of production workers as the Depression deepened, thus creating conditions for the rise of industrial unionism, these corporations were able to keep their managerial organizations, and especially their R&D operations, intact. As a result major managerial corporations sustained the process of knowledge accumulation throughout the 1930s so that, notwithstanding the debacle of the Great Depression, in the 1940s and 1950s these companies were able to resume their growth trajectories of the 1920s. Aided by massive US government investment in the knowledge base, these corporations dominated their markets in the post-World War II decades, and provided the opportunities for career employment that gave rise to the phenomenon of the "organization man".

In the 1950s and 1960s the stock market also began to perform a compensation function under OEBM, but only for top executives -- a special privilege designed for tax avoidance that opened up this use of corporate stock to public criticism. In historical retrospect, we can see the introduction of executive stock options as the first stage in the opportunistic separation of the rewards of top executives from the pay structures of the organizations over which they exercised strategic control. The next stage in segmenting the interests of top executives from the organizations that they headed came in the 1960s when many of these executives tried to build empires through conglomeration, a movement that made OEBM unstable as corporations diversified into too many unrelated lines of business to be managed effectively. Here too, as in the case of executive stock options, corporate stock performed a major function – what I have called "combination" – under OEBM, but one that contributed to instability and inequity in the economy and eventually contributed to the demise of OEBM.

In both its compensation and combination functions, therefore, the stock market under NEBM fostered a separation in major corporations between the strategic allocation of

[5] Japanese industrial corporations exhibited the same financial behavior in the Bubble Economy of the late 1980s (Ide 1998), with the same salubrious effects on the balance sheets when the bubble burst (see Lazonick 1999 and 2005).

resources and the processes of organizational learning. Yet the integration of strategy and learning is a *sine qua non* of innovative enterprise (Lazonick and O'Sullivan 2000b; O'Sullivan 2000a and 2000b; Lazonick 2004; Lazonick 2006b and 2007d). This separation of strategy and learning rendered the US industrial corporation vulnerable to innovative competitors from abroad. During the 1970s, and continuing in the 1980s US companies found that they were losing competitive advantage to foreign corporations in a number of key industries in which US manufacturers had been the world's leading producers. Foreign companies had been able, through licensing agreements, multinational investments, and military contracts, to gain access to the US knowledge base. Given their highly integrated skill bases, Japanese companies were the most adept among foreign competitors at absorbing this knowledge, and improving upon it through a process of indigenous innovation. It is of significance that the business model that enabled Japanese companies to outcompete their US counterparts entailed more highly collectivized forms of OEBM that, through the institutions of cross shareholding, lifetime employment, and main-bank lending, permitted the superior development and utilization of technology (Lazonick 1998; 1999; and 2005).

Reallocation of capital and labor from OEBM to NEBM

The rise of NEBM in the 1960s and 1970s was only minimally influenced by the transformation that was taking place at the same time in the Japanese industrial economy. Nevertheless, in the 1980s and 1990s NEBM emerged as, in effect, the US response to Japanese competition. Through its creation and compensation functions the US stock market supported the reallocation of capital and labor from OEBM to NEBM, while through its combination function it supported the rapid growth of New Economy firms. As such, the stock market became integral to NEBM in the 1990s and 2000s, especially in industries – most notably ICT but also biotech (Lazonick 2007c; Lazonick et al. 2007) -- that have enabled the United States to maintain its position of global high-tech leadership. At the same time, however, the augmented role of the stock market in NEBM has since the 1980s rendered US economic growth unstable and inequitable.

Through its creation and compensation functions, the stock market reallocated capital and labor from Old Economy wealth to New Economy startups. The existence of a highly liquid stock market with lax listing requirements – namely, NASDAQ -- enhanced the prospect of an early and successful IPO, and thereby induced venture capital to invest in high-tech startups. The offer of broad-based stock options, which would only become valuable with an IPO or a private sale to a listed company, encouraged members of the high-tech labor force to reallocate their services from OEBM to NEBM. Once a new venture had done an IPO, the combination function then became important for the growth of New Economy firms, as epitomized by Cisco's growth-through-acquisition strategy; From 1993 through 2000 Cisco did 71 acquisitions for $35.2 billion, of which over 98 percent was paid in Cisco stock (Lazonick 2007c, 1012).

Over the past three decades or so, a highly developed venture capital industry has represented a source of competitive strength for the US economy. Venture capital has played a central role in the reallocation of resources from OEBM to NEBM by enabling startups to tap entrepreneurship and knowledge that may have otherwise remained locked up in established corporations. In its origins, the evolution of venture capital as a distinctive industry for new firm creation depended on Old Economy money. In the 1950s and 1960s the wealth of Old Economy families, including the Rockefellers, Mellons, and Whitneys, was an important source of venture capital funding. In addition, from 1958, under the Small Business Administration, the US government provided subsidies to Small Business Investment Corporations (Noone and Rubel 1970; Wilson 1986; Reiner 1989, ch. 5). In the early 1970s there was only a trickle of institutional money invested in venture capital, and even that flow dried up when the passage of ERISA in 1974 created a fear among pension fund managers that they could be personally liable for making overly risky investments that violated the "prudent man" rule. In July 1979 the well-known Department of Labor "clarification" of ERISA made it possible for pension fund managers of Old Economy companies to invest in venture capital without fear of being deemed imprudent under the law.

The clarification of ERISA did not just happen. Both the venture capital community and the managers of large corporate pension funds lobbied the US government for the relaxation of the strictures of ERISA (Avnimelech et al. 2005, 200-201). In 1998 the National Venture Capital Association gave its first Lifetime Achievement Award to David Morgenthaler, a co-founder of NVCA in 1973, for his seminal lobbying efforts. According to the website of Morgenthaler, the venture capital firm that he founded in Menlo Park, CA in 1968:

> Among his many contributions to the emerging industry, Dave [Morgenthaler] was president of the National Venture Capital Association (NVCA) when the capital gains tax reduction was enacted in 1978, and played a leading role in testifying before Congress for the new legislation. He was also instrumental in helping pass the ERISA legislation of 1979, allowing for pension funds to invest in private equity for the first time.[6]

In 1994 one of the first inductees into the Private Equity Hall of Fame was Janet Hickey, now co-managing director of Sprout Group, a venture capital affiliate of Credit Suisse. From 1970 to 1985, Hickey was involved in the management of General Electric's pension fund, one of the largest in the United States. According to the Private Equity Hall of Fame citation, "[t]wice she came to bat for the private equity community."

> The first time followed the passage in 1974 of the federal Employment Retirement Income Security Act (ERISA). Intended to curtail abusive use of pension fund monies, ERISA had the unintended effect of discouraging all high-risk investing by corporate pension funds. Ms. Hickey worked with a coalition of pension funds and venture capitalists, who convinced the U.S. Labor Department in 1979 to "clarify" ERISA to permit pension funds to invest a "prudent" portion of their capital in high-risk assets.

[6] http://www.morgenthaler.com/about.asp

> Then, in the early 1980s, the Labor Department proposed new regulations that again would have halted venture investing by corporate pension funds. This time, Ms. Hickey led the effort that resulted in the Labor Department exempting "venture capital operating companies" from the proposed ERISA rules.[7]

If venture capital reallocated capital from the Old Economy to the New Economy, stock options played a complementary role in the reallocation of labor. Under NEBM, companies offered stock options to a broad base of professional, technical, and administrative employees to induce them to leave secure employment with Old Economy corporations and enter into insecure employment with New Economy startups. In the Tax Reform Act of 1976, Congress had rescinded the capital-gains tax privilege for all future employee stock options (see Lazonick 2006a, 86-88). The lowering of the capital-gains tax in 1978 and a startup boom subsequent to the clarification of ERISA in 1979, however, set the stage for the American Electronics Association, a nationwide organization that emerged from Silicon Valley,[8] to convince Congress in 1981 to bring back the stock option that qualified for capital-gains treatment (Bacon 1981). At the same time, a company could also grant its employees non-qualified stock options on which ordinary taxes had to be paid at the time of exercise, but on which the company could claim a dollar-for-dollar tax credit without having to show the cost of stock options as an expense that would in turn reduce reported earnings (and as a result presumably place downward pressure on its stock price). In 2000, at the peak of the boom, this tax benefit from non-qualified employee stock options was worth $887 million to Intel, $5,535 million to Microsoft, and $2,495 million to Cisco.

Given the lowering of ordinary tax rates in the Reagan era of the early 1980s, non-qualified options became a favored form of stock-based compensation, especially in Silicon Valley where new ventures abounded. No longer were stock options viewed as an exclusive privilege of top executives as had been the case under OEBM. Rather in the New Economy, stock options could be seen as necessary to attract "talent" to supply their expertise and effort to innovative new ventures that could drive the growth of the US economy.

Venture capital and stock options, therefore, enabled NEBM to lure financial and human resources away from OEBM, and in the process made capital and labor much more mobile in the US economy than it had been in the past. The existence of a highly liquid

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[7] Cited at http://www.assetnews.com/ped/hall_of_fame/hickey.htm, accessed July 26, 2004.

[8] According the website of the AeA (the official name of the American Electronics Association since 2001), "AeA was founded in 1943 by David Packard and 25 of Hewlett-Packard's suppliers to help West Coast companies secure government contracts during World War II. Originally operating as the West Coast Electronics Manufacturing Association (WCEMA), almost all of AeA's earliest members were located in California. By 1946 WCEMA membership had doubled to 50 companies and by 1965 had climbed to 225. In 1969, WCEMA changed its name to the Western Electronic Manufacturers Association (WEMA) to reflect the growing membership outside of the Golden State. By 1971 WEMA membership reached nearly 600 companies. In 1977, the association once again changed its name to the American Electronics Association, in an effort to more accurately represent its 750 members nationwide." http://www.aeanet.org/AboutAeA/aajl_historymain0807.asp.

stock market became critical to the rise of NEBM because, after an IPO, it permitted venture capitalists and entrepreneurs to exit their equity investments in startups and high-tech employees to sell the stock that they received when they exercised their options. The existence of a highly liquid stock market also enabled established companies to use their stock as a combination currency to buy young companies, and thus provided venture capitalists, entrepreneurs, and high-tech employees with an alternative to an IPO as a way of transforming their private equity holdings into liquid assets. The use of stock as a combination currency served as an additional inducement, therefore, for money and people to flow into high-tech startups.

The ubiquitous influence of the stock market

In the 1990s the creation, compensation, and combination functions of the stock market were central to the expansion of NEBM. Entrepreneurs, venture capitalists, and high-tech employees could claim that they were contributing their resources to an innovative economy, and reaping the rewards for these contributions through their stock holdings. In the 1990s, broad-based stock option plans spread to many Old Economy companies that now had to compete with New Economy companies for personnel.

But during the 1980s and 1990s it was not just direct participants in innovative companies who were cashing in on a booming stock market, and thus developing a stake in its performance. The end of fixed commissions on NYSE in 1975, in large part a response to competition from NASDAQ, lowered the transactions costs of trading on the stock market. As a specialized, and indeed pioneering, application of computer networking, NASDAQ was well-positioned to take full advantage of the commercialization of the Internet in the 1990s (Ingrebretsen 2002). The low transactions costs of buying and selling publicly traded shares enabled public investors, including the occupational group known as “day traders”, to share, with a click of the computer mouse, in the stock-price gains of the New Economy boom.

As shown in Table 1, over the last half of the 20th century, Americans became increasingly invested in the stock market. In 1999, holdings of corporate equities in the US economy were at a record 211 percent of GDP, about 3.5 times the percentage in 1990, and holdings of corporate equities per capita were at a peak of $85,585 in 2006 dollars. In 2006, holdings of corporate equities per capita were 42 percent higher in real terms than they had been in 1996, at the onset of the New Economy boom. Back in 1945 households directly held over 93 percent of the value of corporate equities in the US economy; in 2006 only 30 percent. Nevertheless in 2006, on a per capita basis, the direct holdings of households in 2006 dollars were more than five times greater than in 1945. Large numbers of Americans now have substantial wealth invested in the stock market, not only in direct holdings but also indirectly through their investments in mutual funds, pensions, and insurance policies.

Foreigners now hold a much higher proportion of US corporate equities than previously. Foreigners held 5.7 percent ($639 billion in 2006 dollars) of the value of outstanding US corporate stock in 1995, but 11.8 percent ($2,467 billion) in 2006. As a result, Americans are now much more dependent than ever on foreigners to maintain the value of US stock prices.

Pensions (private and government) held only 6 percent of corporate equities in 1965 by 28 percent in 1985. While this share stood at 23 percent in 2006, a steadily increasing proportion of savings has poured into mutual funds, which represented only 5 percent of corporate stockholdings in 1985 but 24 percent in 2006. The growth of mutual funds reflected a shift from defined-benefit (DB) to defined-contribution (DC) pensions, and the trend toward the management of DC pensions through individual retirement accounts (IRAs). The mutual fund share of IRA assets grew from 17 percent in 1985 to 49 percent in 1999. Mutual funds absorbed 30 percent of DC assets, but only 6 percent of DB assets, in 1999, and were heavily invested in equities (Engen and Lenhart 2000, 802-803).

Table 1: Holdings of US corporate equities, 1945-2006

	1945	1950	1955	1960	1965	1970	1975	1980	1985
Holdings in 2006$billions	**1,341**	**1,197**	**2,125**	**2,863**	**4,703**	**4,319**	**3,145**	**3,657**	**4,254**
Holdings per capita, 2006$	**10,049**	**7,861**	**12,807**	**15,844**	**24,332**	**21,062**	**14,564**	**16,061**	**17,838**
Holdings as % of GDP	**53**	**49**	**68**	**80**	**102**	**80**	**51**	**54**	**54**
% share by type of holder									
Households	93.4	91.0	88.1	85.6	83.8	78.2	69.6	67.6	54.2
Private pensions	0.0	0.0	2.2	3.9	5.6	8.1	12.9	15.5	22.7
Government pensions	0.0	0.0	0.7	0.1	0.3	1.2	2.9	3.0	5.3
Insurance companies	2.4	3.3	3.2	3.0	2.9	3.3	5.0	5.3	5.8
Mutual funds	0.9	0.7	2.4	3.5	4.2	4.8	4.0	2.8	5.0
Rest of world	2.3	2.0	2.3	2.2	2.0	3.3	4.0	5.0	3.3
	1990	**1995**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**
Holdings in 2006$billions	**5,447**	**11,219**	**20,636**	**17,429**	**13,336**	**17,112**	**18,558**	**19,106**	**20,906**
Holdings per capita, 2006$	**21,776**	**42,090**	**73,075**	**61,081**	**46,271**	**58,788**	**63,144**	**64,408**	**69,826**
Holdings as % of GDP	**61**	**115**	**180**	**151**	**114**	**142**	**149**	**149**	**158**
% share by type of holder									
Households	55.5	52.3	46.5	42.5	38.9	36.9	34.1	32.3	30.0
Private pensions	17.2	14.8	11.2	12.5	13.3	13.4	13.4	13.1	12.6
Government pensions	8.1	8.4	7.7	8.6	9.3	9.6	9.8	10.0	10.0
Insurance companies	4.6	5.2	6.1	6.4	7.2	7.0	7.2	10.1	7.6
Mutual funds	6.6	12.1	18.3	18.5	18.4	19.5	21.2	22.6	23.9
Rest of world	6.9	5.7	8.4	9.4	10.3	10.7	11.0	11.0	11.8

Notes: Data are for end of calendar year.
Households include nonprofit organizations
State pensions include state and local government retirement funds, both domestic and foreign.
Source: Board of Governors of the Federal Reserve System 2007, Table L213.

In the last half of the 1990s, the booming stock market also became important to the finances of federal and state governments because of the amount of capital gains taxes that flowed into the public coffers. For the period 1991-1995 federal government current tax receipts increased at an annual average rate of 6 percent, personal current tax payments making up 71 percent of receipts. For the period 1996-2000, tax receipts rose by an annual average of 9 percent, with personal taxes making up 74 percent of receipts. After 28 straight years of current account deficits, the federal government ran surpluses from 1998 through 2001. While for the periods 1990-93 and 1998-2001 federal tax receipts from individuals as a proportion of GDP rose from 8 percent to 10 percent, capital gains tax receipts as a proportion of individual tax receipts rose from 6 percent to 11 percent. Then the stock market crashed, and in 2002-2005 individual tax receipts fell to 7 percent of GDP while capital gains tax receipts declined to 6 percent of individual tax receipts. From 2000 to 2003 federal current tax receipts fell by $254 billion, of which $225 billion came from a 23 percent decline in individual tax receipts, including $74 billion in capital gains tax receipts (Congressional Budget Office 2004: 82-83; see also Congressional Budget Office 2002).

Whereas under the Clinton administration booming stock markets had helped the federal government budget deficit to disappear, the bursting of the Internet bubble meant that from 2002 the Bush administration faced deficits that were not made any better by its commitment to tax cuts for the rich as well as the costs of borrowing funds for the invasions of Afghanistan and Iraq. The volatility of the stock market had its greatest impact on high-tech states such as California and Massachusetts, where the widespread use of employee stock options generated a tax bonanza in the boom and virtually no tax revenues in the bust (Dudley 2001; Mitchell 2003; Braunstein 2004). Unfortunately most of the government bodies that reaped these gains from the speculative market pandered to the American taste for lower taxes, and hence declined to treat the capital-gains bonanza as the windfall that it obviously was (see for example Uchitelle, 2000; Rabin 2003).

Given the influx of foreign money into US corporate equities, the booming stock market also supported US government efforts to maintain the value of the US dollar on global exchange markets in the face of persistent trade deficits in the 1980s and 1990s. The United States has had a trade deficit in goods since 1976, and except for a small improvement in the recession of 2001, the deficit has grown larger in both nominal and real terms in every year since 1991. During the New Economy boom, foreigners pumped money into US stock markets, so that the stock market rather than the bond market became the main capital-account item that was bolstering the value of the dollar. Textbook orthodoxy has it that when a nation’s interest rates rise, the value of that nation’s currency should strengthen. But in the stock market boom, a fall in US interest rates led more domestic funds to be shifted from the bond market to the stock market, which in turn induced more foreign funds to be invested in US stocks, thus strengthening the US dollar exchange rate. This dependence of the United States on the inflow of foreign funds to support the US stock market, and with it the US dollar exchange rate, has continued in the 2000s.

Innovation, speculation, redistribution

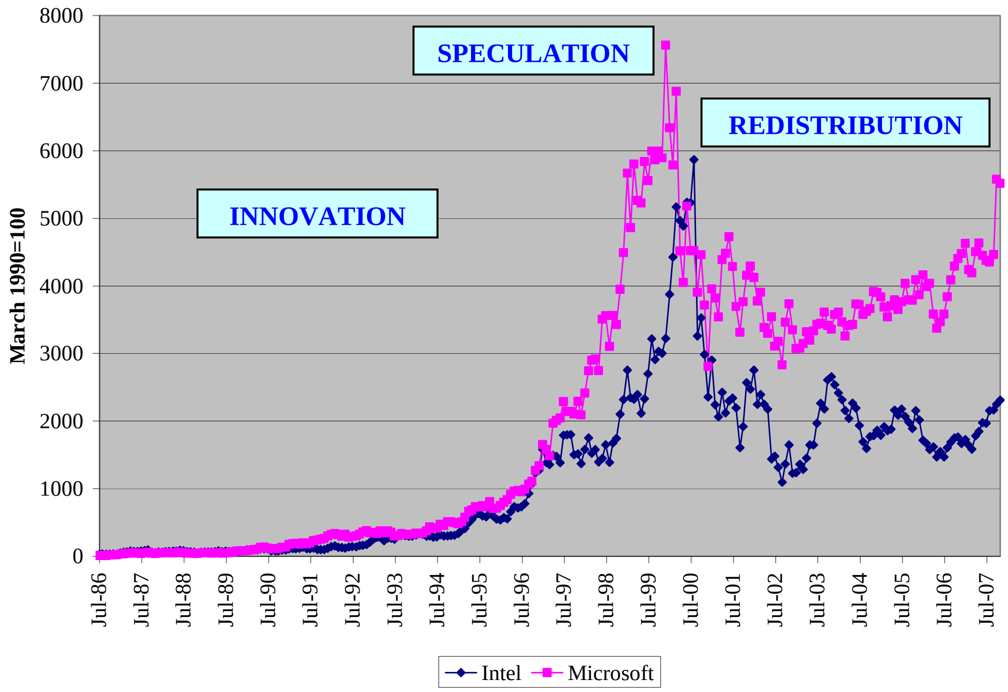
As I have argue at length elsewhere (Lazonick 2007c; 2008, ch. 6), increases in stock prices can be driven by innovation, speculation, or redistribution. All three drivers of the stock market may be acting in concert at any given time, in aggregate and at the level of individual companies. Nevertheless, under NEBM one can argue that innovation was the main driver of stock-price appreciation in the 1980s and early 1990s, speculation in the late 1990s, and redistribution in the 2000s. For example, as shown in Figure 1, the stock price movements of Intel and Microsoft since 1986 (when Microsoft did its IPO) can be divided along these lines into a decade in which stock-price increases came primarily from innovation with the companies reinvesting virtually all of their profits, a shorter period in which market speculation drove up their stock prices at a very rapid rate, and the redistributive phase in the 2000s in which stock buybacks combined with dividends have been instruments with which these companies have sought to support their stock prices in an effort, much encouraged by Wall Street, to re-attain the speculative stock-price peaks of 2000 (Lazonick 2008, ch. 6).

Among the major New Economy companies, Intel and Microsoft were by no means the most extreme cases of speculative price run-ups in the New Economy boom. Figure 2 replicates Figure 1, but with the stock-price movements of Cisco Systems added. Given that Cisco's stock price increased almost 1,000 times from its IPO in April 1990 to its peak in March 2000, the substantial rise in the stock prices of Intel and Microsoft, very obvious in the scale of Figure 1, are barely discernible in the scale of Figure 2.

Like most New Economy companies, Intel, Microsoft, and Cisco Systems are traded on NASDAQ. Figure 3 shows the extent to which the speculative bubble in the NASDAQ Composite Index made the movements of the Dow Jones Industrial Average (DJIA, which includes Intel and Microsoft as the NASDAQ representatives among its 30 stocks) and the S&P500 look like mere blips. Between March 1998 and March 2000, the NASDAQ Composite Index of over 3,000 stocks rose by 149 percent compared with 21 percent for the DJIA and 36 percent for the S&P500.

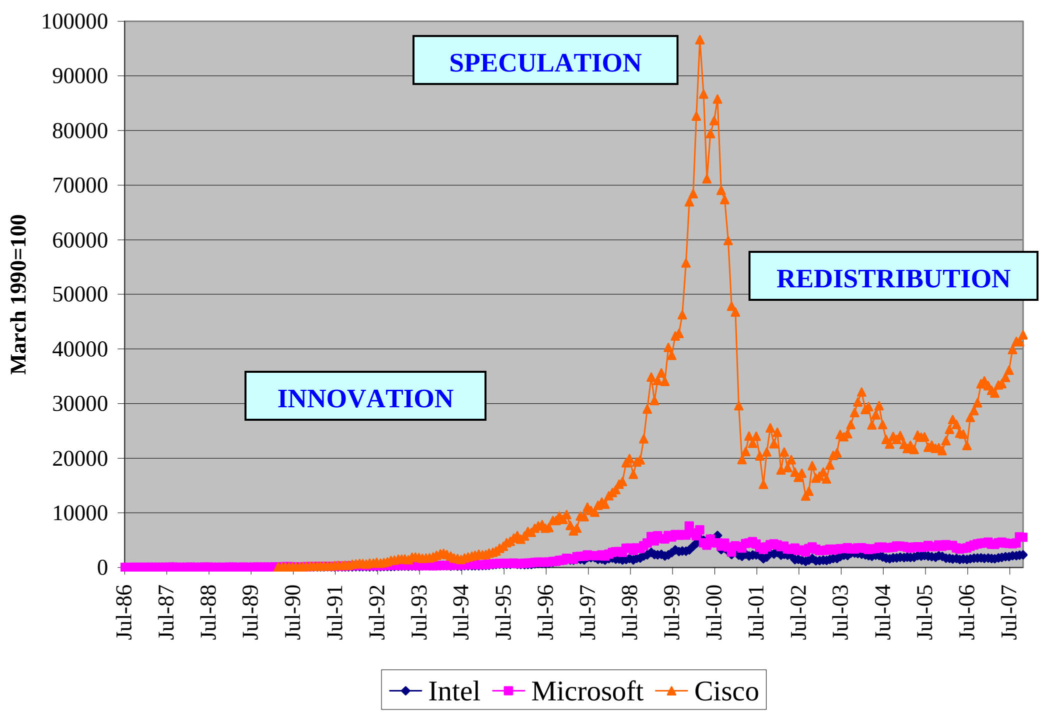
The violent fluctuations of the stock market have imparted substantial instability to the US economy in general, and to household incomes and government tax returns in particular. When, moreover, a major business enterprise bases its strategic decisions on the speculative value of its stock, as Lucent Technologies did in making its ill-fated acquisitions at the peak of the New Economy boom (see Lazonick 2008, ch. 4), the rise and fall of its stock price can exacerbate the instability of employment so that solid productive assets and jobs disappear in the downturn.

Figure 1: Stock price movements, Intel and Microsoft, Jul. 1986-Nov. 2007



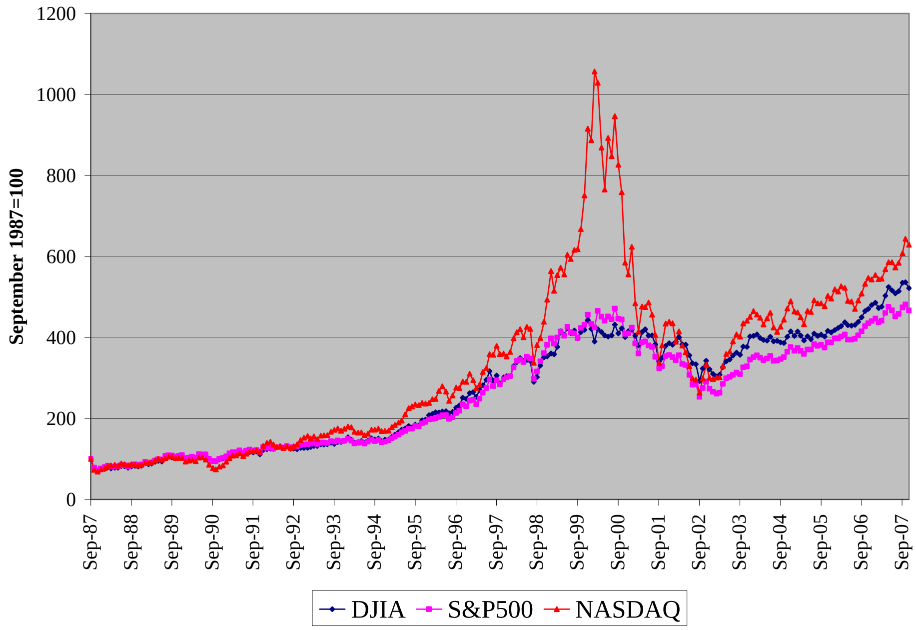
Source: Yahoo! Finance

Figure 2: Stock price movements, Cisco, Mar. 1990-Nov. 2007, and Intel and Microsoft, Jul. 1986-Nov. 2007



Source: Yahoo! Finance

Figure 3: DJIA, S&P500, and NASDAQ Composite Indices, Sep. 1987-Nov. 2007



Notes: Dow Jones Industrial Average (DJIA) consists of 30 stocks, of which 28 are listed on the New York Stock Exchange (NYSE) and 2 on NASDAQ. S&P500 Index consists of 500 stock of which 85 percent are NYSE and 15 percent NASDAQ. NASDAQ Composite Index consists of 3,113 stocks.
Source: Yahoo! Finance

A prime example is the fate of Lucent's Merrimack Valley Works (MVW), located in North Andover, Massachusetts, about 30 miles north of Boston (see Lazonick et al. 2002; Lazonick and Quimby 2007). MVW began operations in 1952 as the Western Electric factory that manufactured telecommunications transmission equipment for AT&T's Bell System, and moved to its North Andover site in 1956. When in January 1984 the Bell System was broken up, MVW became part of the Networks Systems Division of AT&T. As a result of AT&T's 1996 divestiture of its telecommunications equipment capabilities (including Bell Laboratories and product management groups), MVW became part of the Lucent Technologies Transmissions Systems division, which subsequently became known as the Optical Communications division. With 1.8 million square feet of manufacturing floor space, MVW had employed a peak of more than 10,000 people in the mid-1970s. In the boom of the late 1990s, with much more capital-intensive processes than in the past (by the end of 1999 all printed circuit board assembly had been outsourced), MVW still employed 5,600 people in jobs that were viewed as among the best in Boston's Route 128 high-tech region.

Among these employees were 250 university-educated engineers as well as about 3,000 production workers represented by the Communications Workers of America (CWA). During the New Economy boom, in response to the demands of rapid product development in the plant's optical networking products, MVW had been upgrading the skills of many of its production workers to function as testers, the highest skilled shop-floor occupation. When MVW could not generate sufficient employees with the requisite capabilities internally to fill the demand for testers, its HR people searched New England community colleges for technically qualified recruits. With this combination of engineering and production capabilities, in June 2000 Lucent designated MVW as the company's "manufacturing center of excellence and global systems integration center" for optical networking products.[9]

When that announcement was made, no one at Lucent imagined that within three years more than 80 percent of MVW's employees would be gone, with most of the layoffs occurring in 2001 and early 2002. In June 2002, with the telecommunications industry in a major slump, Lucent sold most of MVW's manufacturing operations to a contract manufacturer, A-Plus (owned by Solectron), which agreed to employ about 550 people from MVW. Lucent retained a product development staff of about 2,000 employees at MVW. By April 2003 A-Plus had ceased operations, and Lucent's MVW payroll was down to just over 1,000 people. The CWA, which had represented some 3,000 workers at MVW as late as April 2001, had only 260 of its members employed by MVW in April 2003 (Murray 2003a and 2003b). In September 2003 the MVW campus was sold for $13.9 million to a local developer, with Lucent remaining as a tenant (Murray 2003c). In June 2007 Alcatel-Lucent announced that it would close the North Andover operations, which employed 475 people, and move production to Italy (McCabe 2007a).[10] Beginning in December 2007, Alcatel-Lucent began laying off 290 CWA members, with plans to transfer 190 managerial employees to the company's research center in Westford, Massachusetts (McCabe 2007b). Ultimately the misallocation of resources and financial machinations by Lucent's corporate management in the New Economy boom resulted in the demise of what had been in 2000 a state-of-the-art manufacturing plant.

If the increased reliance of households, governments, and corporations on the stock market has made the US economy more unstable, the distribution of returns from the stock market has made the US economy much more unequal. In 2001 only 52 percent of households held stock directly or indirectly, and in 2004 only 49 percent. In 2004, 37 percent of all corporate equities were held by the wealthiest one percent of households, and 80 percent by the top 20 percent in the wealth distribution (Allegretto 2006). Moreover not all households who could claim that their savings were invested in the stock market benefited from the run of extraordinarily high returns on corporate stocks in the New Economy boom. I am referring to organized labor, whose pension funds have been a key component of institutional investment in the stock market. Virtually all unionized workers in the ICT industries are employed by Old Economy companies, where their retirement incomes are covered by a traditional defined-benefit pension plan. Given the size of these companies, these pension plans are all single-employer plans in which the employing corporation controls the allocation of pension assets and, as was the case in the New Economy boom, can lay claim to all of the stock-market returns from the pension portfolio over and above its liabilities under the DB contract.

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[9] "Lucent Technologies selects Massachusetts site to become global optical systems integration center", Lucent Technologies press release, June 7, 2000.

[10] For an analysis of what happened to the displaced MVW employes, based on training and re-employment data under a US Department of Labor National Emergency Grant, see Lazonick and Quimby 2007.

Organized labor showed concern with labor's lack of influence over the governance of pension funds that represented what some have called "labor's capital", a stock of accumulated assets on which workers rely for a flow of "deferred wages" in retirement (see Ghilarducci 1992; Fung at al. 2001). Of course, the unions would have liked a larger share of the gains that were being generated by the double-digit stock returns of the late 1990s, but in single-employer DB plans that was not the American way. The unions also wanted to direct "labor's capital" to investments in companies that were "labor-friendly"; the labor movement understood from the experience of the 1980s and 1990s that stock market gains during the longest "bull run" in US history were often a direct result of the downsizing of the labor force. In the United States, however, organized labor's exclusion from participation in the allocation of the resources of traditional single-employer DB pension plans was and remains but an extension of its virtually total exclusion -- unique to the United States among advanced nations -- from participation in the governance of the resource-allocation decisions of major business corporations. It is perhaps not surprising that with business sector union membership, and the power of organized labor more generally, in decline since the early 1980s, the US labor movement has failed to confront the ideology of shareholder value.[11]

Under NEBM the challenge for organized labor -- to date unsuccessful -- has been to gain the right to represent high-tech workers in collective bargaining. Organized labor in the United States has never been strong among the professional, technical, and administrative (PTA) employees who constitute the majority of employees in New Economy firms. The most significant example of PTA unionism in the United States is the Society of Professional Engineering Employees in Aerospace (SPEEA) which has almost 24,000 members, and has represented engineers and technicians at Boeing (founded in Seattle in 1916) in collective bargaining for over six decades. Indeed in 2000 SPEEA staged the largest white-collar strike in US history against Boeing, with wages and health benefits at issue (Morrow 2000a and 2000b). Organizing PTA workers is, however, especially difficult in the New Economy, where, to use Albert Hirschman's (1970) terms, employees have depended on "exit" via the labor market rather than "voice" via union representation to exercise influence over their conditions of work and pay.[12]

The most notable attempt to organize US high-tech employees in the 1990s stemmed from Microsoft's practice of employing contingent workers (Van Jaarsveld 2004). In 1990 the Internal Revenue Service had ruled that Microsoft had been misclassifying regular employees as independent contractors in order to exclude them from benefits such as the employee stock purchase plan and savings plan. In 1992 these workers launched a class action lawsuit (*Vizcaino v. Microsoft*) that was finally settled in December 2000 with a payment from Microsoft of $97 million.

[11] That organized labor in the United States lacked an analysis of the changing functions of the stock market in the US corporate economy and a critique of shareholder-value ideology is evident in the volume, <u>Working Capital: The Power of Labor's Pensions</u> (Fung et al., 2001), the major publication (based on a conference in Washington DC in 1999) of the United Steelworkers of America's Heartland Labor Capital Project (see also http://www.heartlandnetwork.org/conference4_99/index.htm).

[12] For the problems of unionism in the "boundaryless workplace", see Stone 2004.

The lawsuit also mobilized contingent workers at Microsoft to form, in 1998, the Washington Alliance of Technology Workers (WashTech), a union that affiliated with the Communication Workers of America.[13] While WashTech has been unsuccessful in gaining union recognition at Microsoft or any other employer, it has wielded a certain amount of political influence in the state of Washington, and has participated in CWA training initiatives (Van Jaarsveld 2004, 373-379). In 2000 WashTech came to the aid of customer service representatives who had been laid off at Amazon.com, and was reportedly able to pressure the company to grant them better severance packages (Wilson and Blain 2001). Also affiliated with the CWA is Alliance@IBM formed in 1999 in response to IBM's adoption of a cash-balance pension plan that significantly reduced the pension benefits of older IBM employees (Lazonick 2008, ch. 4).[14] In the downturn of the early 2000s these types of organizing initiatives fed a discussion of the potential of "open-source unionism" (which should have been termed, more accurately, "open-systems unionism"), a form of labor organization that could provide mutual aid and political influence for New Economy workers whose power vis-à-vis employers resides in individual mobility on labor markets rather than in collective bargaining at the place of work (see Freeman and Rogers 2002).

For many ICT employees, the power of individual labor mobility served them well in the New Economy boom of the late 1990s, especially when they entered into employment at companies with generous stock-option plans. Elsewhere (Lazonick 2007c, 1015-1021) I have shown the enormous average gains of employees at companies like Microsoft and Cisco in the New Economy; so much so that virtually all of the increase in income inequality in the United States in 1999-2000 can be explained by the extraordinary increases in average wages in four counties in the United States – three in California that include Silicon Valley and one in the state of Washington that includes Microsoft (Galbraith and Hale 2004). It has been claimed, quite plausibly, that at Microsoft the boom created 10,000 stock-option millionaires (Harden 2003).[15]

These were gains that all the collective bargaining in the world could not have obtained. Serving as they do to manage the interfirm mobility of labor -- a prime characteristic of NEBM -- broad-based stock options are the antithesis of collectively bargained wages. The relative remuneration of high-tech workers depends on the vagaries of the stock market, with some people finding themselves at the right place at the right time, and other people just like them being at the wrong place at the wrong time. Even at companies like Cisco and Microsoft, where option awards abounded, people employed at the peak of the boom in 2000 and then let go in the downturn of 2001-2002 would have found themselves with absolutely no gains from the options that they received.

The growth of NEBM culminating in the tight labor markets of the late 1990s, and the very real and often realized possibilities for substantial gains from stock options, inured high-tech employees to an employment system in which their career prospects might be

[13] See http://www.washtech.org/about/. For useful works that focus on the roles of contingent employment and flexible labor markets in Silicon Valley, see Benner 2002 and Hyde 2003.
[14] http://www.allianceibm.org/
[15] For the distribution of stock options at Cisco in 1999, see O'Reilly and Pfeffer 2000.

dependent on interfirm labor mobility rather than the movement up and around the hierarchy of one company. But the good times were not to last. The high levels of employment in the ICT professions in 2002 and 2003 sent a rude shock to engineers and programmers who had become used to the idea that interfirm labor mobility would provide them with the possibility of improving their conditions of work and pay, should they become dissatisfied with the prospect of remaining with their current employer.

For Internet bloggers, a particularly well-known example of the deterioration of the conditions of work and pay among high-tech workers in the first half of the 2000s was that of an Electronics Art software engineer whose spouse (female, as it turned out) posted an anonymous open letter on LiveJournal, in November 2004 entitled "EA: The Human Story".[16] The complaint was that, under a permanent "crunch" to meet videogame publishing deadlines, EA compelled game developers like her spouse to work 85-hour weeks: "9am to 10pm -- seven days a week -- with the occasional Saturday evening off for good behavior (at 6:30pm)." For working these long hours, game developers received no overtime pay, extra time off, or sick days. In effect, EA considered these employees to be salaried personnel who were exempt from the overtime pay requirements of the National Labor Relations Act.

Within a month of publication of the open letter, over 4,000 people posted comments on LiveJournal, almost all in support of the "EA Spouse", with many advising that EA employees should join a union. As it happened, under California law, many of the game developers had a claim to overtime pay. EA agreed to the settlement of two class action lawsuits for overtime pay, one by its graphic designers for $15.6 million in October 2005, and the other by its programmers for $14.9 million in April 2006. In both cases, EA then transformed those among the labor force who were non-exempt under the California law into hourly employees who would henceforth be paid time-and-a-half for overtime hours. As part of this change, EA gave these workers a one-time grant of EA stock, but ruled them ineligible for EA stock options.[17]

Offshoring, in-migration, and the employment of ICT labor

As illustrated in the EA story, the deterioration in employment conditions that faced high-tech labor in the first half of the 2000s extended beyond the downturn in economic activity in 2001-2002. Unemployment rates among engineers and programmers rose in the "jobless recovery" that began in late 2002 (Hira 2003; Khatiwada and Sum 2004).[18] A major part of the explanation for the jobless recovery in ICT was the acceleration of offshoring of ICT jobs from the United States in the early 2000s (Groshen and Potter 2003; Houseman 2007), with India and China as the favored locations. There exist no

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[16] http://ea-spouse.livejournal.com/; see also http://en.wikipedia.org/wiki/Erin_Hoffman.

[17] "Electronics Arts settles overtime suit, will reclassify entry-level artists," October 5, 2005, at http://www.gamasutra.com/php-bin/news_index.php?story=6747; Programmers win EA overtime settlement, EA spouse revealed," April 26, 2006, at http://www.gamasutra.com/php-bin/news_index.php?story=9051.

[18] See IEEE-USA press release, May 4, 2004 at http://www.ieeeusa.org/releases/2004/050404pr.html; See IEEE-USA press release, July 26, 2004 at http://www.ieeeusa.org/releases/2004/072604pr.html; also Hira 2003.

reliable data on the extent of offshoring, the proportion of offshored jobs that are high skill, or the impacts of offshoring on employment in the United States and the performance of the US economy as a whole.[19] What is clear is that US companies have over the past decade or so been able to access growing supplies of high-tech labor in India and China with the capabilities to perform increasingly sophisticated work that had previously been done in the United States (Lazonick 2007b; Lazonick 2008, ch. 7).

Indeed, when US companies offshore, some of the high-quality, high-tech labor that these companies employ in places like China and India actually gained their work experience, and sometimes also their graduate education, in the United States. In May 2007, The Indus Entrepreneurs (TiE) Group put out a story that 60,000 IT professionals had returned to India from Silicon Valley "in recent years"; probably meaning since 2001.[20] Such a figure is certainly plausible. What we do know is that, in recent years, US MNCs such as IBM, HP, and Accenture have been expanding their employment in India at a rapid pace. Undoubtedly, as these companies offshore, many of the key employees are Indians who have worked for these companies under immigrant and non-immigrant visas in the United States. Such is certainly the case for Indian IT services companies such as TCS, Wipro, and Infosys, which have been among the leading users of H-1B visas in the United States in the 2000s even as their strategic orientations have been to return back to India as much of the work as possible that is being done in the United States (Lazonick 2008. ch. 7).

The H-1B program has come under heavy criticism from those who see the influx of non-immigrant labor into the United States as subverting the remuneration and work conditions of permanent members of the US labor force (Matloff 2004). In principle, employers are supposed to pay workers on H-1B visas "at least the local prevailing wage or the actual wage level paid by the employer to others with similar experience and qualifications, whichever is higher." The law also stipulates that an employer can only engage someone on an H-1B visa, if such employment "will not adversely affect the working conditions of workers similarly employed".[21] In practice, it is difficult to enforce these labor conditions since there is little if any enforcement for non-compliance on the part of the employer.[22] Even when the employer complies with the letter of the law, the H-1B worker is not in the same position of power vis-à-vis her employer as a US citizen or permanent resident. Under NEBM, the power of the employee resides in her ability to switch jobs. An H-1B worker can only leave her employer, and remain in the United States, if she can find another employer with a vacant H-1B visa ready to hire her. The employer may use his leverage over H-1B employees to demand that they be reassigned to different geographic locations within the United States that regular members of the US labor force might be unwilling to accept. The dependency of the H-1B worker on her employer will be even greater, moreover, when the employer has

[19] For an attempt to use newspapers articles and press releases to track the number of offshored jobs and the companies that are doing the offshoring, see the TechsUnite offshore tracker at http://www.techsunite.org/offshore/.

[20] "60,000 Indian techies in US return home: Report," Times of India, May 14, 2007.

[21] http://www.dol.gov/eta/regs/fedreg/proposed/2005006454.htm

[22] For a list of problems with the H-1B program from an anti-H-1B website, see http://www.zazona.com/ShameH1B/H1BFAQs.htm#IfH-1BAbolished.

sponsored the employee for US permanent residency, the acquisition of which may be a long, drawn-out process (Chakravartty 2006).

The annual new H-1B visa cap was 65,000 through 1998, 115,000 in 1999 and 2000, and 195,000 in 2001 through 2003, before reverting back to 65,000 in 2004, with an additional 20,000 for foreigners with a graduate degree from a US university or people hired by a US institution of higher education or non-profit research organization. The cap was fully utilized in the boom conditions of 1997 through 2000 when Congress authorized the 195,000 level -- just in time for the downturn. The number of unused visas rose from 31,400 visas (or 16 percent of the total) in 2001, 115,900 (59 percent) in 2002, and 117,000 (60 percent) in 2003, before the normal cap was lowered to its original level of 65,000 – just in time for the post-"jobless-recovery" upturn (Wasem 2006). With all of these 65,000 visas being snapped up quickly since 2004, high-tech employers have been clamoring for a substantial increase in the cap that would alleviate, so they claim, a shortage of high-tech labor in the United States. The Comprehensive Immigration Reform Bill that was passed in the Senate in May 2006 would have raised the H-1B cap to 115,000 with an automatic increase of 20,000 per year whenever the previous year's quota was reached.[23] In 2007, however, legislative approval for an increase was stalled in the House of Representatives, not over the H-1B question, but rather, given the comprehensive intentions of the bill, over the treatment of illegal foreign entrants to the US labor force.

There is considerable debate over whether in the 2000s there exists a shortage or surplus of high-tech labor in the United States (Gordon 2007). ICT employers generally argue that there is shortage of high-tech labor. Absent a remedy that includes, in the short-run, an expansion of the H-1B visa program and, in the long run, an upgrading of the US K-12 education system, they warn of a deterioration of innovative capabilities in the United States and a further acceleration of offshoring of high-tech jobs. A particularly influential statement of this position appeared in an op-ed piece that Bill Gates (2007) published in the Washington Post in February 2007. Gates began:

> Innovation is the source of U.S. economic leadership and the foundation for our competitiveness in the global economy. Government investment in research, strong intellectual property laws and efficient capital markets are among the reasons that America has for decades been best at transforming new ideas into successful businesses. The most important factor is our workforce. Scientists and engineers trained in U.S. universities -- the world's best -- have pioneered key technologies such as the microprocessor, creating industries and generating millions of high-paying jobs. But our status as the world's center for new ideas cannot be taken for granted. Other governments are waking up to the vital role innovation plays in competitiveness.

Gates then went on to say that the US schooling system had to be improved to enable "young Americans [to] enter the workforce with the math, science and problem-solving

[23] See also http://en.wikipedia.org/wiki/Comprehensive_Immigration_Reform_Act_of_2006.

skills they need to succeed in the knowledge economy." He cited a 2003 report that found that US high school students ranked 24^{th} out of 29 developed economies in math scores.[24] Gates called upon business and government to work together to improve the delivery of science and math education in the US K-12 system.

He also counseled that the United States should make it "easier for foreign-born scientists and engineers to work for U.S. companies." Indeed, Gates argued that the shortage of computer science graduates in the United States had reached a "crisis point". He called for an increase in the quota of H-1B visas as well as a faster and simpler process for acquiring permanent residency. Given that foreigners constitute half of the doctoral candidates in computer sciences in the United States, an important impact of these changes would be to increase the number of foreign graduates from US universities who remain in the United States after completion of their studies. In testimony to Congress in March 2007, Gates noted that in fiscal 2008 (the year beginning on October 1, 2007), the 65,000 regular quota of H-1B visas plus additional 20,000 quota for visa holders with US graduate degrees would probably by snapped up by companies in the first month. If so, Gates observed, "for the first time in the history of the program, the supply will run out before the year's graduating students get their degrees. This means that U.S. employers will not be able to get H-1B visas for an entire crop of U.S. graduates. We are essentially asking top talent to leave the U.S." (quoted in Elstrom 2007). As it happens, on April 2 and 3, 2007, the first two days on which applications could be filed for fiscal 2008 H-1B visas, the 65,000 quota was oversubscribed while 18,000 of the 20,000 graduate degree supplement were snapped up (Raskin et al. 2007; Taylor 2007).

Not surprisingly, the United States branch of the Institute of Electrical and Electronics Engineers, which "promotes the careers and public-policy interests of more than 220,000 engineers, scientists and allied professionals" (IEEE-USA 2006 Annual Report, 2[25]) is far from enthusiastic about changes in immigration law that would expand the supply of high-tech workers in the United States. After the US Senate passed the Comprehensive Reform Bill in May 2006, IEEE-USA President Ralph W. Wyndrum, Jr. commented that "The bill opens the spigot on numerous skilled visa categories. The question is how many high-tech workers can the United States absorb annually without driving up unemployment and driving down wages? The Senate demonstrated its concern about the number of unskilled workers it would allow into our country; it should show the same concern for skilled employees."[26]

Responding generally to claims of crisis in the reproduction and expansion of the STEM (scientific, technical, engineering and mathematics) workforce in the United States, a 2004 study by the RAND corporation for the US Office for Science and Technology Policy and the Alfred P. Sloan Foundation, argued that "many of these claims of

[24] Gates was undoubtedly referring to the 2003 International Student Math Assessment, sponsored by the OECD Programme for International Student Assessment (PISA) (OECD 2004), which is discussed below.
[25] Available at http://www.ieeeusa.org/about/Annual_Report/2006.pdf.
[26] http://www.ieee-cr-section.org/content.asp?ID=1296&I=5169

shortfalls are suspect or are based on metrics that must be taken in context" (Kelly et al. 2004, 5).

> Viewed broadly since the 1950s, evidence for these periodically anticipated shortages in the general STEM workforce have been hard to find. Indications of resulting national crisis have, so far, been even less evident. Ironically, the closest thing to a crisis was perhaps the distress of unemployed and underemployed engineers in the early 1970s, mathematicians and physicists in the 1990s, molecular and cellular biologists in the late 1990s, and Silicon Valley scientists and engineers thereafter. But these are manifestations of surpluses, not shortages, in the STEM workforce.

Writing during the "jobless recovery" of 2003, Michael S. Teitelbaum (2004, 13), a demographer and program director (now vice-president) at the Alfred P. Sloan Foundation, observed that "[t]he profound irony of many such claims [of labor shortage]

> is the disjuncture between practice in the scientific and engineering professions – in which accurate empirical evidence and careful analyses are essential – and that among promoters of "shortage" claims in the public sphere, where the analytical rigor is often, to be kind, quite weak. Few, if any of the market indicators signaling shortages exist. Strong upward pressure on real wages and low unemployment rates relative to other education-intensive professions are two such indicators conspicuously absent from the contemporary marketplace.

Rhetoric of crises aside, given rapid changes in technology and the high degree of specialization of high-tech workers, the possibility exists that these two very different perspectives on the adequacy of the supply of high-tech personnel in the United States are in fact two sides of an age-related coin. It is quite plausible that at any point in time there is a labor market "mismatch" between the skill-set of the extant supply of high-tech employees and the demand for new skills inherent in new high-tech jobs (see Levy and Murnane 1992; Morris and Western 1999; Powell and Snellman 2004). It is also quite plausible that, for members of the ICT labor force generally, one's age has an inverse relation to the relevance of one's learned skills to meet new demands for ICT labor. If companies are systematically employing younger workers, ostensibly with up-to-date skills, and systematically laying off older workers, ostensibly with obsolete skills, it is quite possible that there will exist, simultaneously, a shortage of the new workers that companies want to hire and a surplus of the old workers that companies have decided to fire.

Such a scenario is entirely consistent with everything we know about the transition from OEBM to NEBM. A key characteristic of NEBM is a lack of commitment by companies to career employment. Under NEBM, companies continue to value the productivity that emanates from the experience of many of their existing employees, and for employees the prospect of promotion within the organizational hierarchy still can serve as a powerful inducement for supplying more and better effort in making productive contributions to the firm. At the same time, however, under NEBM there are no *institutional constraints* to terminating some employees even as, or often *because*, the company seeks to take advantage of new profitable opportunities that result from changes in its industry's technological, market, or competitive conditions. When such opportunities present themselves – and in the fast-changing ICT industries such events are regular and perhaps even continuous phenomena – the company will be apt to replace older workers with younger workers.

In sharp contrast, a key characteristic of OEBM was the employment of older workers. One need only look at the transformation in employment relations at IBM between 1990 and 1994 (Lazonick 2008, ch. 4) to see how older employees could be made redundant as the company restructured with a bias toward hiring younger employees. A central purpose of IBM's massive restructuring in the 1990s was to rid itself of its decades old system of "lifelong employment". Indeed, in 1994 about 3,500 IBM employees filed a class action lawsuit against the US Internal Revenue Service, claiming that IBM should not have withheld taxes on their severance pay since these awards represented a legal settlement obtained in return for signing an agreement in which they waived their right to sue IBM for age discrimination (Ramstad 1994a and 1994b; Debare 1997).[27] In 1995 and 1999, IBM made fundamental changes in its pension system for the expressed purpose of making the company more attractive to younger employees (Lazonick 2008, ch. 5). In the process, older IBM employees were short-changed, although CEO Louis Gerstner agreed to reduce the damage to many of them when Rep. Bernie Sanders and Sen. Jim Jeffords, both of Vermont, threatened that the federal government would go after IBM for age discrimination.

Given its size, reputation, and central position in the ICT industries, IBM's transformation from OEBM to NEBM marked a fundamental juncture in the transition from employment security to employment insecurity in the US corporate economy. Indeed, in line with the IBM experience, for the period 1992-1997 John Abowd and his co-authors (2007) find a general shift in US employment from older experienced workers to younger skilled workers related to the adoption of computer technologies. Using Current Population Survey data, Charles Schultze (1999, 10) has shown that "[f]rom 1983 to 1998, median job tenure for men as a whole fell just a little, from 4.1 years to 3.8 years. But broken down by age, the picture is different. "

> While the median tenure of the two youngest age groups fell only slightly, the tenure of older men fell substantially. Some of the decline in the 55-64 group—from 15.3 years to 11.2 years—undoubtedly reflects the continuing trend to earlier retirement, but the reductions in average tenure among the 35-44 year age group (from 7.3 years to 5.5 years) and among the 45-54 year age group (12.8 to 9.4 years) are quite large. The situation here is the reversal of that before 1981: the widespread decline in average male tenure between 1983 and 1998 is masked by the aging of the baby

[27] See also "Lotus Development ordered to pay $275,000 in age discrimination suit," Associated Press, November 30, 1994; "Ex-IBMers file redux of suit against severance tax," Raleigh News and Observer, March 29, 1996, C9.

> boomers, which decreased the relative importance of younger and low-tenured groups. When that demographic change is taken into account, tenure fell rather sharply. Middle-aged and older men, for whatever reason, are not staying as long with their employers as they once did.

Schultze (1999, 11) goes on to show, moreover, that the job displacement rate for white-collar workers relative to blue-collar workers rose substantially in the 1980s and 1990s, starting at 33 percent in 1981-1982 and rising to about 80 percent in the 1990s.

In late 1998, as the New Economy boom gained momentum and as Congress stood ready to increase the H-1B visa cap from 65,000 to 115,000, IEEE-USA published its "Misfortune 500" – a website with letters from hundreds of experienced engineers who had lost their jobs and could not find work as engineers during the boom.[28] In IEEE-USA surveys of unemployed engineers, age was listed as the primary barrier to getting a new job by 67 percent of respondents in 2004 and 72 percent in 2006.[29]

While anecdotal information abounds on the displacement of senior ICT personnel in the 1990s and 2000s (see, for example, Hira 2007), there remains a deficiency of systematic research on this phenomenon. For example, HP's "churning" of its labor force in the 2000s, subsequent to the merger with Compaq, presumably reduced the average age of employees (Wong 2006); it would be of interest to know how older employees fared relative to younger employees when thousands of positions were eliminated in the aftermath of the merger. In the absence of firm evidence, it is also debatable whether the displacement of older workers in favor of younger workers reflects the need of companies to employ people with different skills sets, or simply a way to save money by getting rid of long-time employees who in the US workplace have traditionally received a pay premium for their seniority.

The possibility that the substitution of younger for older personnel is just about cost reduction, and not about skill acquisition, is particularly possible when the change in the age-composition in employment is achieved through offshoring to lower-wage regions. In their book on "turbulence" in employment that compares the financial services, retail food, semiconductor, software, and trucking industries, Clair Brown, John Haltiwanger,

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[28] "IEEE-USA releases 'Misfortune 500' list of displaced high-tech workers," PR Newswire, October 12, 1998. See also Langbein 1998. According to Norman Matloff (email April 10, 2006 at heather.cs.ucdavis.edu/Archive/IEEEUSAHastensDemise.txt), among the most vocal critics of corporate and government policies that have generated surpluses of experienced engineers, in 2000 "IEEE-USA came under heavy pressure from the IEEE parent organization, which is dominated by industry and academia and thus is highly pro-H-1B. So IEEE-USA suddenly changed its stance. It still was critical of the H-1B program, but it started extolling "instant green cards" for foreign workers instead of H-1B visas. It ignored member complaints that the green card idea would be just as harmful to IEEE-USA members as H-1B. The Misfortune 500 Web page was taken down."

[29] 2006 IEEE-USA Unemployment Survey Results (10.19.06), at http://www.ieeeusa.org/careers/pdf/EmploymentSurvey2006Report.pdf. Alan Hyde (2003, ch. 12) argues that employment discrimination law, including that which relates to age discrimination, is based on "an assumption of stable long-term careers inside individual firms", and is very difficult to prove in the context of what he calls "a high-velocity labor market" such as exists in Silicon Valley.

and Julia Lane (2005, 108) suggest that both factors may be at work in ICT, thus posing a double whammy for older, higher-paid employees:

> In sum, jobs at the bottom end of the earnings distribution and in low-skilled industries are much less likely to be stable than jobs at the top end and in high-skilled industries. However, *a particularly intriguing finding is that the two industries, software and semiconductors, that have been most affected by globalization and rapid technological change are also the two industries that have the lowest retention rates for workers in the top income category.*[30]

More research is also needed on what skills older employees actually lack in an NEBM setting. The details of an age-discrimination lawsuit at Google are instructive. In 2002, Google hired Brian Reid, age 52, as director of operations and director of engineering. Reid had been a pioneer in setting Internet standards in the 1970s when he was doing a doctorate in computer science at Carnegie Mellon University.[31] He subsequently was on the faculty of Stanford University, co-founded a company that later became Adobe, and joined DEC's research organization in 1987 where he worked until taking a position at Bell Lab's Silicon Valley site in 1999. Google demoted Reid in October 2003 and fired him in February 2004, just ahead of Google's lucrative IPO in April 2004. In his lawsuit, which as of late 2007 was still before the courts, Reid charged that the reason he was given for his dismissal from Google was that he was not "a cultural fit".

That message was delivered by Google vice-president of engineering, Wayne Rosing, himself 55 at the time, who had previously written an evaluation of Reid that described him as having "an extraordinarily broad range of knowledge concerning operations, engineering in general, and an aptitude and orientation toward operational and IT issues." In the same evaluation, however, Rosing had written: "Adapting to the Google culture is the primary task for the first year here ... Right or wrong, Google is simply different: Younger contributors, inexperienced first-line managers and the super fast pace are just a few examples of the environment." Another of Reid's supervisors, 15 years his junior, informed Reid that his ideas were "obsolete" and "too old to matter" (Egelko 2007; Riley 2007; Rosencrance 2007). Reid claimed that he was also told by various Google managers that he was an "old man" and an "old fuddy-duddy" as well as that he was "fuzzy", "slow", "lethargic", "lacked energy", and "did not display a sense of urgency", among other ostensibly ageist epithets. One report on the website TechCrunch noted that when Reid would leave the office at 7PM, "he was regularly asked why he wasn't remaining at work when Google provided dinner for its employees" (Riley 2007).

Of the many comments on the TechCrunch piece, one by a blogger identified as S. is worth quoting for its succinct summary of the relation between the expenditure of work effort and employment expectations in the New Economy:

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[30] Italics in original.
[31] "Brian Keith Reid, Ph.D." at http://justus.anglican.org/reid.html

> October 13th, 2007at 5:40PM
>
> Like many tech companies, Google hires the young by selling them an illusion. The illusion is that working these 14 hour days gets you ahead. The truth is that this effectively reduces your compensation to 50% of what you were hired for, and guarantees you nothing. Youthful enthusiasm chooses to ignore this, and for the hiring company, it's fantastic.
>
> Older workers have seen through this illusion. It is not that they are less intelligent or less motivated, just they are less inclined to be manipulated. It only takes one or two layoffs to figure out the game, and how disposable all of us are. This is the wisdom garnered from experience.
>
> The irony in all this is that we "older" workers were the young "rising stars" in our industry at one time that pulled these long hours. The new group of "rising stars" fails to realize that we are their future.[32]

Under NEBM, companies want to retain workers who have, or are willing to learn, the requisite skills, and who, in a highly competitive environment with "time-to-market" as a key to profitability, are willing to work long and hard.[33] At a company like Microsoft, for example, software programming is a highly collective and cumulative process in which the generation of a faster, better, and cheaper product depends on the integration of the work of hundreds of individual contributors (Cusumano 2000). A high level of productivity at a company like Microsoft depends on a relatively low level of labor turnover that in turn reflects a relatively high level of dependence of a particular employee on his or her current employer for remunerative work.

Bill Gates lobbies the US government for an expansion in the H-1B visa program not simply, or even primarily, because the availability of more high-tech workers will help to keep down wage costs. If Microsoft wants to lower its wage bill, it can offshore more routine activities to India or China, as indeed it does. For work that is kept in the United States, however, the problem for Microsoft is not the *wages* of labor but rather the *productivity* of labor. While, given its growth and profitability, Microsoft certainly offers any given employee the possibility of a career with the company, in NEBM fashion the company makes no commitment to retaining those employees over the course of their careers. Well aware of the possibility of changes in the company's employment strategy that could bring a career within that company to an end, and supported by a labor market that encourages interfirm mobility, employees at a company like Microsoft are on the

[32] Comment 71 at http://www.techcrunch.com/2007/10/11/does-googles-equality-drive-extend-to-old-people/#comments (with minor corrections of spelling).

[33] For evidence on these internal job ladders and career paths in the US semiconductor and software industries (along with financial services, retail food, and trucking) see Brown et al. 2005, ch. 5. For example, they find that "[h]igh-educated male semiconductor workers find the best job ladders in growing firms with low turnover; high-educated women find the best job ladders only in large growing semiconductor firms with low turnover. A woman shouldn't expect to find good job ladders in financial services. Their best jobs are in software, especially for high-educated women, where large growing firms provide the best job ladders for all high-educated software workers." (Brown et al. 2005, 77).

lookout for employment opportunities with other companies that might be beneficial to their personal careers. All other things equal, the larger the available high-tech labor supply, the more dependent are current high-tech workers on employment with their current company, and the greater power of the employer to demand that these employees work long and hard.

Labor productivity, that is, depends on effort as well as skill, and tight labor markets reduce the power of employers to demand that their employees deliver high levels of work effort (see Lazonick 1990). An exclusive focus on wage rates as the equilibrating mechanism in the labor market misunderstands the nature of the problem from an employer's point of view, especially in a high-wage, high-skill sector of the economy. The key issue for ICT employers operating in the United States is not the level of remuneration per se but *the lack of control over the work effort of a highly mobile labor force*.

It is a problem that was recognized in the first decades of the 20th century in leading sectors of the US economy. The OEBM solution was the creation of career employment that used the realistic promise of promotion to positions with better pay and work conditions as a prime mode of inducing more and better effort from employees. Indeed, in the capital-intensive mass-production industries such expectations of career employment even extended to "semiskilled" shop floor workers who could work their way up internal job ladders as "hourly" employees (Lazonick 1990, ch. 7-10). Under NEBM, in which career employment is neither offered nor expected, the OEBM solution to the problem of work effort loses its force.

Here then is the significance of Bill Gates' demand for unlimited H-1B visas. The holders of H-1B visas are much more dependent on their current employer for continuing employment. Moreover, they also tend to be younger than citizen members of the US ICT labor force (see Table 2). Among electrical/electronic engineers, the median age of H-1B workers approved in 2002 was 32 years compared with 41 years for US citizen workers, while among systems analysts/programmers these median ages were 31 and 37 respectively. The combination of youth and dependence renders them able and willing to work long and hard. Moreover, as already mentioned, these up-and-coming H-1B visa holders are ideal recruits for a company operating in the United States that may want its employees to pursue global career paths as it decides to offshore higher value-added activities. With years of experience in the United States, still young former H-1B holders from places like China and India can be very valuable to a company as, through the company's offshored operations, they follow their global career paths back to the countries from whence they came.

Table 2: Age-distribution of H-1B visa beneficiaries approved in 2002 and US citizen workers in 2002, selected high-tech occupations

	ELECTRICAL/ ELECTRONIC ENGINEERS		SYSTEMS ANALYSTS/ PROGRAMMERS		BIOLOGISTS	
	H-1B	US	H-1B	US	H-1B	US
Median age	32	41	31	37	35	39
% distribution by age group						
20-24	2	5	2	6	1	4
25-29	27	11	37	17	12	20
30-34	33	12	39	19	34	14
35-40	22	21	16	19	37	17
41+	16	52	6	39	16	45

Source: US Government Accounting Office 2003, 14, 42.

Increasing the supply of highly qualified ICT labor

For global ICT employers like Microsoft, there are three ways of increasing the supply of young ICT workers: in-migration, offshoring, and, over the longer term, US K-12 education that prepares US citizens for higher education relevant to ICT. Given that the education systems of nations such as China and India have been generating massive numbers of potential ICT workers, both in-migration and offshoring have become the most viable solutions in the here and now of the 2000s. It has been estimated that in 2003-2004, US universities awarded (in round numbers) 137,000 four-year bachelor's degrees in engineering, computer science, and information technology compared with 139,000 in India and 361,000 in China (Wadhwa et al. 2007, 75). The US number for 2003-2004 was up sharply from 109,000 in 1999-2000, but it declined to 134,000 in 2004-2005. The increase in these bachelor's degrees awarded in China and India exhibited a much steeper trajectory during the 2000s, with further growth in 2004-2005.

The greatly increased availability of a global supply of high-quality high-tech labor, via either in-migration or offshoring, in the 2000s, has raised concerns in the United States about the adequacy of the US K-12 education system to prepare the next generation of entrants to the US labor force to compete in the global high-tech labor market. While the specter of a massive flow abroad of the best high-tech jobs is a phenomenon of the 2000s, the concern with the adequacy of the K-12 system for preparing US youth for the "new world of work" is not new. Since the early 1980s, various interests, including business associations, civil society organizations, and government agencies, have expressed concern with the adequacy of the US K-12 education system in providing students with levels of proficiency in math and science needed to pursue college degrees in the STEM disciplines.

In 1981, the US Secretary of Education created the National Commission on Excellence in Education because of "the widespread public perception that something is seriously remiss in our educational system".[34] The inquiry of the Commission paid particular attention to educational deficiencies among teenage youth. In its 1983 report, A Nation at Risk: The Imperative for Educational Reform (National Commission on Excellence in Education 1983), the Commission highlighted the lack of preparedness of American youth for the world of work "at a time when the demand for highly skilled workers in new fields is accelerating rapidly".[35] The Commission noted:

- "International comparisons of student achievement, completed a decade ago, reveal that on 19 academic tests American students were never first or second and, in comparison with other industrialized nations, were last seven times."
- "There was a steady decline in science achievement scores of U.S. 17-year-olds as measured by national assessments of science in 1969, 1973, and 1977."
- "Between 1975 and 1980, remedial mathematics courses in public 4-year colleges increased by 72 percent and now constitute one-quarter of all mathematics courses taught in those institutions."

In the 2000s it would appear that the nation is still at risk. The United States participates in the OECD's Programme for International Student Assessment (PISA) that has done three rounds of data collection and analysis on the literacy in reading, mathematics, and science of 15-year-old students around the world. The first assessment, done in 2000, focused on reading; the second assessment, done in 2003, focused on mathematics; and the third assessment, done in 2006, focused on science. In PISA 2000, the reading performance of US students was just above the average for the 27 participating OECD nations, with the United States ranked 15th (Lemke et al. 2001, 7). In PISA 2003, the mathematics performance of US students was significantly below the OECD average, with the United States ranked 24th of 29 OECD countries (Lemke et al. 2004, 14-15).[36] In PISA 2006, the science performance of US students was significantly below the OECD average, with the United States ranked 21st of 30 OECD countries (Baldi et al. 2007, 6).

In all cases, in the United States blacks and Hispanics did significantly worse on these assessments than whites and Asians (Lemke et al. 2001, 50; Lemke at al. 2004, 38; Baldi et al. 2007, 55). In the PISA 2000 reading rankings, US non-Hispanic whites had a score that would have placed them (as a hypothetical nation) 2nd after Finland and just ahead of Canada, while US blacks had a score (again as a hypothetical nation) that would have placed them 25th, leading only Luxembourg and Mexico. In the PISA 2003 math rankings, US non-Hispanic whites, with a score above the OECD average, would have placed 13th out of 29 OECD countries, while US blacks would have ranked 28th, ahead of Mexico. In the PISA 2006 science rankings, US non-Hispanic whites would have been 7th among 30 OECD nations, while US blacks would have been last, just behind Mexico. In each case, US Hispanics performed better than US blacks, but well below the OECD average. US Asians did less well than US non-Hispanic whites, and were above the OECD average in reading and math, but just below it in science. Much of the poor showing of the United States as an actual nation in PISA, therefore, can be attributed to

[34] http://www.ed.gov/pubs/NatAtRisk/intro.html.
[35] http://www.ed.gov/pubs/NatAtRisk/risk.html.
[36] Trailing the United States were Portugal, Italy, Greece, Turkey, and Mexico.

deficiencies in the K-12 educations of blacks and Hispanics. During this period, of the US population ages 15-19, non-Hispanic whites were 63 percent, blacks 15 percent, Hispanics 16 percent, and Asians 4 percent (US Census Bureau 2004-2005, 14-15).

The relatively poor overall performance of the US K-12 system in international comparison cannot be attributed to a lack of spending on primary and secondary education. In 2005 the United States spent 4.5 percent of GDP on elementary and secondary education data, a figure that was down slightly from the historic peak of 4.7 percent reached in 2001 through 2003 (National Center for Education Statistics 2007, Table 25). In 2003 the United States spent $8,900 per student in primary and secondary education, while France spent $7,200, Japan $6,800, and Germany $6,500 (Miller et al, 2007, 45). Yet all of these countries have consistently ranked better than the United States in the PISA scores. As shown in Table 3, where the United States falls short compared with major OECD nations is on teachers' salaries adjusted for GDP per capita. The implication is that, compared with other advanced nations, K-12 teaching in the United States is a relatively unattractive occupation, especially in terms of remuneration.

Table 3: Ratios of average annual salaries of public school teachers in US dollars (purchasing power parity) to GDP per capita, G-6 countries, by education level and level of teacher training/experience

	Average starting salary with minimum training expressed as a ratio of GDP per capita		Average salary with minimum training plus 15 years of experience expressed as a ratio of GDP per capita		
	Primary	Upper secondary	Primary	Upper secondary	GDP per capita
England*	0.93	0.93	1.36	1.36	$30,800
France	0.80	0.89	1.07	1.17	29,000
Germany	1.31	1.47	1.63	1.80	28,800
Italy	0.87	0.94	1.05	1.18	27,300
Japan	0.83	0.83	1.55	1.55	29,600
Scotland*	0.93	0.93	1.48	1.48	30,800
United States	0.82	0.79	1.00	1.01	39,700

* GDP per capita for the United Kingdom
Source: Miller et al. 2007, 44.

These deficiencies of the US K-12 education system have been noted in two "Nation at Risk" reports for the 2000s. One report, Tough Choices or Tough Times, was undertaken by the National Center on Education and the Economy (New Commission 2007).[37] The other report, Rising Above the Gathering Storm: Energizing and Employing America for a Brighter Future, was undertaken by the National Academy of Sciences at the behest of

[37] In 1990 the National Center on Education and the Economy produced the report, America's Choice: High Skills or Low Wages! (available at http://www.skillscommission.org/pdf/High_SkillsLow_Wages.pdf). According to a statement in NCEE 2007, vii: "The National Center on Education and the Economy is a nonprofit organization created to develop proposals for building the world-class education and training system that the United States must have if it is to continue to be a world-class economy. The National Center engages in policy analysis and development and works collaboratively with others at the local, state, and national levels to advance its proposals in the policy arena."

Congress, beginning in 2005.[38] Tough Choices focuses almost entirely on the transformation of the K-12 system as a condition for US competitiveness, and almost all the members of its "New Commission on the Skills or the American Workforce" were academics, civil servants, and politicians whose bios reflect a concern for, and substantial work on, the system of primary and secondary education. Rising Above, which formed the basis for the (laboriously named) America Creating Opportunities to Meaningfully Promote Excellence in Technology, Education, and Science (COMPETES) Act passed by Congress in August 2007, focuses much more on public support for the development of science and technology (S&T) capabilities as a condition for US competitiveness. Its (rather pompously named) Committee on Prospering in the Global Economy in the 21st Century was composed of eight academics, six corporate executives, and five presidents of major universities (Committee 2007, iv). Whereas the Tough Choices Commission included four former US Secretaries of Labor or Education and a number of high-level public school officials, the Rising Above Committee had only one public school official (Nancy S. Grasmick, Maryland State Superintendent of Public Schools). All of the academics on the Rising Above Committee were in science and engineering, while, of the two academics on the Tough Choices Commission, one was an economist (Ray Marshall of the University of Texas, also a former Secretary of Labor in the Carter Administration) and one was a professor of early childhood and family policy (Sharon Lynn Kagan of Columbia University). Rising Above had no representatives of the labor movement on its Committee, whereas Tough Choices had two (Morton Bahr, former president of the CWA, and Dal Lawrence, former president of the Toledo Federation of Workers).

These two reports provide very different, but generally complementary, perspectives on how to restructure the US system of education and knowledge creation to expand the high-quality employment opportunities available to US citizens in the 21st century. I will summarize the main arguments of each report, and show the implications of the rise and dominance of NEBM for the problems that these reports highlight and policies that they propose. Based on this analysis, I will then conclude this paper by focusing attention on a critical dimension of the future of employment in the US economy that both of these reports completely ignore – namely the governance of high-tech corporations so that they make the business investments, and support the government investments, that will be necessary to provide a larger proportion of Americans will high value-added jobs over the next generation.

The central argument of Tough Choices or Tough Times is that "[t]he problem is not with our educators. The problem is with the system in which they work" (New Commission 2007, xxi). The report advocates the setting of high-level achievement standards, through two stages of State Board Exams administered in high school, that encourage students to reach their full potential, at an accelerated pace if possible, rather than, as is currently the case, have standard tests that represent the lowest common denominator for getting students out of high school (New Commission 2007, xxiii). While the Commission highlights the deficiency of US school in teaching math and science, it also argues that

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[38] The chairman of the committee responsible for Rising Above the Gathering Storm, Norman Augustine, retired chairman and CEO of Lockheed Martin and former secretary of the Army, presented the report to Congress in October 2005.

"high earnings are not just associated with people who have high technical skills….History, music, drawing and painting, and economics will give our students an edge just as surely as math and science will" (New Commission 2007, 29).

The Commission calls for a reduction in bureaucracy by taking control of schools away from local school districts and having them "operated by independent contractors, many of them owned and run by teachers" (New Commission 2007, xxvii). These contract schools would be a variant of charter schools, an educational innovation that enables a party that wants to deliver high-quality public high school education to enter into a contract with the state that bypasses many existing bureaucratic rules and procedures but requires that the school meet the performance criteria, typically focusing on the education of disadvantaged youth, contained in its charter. In 2007 over one million children attended some 3,500 charter schools in 40 states as well as DC and Puerto Rico.[39]

Tough Times places particular emphasis on creating new terms for the employment of teachers: annual salaries (adjusted for local cost-of-living differences) that would start at "about $45,000, which is now the median teachers' pay," rising to "about $95,000 per year to the typical teachers working at the top of the new career ladders for a regular teaching year and as much as $110,000 per year to teachers willing to work the same hours per year as other professionals typically do". Further, the Commission recommends that "teachers be employed by the state, not the local districts, on a statewide salary schedule". Specifically, "[t]he current policies regarding teacher education would be scrapped. The state would create a new Teacher Development Agency charged with recruiting, training, and certifying teachers." Teachers would have to hold "at least a bachelor's degree in the subject they propose to teach and would have to pass a rigorous teaching and performance assessment" (New Commission 2007, xxiv).

The Commission also advises that, in order to attract younger teachers, the defined-benefit pensions that most public school teachers get should be replaced by defined contribution plans or cash-balance plans. Indeed, the report argues that when one takes into account lifetime remuneration from defined benefit pension plans and retirement health benefits – a benefit that it notes has been "rapidly becoming untenable in the private sector" -- public school teachers actually get paid "above the average for people with comparable amounts of education" (New Commission 2007, 60-61). The advantage of these alternative pension plans, the Commission notes, is portability; the report gives the example of TIAA-CREF for college teachers that provides "complete portability across the whole country" (NCEE 2007, 62).

A transformation of pension systems reflects a transformation in employment relations (Lazonick 2007a). Indeed the vision that the Commission has for K-12 public schools

[39] See the US Charter School website at http://www.uscharterschools.org/pub/uscs_docs/o/history.htm. One of only two dissenting comments published with the Tough Choices report came from the Commission's two labor representatives, Dal Lawrence and Morton Bahr, who warned that "[t]he [report's] design for contract schools can become an open door for profiteers. One of us is a citizen of Ohio, where charter school legislation has resulted in almost universal poor student achievement, minimal accountability, and yet considerable profits for charter operators, many with peculiar agendas." (New Commission 2007, 96)

entails the transition from tenured employment with one school to a flexible teachers' labor market that resembles employment relations under NEBM. The second half of Tough Choices is written as a retrospective scenario on the implementation of the Commission's recommendations from the vantage point of the year 2021, 15 years after the report was written. The proposed transformation of employment relations, the scenarist observes, had "cost money, especially in teachers' salaries."

> Many states concluded that they were not going to get value for money unless they could be sure that they could set market rates for teachers in shortage subjects, get rid of seniority as a principle of teacher assignment, compensate teachers based on their actual classroom performance, retrain teachers who were not able to do the job expected of them, and fire those who could not do it after retraining.

To implement these dramatic changes in employment relations, the Commission scenarist continues (New Commission 65-67), many states legislated that the state itself would become the teachers' employer, "a change that happened much more quickly than many had predicted."

> These changes produced a revolution in the teaching profession. A surprisingly large fraction of students from the best colleges in the country decided to make teaching their first career. Many stayed for only five or six years, but many others stayed much longer. And some who stayed only five or six years, and then went on to do something else, decided to return later. Many of the best retired teachers who had gone on to other careers decided to come back. These teachers worked whatever hours were required to get the job done….
>
> The new state schedules for teachers were partly based on the new career ladders, which were based not on seniority but on the quality of the teacher's work. In these systems, teachers who were most successful at producing outstanding student performance were paid more and were asked to demonstrate their methods to other teachers, sharing the methods that accounted for their success. As the public became aware of how hard it was to get into school teaching, and schools enjoyed more and more success, even with the students who had been hardest to teach, the status of teachers shot up. For the first time in anyone's memory the number of people applying for teaching positions outnumbered the available positions.

Tough Choices also talks about changes in student incentives and the provision of public pre-kindergarten schooling. But the transformation of the terms on which public school teachers are employed is at the heart of the Commission's proposals. In effect, it proposes a new "business model" for the K-12 system. The expected product of this "business model" will be a new generation of American workers who are capable of competing for high value-added jobs in the global economy. The Commission does not, however, address the critical question of whether, given globalization, these jobs will become available in sufficient numbers in the United States to provide appropriate employment for this new generation of well-educated workers. If not, what will be the incentives for cynical students and hard-pressed teachers, along with the investing public, to transform the way in which the underperforming classes of students are educated?

As we have seen, these underperforming classes of students are predominantly black and Hispanic. In the case of blacks, the War on Poverty, launched in the mid-1960s, was by the 1970s helping them access good-paying union jobs in mass-production industries. Blacks who had in the 1970s moved into these good manufacturing jobs were disproportionately affected by the permanent downsizing of OEBM labor forces that began in the blue-collar recession of 1980-1982 and continued with the plant closings and widespread layoffs in the ensuing years (Kletzer 1991; Fairlie and Kletzer 1998).[40] As William Julius Wilson has argued, this deterioration in the employment prospects of blacks with high-school education had far-reaching adverse impacts on the stability of family life in urban centers that were predominantly black, the quality of K-12 education that blacks received, and the extent to which black communities were capable of supporting the upward social mobility of their members (Wilson 1987 and 1991-1992).

These problems of black and Hispanic poverty persist in the 2000s. But whereas until the late 1970s a high school education could still be sufficient to land one a good job with an Old Economy company, in the New Economy of the 2000s one needs a higher degree to secure entry into labor markets that offer decent wages. As shown in Table 4, increasing proportions of the black and Hispanic populations, 25 years old or over, have attained university degrees at the bachelor's level or higher. Nevertheless their numbers still lag far behind those of the white population. And, as shown in Table 5, in 2006 blacks and Hispanics were also still lagging whites at the associate's degree level. The critical question going forward in the 2000s is whether, given the globalization of the high-tech labor force, blacks and Hispanics as groups will be able to take advantage of new educational and employment opportunities, and, so to speak, "rise above the gathering storm".

[40] On review of the literature on the deterioration of black employment and earnings from the late 1970s to the early 1990s, see Holzer 1994.

Table 4: Attainment of bachelor's degrees or higher of the US population, age 25 or over, by race/ethnicity, 1975-2006

Percent of race/ethnicity group

	Total	White	Black	Hispanic
1975	13.9	14.9	6.4	6.6
1980	17.0	18.4	7.9	7.6
1985	19.4	20.8	11.1	8.5
1990	21.3	23.1	11.3	9.2
1995	23.0	25.4	13.3	9.3
2000	25.6	28.1	16.6	10.6
2001	26.1	28.6	16.1	11.2
2002	26.7	29.4	17.2	11.1
2003	27.2	30.0	17.4	11.4
2004	27.7	30.6	17.7	12.1
2005	27.6	30.5	17.7	12.0
2006	28.0	31.0	18.6	12.4

Source: National Center for Education Statistics 2007, Table 8.

Table 5: Levels of educational attainment, US population, age 25 or over, by race/ethnicity, 2006

(in thousands)	Total	White	Black	Hispanic
Population 25 years and over	191,884	135,661	20,913	23,499
Less than high school graduation	27,896	12,831	3,942	9,567
Graduated high school	60,898	43,955	7,496	6,672
Some college	32,611	24,011	3,969	2,974
Associate's degree	16,760	12,855	1,616	1,379
Bachelor's degree	35,153	27,376	2,661	2,068
Master's degree	13,053	10,313	972	566
Professional degree	3,050	2,423	158	176
Doctorate	2,464	1,898	99	97
		% of race/ethnicity group		
	% of total population	Whites	Blacks	Hispanics
Population 25 years and over	100.0	70.7	10.9	12.2
Less than high school graduation	14.5	9.5	18.8	40.7
Graduated high school	31.7	32.4	35.8	28.4
Some college	17.0	17.7	19.0	12.7
Associate's degree	8.7	9.5	7.7	5.9
Bachelor's degree	18.3	20.2	12.7	8.8
Master's degree	6.8	7.6	4.6	2.4
Professional degree	1.6	1.8	0.8	0.7
Doctorate	1.3	1.4	0.5	0.4

Source: National Center for Education Statistics 2007, Table 9.

While some progress has been made, thus far blacks and Hispanics are not well represented in the STEM occupations -- in sharp contrast not only to whites but also to people of Asian origin in the US population, as is shown in Tables 6 and 7. As can be seen in Table 6 which shows the proportions of racial and ethnic minorities in the non-social-science STEM occupations since 1950 (with more detailed occupational breakdowns since 1970), over the last half of the 20th century blacks increased their representation in these occupations relative to their representation in the labor force as a whole by 5 times, but in 2000 this ratio was still only 0.55:1. Hispanics did even worse. As they came to represent about as large a proportion of the labor force as blacks by the end of the 20th century, their representation in the STEM occupations actually declined, falling from 0.48:1 in 1980 to 0.46:1 in 1990 to 0.43:1 in 2000. Contrast the experience of blacks and Hispanics with that of Asians, who represented less than 4 percent of the labor force in 2000, but over 10 percent of the non-social-science STEM occupations. Table 6 shows, moreover, that much of the progress that blacks and Hispanics made in these STEM occupations in the last decades of the century were at the lower-paid technician levels – occupations that are among the most vulnerable to be offshored. Indeed, from 1990 to 2000, the growth of the representation of both blacks and Hispanics into science technician jobs lagged the growth of their representation in the overall labor force. Meanwhile, the absolute proportions of blacks in life sciences and physical sciences actually declined from 1990 to 2000, even as their proportional representation in the labor force increased. In contrast, while the Asian representation in the labor force went up just over 1 percentage point from 1990 to 2000, their representation among both life scientists and physical scientists went up by more than 6 percent in each.

Table 7 displays the situation in 2006, with finer occupational breakdowns. Note the vast overrepresentation of Asians as computer software engineers, computer hardware engineers, and medical scientists, while blacks were overrepresented as operations research analysts and chemical technicians. Women also still remain significantly underrepresented in the non-social-science STEM occupations, particularly engineering. In 2006, women were 46.3 percent of the labor force and 56.9 percent of all professional and related occupations, but only 7.7 percent of electrical and electronics engineers and 5.8 percent of mechanical engineers. In the 2003 PISA, US males performed somewhat better than US females in mathematics literacy (486 versus 480) (Lemke et al. 2004, 35). Nevertheless, from the perspective of the engineering profession, it is women with math capabilities who are the prime targets for recruitment in the United States.[41] While some of these women are obviously from ethnic minorities, it will remain females as a social group, rather than blacks or Hispanics, who will attract the attention of those concerned with bringing more Americans into engineering education.

[41] I am grateful to John Hodgman of the UMass Lowell Faculty of Engineering for providing me with information on the importance of women to the future of the engineering professions.

Table 6: Workers in STEM occupations by race and ethnicity, 1950-2000

Types of workers, in thousands	**1950**	**1960**	**1970**	**1980**	**1990**	**2000**
All workers reporting an occupation	**60,288**	**69,053**	**81,450**	**105,665**	**124,773**	**138,754**
All STEM, except social scientists	**874**	**1,466**	**2,657**	**3,239**	**4,648**	**6,520**
Life sciences	42	52	82	126	159	222
Physical sciences	98	115	166	188	250	372
Engineering	556	859	1,250	1,470	1,781	1,820
Mathematics and information technology	25	27	377	646	1,457	3,267
Science technicians	112	251	514	190	215	299
Engineering technicians	27	136	261	618	785	540
Percent black						
All workers reporting an occupation	**9.8**	**9.7**	**9.8**	**10.1**	**10.5**	**10.9**
All STEM, except social scientists	**1.0**	**1.2**	**2.1**	**4.1**	**5.2**	**6.0**
Ratio, All STEM workers: All workers	**0.11**	**0.12**	**0.22**	**0.41**	**0.50**	**0.55**
Life sciences			3.2	3.8	3.9	2.9
Physical sciences			2.9	3.7	4.4	4.0
Engineering			1.1	2.5	3.5	4.0
Mathematics and information technology			2.9	5.4	6.3	7.1
Science technicians			3.1	7.2	9.0	9.1
Engineering technicians			2.9	5.7	7.0	7.5
Percent Hispanic						
All workers reporting an occupation	**1.4**	**1.6**	**1.9**	**5.7**	**8.1**	**10.7**
All STEM, except social scientists	**0.6**	**0.8**	**1.8**	**2.7**	**3.7**	**4.6**
Ratio, All STEM workers: All workers	**0.40**	**0.46**	**0.98**	**0.48**	**0.46**	**0.43**
Life sciences				2.5	3.1	3.7
Physical sciences			1.7	2.1	2.9	3.5
Engineering			1.4	2.2	3.2	3.9
Mathematics and information technology			1.4	2.6	3.2	4.5
Science technicians			3.0	4.4	6.5	7.3
Engineering technicians			2.7	4.0	5.5	7.4
Percent Asian						
All workers reporting an occupation	**0.2**	**0.5**	**0.8**	**1.6**	**2.8**	**3.9**
All STEM, except social scientists		**0.8**	**1.5**	**3.9**	**6.3**	**10.2**
Ratio, All STEM workers: All workers		**1.49**	**1.77**	**2.35**	**2.25**	**2.60**
Life sciences				3.9	6.4	13.8
Physical sciences			2.8	5.5	6.8	13.9
Engineering		0.8	1.5	4.3	6.8	8.9
Mathematics and information technology			1.2	3.9	6.7	11.4
Science technicians			1.4	2.9	5.2	6.9
Engineering technicians			1.2	2.5	4.6	5.5

Source: Lowell and Regets 2006, 16-18.

Table 7: Employed civilians in STEM occupations by sex, race, and ethnicity, 2006

	Total employed (000s)	Female	His-panic	Black	Asian
All occupations, persons 16 years and over	**144,427**	**46.3**	**13.6**	**10.9**	**4.5**
Professional and related occupations	**29,187**	**56.9**	**6.4**	**9.3**	**7.1**
STEM OCCUPATIONS					
Computer and mathematical occupations	**3,209**	**26.7**	**5.0**	**7.3**	**16.2**
Computer scientists and systems analysts	715	31.9	5.0	9.5	12.7
Computer programmers	562	25.3	5.3	3.9	18.1
Computer software engineers	846	21.8	3.4	5.8	26.9
Computer support specialists	314	28.9	7.2	10.5	7.4
Database administrators	90	37.0	3.0	8.9	14.8
Network and computer systems administrators	180	16.6	7.0	4.4	11.0
Network systems and data communications analysts	356	25.5	6.0	7.9	8.1
Operations research analysts	85	40.3	4.0	18.1	6.6
Architecture and engineering occupations	**2,830**	**14.5**	**5.9**	**5.6**	**9.7**
Architects, except naval	221	22.2	7.7	3.2	11.5
Aerospace engineers	110	13.1	5.1	5.6	12.9
Civil engineers	304	11.9	4.0	5.0	8.2
Computer hardware engineers	80	16.2	7.4	3.8	26.5
Electrical and electronics engineers	382	7.7	4.2	5.9	15.8
Industrial engineers, incl. health & safety	174	22.6	2.9	7.0	5.9
Mechanical engineers	322	5.8	4.0	4.3	9.5
Drafters	181	21.8	10.3	3.0	6.8
Engineering technicians, except drafters	396	20.6	11.2	9.3	5.3
Surveying and mapping technicians	96	9.9	8.5	3.0	0.3
Life, physical, and social science occupations	**1,434**	**43.3**	**4.1**	**5.7**	**12.2**
Biological scientists	116	46.6	3.8	3.5	11.9
Medical scientists	164	45.4	2.4	5.3	35.6
Chemical and material scientists	116	34.1	1.7	7.4	13.3
Environmental scientists and geoscientists	101	22.0	1.8	2.9	3.4
Market and survey researchers	129	61.3	3.4	9.0	8.7
Psychologists	189	67.7	3.5	2.6	2.2
Chemical technicians	76	35.9	8.8	11.4	4.4

Source: US Census Bureau 2008, 388.

Ultimately, whether blacks and Hispanics prosper in the New Economy will depend on their employment progress at the major US high-tech companies. In general, very little publicly available data on employment by race and ethnicity at the company level are available. In recent years, however, as an apparent response to the "corporate social responsibility" movement, a few ICT companies have begun to provide data on employment by race, ethnicity and sex as part of the diversity sections of their "global citizenship" reports. The major ICT companies for which such data are available are HP, Intel, and IBM.

For 2004-2006, HP provides a breakdown of all of its US employees by gender, race, and ethnicity across a range of positions in the corporate hierarchy from officers and managers at the top to laborers at the bottom. Table 8 shows this distribution for 2006. Of all US employees, 13 percent were officers and managers, 71 percent professionals, and 8 percent technicians, leaving a total of 8 percent for the other five employment classifications further down the hierarchy. Note that in 2006 females, blacks and Hispanics were underrepresented as HP US employees relative to their participation in the labor force, while males, non-Hispanic whites, and Asians were overrepresented. Relative to their representation among HP's US employees, blacks and Hispanics were underrepresented among officers/managers and professionals. Asians were over-represented as both professionals and laborers.

HP also provides data for all employees and those employed in the officers and managers categories from 2002 through 2006. During this time, the total number of people employed by HP in the United States fell from 67,350 to 54,085, even as its worldwide employment increased from 141,000 to 156,000, with the result that US employment fell from 48 percent to 35 percent of the total. With the exception of Native Americans (whose numbers increased from 258 in 2002 to 287 in 2006), every group included in Table 8 lost jobs over this period. But the largest declines as a proportion of the jobs held in 2002 were for blacks, whose net loss was 25 percent of 3,718 jobs, and females, whose net loss was 24 percent of 22,160 jobs. Every group lost officers and managers jobs, with Native Americans experiencing a net loss of 33 percent of the 30 such positions held in 2002, followed by blacks with a net loss of 27 percent of 309 jobs.

Table 8: Distribution of employment at HP, by sex, race, and ethnicity, 2006

Type of employment	Total	Male	Female	White	Black	Hispan.	Asian	Native Amer.
Officials and managers	6,868	5,020	1,848	5,776	225	355	492	20
Professionals	38,325	26,578	11,747	29,338	1,782	2,054	5,023	128
Technicians	4,307	3,792	515	3,288	329	320	342	28
Sales workers	758	505	253	653	39	43	18	5
Office and clerical	2,310	371	1,939	1,736	231	214	123	6
Craft workers (skilled)	28	27	1	24	3	1	0	0
Operatives (semi-skilled)	311	212	99	181	43	38	35	14
Laborers	1,178	635	543	631	132	164	165	86
Total	54,085	37,140	16,945	41,627	2,784	3,189	6,198	287
Percent	Total	Male	Female	White	Black	Hispan.	Asian	Native Amer.
Officials and managers	100.0	73.1	26.9	84.1	3.3	5.2	7.2	0.3
Professionals	100.0	69.3	30.7	76.6	4.6	5.4	13.1	0.3
Technicians	100.0	88.0	12.0	76.3	7.6	7.4	7.9	0.7
Sales workers	100.0	66.6	33.4	86.1	5.1	5.7	2.4	0.7
Office and clerical	100.0	16.1	83.9	75.2	10.0	9.3	5.3	0.3
Craft workers (skilled)	100.0	96.4	3.6	85.7	10.7	3.6	0.0	0.0
Operatives (semi-skilled)	100.0	68.2	31.8	58.2	13.8	12.2	11.3	4.5
Laborers	100.0	53.9	46.1	53.6	11.2	13.9	14.0	7.3
Total	**100.0**	**68.7**	**31.3**	**77.0**	**5.1**	**5.9**	**11.5**	**0.5**

Note: In 2006 proportional representation in the US employed civilian labor force was males, 53.7 percent; females, 46.3 percent, whites (non-Hispanic), 70.4 percent; blacks, 10.9 percent; Asians 4.5 percent; Hispanics, 13.6 percent; Native Americans, 0.6 percent.
Source: HP 2006 Global Citizenship Report, 141-142.

Intel reported diversity data for 2001-2006 for the US labor force as a whole and for officers and managers.[42] Over this period, despite a decline in Intel's US employment from 54,219 (65 percent of the company's worldwide total) to 50,348 (54 percent), blacks increased their employment from 2.4 percent (1,286 jobs) in 2001 to 3.6 percent in 2006 (1,787 jobs), although a peak of 1,849 jobs was reached in 2005. Hispanics were far better represented than blacks at Intel; they increased their employment from 6.1 percent (3,322 jobs) in 2001 to 9.0 percent in 2006 (4,474 jobs), although a peak of 4,647 jobs was reached in 2005. As at HP, however, Asians did best at Intel's US operations over this period; they increased their employment from 14.4 percent (7,815 jobs) in 2001 to 25.3 percent in 2006 (12,712 jobs). The 2006 Asian headcount surpassed that of 2005, notwithstanding the fact that there was a net reduction of over 3,600 Intel employees in the United States during 2006. Among officers and managers, blacks held 1.6 percent of the positions in 2001 rising to 2.0 percent in 2006; Hispanics 6.1 percent rising to 8.9 percent; and Asians 9.2 percent rising to 20.4 percent. Intel reported diversity data for

[42] The company also provided data on the sex, race and ethnicity of the board of directors (11 positions), corporate officers (32 positions in 2001-2005, and 25 in 2006), and the top 50 people in the company. Except for one Hispanic in a top 50 position in 2001, no other Hispanics and no blacks were represented in these categories.

the professional category in 2002 only, with blacks holding 1.9 percent of these positions, Hispanics 4.9 percent, and Asians 24.2 percent.

For observing the impact of changes in the employment on different social groups in the economy, IBM's diversity data is the most useful among the ICT companies.[43] It covers not only seven different types of employment but also 11 years from 1996 through 2006 (see Tables 9 and 10). The period begins at a time when IBM had already undertaken the massive restructuring that enabled it to rid itself of the institution of lifetime employment, and make the transition from OEBM to NEBM (Lazonick 2008, ch. 4). From 1996 to 2001, IBM increased its worldwide employment from 217,000 to 319,000, with its US employment increasing from 126,000 to 152,000. In 2006, the company's worldwide headcount stood at almost 356,000, but its US employment had declined to 134,000. In the process, the share of US employment in the worldwide total fell from 52 percent in 1996 to 38 percent in 2006.

As can be seen in Table 9, with IBM 2006 US employment almost 7 percent above its 1996 level, the proportion of US employees in marketing increased 2.5 times over the decade, while the proportion who worked as operatives almost disappeared, falling steadily from 12.3 percent of the total in 1996 to 1.3 percent in 2006. Other employment areas that experienced significant proportionate declines were technicians and office/clerical. Unfortunately, as can be seen in Table 10, in 1996 over 43 percent of blacks – 5,739 employees -- were clustered in the operative and office/clerical categories in 1996. In 2006, as the combined result of divestments of manufacturing facilities and offshoring, IBM employed only 121 black operatives in the United States, down from 3,474 a decade earlier. In 2006 the largest cluster of black employees was in office/clerical work, but they held only 61 percent of the jobs in this area than they had ten years before. Blacks benefited from the growth of marketing in terms of numbers of positions held, although the black proportion in this area declined from just under 8 percent in 1996 to just over 7 percent in 2006.

On net, blacks had 2,201 fewer jobs at IBM in 2006 than in 1996, while every other diversity group saw its headcount rise. Note that the employment of all diversity groups was hard hit by the massive decline in operative jobs, but groups other than blacks more than made up for it through job growth in higher level areas of employment. Asians, for example, increased their net employment by almost 6,000 jobs over the decade, so that the Asian proportion of IBM's total US employment rose from almost 8 percent to almost 12 percent, with marketing shooting up by over 9 percentage points to 14.6 percent in 2006. Blacks gained jobs as professionals, but not nearly as many as females, Asians, and Hispanics, and they actually had a net loss of positions as officials/managers, even though for IBM's US operations as a whole the total number employed at this level was greater in 2006 than in 1996.

[43] Given the importance of these type of data to policy-making in the United States, there is no reason why all companies should not follow IBM's example in making detailed diversity data publicly available on an annual basis.

Table 9: IBM, distribution of US employment by type of employment, 1996-2006

Type of Employment	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Officials/Managers	16,638	18,018	20,388	22,307	23,837	19,464	18,018	17,494	17,494	17,385	17,363
Professionals	54,805	49,847	58,139	61,747	62,080	65,084	62,140	60,120	60,353	55,827	55,742
Technicians	12,534	13,159	17,528	16,508	15,760	15,639	13,068	12,319	11,992	11,549	10,349
Marketing	15,798	32,331	29,294	31,855	34,384	36,891	40,697	39,783	39,699	40,052	42,133
Office/Clerical	8,880	8,680	8,939	8,432	8,048	7,327	6,670	7,412	6,747	5,951	5,409
Craft Workers	1,628	3,421	2,966	2,693	2,478	2,546	1,687	1,444	1,338	1,232	1,193
Operatives	15,415	11,031	10,237	7,058	7,000	5,244	3,425	2,450	2,276	1,971	1,784
Totals	**125,618**	**136,487**	**147,491**	**150,600**	**153,587**	**152,195**	**145,705**	**141,022**	**139,899**	**133,967**	**133,973**
Worldwide employees	240,615	269,465	291,067	307,401	316,303	319,876	315,889	319,273	329,001	329,373	355,766
Percent US employees	52.2	50.7	50.7	49.0	48.6	47.6	46.1	44.2	42.5	40.7	37.7
Percent of group total											
Officials/Mgrs	13.2	13.2	13.8	14.8	15.5	12.8	12.4	12.4	12.5	13.0	13.0
Professionals	43.6	36.5	39.4	41.0	40.4	42.8	42.6	42.6	43.1	41.7	41.6
Technicians	10.0	9.6	11.9	11.0	10.3	10.3	9.0	8.7	8.6	8.6	7.7
Marketing	12.6	23.7	19.9	21.2	22.4	24.2	27.9	28.2	28.4	29.9	31.4
Office/Clerical	7.1	6.4	6.1	5.6	5.2	4.8	4.6	5.3	4.8	4.4	4.0
Craft Workers	1.3	2.5	2.0	1.8	1.6	1.7	1.2	1.0	1.0	0.9	0.9
Operatives	12.3	8.1	6.9	4.7	4.6	3.4	2.4	1.7	1.6	1.5	1.3
Totals	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

NOTE: Tables reflect all regular and complementary U.S. employees. The company's complementary workforce includes various workers hired under temporary, part-time and limited-term employment arrangements

Source: IBM website: http://www-03.ibm.com/employment/us/diverse/employment_data.shtml

Table 10: Distribution of US employment at IBM by race, sex , and ethnicity, 1996 and 2006

	IBM 1996							IBM 2006						
Type of Employment	**Total**	**Male**	**Female**	**Black**	**Asian**	**His-panic**	**Native Amer.**	**Total**	**Male**	**Female**	**Black**	**Asian**	**His-panic**	**Native Amer.**
Officials/Mgrs	16,638	12,513	4,125	1,149	616	452	54	17,363	12,343	5,020	990	1,288	579	117
Professionals	54,805	39,124	15,681	3,641	4,580	1,667	152	55,742	37,438	18,304	3,926	7,524	2,337	316
Technicians	12,534	11,248	1,286	834	444	649	44	10,349	9,119	1,230	923	584	611	79
Marketing	15,798	11,444	4,354	1,248	850	477	66	42,133	30,514	11,619	2,985	6,130	1,639	250
Office/Clerical	8,880	2,951	5,849	1,905	235	480	43	5,409	1,558	3,851	1,171	229	352	68
Craft Workers	1,628	1,422	206	161	102	62	4	1,193	751	442	95	58	37	5
Operatives	15,415	8,613	6,802	34,74	2,882	1,271	69	1,784	1,154	630	121	109	54	13
Totals	125,618	87,315	38,303	12,412	10009	5058	432	133,973	92,877	41,096	10,211	15,922	5,609	848
Percent of area total	**Total**	**Male**	**Female**	**Black**	**Asian**	**His-panic**	**Native Amer.**	**Total**	**Male**	**Female**	**Black**	**Asian**	**His-panic**	**Native Amer.**
Officials/Mgrs	100.0	75.2	24.8	6.9	3.7	2.7	0.3	100.0	71.1	28.9	5.7	7.4	3.3	0.7
Professionals	100.0	71.4	28.6	6.6	8.4	3.0	0.3	100.0	67.2	32.8	7.0	13.5	4.2	0.6
Technicians	100.0	89.7	10.3	6.7	3.5	5.2	0.4	100.0	88.1	11.9	8.9	5.6	5.9	0.8
Marketing	100.0	72.4	27.6	7.9	5.4	3.0	0.4	100.0	72.4	27.6	7.1	14.5	3.9	0.6
Office/Clerical	100.0	33.2	65.9	21.5	2.6	5.4	0.5	100.0	28.8	71.2	21.6	4.2	6.5	1.3
Craft Workers	100.0	87.3	12.7	9.9	6.3	3.8	0.2	100.0	63.0	37.0	8.0	4.9	3.1	0.4
Operatives	100.0	55.9	44.1	22.5	18.7	8.2	0.4	100.0	64.7	35.3	6.8	6.1	3.0	0.7
Totals	100.0	69.5	30.5	9.9	8.0	4.0	0.3	100.0	69.3	30.7	7.6	11.9	4.2	0.6
Percent of group total	**Total**	**Male**	**Female**	**Black**	**Asian**	**His-panic**	**Native Amer.**	**Total**	**Male**	**Female**	**Black**	**Asian**	**His-panic**	**Native Amer.**
Officials/Mgrs	13.2	14.3	10.8	9.3	6.2	8.9	12.5	13.0	13.3	12.2	9.7	8.1	10.3	13.8
Professionals	43.6	44.8	40.9	29.3	45.8	33.0	35.2	41.6	40.3	44.5	38.4	47.3	41.7	37.3
Technicians	10.0	12.9	3.4	6.7	4.4	12.8	10.2	7.7	9.8	3.0	9.0	3.7	10.9	9.3
Marketing	12.6	13.1	11.4	10.1	8.5	9.4	15.3	31.4	32.9	28.3	29.2	38.5	29.2	29.5
Office/Clerical	7.1	3.4	15.3	15.3	2.3	9.5	10.0	4.0	1.7	9.4	11.5	1.4	6.3	8.0
Craft Workers	1.3	1.6	0.5	1.3	1.0	1.2	0.9	0.9	0.8	1.1	0.9	0.4	0.7	0.6
Operatives	12.3	9.9	17.8	28.0	28.8	25.1	16.0	1.3	1.2	1.5	1.2	0.7	1.0	1.5
Totals	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Source: IBM website: http://www-03.ibm.com/employment/us/diverse/employment_data.shtml

A New Agenda for Investment in S&T

Over all, then, in an age of high–tech global competition, the data on education and employment by race and ethnicity in the United States strongly suggest that significant groups within American society will still face "tough times" some 15 years hence, if proposals to transform the K-12 education system do not address directly the systemic socioeconomic barriers to advancement that still face large proportions of blacks and Hispanics in the United States. That having been done, the "tough choices" that public policymakers must confront cannot be confined to the "supply-side" problem of the transformation of the K-12 system alone, as the "New Commission on Skills of the American Workplace" has done. They must also consider the types of policies that can deal with the "demand-side" problem of the expansion and augmentation of high-tech employment in the United States in the face of the apparently irreversible tendency for former US jobs of ever higher quality to go abroad.[44] The challenge of sustainable prosperity in the United States is not simply to replace the jobs that disappear but to generate an ever-expanding number of high-quality jobs that can draw members of previously excluded groups into the remunerative and meaningful work.

Such is the challenge that Rising Above the Gathering Storm apparently takes up. At the outset, the "Committee on Prospering in the Global Economy of the 21st Century" makes it clear that the future prosperity of the United States depends on investing in the nation's science and technology capabilities:

> The prosperity the United States enjoys today is due in no small part to investments the nation has made in research and development at universities, corporations, and national laboratories over the last 50 years. Recently, however, corporate, government, and national scientific and technical leaders have expressed concern that pressures on the science and technology enterprise could seriously erode this past success and jeopardize future US prosperity. Reflecting this trend is the movement overseas not only of manufacturing jobs but also of jobs in administration, finance, engineering, and research. (Committee 2007, ix)

Rising Above the Gathering Storm contains a set of recommendations about what to do about this threat to the nation's future. The Committee makes four recommendations (Committee 2007, 5-12), which I quote:

> Recommendation A: *Increase America's talent pool by vastly improving the K-12 science and mathematics education.*
>
> Recommendation B: *Sustain and strengthen the nation's traditional commitment to long-term basic research that has the potential to be transformational to maintain the flow of new ideas that fuel the economy, provide security, and enhance the quality of life.*
>
> Recommendation C: *Make the United States the most attractive setting in which to study and perform research so that we can develop, recruit, and retain the best*

[44] For a recent critique of the argument that there is a shortage of qualified science and engineering graduates in the United States, see Lowell and Salzman (2007).

> *and brightest students, scientists, and engineers from with the United States and throughout the world.*
>
> Recommendation D: *Ensure that the United States is the premier place in the world to innovate: invest in downstream activities such as manufacturing and marketing; and create high-paying jobs based on innovation by such actions as modernizing the patent system, realigning tax policies to encourage innovation, and ensuring affordable broadband access.*

Recommendations A, B, and C would form the foundation for the America COMPETES Act, which became Public Law 110-69 on August 9, 2007.

The implementation of Recommendation A (K-12 education) requires a) the annual recruitment of 10,000 science and math teachers to the K-12 science, with 4-year college scholarships as an inducement; b) education and training programs for 250,000 existing teachers; and c) an increase the number of high school students who have attained levels of science and math that will enable them to graduate from college with degrees in science, engineering, or mathematics.

The implementation of Recommendation B (national research effort) requires a) federal government investment in long-term basic research that increases by 10 percent over the next seven years; b) five-year, $500,000 research grants to 200 outstanding researchers in the United States who are at the early stages of their careers; c) the setting up of a national advanced research coordinating office to manage the allocation of $500 million in incremental research funds over the next five years; d) the allocation of at least 8 percent of federal research budgets to discretionary funding; e) the creation within the Department of Energy an agency analogous to the Defense Advanced Research Projects Agency (DARPA); and f) the establishment of a Presidential Innovation Award for science and engineering advances that are in the national interest.

The implementation of Recommendation C (pool of scientists and engineers) requires a) 25,000 new undergraduate scholarships annually for bachelor's degrees in the physical sciences, life sciences, engineering, and mathematics for which US citizens attending US institutions of higher education would be eligible to compete; b) 5,000 new graduate fellowships for US citizens for studies in "areas of national need"; c) a federal tax credit to companies for the cost of providing continuing education to the scientists and engineers whom they employ; d) the streamlining of visa processing for foreign students and scholars; e) one-year automatic visa extensions to foreign recipients of doctorates from US institutions in science, technology, engineering, mathematics, or other fields of national interest, with, subject to security clearance, automatic work permits and fast-tracks to permanent residencies when offered jobs by employers based in the United States; and f) new immigration preferences based on skills; and g) the reform of "deemed exports" regulation that currently excludes foreigners engaged in fundamental research in the United States from access to certain science and technology information that they need to make creative contributions to the US S&T effort.

The implementation of Recommendation D (incentives for innovation) requires a) enhanced intellectual property protection; b) augmented research and development tax credits to business; and c) tax incentives to companies for carrying out innovation in the United States: and d) ubiquitous broadband access.

The body of Rising Above provides details on the form, content, and potential impact of these 20 actions items. At the end of the report, the Committee outlines three scenarios that could ensue, depending on what actions are in fact taken to strengthen the nation's S&T capabilities. In the first scenario, if nothing changes in approaches to S&T in the United States or abroad, the United States will be able to live off its current lead for a generation but in the process will suffer economic decline. "Today's leadership position," the Committee (Committee 2007, 219) recognizes, "is built on decisions that led to investments made over the past 50 years. The slow erosion of those investments might not have immediate consequences for economic growth and job creation, but the long-term effect is predictable and would be severe." In the second scenario, the United States lessens its commitment to S&T, an approach that "would run counter to our national history" (Committee 2007, 219). Under this scenario, "[t]he rapid pace of technological change and the increasing mobility of capital knowledge and talent mean that our current lead in science and technology could evaporate more quickly than is generally recognized if we fail to support it. The consequences would be enormous, and once lost, our lead would be difficult to regain" (Committee 2007, 220). In the third scenario, the United States (following the recommendations of the Committee) increases its commitment to S&T. Even in this scenario, "[t]he relative competitive lead enjoyed by the United States will almost certainly shrink as other nations rapidly improve their science and technology capacity" (Committee 2007, 221). But the results of innovation based on S&T is not zero-sum. By following this approach, the United States will help "to raise living standards and improve quality of life around the world and to create a safer world." Given the globalization of innovation, the US share of the world economy will inevitably fall even under the most optimistic scenario, but depending on the S&T effort that the United States makes, the absolute standard of living of Americans as a nation could, and should, rise.

In conclusion,[45] the Committee warns:

> It is easy to be complacent about US competitiveness and preeminence in science and technology. We have led the world for decades, and we continue to do so in many research fields today. But the world is changing rapidly, and our advantages are no longer unique. Some will argue that this is a problem for market forces to resolve—but that is exactly the concern. Market forces are *already at work* moving jobs to countries with less costly, often better educated, highly motivated workforces and friendlier tax policies.
>
> Without a renewed effort to bolster the foundations of our competitiveness, we can expect to lose our privileged position. For the first time in generations, the nation's children could face poorer prospects than their parents and grandparents did. We owe our current prosperity, security, and good health to the investments of past generations, and we are obliged to renew those commitments in education, research, and innovation policies to ensure that the American people continue to benefit from the remarkable opportunities provided by the rapid development of the global economy and its not inconsiderable underpinning in science and technology.

[45] This version of the conclusion is taken from the Executive Summary (Committee 2007, 12-13).

The Committee recognizes at various points throughout the report that, for this commitment to science and technology to benefit the American people as a whole, the science and math education for blacks and Hispanics must be transformed (Committee 2007, 95, 131, Appendix D). But will a renewed and augmented commitment of the US government to investment in S&T necessarily result in an increase in the quality and quantity of business sector jobs that available to the next generation of US graduates of higher education? In concluding the description of the pessimistic first scenario mentioned above, the Committee (2007, 219) recognizes that "[i]ncreasingly, it is no longer true that what is good for GM (or GE or IBM or Microsoft) is good for the United States."

> What it means to be a US company is likely to change as all multinationals continue to globalize their operations and ownership. As China and other developing nations become larger markets for many products and services, and as they maintain their cost advantages, US companies will increasingly invest there, hire there, design there, and produce there. This nation's science and technology policy must account for the new reality and embrace strategies for success in a world where talent and capital can easily choose to go elsewhere.

What might those "strategies for success" be? Specifically, to what extent and in what ways, will "rising above the gathering storm" require changes in the ways in which *business corporations* are regulated in the United States? On this critical issue, the Committee is silent, perhaps because it chooses to view the resource allocation decisions of companies such as Cisco, HP, IBM, Intel, and Microsoft as "market forces" that are presumably outside the purview of legitimate government policy – but yet cannot be relied upon to ensure that good jobs are created in the United States. Based on the analysis that I have provided in this book, however, I would submit that for the Committee's 20-point plan for government investment in S&T to have any chance of resulting in prosperity for most Americans over the next generation, the government will have to intervene strategically to influence the allocation of resources by business corporations, US-based and foreign, that make use of the high-tech knowledge and highly qualified people that would result from such a massive government effort to "rise above the gathering storm".

Corporate governance for sustainable prosperity

The critical area for strategic policy intervention -- yet one that is totally absent from the US S&T policy debate – is on the role of the stock market in the corporate allocation of resources. There are two interrelated areas of corporate governance in which government intervention is needed. The government needs to enact legislation that restricts the practice of corporate stock repurchases. The government also needs to enact legislation that drastically reins in top executive pay, which means placing restrictions on stock-based remuneration, especially stock options.

Stock repurchases are out of control, especially among high-tech companies. In 2006, on average for 496 companies in the S&P500 index in October 2007, net income was $1,521 million, dividends $484 million, stock repurchases $908 million, and R&D expenditures $351 million. In 2007 eight major ICT companies – Cisco, Dell, HP, IBM, Intel, Microsoft, Oracle, and Sun -- expended a total of $67.1 billion on repurchases compared with $28.7 billion on R&D – a ratio of 2.3:1.[46] Clearly, the

[46] The 2007 repurchase and R&D data in billions of dollars are: Cisco, 7.7 and 4.5; Dell, 3.0 and 0.5; HP, 10.9 and 3.6; IBM, 18.8 and 6.1; Intel, 11.5 and 5.8; Microsoft, 27.6 and 7.1; Oracle, 3.9 and 2.2; and Sun, 0.2 and 2.).

extraordinary profitability of many US corporations from 2003 through 2006 gave them the wherewithal to do repurchases on an unprecedented scale. Over these four years combined, the S&P500 companies averaged $4.9 billion in net after-tax income, and distributed an average of $2.2 billion in repurchases and $1.6 billion in dividends to shareholders.

More generally, one might argue that companies do repurchases because the marginal productivity of other types of resource allocation, such as investments in R&D, is very low (see, for example, Weiss 1997); that is these repurchases reflect what agency theorists call "free cash flow" (Jensen 1986; for a critique, see Lazonick 2007c). But, if that were the case, why would the Committee on Prospering in the Global Economy of the 21st Century recommend tax breaks to these companies to encourage innovation? Indeed, given the extent to which, as the Committee acknowledges, the US government has made the critical investments in the knowledge base on which these US-based companies can draw, should not these companies be the ones who are paying more, not less, taxes to the government, both as a return on the taxpayers' investments and to help fund the augmented government S&T expenditures that the Committee recommends? And if indeed the marginal productivity of investment in R&D is low -- and there is no evidence that such is the case, much less that it is the factor driving stock repurchases – perhaps it could be increased if these companies themselves invested in basic research in corporate labs, as was the case with their Old Economy predecessors (see Rosenbloom and Spencer 1996), and thus increased their capacities to contribute to the fundamental knowledge base and absorb externally generated knowledge. That is, the marginal productivity of R&D may be dependent less on how much a company spends on R&D and more on what types of investments in R&D it makes.

That having been said, it is unlikely the one would find high-tech top executives who would argue that stock repurchases are driven by a lack of profitable opportunities (see, for example, Baker et al. 2003). Corporate executives could argue that they have to do massive stock repurchases so that their stock will be attractive as a combination and compensation currency, which in turn will support the accumulation of innovative capabilities. There are a number of problems with this argument.[47]

When used as a combination currency to acquire other companies, there is no doubt that a company with a soaring stock price will have a competitive edge. But that soaring stock price will tend to be the result of innovation and/or speculation rather than redistribution through stock repurchases. Such is the case for Cisco Systems, which from 1993 through 2007 acquired 125 companies. It used its stock as an acquisition currency during the period in which its stock price rose through innovation and speculation but from 2003 through 2007 relied almost exclusively on cash as the currency for 45 acquisitions for a total of $14.3 billion even as it also dispensed $43.1 billion for stock repurchases (Lazonick 2007c). Indeed, one might argue that companies that are doing large-scale stock repurchases will refrain from using stock as a combination currency. Otherwise, all other things equal, the stock repurchases would have to be even larger to offset dilution from stock-based acquisitions.

When used as a compensation currency in the form of stock options, the reward to an employee is supposed to be reaped in future years when the stock price has risen as the innovative investments of

[47] For an in-depth analysis in the context of the New Economy boom and bust of the late 1990s and early 2000s of the conditions under which the use of stock as a combination and compensation currency can support, or undermine, the innovation process, see Carpenter et al. 2003.

the company generate revenues. Does the use of repurchases to boost stock prices today help a company attract and retain employees? Yes, when labor markets are tight,[48] but only if employees expect that the company will be willing and able to do repurchases systematically over time – which is perhaps a reason why Intel has a page on its website that shows all the buybacks that it has done going back to 1990, with only one quarter (Q3 of 2003) having been missed since Q2 of 1993.[49] If employees think that the company may not be able to sustain its repurchase program, or that, alternatively, in allocating resources to stock repurchases, the company has foregone critical investments in innovation required to make it competitive in the future, they might see today's repurchases as a sign that it is time to cash in their vested options and leave. Hence once a company starts down the path of stock repurchases, executives may feel compelled to remain on that path if the company is going to use buybacks to increase the value of its stock as a compensation currency. At some point, however, this commitment to supply cash to the stock market may undermine the financial commitment that, particularly in highly competitive global industries, is essential to fund innovation.

Companies often state explicitly in their financial statements that they are doing stock repurchases to offset dilution from their stock option programs. Even from a shareholder-value perspective, the economic rationale for this argument is not clear. If a company that seeks to maximize shareholder value deems it worthwhile to partially remunerate employees with stock options, it should see that remuneration as adding to rather than subtracting from earnings per share. True, these additions to earnings per share may only accrue in years to come; but then, from the shareholder-value perspective, the issue is simply one of whether remuneration in the form of stock options (or any other mode of compensation) is expected to yield positive net present value of future earnings at the appropriate discount rate. "Disgorging the cash flow" through stock repurchases may provide short-term support for a company's stock price at the expense of the generation of profits over the long run.

Top executives often simply argue that in doing stock repurchases, they, as corporate decision-makers, are "signaling" confidence that their company's stock price will rise over the long-term (see Louis and White 2007). Yet, from a financial point of view, such an investment would only make sense if one could expect that at some point in the future when innovation and speculation have resulted in an overvalued stock, the corporation would turn from being a purchaser to a seller of its own stock. Otherwise, corporate executives are taking the position that their stock can never be over-valued, even in a highly speculative boom. According to the "signaling" argument, we should have seen massive sales of corporate stock in the speculative boom of the late 1990s, as was the case of US industrial corporations in the speculative boom of the late 1920s. Indeed in the boom of the late 1990s corporate executives as *personal investors* sold their own stock to reap the speculative gains (often to the tune of tens of millions, and in some cases even hundreds of millions of dollars). Yet if anything these same corporate executives as *corporate decision-makers* used corporate funds to repurchase shares and, to *their own personal gain*, push the speculative stock price even higher. Given the extent to which stock repurchases have become a systematic mode of corporate resource allocation, and given the extent to which through this manipulation of their corporation's stock price top executives have enriched themselves personally in the process, there is every reason to believe that, in the absence of legislation that restricts both stock repurchases and the gains from stock

[48] For an in-depth analysis of the attraction, retention, motivation, and recognition functions of employee stock options, and the labor-market conditions under which they might perform different functions, see Glimstedt et al. 2006.
[49] http://www.intc.com/phoenix.zhtml?c=101302&p=irol-stockBuyBack

options, executive behavior that places personal interests ahead of corporate interests will continue in the future.[50]

Stock repurchases are, in my view, central to a massive redistribution process that has made the rich even richer at the expense of stable and equitable economic growth. It is a process that received ample encouragement from the inaptly named Jobs and Growth Tax Relief Reconciliation Act of 2003 that reduced tax rates on dividends from 38.6 percent (the top tax on ordinary income) to 15 percent and on capital gains (including of course those from selling stock) from 20 percent to 15 percent (McNamee and Scherreik 2003). Despite the fact that the 2003 Act reduced the tax on dividends even more than the tax on capital gains, since 2002, as we have seen, US corporations have increased stock repurchases even more than they have increased dividends (Blouin et al. 2007). The main reason, in my view, is that repurchases tend to boost stock prices, which in turn increases the returns from stock options.[51] I have shown that the gains from stock options of the people at the top of the corporation are typically hundreds of times, and often thousands of times, the average gains per employee in their company (Lazonick 2007c). Certainly, as in the late 1990s, when the stock market has moved up rapidly, millions of non-executive employees who held stock options benefited, and at companies like Cisco and Microsoft, smaller numbers of non-executive employees benefited immensely. For many if not most non-executive employees, however, the gains from stock options were ephemeral, as the decline of the early 2000s was followed by the "jobless recovery" of 2003 in which the acceleration of offshoring played an important role.

When combined with lavish stock option grants, stock buybacks are an important part of the explanation of the continuing explosion in CEO pay in the 2000s. Yet there has been to my knowledge no public policy debate over the practice of buybacks, its acceleration in recent years, or the implications for both the distribution of income and economic growth. Should, as the Committee on Prospering in the Global Economy of the 21st Century argues, the US government invest in the S&T knowledge base when the high-tech companies that make use of this knowledge base allocate the lion's share of their profits to pump up the value of their stock rather than make investments that can return greater value to the American taxpayers who have been footing the bills?

In the high-tech arena, the problem is not confined to ICT. In the pharmaceutical industry, there has long been a debate over the high prices of prescription drugs in the United States compared with other parts of the world including Japan and the high-wage nations of the European Union (Love 1993; Frank 2004). The pharmaceutical companies argue that, since so much of the research on these drugs is done in the United States, they need to charge higher prices to fund R&D. This is an industry that

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[50] It should be noted in this regard that most countries do not permit stock repurchases (Grullon and Michaely 2002, 1677). Indeed, until 1982 the US Securities and Exchange Commission (SEC) had at times viewed stock repurchases as a manipulation of a company's stock price. As Grullon and Michaely (2002, 1649) put it: "[U]ntil 1982, there were no explicit rules directly regulating share repurchase activity in the United States. This situation exposed repurchasing firms to the risk of triggering a SEC investigation and being charged with illegal market manipulation." In that year, however, as part of the general deregulation of financial institutions that had been taking place since the late 1970s, the SEC "made it easier for companies to buy back their shares on the open market without fear of SEC stock-manipulation charges" (Hudson 1982). Specifically, under Rule 10b-18, the SEC assured companies that manipulation charges would not be filed if each day's open-market repurchases were not greater than 25 percent of the stock's average daily trading volume (see Grullon and Michaely 2002, 1676-1682).

[51] Also slowing the growth of dividends relative to repurchases is the fact that insofar as a company that pays dividends reduces its shares outstanding through repurchases, it automatically reduces the total amount of dividends that it pay out.

is the direct beneficiary of some $28 billion per year spent on life sciences research by the National Institutes of Health (NIH). Indeed, from the launch of the NIH in 1938 through 2007, the US government invested $615 billion in 2007 dollars in life sciences research. Yet if one looks at the financial behavior of the largest drug companies, as Table 11 shows, a number of them distribute more cash to their shareholders in the forms of dividends and repurchases than they spend on R&D. Indeed over this decade Pfizer distributed more cash to shareholders in the form of repurchases than dividends, and the two combined were 18 percent higher than its net after-tax income. Over the decade 1997-2006, Merck did repurchases equal to 81 percent of R&D expenditures, Pfizer 76 percent, and Johnson & Johnson 54 percent of R&D expenditures. When the substantial dividends that these companies pay are added to their repurchases, the ratio of distributions to R&D shoots up to 179 percent at Merck, 135 percent at Pfizer, and 110 percent at Johnson & Johnson. Indeed for the period 1995-2001 Merck did buybacks that were 1.49 times its R&D expenditures, making total distributions 2.65 times its R&D expenditures.

Table 11: Distributions to shareholders in the forms of dividends and stock repurchases by the seven largest US-based pharmaceutical companies, 1997-2006

	Sales, 2006	TD/NI	(TD+RP)/NI	RP/R&D	(TD+RP)/R&D
	$m	1997-2006	1997-2006	1997-2006	1997-2006
J&J	53,324	0.38	0.74	0.54	1.10
Pfizer	48,371	0.52	1.18	0.76	1.35
Merck	22,636	0.51	0.92	0.81	1.79
Abbott	22,476	0.53	0.74	0.26	0.94
Wyeth	20,351	0.60	0.73	0.13	0.70
BMS	17,914	0.69	0.97	0.33	1.13
Lilly	15,691	0.59	0.62	0.02	0.58

TD=total (preferred plus common dividends; RP=stock repurchases; NI=net income after taxes but before extraordinary items; R&D=research and development
Source: Compustat database

The stock buyback disease also afflicts the largest independent biopharmaceutical companies. Among them in 2006, Amgen was the largest with $14.2 billion in revenues, and Genentech the second largest with $9.3 billion in revenues. In keeping with NEBM, Amgen and Genentech do not pay dividends. In 1997-2006 Amgen did $17.9 billion in buybacks, 97 percent of the level of its R&D expenditures, and Genentech did $5.3 billion in buybacks, 73 percent of the level of its R&D expenditures. In 2003-2006 the proportion of repurchases to R&D was 110 percent at Amgen and 109 percent at Genentech. Aided by this financial behavior, the CEO and other four highest paid executives at Amgen reaped an average of $92.1 million from gains from stock options for the period 1997-2006, while the top 5 at Genentech averaged $109.2 million (Lazonick et al. 2007).

That is not the end of the story. In May 2007 Amgen borrowed $4.0 billion ($2.0 billion due in 2008, $1.1 billion in 2017, and $0.9 due in 2037), of which $3.2 billion would be used for buybacks (Amgen 10-Q, period ending June 30, 2007). Through the first six months of 2007, Amgen repurchased a total of $5.0, of which almost $4.5 million was in the second quarter. In July 2007 the Amgen board authorized an additional $5.0 billion stock repurchase. But Amgen also experienced a second-quarter decline in sales of its blockbuster anemia drug Aranesp because of reported cases that high doses of the drug induced heart attacks (Chase 2007). On August 13, just after Amgen issued its second quarter 10-Q filing that recorded the sales decline, an analyst at Bernstein Research noted that

"Amgen will likely lose at least 40 percent of their US Aranesp revenue by 2008 with even greater downside possible for both Aranesp and Epogen if upcoming [Medicare and Medicaid] reimbursement and regulatory decisions go against them." But the analyst reportedly added: "If Amgen cuts costs, continues to buy back stock and improves its tax rate…it could increase its earnings per share by 10-12 percent each year from 2008 to 2011, even if it does not develop any significant drug candidates."[52] Two days later, on August 15, Amgen announced that it would downsize its workforce by 14 percent, or 2,600 jobs, cut capital expenditures by $1.9 billion, close some of its production facilities, and reduce R&D expenses, which had been at 27 percent of sales from 2003 through 2006, to 20 percent of sales (Chase 2007). It may well be that Amgen borrowed money to do its second-quarter repurchases because it wanted to offset the adverse impact of the Aranesp news on its stock price. In any case, in the allocation of corporate resources, the top priority of Amgen's top executives appears to be stock-price performance rather than sustainable productive performance.

If, in the 2000s, the US Congress has not addressed the issue of massive and systematic stock repurchases and their adverse implications for sustainable prosperity, it has also stayed clear of debate over the influence of executive pay. It has not always been this way. As mentioned earlier, in the 1960s until the Tax Reform Act of 1976, there was a legislative movement toward restricting the tax advantages of stock options. All that changed in the last half of the 1970s as the newly organized high-tech lobby swung into action, and got the capital gains tax reduced, accounting rules changed, and stock repurchases permitted to enhance the benefits of employee stock options. The high-tech lobby has had its political way ever since. A particularly risible attempt to control CEO pay was the implementation in 1993 of President Bill Clinton's campaign promise to legislate a cap of $1 million on the amount of non-performance-related, top-executive compensation that could be claimed as a corporate tax deduction. One perverse result of this law was that companies that were paying their CEOs less than $1 million in salary and bonus *raised* these components of CEO pay toward $1 million, which was now taken as the government-approved "CEO minimum wage" (Byrne 1994). The other perverse result was that companies increased CEO stock option awards, for which tax deductions were not in any case being claimed, as an alternative to exceeding the $1 million salary-and-bonus cap (Byrne 1995).

In the US context, it is also quite laughable to construe the gains from stock options as "performance-related" pay. The greatest gains from stock options come in periods of stock-market speculation, when holders of options benefit from the fact that in the United States there is virtually never any requirement that option gains can only be reaped if a company's stock does better than comparators in its industry. And when the market is less speculative, buybacks help to manipulate the price of stock, and, presto, the "performance" of the company improves.

In the 2000s, however, the employment insecurity that has resulted from the dominance of a stock-market-oriented business model is anything but a laughing matter. The Old Economy business model was hardly perfect, but it did provide employment security, health coverage, and retirement benefits to tens of millions of people whose work was at the heart of the economy. Under NEBM, the

[52] "Amgen moves up after analyst says company will restructure to increase earnings," Associated Press Financial Wire, August 13, 2007.

corporate economy no longer assumes these collective functions. In an era of open standards, rapid technological change, convergence of technologies, and intense global competition, business enterprises do need to be flexible in the deployment of capital and labor. One way of attaining this flexibility is by giving the organized labor force a major role in enterprise governance, as for example the Japanese, Germans and Swedes have done, each in their own particular ways (Lazonick 2005 and 2007d). In such a system, there is the possibility of an interaction between business and government to provide widespread economic security in employment and retirement while remaining innovative and competitive on a global scale. The other way is the American way in the era of NEBM, which, in an updated version of what I have elsewhere called "the myth of the market economy" (Lazonick 1991), works under the pretense that the collective provision of economic security is not required. Just get enough education to be "employable" in a well-paid job, and individual initiative will provide one with the lifetime of security that one needs. From the NEBM perspective, the only legitimate function of the government is to invest in the knowledge base, and even then with no notion that, through taxation, a substantial proportion of the gains from innovative enterprise that this knowledge base makes possible should be returned to the government to support the development of the economy as a whole.

In the United States in the 2000s, the quest for economic security evades even a substantial portion of the better educated population. In its stead stands the quest for shareholder value; the worship of wealth in the 2000s has rewritten the 1980s' motto, "greed is good", to read "greed is god". That small minority of the population that controls the allocation of corporate resources is reaping unprecedented wealth, while demanding that the government spend more of the taxpayers' money on knowledge creation and warning that only lower taxes on their wealth can keep the spirit of innovation alive. With the aid of a compliant government, the New Economy business model may continue to generate respectable economic growth – although, given global competition and the corporate allocation of resources, even that is debatable in the 2000s. What does seem certain, however, is that for a growing majority of Americans, the stock-market oriented political economy that has NEBM as its foundation will generate instability and inequity as a normal way of life.

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